CHILD HEALTH AND NUTRITION IN RURAL MEXICO: DID PROGRESA IMPROVE THE LIFE CHANCES OF THE VERY POOR?

María Carmen Huerta
London School of Economics and Political Science

Thesis submitted for the degree of Doctor of Philosophy
University of London
2005

STATEMENT OF ORIGINALITY

I hereby declare that this thesis – *Child Health and Nutrition in Rural Mexico: Did Progresa Improve the Life Chances of the Very Poor?* – is my own work.

Signed: María Carmen Huerta

ABSTRACT

It is well established that poverty during early childhood can have deleterious consequences. Unfavourable childhood conditions are likely to be transmitted over the life course and across generations, thereby perpetuating the "vicious circle" of poverty. Progresa – Mexico's main anti-poverty programme – aims to shift the odds of disadvantage by promoting and supporting parents' investments in children's education, health and nutrition. The Programme is based on the philosophy that investing in human capital can set the grounds for breaking the intergenerational transmission of poverty in which poor families find themselves. Progresa provides benefits in three areas that are closely linked to each other: education, health, and nutrition. It gives a set of monetary and in-kind benefits that vary according to the demographic characteristics of each family. These benefits are conditional on children's attendance to school and on regular health check ups.

The aim of this thesis is to investigate whether this Programme did indeed improve children's life chances during its first three years of intervention. The specific outcomes we examined include family-level food security (measures of both caloric availability and dietary diversity), children's early feeding patterns (breastfeeding and exclusive breastfeeding), the incidence of infectious diseases (diarrhoea and respiratory infections), and anthropometric indicators (stunting and underweight). For each outcome, models were constructed to test whether there are differential Programme effects over time and according to households' severity of poverty. The analyses were carried out using longitudinal data from a unique data set that contained randomised treatment and control groups.

The results indicate that, over a three year period, the Programme had a modest effect on young children's outcomes. Estimates suggest that the Programme contributed a reduction in the incidence of diarrhoea among children and to an improvement in their weight for age, but only for a selected group of the population: those aged 0 to 23 months at baseline.

Estimates also show a modest, but positive effect on household food security (an increase of 7 percent on caloric availability and of 7.3 percent on dietary diversity), but it is not clear whether the increased access to food is large enough to meet the families' nutritional needs. Moreover, Progresa's positive effect on caloric availability was largely protective because caloric availability fell substantially over the period of study in both treatment and control localities. Finally, Progresa's intervention had a modest impact on extending the duration of overall breastfeeding (already long at baseline) but no impact at all on exclusive breastfeeding (rarely practised before the intervention). Although the programme effects are somewhat small, one positive finding is worth emphasising. The results clearly and consistently demonstrate that it is children living in families with fewer resources that benefit most from the Programme's intervention. The findings aim to provide useful recommendations for child poverty alleviation strategies in developing countries and to point out lessons learned so that programmes like Progresa can be more effectively replicated in other countries.

ACKNOWLEDGEMENTS

I owe immense gratitude to my two supervisors, Professor John Hobcraft and Dr. Wendy Sigle-Rushton. I am extremely grateful to John for his insightful comments and ideas, for his immense support, and for lifting my spirits and motivation at each supervision. I am deeply grateful to Wendy for clarifying many doubts, for correcting countless mistakes with infinite patience, and for her pragmatism which guided me through this vast maze.

This thesis would have never seen the light without the late Dr. José Gómez de León whose concern for the poorest families in Mexico was at the inception of Progresa. I remain very grateful to Daniel Hernández and Mónica Orozco for the opportunity they gave me to come and work in Progresa, an experience that changed my outlook on life. I would also like to thank all the staff of Progresa who helped me in numerous occasions throughout this project.

I gratefully acknowledge the financial support received for this work from CONACYT. Their economic assistance along with the opportunity I had to work at CASE at the London School of Economics provided much practical support.

I was fortunate to share the PhD experience with Gerry, Hyun and Sam. Our long discussions and chats helped me understand that I was not alone during some difficult moments of this journey. I am thankful to my friends at Rosebery Hall who provided enormous help and encouragement during the many years living there. I also owe great thanks to my Mexican friends in the U.K. (Ana, Ana Mari, Elena, Marta, Max, Moisés, Pablo, Román and Susana) who each helped in different ways with the completion of this thesis.

To Amani for her very helpful comments and suggestions made at the beginning of this project. To Annu for her restorative *dal* and her wonderful stories. To Bani for her contagious happiness which brightened many moments at CASE. To Ceema for her continuous advice, attentive proof-reading and feedback. To Caroline for her time, her boundless generosity and care. The support of all these friends nurtured this thesis in a very special way.

I cannot thank enough Ana and Ana Mari for their outstanding role as my next of kin in the U.K., for their thoughtful words, and for sharing another important stage of my life.

I shall always remain indebted to Annu and Caroline without whom the completion of this thesis would have been impossible.

The energy which sustained me during the long, and often lonely, months was from my family. To my beloved grandmother for teaching me how to be self-reliant and resilient, to my siblings for their continuous encouragement, to my nieces (Paola and Paulina) and nephews (Claudio, Pablo, Sebastián, Daniel and Matías) for bringing joy into my life, to my parents for their much needed prayers and unconditional love.

And last but not least, I would like to thank Pablo who, although far away now, has had a key influence on determining this and other positive outcomes in my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Chapter 1. Child Health and Poverty

1.1. Introduction

During the early stages of life, adverse influences such as poverty and its associated mechanisms can have lasting effects over the life course and across generations. Nevertheless, there is evidence that effective and opportune interventions can shift the odds of disadvantaged children towards more favourable outcomes. The aim of this thesis is to investigate whether Progresa, Mexico's main anti-poverty programme, improves the life chances of the very poor, specifically those of children under the age of five. Progresa's efforts aim to support and promote parents' investments in their children. The goal of an anti-poverty intervention of this type is to enhance the conditions that can improve the present and future living conditions of families in extreme poverty, and to break the intergenerational transmission of poverty. Thus, it is important to investigate whether poor Mexican children are indeed likely to have a better future due to an intervention like Progresa. Given that Progresa's approach is similar to the current anti-poverty approach of several countries, it is important to evaluate if a strategy of this kind is achieving its goals.

This thesis examines whether Progresa's[1] interventions are associated with a positive effect on children's health and nutritional status. We focus our analysis on children under the age of five because early experiences are crucial for future achievements (Duncan and Brooks-Gunn 1997; Shonkoff and Philips 2000). It is important to look at the impact on children's health and nutritional status because these outcomes influence further accumulation of human capital. Moreover, health is one of the key channels of the intergenerational transmission of poverty. Specifically, we analyse the impact of the Programme on family's food security (caloric availability and dietary diversity), early feeding practices (breastfeeding and exclusive breastfeeding), incidence of infectious diseases (diarrhoea and respiratory infections), and prevalence of malnutrition (stunting and underweight). We examine the fluctuations over time and look at the characteristics that differentiate those children whose living conditions improve from those whose do

[1] Hereafter referred to also as the Programme.

not. The results of our analyses aim to provide some useful policy recommendations.

This chapter is organised as follows. Section 1.2 provides a literature review on the pervasive influence of early experiences on future developmental outcomes. Section 1.3 discusses the findings from several studies that have looked at the continuities of disadvantage over the life course and across generations. Section 1.4 highlights two important aspects in the analysis of poverty: poverty as a multidimensional approach and the importance of having a dynamic perspective on poverty. In Section 1.5 we present the findings from intervention studies on child heath in developing countries, and discuss recent approaches to poverty alleviation adopted by several countries, especially in Latin America. In Section 1.6 we present the conclusions of the chapter, the aims of the thesis and a brief summary of each of the following chapters.

1.2. Poverty during early childhood: Why does it matter?

Experiences lived during the first years of life are of vital importance because they contribute to building either a sturdy or a fragile basis for future life chances (Shonkoff and Philips 2000). This initial phase is critical for the intellectual, physical and emotional development of the individual. In particular, during the first three years of life, individuals grow physically and intellectually at the fastest rate over the life span (Carnegie Corporation of New York 1994; Young 1996; Shonkoff and Philipps 2000; UNICEF 2001). Thus, adverse influences during this stage can have long-lasting effects because, although not insuperable, deficiencies accumulted during this period are more difficult to make-up later in life. It is important to underline that early experiences do not determine children's life chances, but they do increase or decrease the likelihood of having positive or negative repercussions later in life.

It is well recognised that, throughout one's life course, healthy development depends on the mutual influence of genetic and environmental factors (Shonkoff and Meisels 2000). However, the prenatal period and the first years of life are highly sensitive to environmental factors. One of the reasons for this vulnerability is children's dependence on their parents for meeting physical, emotional and economic needs. If they are born into a family without the capabilities to provide a protective environment, their development is more likely to be compromised.

The influence of environmental mechanisms on children's healthy development begins even before the child is born. During pregnancy, maternal health and health related behaviours (e.g. nutrient intake, prenatal care, smoking) play a crucial role. Malnourished mothers, for example, are more likely to deliver newborns with dysfunctional developments, including brain damage[2] and low birth-weight (weight under 2,500 grams) (Galloway and Anderson 1994; Norton 1994). Several studies in developed and developing countries provide evidence that supports the 'foetal origins' hypothesis, which argues that the prenatal environment has important consequences for later health outcomes (such as coronary heart disease, diabetes, high blood pressure) (Roseboom et al. 2001; Singer and Ryff 2001; Yaqub 2002; Burgess et al. 2004; Case et al. 2004).

Once born, children are exposed to a larger number of environmental conditions that have a significant influence on their health and development. The interaction of these factors makes young children very susceptible to a set of negative outcomes. Children who grow up in poor quality environments are likely to suffer from inadequate nutrition, frequent and severe diseases, poor health care practices, and unhygienic living conditions. In these circumstances, it is likely that children's speed of growth will start diminishing as early as the third to sixth month of life; hence, by the second or third year of life, many children are stunted and/or underweight (Martorell 1999b). Additionally, the early years of life constitute a period of rapid brain growth during which neurons, dendritic branching and the synaptic connections of the nervous system are generated (Shonkoff and Marshall 2000). Thus, if proper conditions do not prevail, young children's physical, cognitive and emotional development is likely to be affected (Chase-Lansdale and Brooks-Gunn 1995; Haveman and Wolfe 1995; Duncan and Brooks-Gunn 1997; Feinstein 2000).

One of the most cited results in the child development literature is the negative association between poverty and children's attainments. It is widely acknowledged that poor children tend to have poorer outcomes later in life than their more affluent counterparts (Haveman and Wolfe 1995; Duncan and Brooks-Gunn 1997; Hobcraft 1998; Castañeda and Aldaz-Carroll 1999; Dahan and Gaviria 1999;

[2] Research in neuroscience has shown that the sensitive period for brain development starts at mid-pregnancy and extends up to the third to fourth year of life (Nelson 2000; Shonkoff and Marshall 2000; Singer and Ryff 2001).

Behrman et al. 2001; Mayer 2002; Behrman and Skoufias 2004; Burgess et al. 2004; Case et al. 2004). The negative influence of poverty is particularly important given the strong likelihood of transmitting disadvantages from childhood to adulthood and from parents to children.

In addition, there is broad evidence that if poverty is experienced during early childhood it can have a more detrimental effect than if it was experienced at any subsequent stage of life (Haveman and Wolfe 1995; Duncan and Brooks-Gunn 1997; Bynner 1999; CDC 1999; Hobcraft and Kiernan 1999; Shonkoff and Philips 2000). The deficiencies suffered during this stage have long lasting effects that influence not only how a child develops during its first years of life but also during adolescence and adulthood (UNICEF, 2001).

Furthermore, it has been argued that not only the timing but also the duration of poverty has a significant effect on later outcomes (Chase-Lansdale and Brooks-Gunn 1995; Duncan and Brooks-Gunn 1997; Korenman and E.Miller 1997; Mayer 2002). Results from an investigation looking at the effects of long-term poverty on children's nutritional status in the United States suggest that persistent poverty is strongly linked with deficits in height (Korenman and E.Miller 1997). Similarly, findings from a study looking at school achievements among young children in the US suggest that five years old who never lived in poverty had higher IQ scores than children who lived in transient or persistent poverty (4 and 9 points higher, respectively) (Brooks-Gunn et al. 1997). Thus, resilience is less likely to occur among children who are chronically poor than among those who are transitorily poor.

It is important to highlight that parental income has an unquestionable influence on children's future achievements. Nevertheless, income does not act in isolation; it is one of many factors associated with children's outcomes. A recent review by Susan Mayer (2002) concerning this matter shows that all the studies considered in her review find a positive effect of parental income on children's well-being, no matter the indicator used (health measures, cognitive test scores, educational achievements, future economic status, teenage childbearing, behavioural problems, socio-emotional well-being and mental health). However, economic hardship is linked with other characteristics of family (e.g. parental education, parental employment, maternal care, family structure and size, single motherhood) and community (e.g. availability and access to basic services) that influence children's health and growth. Thus, children in low income families have to struggle with multiple deprivations, making them more vulnerable to negative outcomes.

Despite the potential correlation between income and its associated repercussions on a child's development, there is conflicting evidence in the literature regarding the size and significance of the effects of income (Thomas et al. 1991). It is difficult to assess or disentangle the effect of parental income on offsprings' achievements because of its association with observed and unobserved characteristics (parenting practices, innate ability, intelligence, preferences, tastes among others). Studies that have examined the true effect of parental income provide considerably different estimates depending on the population analysed, the analytical methods used and the controls included for isolating its effect (Yaqub 2000; Mayer 2002; Blanden and Gregg 2004). Mayer (1997) argues that, due to a range of unobserved parental characteristics, the direct effect of economic resources is smaller than it is generally believed to be. Indeed "once basic materials are met, factors other than income become increasingly important to how children fare" (Mayer 1997 : 148).

Furthermore, it is well known that family characteristics such as family structure, ethnicity, parental education, parental occupation, maternal age, access to basic services, quality of housing, among others play important roles in determining children's well-being (Hobcraft et al. 1984; Bicego and Boerma 1991; Hobcraft 1994; Haveman and Wolfe 1995; Pebley and Goldman 1995; Corcoran and Adams 1997; Sahn and Alderman 1997; Baker et al. 1998; Shonkoff and Philips 2000; Smith and Haddad 2000; Feinstein 2003; Behrman and Skoufias 2004). However, because of the complex interplay of these background characteristics, less is known about the causal mechanisms through which these factors influence children's outcomes. In developing countries, it is widely acknowledged that maternal education has one of the strongest and most significant associations with children's outcomes, even after controlling for the influence of other explanatory variables (Hobcraft et al. 1984; Bicego and Boerma 1991; Thomas et al. 1991; Hobcraft 1994; Ruel et al. 1999; Behrman and Skoufias 2004). However, not only parental characteristics but also parental decisions play an important role in shaping children's developmental outcomes. Evidence from Brazil, Ghana and the US show differential effects of mother's and father's characteristics on child health (Thomas 1994). In these countries maternal education has a larger effect on a daughter's height, and paternal education on a son's height.

As can be seen, the early years are a critical period for future development. Among the different factors influencing children's development, family resources – economic and non-economic – play a crucial role. The interconnection of family background characteristics places poor children at a higher risk of having detrimental outcomes because they have to cope with multiple disadvantages. As poor children age, the relationships between these factors and children's outcomes become more pronounced (Hobcraft 2000; Case et al. 2002; Mayer 2002; Case et al. 2004), suggesting that the adverse influence of these conditions have a cumulative effect. Thus, what happens early is critical, but what happens afterwards also matters because the individual is continuously influenced by the interaction of nature and nurture.

1.3. Continuity across the life course and between generations

Findings from longitudinal studies show that disadvantage during childhood can have significant and enduring consequences in adolescence and adulthood (Duncan and Brooks-Gunn 1997; Hobcraft 1998; Hobcraft and Kiernan 1999; Martorell 1999a; Hobcraft 2000; Glewwe et al. 2001; Hobcraft 2002; Feinstein 2003; Hobcraft 2003; Case et al. 2004; Sigle-Rushton 2004). Moreover, there is a high risk of transmitting these unfavourable conditions to the next generation, therefore, perpetuating the vicious circle of poverty (Chase-Lansdale and Brooks-Gunn 1995; Duncan and Brooks-Gunn 1997; Hobcraft 1998).

> "...the probabilistic life-course pattern, with its origins in childhood poverty, portends higher rates of poor health, low productivity, and dysfunction in early adulthood, all of which increase the likelihood that the next generation will be poor." (Chase-Lansdale, 1995: p 109)

Most of what we know about the patterns of transmission over the life course and between generations comes from longitudinal studies carried out in developed countries, mainly the US[3] and the UK[4]. These countries have followed up specific

[3] Longitudinal studies in the U.S. include:

WLS	Wisconsin Longitudinal study;
PSID	Michigan Panel Study of Income Dynamics;
NLS	National Longitudinal Survey;
NLSY	National Longitudinal Survey of Youth;
NLSH	National Longitudinal Study of the High School Class of 1972;
NSFG	National Survey of Family Growth;
NSFH	National Survey of Families and Households.

[4] Longitudinal studies in the U.K. include:

NSHD	National Survey of Health and Development (cohort born in 1946);
NCDS	National Child Development Study (cohort born in 1958);
BCS	British Cohort Study (cohort born in 1970);

cohorts over time, collecting detailed data that have allowed thorough analyses of the mechanisms associated with poverty. In contrast, most of what we know about the determinants of poverty in the developing world[5] comes from cross-sectional surveys or from retrospective data collected in household surveys, mainly the World Fertility Surveys (WFS), the Demographic and Health Surveys (DHS) and the Living Standards Measurement Study surveys (LSMS). Additionally, there is evidence from a few longitudinal studies (some of them reviewed in Table 1.1), but these surveys have important limitations (very small sample sizes, or few repeated observations, or the variables are not comparable between waves, or experimental studies whose target populations are disadvantaged groups). Studies of this kind are not common in developing countries because they are costly and difficult to implement and maintain.

Evidence from developing countries shows that poor health and nutritional status during the early years are associated with increased chances of child mortality, limited physical growth, delayed cognitive development, poor schooling achievements, low productivity and decreased earnings in adulthood (Martorell 1999a; Martorell 1999b; Alderman et al. 2001; Glewwe et al. 2001; Alderman et al. 2003). In a review by Reynaldo Martorell (1999a) on the consequences of child undernutrition, he finds broad evidence from experimental studies (in Guatemala, Jamaica and Colombia) and adoption studies (in Korea, Chile and Romania) of the detrimental effects of undernutrition on physical and cognitive development in middle childhood, adolescence and adulthood. Additionally, results from a longitudinal study in Peru indicate that both stunting and infectious diseases (*giardia* infections) during infancy affect children's cognitive function in late childhood (at age 9 years these health indicators were associated with an IQ deficit of 15 points) (Berkman et al. 2002). Findings from the *Cebu* longitudinal study and from rural Zimbabwe confirm these results: early childhood undernutrition limits children's cognitive performance later in life and it also affects their height in young adulthood (Alderman et al. 2003).

ALSPAC Avon Longitudinal Study of Parents and Children (cohort born in early 1990s);
BHPS British Household Panel Survey (cohort born in 1991);
MCS Millennium Cohort Study (cohort born in 2000).

[5] For convenient purposes, in this thesis we refer to developing countries as those classified by UNDP in this category. This classification groups countries into three major world aggregates: 1) developing countries, 2) Central and Eastern European and the Commonwealth of Independent States and 3) OECD countries (UNDP 2003).

Disadvantaged adults are likely to transmit the life course patterns to the next generation. Studies looking at the association between parental characteristics (income, social class, occupational status, unemployment, educational attainment, young parenthood, parental health, among others), and children's outcomes as adults, have found a strong correlation (Gregg and Machin 1998; Hobcraft 1998; Machin 1998; Hobcraft and Kiernan 1999; Behrman et al. 2001; Feinstein 2003). A good example is Hobcraft's 1998 study that finds numerous linkages between generations: children born outside marriage are more frequent among women who were themselves born outside marriage; multiple partnerships are more common among individuals who suffered from parental divorce during childhood; living in social housing as an adult is more likely among those who lived in social housing as children; low income is associated among other things with social class of origin (Hobcraft 1998). These results are quite worrying because they suggest a high degree of immobility across generations, where opportunities are mainly determined by family background and not by personal choices and/or achievements.

In developing countries, very little is known about the extent of intergenerational mobility and of its consequences on future outcomes. The main reason for this lack of knowledge is the absence of high quality longitudinal studies. One good exception is the *INCAP*[6], study, a pioneering study carried out in rural Guatemala. A recent paper using data from its last follow-up survey indicates that children who were born to mothers who had received an enhanced supplement during childhood were taller than those who were born to mothers that did not receive this kind of supplement (Stein et al. 2003), providing evidence of the association between parental and offspring health.

At present, most studies looking at intergenerational mobility in developing countries have used cross-sectional datasets and have mainly focused on one outcome, schooling achievements. The main reason for the emphasis on educational outcomes is because most of these studies come from the economic literature. Although schooling is an important mechanism through which opportunities between generations can be transmitted, there are other factors determining children's future outcomes. Despite this caveat, these studies do shed some light on the transmission of disadvantage across generations in developing countries.

---

[6] INCAP is the acronym for the Institute of Nutrition of Central America and Panama.

In recent work using retrospective data[7], Behrman et al. (2001) found that intergenerational mobility in Latin America is very limited. Their results point out that "socio-economic success, whether indicated by schooling or occupational status, hinges heavily on family background in the region" (Behrman et al 2001 :34). These results coincide with those of a study looking at social mobility in the Latin American region through the correlation of schooling achievements between siblings (Dahan and Gaviria 1999). The authors conclude that in the countries included in their analysis[8], intergenerational mobility is low and half of educational attainments (used as a proxy for socio-economic performance) can be explained by family background (Dahan and Gaviria 1999). In addition, results from an investigation using Peruvian data for 1985 and 1994 and cross-sectional data for 16 countries in the region show that family background characteristics (number of siblings, parental education and household income) are strongly associated with completion of secondary education, considered by the authors to be the minimum educational level needed to break the intergenerational transmission of poverty (Castañeda and Aldaz-Carroll 1999). Furthermore, a study looking at child labour in Brazil corroborates the strong links between generations (Emerson and Souza 2003). The authors find strong evidence that children are more likely to be child labourers if their parents were child labourers as well.

Immobility across generations in Latin America is a significant and persistent problem which is strongly linked with income inequality and lack of opportunities. What is of greater concern is that this immobility pattern is more pronounced among the poorest and the richest groups in the population (Yaqub 2000). Behrman and colleagues (1999c) suggest that in Latin America family background characteristics (parental education and household income) have a stronger influence on determining schooling gaps for children from the lowest income quintiles. If the poorest of the poor are the least mobile of all groups, then the links found across generations have a stronger connection and a more pervasive effect among this vulnerable group.

[7] The Latin American countries included in this study are Brazil, Colombia, Mexico and Peru.

[8] This paper examines the following countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.

1.4. A multidimensional and dynamic approach to poverty

The condition of poverty has different meanings depending on the timing, the setting, and the discipline in which it is analysed. There is a large debate in the literature regarding its definition, in addition to how it should be measured.

Most economic analyses measure poverty using a single indicator such as income, consumption or expenditure. This approach considers an individual as poor if his/her level of income, consumption, or expenditure lies below a minimum threshold or poverty line (World Bank 2000). That is, an individual is classified as poor if s/he is unable to acquire a minimum bundle of goods for the "maintenance of merely physical efficiency" (Rowntree 1901: 86). Another approach, used especially in Europe, is to measure income poverty in relative terms, e.g. those whose income falls below a set threshold (usually below half the mean or median of the population income) are classified as poor.

Several researchers have considered that using a single indicator to measure well-being has certain limitations. Poverty, as any other social condition, "is not restricted to one dimension, e.g. income, but it manifests itself in all domains of life" (Deleeck et al. 1992). As previously discussed, there are multiple factors that influence well-being and it would be a shortcoming to restrict the analysis to just one. Lack of income is strongly associated with inadequate living conditions, but there are other non-economic features strongly linked with well-being. Among the most influential researchers, whose focus has gone beyond the lack of material needs, is Amartya Sen. He argues that poverty must be seen not only as low income, but rather as the deprivation of a combination of capabilities (what people can do and be) which are intrinsically important to well-being (Sen 1999).

Another important feature of the definition of poverty is that its nature and characteristics differ between and within countries. In developing countries, people in poverty, experience different forms of deprivation to those in poverty in the developed world. The nature of poverty in developing countries is about struggling to satisfy the most basic needs in order to survive (Bourguignon 1999). People suffering this condition do not have enough assets to face adverse situations that affect their lives. Sen argues that in developing countries the list of basic capabilities for the extremely poor is very elementary "the ability to be well-nourished and well-sheltered, the ability of escaping avoidable morbidity and premature mortality" (Sen 1993): 31). It is important to underline that within countries there are different degrees of deprivation, where the poorest of the poor are those without access to the most basic needs, referred to as the extreme or "absolutely" poor.

In developed countries, the nature of poverty has to do much more with not having equal conditions (Bourguignon 1999). In these settings, the relatively poor are able to cover the most basic needs for the support of life, but are unable to access the commodities considered by their society and times to be necessary. This group does not have the same living standards as the rest of the population, thus their poverty is relative (Townsend 1979). An additional way of categorising these inequalities is social exclusion.

In Europe, there has been a conceptual shift from income poverty to social exclusion because it is believed to be a more comprehensive approach. This concept acknowledges that not only economic resources but numerous factors associated with disadvantage (e.g. poor educational achievements, unemployment, poor housing, health problems, lone parenthood, among others) represent an obstacle for the individual to participate fully in society (Townsend 1979; Kamerman 2001; Hobcraft 2002). Despite its added value to an income poverty measurement, it has certain limitations that have restricted its wider use, mainly there is no general agreement on its definition and there are several difficulties associated with its measurement: its relativity has an intrinsically high degree of subjectivity, making it difficult to agree on the dimensions it should include (Kamerman 2001).

It has been argued that social exclusion should complement (not substitute) our understanding of poverty. The inequality of conditions that leads to social exclusion can hinder future outcomes, especially those of children. It is therefore an important issue for social policy and research. Yet, for policy-making in societies where a major proportion of the population cannot meet its basic needs, the greater priority is to find solutions for extreme poverty.

In Latin America, a multidimensional concept of deprivation with wide application in recent years is that of marginality. Its popularity stems from the fact that it is a single indicator that comprises a set of dimensions associated with the exclusion process: educational level, access to basic services, quality of housing, degree of isolation among others. This marginality indicator is usually constructed with aggregate data at the locality or regional level, thus it cannot be used for the analysis of households or individuals. Yet, it is very useful for targeting social policies because it allows the identification of areas with greatest needs.

1.5. Interventions to improve childhood outcomes

The previous sections have shown the persistent continuities of early disadvantage over time. However, intervention studies have shown that the transmission of disadvantage can be altered if proper actions are implemented and if the timing of these interventions is opportune (Myers 1992a; Brooks-Gunn 1995; Young 1996; Waldfogel 1999; Shonkoff and Philips 2000). Timing is crucial because the cumulative effect of negative experiences makes children's development less amenable to change as they become older. For this reason, strategies that prevent the harmful effect of early experiences are likely to have greater benefits than those implementing corrective actions later in life. There is consensus that investing in early childhood can have long lasting effects, making it a cost-efficient strategy for breaking the intergenerational cycle of poverty and inequality.

Evaluations of investments in early childhood (most of them looking at early child development programmes, which are aimed at promoting child development before entrance to school among disadvantaged children) show that these initiatives yield favourable impacts not only for the child and its family but also for the society. The positive outcomes from these initiatives include higher levels of schooling, positive social behaviour and reduced social welfare costs (Myers 1992a; Young 1996; Waldfogel 1999). These studies confirm the importance of early interventions on developing numerous skills.

Equally, nutrition and health interventions in developing countries have shown that children who experienced positive effects during early childhood have benefits that translate into better outcomes later in life. Table 1.1 shows a review of longitudinal studies from developing countries which examined child health and nutritional status. The most consistent result from these studies is that nutrition interventions are most effective early in childhood, generally among children under three years of age. In the *Tezonteopan Puebla* study in Mexico, the optimal age was 3 to 20 months of age. In the *INCAP* study in Guatemala, the critical period was during pregnancy and the first 3 years of life. In the *Tamil Nadu* study in India, the most favourable age was 6 to 24 months old. Findings from the *INCAP* study illustrate the positive effect interventions can have on children's subsequent outcomes. For instance, children who received supplementary feeding during early childhood had taller stature and better intellectual performance during adolescence than those who did not receive treatment (Martorell 1995a).

On the other hand, these studies have also shown that children who receive an intervention after the age of three show only a modest short-term positive impact, which tends to diminish as children age (Guatemala *INCAP*, Philippines *Cebu*). By the age of three, many children have already experienced growth faltering; hence, it is much more difficult to improve their condition once their growth trajectory has been altered, as shown in the *Kingston* study in Jamaica. Nevertheless, there is evidence from some studies (Philippines *Cebu*, Cali Colombia, and Jamaica), that although the potential for growth catch-up is limited, malnutrition may be reversed if children are adequately nourished. Results from the *Cebu* study in the Philippines found a considerable degree of catch-up growth during childhood (from age two to eight and a half years), especially among children who were not born with low birth weight or who were not severely stunted in infancy (Adair 1999). On the other hand, there is evidence of few opportunities for growth catch-up in adolescence among stunted children who grow up in poor environments (Adair and Guilkey 1997); these children are likely to remain stunted in adulthood (Martorell et al. 1994). Hence, these findings emphasize the need to prevent stunting from an early age.

Recent findings from a follow-up study of the INCAP Guatemalan cohort have shown that positive effects on early childhood nutrition can be transmitted to subsequent generations (Stein et al. 2003). Their results show that children born to women who received a fortified supplement (*atole*) during childhood were taller than those whose mothers received a low-energy supplement (*fresco*).

A crucial finding from the studies in Table 1.1 is that interventions can mitigate the effects of inequalities in child health. Results from these investigations have shown a larger impact among the most disadvantaged. A study carried out in Bogota, Colombia, noted that in most domains the largest intervention effects were found among children whose parents had very few years of education (Myers 1992). Additionally, results from the *INCAP* follow-up study indicate that the intervention helped attenuate differences in school performance by socio-economic status (Martorell 1995a). These interventions provide a valuable substitute for lack of resources; hence, those more deprived are likely to benefit more from the benefits received.

An important characteristic of successful programmes is that they combine strategies to improve child health outcomes (Haiti). They not only provide food supplementation; but they also offer health services to treat and prevent diseases, provide educational sessions on nutrition, reproductive and health issues, and promote community participation. It is a complex task to try to identify which of these activities has the greatest impact on health outcomes. However, studies with different combinations of treatment (*Kingston*, Jamaica, *Narangwal* India and *Bogota*, Colombia) have shown that children who received more than one treatment component do much better than those who only receive one treatment or none.

Unfortunately, not all interventions have shown positive results. The main reasons for this are to do with the fact that these programmes are expensive and difficult to manage. Moreover, results are not always evident in the short run. Some of the studies included in Table 1.1 show no programme effects on anthropometric outcomes mainly because improving malnutrition was not the main objective; hence, the provision of supplements was not consistent (PRONOEI in Peru, PROAPE in Brazil, *Hogares Comunitarios* in Colombia). On the other hand, there is evidence that the effect of interventions may reduce over time. In *Cali*, Colombia, two years after programme intervention, the positive impact on cognitive performance had declined (Myers 1992). Likewise, in Jamaica, four years after intervention, there was no evidence of an effect of supplementation or stimulation on growth (Walker et al. 1996).

A new approach to childhood interventions

During the past decade, a new type of anti-poverty approach promoting investments in human capital has been implemented in numerous countries, especially in Latin America. The argument behind investing in human capital – improvements in education, health, nutrition and other dimensions associated with human development – is that economic growth is necessary but not sufficient for diminishing poverty. If people do not have the capabilities to make use of the different available goods, then they cannot profit from any kind of development or economic growth (Psacharopoulos and World Bank. 1995).

The previous sections showed the strong influence parental resources have on children's initial and future outcomes. Poor families allocate most of their resources to basic needs, leaving them with limited resources (money, time and energy) for investing in children's human capital (Becker and Woytinsky 1967). In countries where parents are the only source of investment in children, family resources play a crucial role on influencing children's attainments. Thus, in order to improve children's life chances it is necessary to promote policies that support families in making investments in the human capital of their children. Moreover, in settings where extreme poverty is a significant and persistent problem and where resources for social assistance are limited, efforts should prioritise improving the living conditions of the extremely poor as they lack the means to exit this negative state.

During the past decade, a new type of anti-poverty approach promoting investments in human capital has been implemented in numerous countries, especially in Latin America. This new approach was initiated in Mexico with the implementation of Progresa and has expanded to other countries in the region: Bolivia, Brazil, Chile, Colombia, Ecuador, Honduras, Jamaica and Nicaragua. The aim of these programmes is to strengthen the positive and mitigate the negative effects that family background has on children's outcomes. Through an increase in capabilities, poor individuals may accumulate human capital and hence increase the chances of breaking the intergenerational transmission of poverty. An important feature of these interventions is that most of them provide benefits in more than one area (education, health and nutrition) since the positive interactions between these factors are likely to be synergistic. Moreover, benefits are targeted towards families in extreme poverty with a special focus on children, the most vulnerable group in the transmission of disadvantage.

Table 1.1 Longitudinal studies of Child Health and Nutritional Status in Developing Countries

Gambia *The Gambia*	Duration	Started 1949 – currently operating. Several stages. Between 1979 - 1993, growth and morbidity were documented routinely.
	Intervention components	Macronutrient and micronutrient (iron) supplementation. Treatment and prevention of diseases (malaria).
	Target groups	All children under 2 years of age from Keneba and two neighbouring villages
	Evaluation design	Before/After
	Sample size	1,190 children aged 0-2 years
	Topics studied	Nutrition in childhood, pregnancy, and lactation; morbidity
	Findings	• Reduction in mortality among young children; • Reduction in prevalence and duration of illnesses (diarrhoea); • Improvements in diarrhoeal disease have not been associated with increased child growth; • Populations with a high prevalence of diarrhoea and undernutrition need nutritional supplementation with a high energy-protein supplement to promote rapid catch-up growth and nutritional recovery.
	Reference	(Poskitt et al. 1999)
Guatemala *Santa María Cauqué study*	Year/ Duration:	The community was part of a previous study in 3 predominantly Mayan villages that took place between 1959 and 1963. Period: 1963 - 1972
	Intervention components	Minimised during study Three programmes implemented: • Improvements of medical care and hygiene; • Improvement of diet through maize fortification; • Improvement of housing and income after 1976 earthquake.
	Target groups	All cohorts of mothers and infants of the village between 1963 and 1972
	Evaluation design	Long-term prospective observational study
	Topics studied	The study gathered a rich set of biological and sociological data
	Findings	• Lessons on determinants of health and survival in less developed populations; • Infections main cause of poor health, malnutrition, growth retardation, and death of infants and young children; • At end of maize fortified intervention, no significant changes in means of birth weight, nor in rates of infectious diseases, nor in growth velocity;
	Reference	(Scrimshaw 1995)

India *Narangwal, Punjab*	Year/ duration	Period: 1967-1973
	Intervention components	Two research projects: 1. Maternal and child services with family planning 2. Health and nutrition • Nutrition supplementation and nutrition education
	Target groups	Children <3 years of age
	Evaluation design	*Health and Nutrition project (10 villages):* • Control: 3 villages • Nutrition care: 2 villages • Health care: 2 villages • Nutrition and health care: 3 villages
	Sample size	Nutrition project: 12,800
	Topics studied	• Census on demographic and socio-economic characteristics carried out at three points: 1967,1971,1973; • Vital statistics collected from 1969 -1973; • Child morbidity collected weekly; • Anthropometric data collected monthly.
	Findings	• Nutrition supplementation alone or with health care significantly increased weight and height in children over the age of 17 months; • Perinatal and neonatal mortality was significantly reduced in nutritional supplementation and health-care villages; • Reduction in duration of acute infections, no change in incidence; • Psychomotor tests showed that combination of supplementation and health care had a synergistic effect on children.
	Reference	(Taylor and Sweemer 1997)
Mexico *Centro Rural de Tezonteopan, Puebla*	Intervention components	Food supplementation provided to pregnant women and children from 12 wks of age up to 10 yrs of age. Type of supplement changed with age
	Target groups	Newborns followed up until young adulthood (17 to 22 years old)
	Evaluation design	Case study, not epidemiological survey Treatment and control group
	Sample size	36 individuals
	Topics studied	• Behavioural studies during early childhood and school period; • Neurological, psychological, and cognitive measurements; • Morbidity records.

	Findings	• Food supplementation benefited infant behaviour, child IQ, performance at school (repetition 1st grade:0% (control 35%), behaviour at adolescence, and adult body size; • Optimal age for nutrition interventions 3 to 20 months of age; • Complemented with prenatal care and primary health measures.
	Reference	(Chávez et al. 1995)
Guatemala *INCAP* *Rural 4 villages*	Year/ duration	First stage: Jan 1969- Sep 1977; with 3 follow up surveys: 1. 1988-1989 2. 1991-1996 3. 2001-2006
	Intervention components	Food supplementation (*atole* or *fresco*) All villages received similar medical care
	Target groups	Children < 8 years old (cohorts 1962 up to 1977)
	Evaluation design	Random assignment into 2 treatment groups: • 2 villages were provided a high energy, moderate protein drink *atole* • 2 villages received a low energy, no-protein drink *fresco*
	Sample size	2,169 children baseline 1,574 follow-up study
	Topics studied	• Maternal characteristics, prenatal period, and pregnancy outcomes; • Children's growth, diet consumption, morbidity, and psychological development; • Adolescent's body size, work capacity, school attendance, and intellectual performance.
	Findings	*Short-term effects:* • Improved birth weights; • Reduced infant mortality rates; • Improved growth rates among children < 3 years of age; • No effects after 3 years of age on physical growth; • Earlier school enrolment. Academic performance: no effect. *Long-term effects:* • Individuals exposed to *atole* during first three years of life were taller, had greater fat-free masses, improved work capacity (males only), and enhanced intellectual performance. *Other:* • Greatest impact on growth and intellectual performance when targeting vulnerable periods: pregnancy and first 3 years of life; • Greatest effect observed among low-socioeconomic status subjects.
	Reference	(Martorell 1995a; Martorell 1995b; Martorell 1999a)

Haiti *Projet Intégré de Santé et de la Population*	Year/ duration	Period: 1974-1978
	Intervention components	Series of health interventions (oral rehydration therapy), food supplementation, nutrition surveillance, nutrition education, family planning, and community participation
	Target groups	All family members with special focus on children and women in reproductive ages
	Evaluation design	3 census
	Sample size	33,000 inhabitants
	Topics studied	Demographic characteristics, epidemiologic data, nutritional status, economic characteristics, and anthropologic data
	Findings	• Decline in infant and child mortality rates; • Nutrition intervention prevented stunting; • Malnourished children with food supplementation had lower morbidity rate; • Death rates among malnourished children significantly decreased if mother participated in nutrition-health education programs.
	Reference	(Berggren et al. 1997)
Mexico, Kenya, and *Egypt (rural areas)* *"Food Intake and* *Human Function," the Nutrition Collaborative Research Support Program (NCRSP)*	Year / duration	Designed late 1970s and implemented early 1980s Follow up for one to two years
	Intervention components	None
	Target groups	Three cohorts of children of different ages, their parents and other household members
	Evaluation design	Observational study
	Sample size	250 households in each country
	Topics studied	• Food intake, growth patterns over time, morbidity, and household and environmental characteristics; • Study mothers before, during and after pregnancy and their newborns for at least the first 6 months of life.
	Findings	• Poor maternal nutritional status had an adverse effect on breastmilk composition. • Growth failure occurred very early in life (3-4 months after birth), causing permanent growth stunting and functional deficits. • Early growth stunting associated with current and later performance (cognitive scores, verbal comprehension, school performance, and behavioural outcomes).
	Research	Funded by USAID
	Reference	(Allen 1995)
India	Year	One of numerous small studies of ICDS in India. The national trial cover 17.8 million children (<6 yrs). Largest programme in the world. 1975 to present

Integrated Child Development Service (ICDS): Dalmau Project	Intervention components	Nutrition supplementation, Immunisation, health checkups. Education, non-formal pre-school education
	Target groups	Children aged 6-8 in primary school
	Evaluation design	Comparison group: children in adjoining area not participating in ICDS but similar in socio-culture, geographic, anthropological features. Villages within area selected randomly
	Sample size	Children aged 6-8 in primary school 214 ICDS 205 non ICDS
	Findings	• Girls entrance by ICDS at earlier age (85% vs. 74% by age 6) • Regular attendance for ICDS (88% vs. 74% had average or above attendance record) • Teacher rating: Scholastic performance by ICDS: 90 (Others:76). Behaviour: 93 (Others:81)
	Reference	(WHO 1999; World Bank 2004)
India *ICDS Haryana State*	Intervention components	Nutrition supplementation, Immunisation, health checkups. Education, non-formal pre-school education
	Target groups	Children in primary school
	Evaluation design	Comparison group: children from same area who did not participate in ICDS.
	Sample size	Children in primary school:1,271 ICDS 436 non-ICDS
	Findings	• Right age for grade by caste: lower caste:80 (others:56),middle caste:75 (56), higher caste:82 (59); • Dropout rates by 3d grade by caste: lower caste:19 (others:35), middle caste:5 (25), higher caste:7 (8). • Teacher assessment: "Overwhelming majority of the children in top 10 to 20% had 2 to 3 yrs of exposure to Anganwadi. Their attention span and retention power were both superior."
	Reference	(World Bank 2004)
India *Tamil Nadu Integrated Nutrition Project I*	Year/Duration	Approved 1980 and completed 1989
	Intervention components	• Supplementary on-site feeding with limited duration (90 days) • Nutrition and health education (management of diarrhoea) • Primary health care (administration of vitamin A, periodic deworming) • Monthly growth monitoring.
	Target groups	Children 6-36 months old if they were identified as severely malnourished or if they had incipient malnutrition, and pregnant and nursing women.
	Sample size	9,000 villages in 173 rural blocks

	Evaluation design	Before/After
	Findings	• Substantial effects on reducing levels of severe malnutrition (50 percent), and modest effects on moderate malnutrition (14 percent). • Greater impact among children 6 to 24 months old • Inputs must begin prior to the age of 6 months to yield significant impact on malnutrition and morbidity.
	Reference	(Balachander 1993)
Philippines *CEBU Longitudinal Health and Nutrition Survey*	Year/ Duration	Baseline: May 1983-April 1984 First follow-ups: immediately after birth, bimonthly for 24 months Follow-up surveys: 1)1991-1992 2)1994-1995 3)1998-1999
	Intervention components	None
	Sample size	Baseline sample: 3,080 non-twin live births; 2,600 households
	Topics studied	Survey began as a study of infant feeding patterns and practices. Afterwards, included other topics such as prenatal care, birth weight, infant morbidity, maternal diet, use of medical care, sanitation, achievement tests.
	Findings	• Quality and accessibility of care had important effects on prenatal patterns; • Prenatal interventions needed to optimise birth weight; • Promotion full breastfeeding positive in early postnatal period; • Early interventions are vital to prevent stunting; • Preventive health care in order to protect against diseases; • Better nourished children perform significantly better in school: enter school earlier and have greater learning productivity.
	Reference	(Adair and Guilkey 1997; Glewwe et al. 2001)
Jamaica *Kingston poor urban neighbourhoods*	Year/ duration	Started in 1986 2 years of intervention Follow-up 4 years after intervention ended
	Intervention components	Nutritional supplementation and/ or stimulation
	Target groups	Children 9-24 months of age who were malnourished at baseline

	Evaluation design	Random assignment into 4 treatment groups: 1. Nutritional supplementation 2. Stimulation 3. Both treatments 4. Control Before/After
	Sample size	129 stunted children and 32 non-stunted children
	Topics studied	Cognitive function, school achievement, motor tests, anthropometry
	Findings	• Children who received both interventions did better than those who only received stimulation; • Positive effect on anthropometric measures at the end of intervention; • No significant effects of supplementation or stimulation on growth at follow up (4 years after intervention ended); • Severe malnutrition affects behavioural and cognitive development of children; • Lon-term benefits of supplementation may not be achieved if intervention begins after age 12 months in children who have already become undernourished.
	Reference	(Walker et al. 1996)
Colombia *Bogota*	Intervention components	Food supplementation and/or stimulation according to ages Health care, free obstetric and paediatric care
	Target groups	Families where mothers were in first trimester of pregnancy and at least half of children were <85% weight for age as compared with Colombian reference standards
	Evaluation design	Random assignment into treatment groups: 1. Food supplementation mother 2. Food supplementation child (3 months – 3 years) 3. Early childhood stimulation (birth – 3 years) 4. Early stimulation and nutrition 5. Control Before/After
	Sample size	443 families
	Topics studied	Dietary intake, feeding practices, infant and child morbidity, anthropometric measures

	Findings	• Periods of greatest response coincide with weaning period (3-6 months) and with peak incidence of diarrhoeal diseases (9-12 months); • Length is more responsive than weight to supplementation; • Strongest effect among fully supplemented and home-visited group; • Largest effects in most domains found among most disadvantaged children; • Earlier age of enrolment 5.6 yrs. (control 6.4 yrs.) and greater learning productivity (school repetition 4% (control 13%)).
	Reference	(Myers 1992) (Lutter et al. 1990)
Colombia *Cali*	Intervention components	Food supplementation Health surveillance / care Health and Nutrition education
	Target groups	Children 3 - 7 years old
	Evaluation design	Random assignment into treatment groups: 1. 4 years beginning age 3 2. 3 years beginning age 4 3. 2 years beginning age 5 4. 1 year beginning age 6 Control groups: 1. No treatment, low income group, normal weight and height 2. No treatment, high income group Before/after
	Sample size	333 malnourished children in low-income families
	Findings	• Treatment children showed significantly greater cognitive ability than low income control group, during and immediately after intervention; • Cognitive gains were related to age of initiation and duration of treatment; • Two years after intervention, cognitive effects were still evident, although reduced.
	Reference	(Myers 1992)

Peru *PRONOEI, non-formal Program in Initial Education*	Year:	Initiated small scale 1967, expanded in mid-1970s.
	Intervention components	An "alternative" to the traditional pre-school being offered by the Ministry of Education: non-formal preschool, nutrition supplement (not a consistent focus of programme), community improvement projects.
	Target groups	Children 3 to 5 years old
	Evaluation design	Comparison group: children in non-PRONOEI villages with partial attempt to match on SES status. Before/ after
	Sample size	334 children
	Topics studied:	Testing of mental, motor and social development with locally developed scales
	Findings	• Effects on anthropometric indicators not seen, except gap between boys and girls was less prominent in some PRONEI groups. Lack of effect not surprising not main focus of programme; • Enrolment age: lower; • Progress: no difference in 1st or 2nd grade promotion rates; • Grades: no difference.
	Reference	(WHO 1999; World Bank 2004)
Chile *Osorno Parents and Children Project (PPH*	Intervention components	Health/nutrition education. Child development education. Community development.
	Target groups	Children 4 to 6 years old
	Evaluation design	Comparison group: children in same class who did not participate in programme
	Sample size	Children in 52 communities
	Findings	• Percentage rated as good: Teacher rating: 71 (Others:39), parental assessment: Better
	Reference	(World Bank 2004)
Colombia *PROMESA*	Year:	Started in 1978 with 100 families
	Intervention components	Health/nutrition/child development education. Early stimulation program. Community improvement projects.
	Target groups	Children 0 to 7 years old
	Evaluation design	Comparison group: children from same communities who did not participate in PROMESA.
	Sample size	4 rural communities in pacific coast of Colombia

	Findings	• Enrolment 1st grade: 100% (others:87%); • Reached grade 2: 83% (others:77%) ; • Reached grade 3: 73% (others:44%) ; • Reached grade 4: 60% (others:30%) .
	Reference	(World Bank 2004)
Colombia *Hogares Comunitarios de Bienestar*	Year:	Started in 1980s up to date
	Intervention components	Community mothers (CM) hold around 15 children from 0 to 7 years old five days a week. CM provide protection, educational activities, and food. Children were weighed and measured at least three times a year.
	Target groups	Children 2 to 5 years old
	Evaluation design	Nation wide probability sampling of community homes.
	Sample size	Centres in 1042 municipalities, 882,000 children, 54.3% of target pop. of poorest families
	Findings	• In general, no evidence for improvement in nutritional status.
	Reference	(WHO 1999)
Brazil *Alagoas Programa de Alimentaco de Pre-escolar PROAPE*	Year:	Pilot began in 1977, not currently operating.
	Intervention components	Health surveillance (check-ups, immunisation dental care, hygiene, visual examinations). Nutrition supplement. Pre-school
	Target groups	Children 3 to 6 years old
	Evaluation design	Comparison between children from different pre-schools with non preschoolers in first grade
	Sample size	184 PROAPE; 556 CASULO; 320 Kinder; 334 No preschool
	Findings	• Marginal impact on physical growth, same reasons for PRONOEI • Dropout 1st grade: 18% (others: 14%); • Repetition rate: 9% (others: 33%); • Dropout + Repeat: 27% (others: 47%).
	Reference	(World Bank 2004); (WHO 1999)
Brazil *Sao Paolo CEAPE*	Intervention components	Cognitive enrichment. Nutrition.
	Target groups	Children 4 to 6 years old
	Evaluation design	CEAPE vs. non-CEAPE children from same community
	Sample size	CEAPE - 268 No-CEAPE-268
	Findings	• Repetition 1st grade: 26% (others: 44%); Repetition 2nd grade: 6% (others: 26%).
	Reference	(World Bank 2004)

1.6. Conclusions

The literature review in this chapter has shown that growing up in poverty has deleterious and long lasting detrimental effects on future attainments. Throughout the lifespan, an individual's development is continuously influenced by the interaction between nature and nurture. Thus, children born into disadvantage have higher odds of being exposed to negative influences that affect their growth and development. Furthermore, if children grow up in deprived environments, the exposure to negative experiences and their corresponding consequences are likely to continue over time.

The early years are a crucial stage of life because in this period individuals set the grounds for subsequent achievements. Deficiencies suffered during these years are more difficult to catch up in later life. Thus, experiencing poverty during the early years has a more detrimental effect than if it was experienced at any other stage of life. Not only the timing but also the duration of poverty has important consequences for future outcomes. Children living in persistent poverty are worse-off than those experiencing transitory poverty because they are vulnerable to risks for a longer period and have to cope with the cumulative effects of their unfavourable situation.

A large body of research has documented the significant and consistent associations between family resources, whether economic or non-economic, and children's well-being. It has been argued that there is an unquestionable influence of income poverty on children's outcomes, but that economic hardship is not the only factor influencing children's performance. Poor families have multiple disadvantages that are interconnected, placing children at higher risk of poor outcomes in adolescence and adulthood. Although not all children growing up in poverty are doomed to failure, there is a strong likelihood of transmitting disadvantages over the life course and across generations.

The nature and characteristics of poverty differ between and within countries. In developing countries, people living in extreme poverty lack the capabilities to access the most basic needs for survival: nutrition, health, education, shelter. In these deprived settings, families have limited resources for investing in children's human capital. Thus, in order to improve children's life chances it is necessary to promote policies that support families in making investments in children. Alleviating poverty in childhood can help prevent the entrapment of poverty.

In recent years, a new type of intervention to alleviate poverty has been implemented in numerous countries, especially in Latin America. The main objective of this approach is to increase the capabilities of poor individuals in accumulating human capital in order to break the intergenerational transmission of poverty. The target population is families in extreme poverty, with a special focus on children.

The aim of this research is to assess whether Progresa improved children's life chances during its first three years of intervention. This will be investigated by analysing the effect this government intervention has had on improving children's health and nutritional status. We focus our analysis on children under the age of five because as this chapter has shown experiences during the first years of life are crucial for shifting the odds towards more favourable outcomes. It is important to look at the impact on children's health and nutritional status because these outcomes influence the accumulation of human capital in subsequent stages of life. Moreover, health is an important channel of the intergenerational transmission of disadvantage. Thus, to assess whether Progresa improves the life chances of its beneficiaries, it is necessary to evaluate whether it has strengthened young children's basis for future attainments.

The longitudinal studies reviewed in Table 1.1 have provided valuable lessons and have contributed to the design and implementation of child health related interventions. However, not all of them have the characteristics needed to evaluate with objectivity and precision the effectiveness of an intervention. Ideally, to identify the multiple causes of a specific event and to assess the performance of an intervention, studies should collect longitudinal data from a randomised controlled trial. Yet, studies of this kind are not common because they are costly and difficult to implement and maintain. One of the key and successful aspects of Progresa is its evaluation design, which provides a unique opportunity to assess changes over time and to evaluate the impact of the Programme in its different strands.

The analyses in this thesis are carried out using longitudinal data from a randomised treatment and control survey. We use special statistical techniques for the analysis of panel data, taking into account special characteristics of the data such as its hierarchical structure. The findings from this research aim to provide useful recommendations for child poverty alleviation strategies in developing countries. With this aim in mind, the thesis shall be developed as follows:

Chapter 2 provides the context of this research. It describes Mexico's inequality profile, reviews the progress made in socio-economic indicators, and gives a detailed explanation of Progresa's characteristics. This chapter shows that Mexico is a country with enormous inequalities, where the benefits of social progress have not reached the entire population. According to official statistics, at the time Progresa was launched, in 1998, 26.8 percent of households (or 33.9 percent of individuals) lived in extreme poverty. Moreover, our estimates suggest that between 34.4 and 48.3 percent of Mexican children grow up without access to the most basic needs. Progresa is a nation wide anti-poverty programme, whose main objective is to improve the basic capabilities of the poorest families in the country. It has an integral approach, giving benefits in three areas closely linked to each other: education, health, and nutrition. In this chapter, studies that have carried out assessments on the performance of Progresa will also be reviewed. We will also highlight those aspects which must be analysed more closely in order to answer whether Progresa is improving the life chances of these families.

Chapter 3 presents the conceptual framework underpinning this research, explains the data sets and the analytical approaches used for answering the research questions, and presents the findings of an assessment on the quality of the data. Results from our data quality analyses highlight the need to control for observed and unobserved differences as the randomisation of the samples is not perfect. Additionally, this assessment indicates that our sample experienced selective attrition. However, we observed no differences in the attrition of treatment and control households, thus our comparisons between these two groups will not be affected by attrition patterns.

Chapter 4 examines the impact of Progresa in improving households' food security, as measured using caloric availability and dietary diversity. Although our main interest is to examine child-centred outcomes, we look at this household indicator as a proxy for children's dietary intake. Our estimates show that Progresa had a positive, albeit if only, by having a protective effect on access to calories. In contrast, dietary diversity showed a positive Programme effect, suggesting that beneficiary households incorporated more diverse products into their diet than their control peers.

Chapter 5 explores whether there have been any changes in child feeding practices since Progresa's implementation. In order to do so, we examine the duration of breastfeeding and exclusive breastfeeding, and look at the type of food products first introduced into children's diet. This analysis is relevant because certain activities of the Programme (educational sessions on heath related issues) could promote healthy behaviours, but others (provision of supplements) could have a negative influence. Moreover, identifying the patterns prevailing in these localities allows us to better understand the findings of the following chapters. Our results indicate that child feeding practices in these rural localities are far from optimal, especially with regard to exclusive breastfeeding.

Chapter 6 estimates the impact of the Programme on reducing the prevalence of diarrhoea and respiratory infections, which are still the most common childhood diseases in developing countries. Positive outcomes in morbidity risks are essential to observe positive outcomes in nutritional status. Our results show some evidence that Progresa contributes to reducing the morbidity risks, specifically that of children aged between 24 and 47 months, with a stronger effect for diarrhoea than respiratory infections.

Chapter 7 evaluates whether Progresa's activities improve children's nutritional status, using anthropometric indicators, specifically weight for age and height for age. These outcomes are of special interest because anthropometric indicators are recognised as good measures of child well-being. We control for the effect of Progresa's supplement to assess whether this in-kind benefit is having a positive influence or not. We find little evidence of a Programme effect on children's nutritional status.

Chapter 8 presents a summary of the conclusions of our analytical chapters, discusses some of the policy implications drawn from our study, and provides a brief overview of possible areas for future research.

Chapter 2. Contextual Background and Introducing Progresa

2.1. Introduction

In order to better understand the aim of this thesis, in this chapter, we will present the contextual background. In the next section, we give an overview of Mexico's socio-economic inequalities, describe the progress achieved in relation to different social indicators, and provide estimates of the prevalence of household and child poverty. In Section 2.2, we present the anti-poverty policies implemented by the government during the last decades of the 20th century. In Section 2.3, we explain in detail the main features of the Education, Health and Nutrition Programme (Progresa), and summarise the main findings of other studies examining its performance. Finally, in Section 2.4, we present a brief review of the conditional cash transfers that have recently been implemented in Latin America, largely influenced by Progresa's results.

2.2. Mexico's inequality profile

During the second half of the last century, Mexico's economic situation was unstable, characterised by a combination of crises and of small periods of recuperation and growth (Lustig and Székely 1997). Despite these fluctuations, Mexico is considered to be an upper-middle income country (World Bank 2000). Recent statistics show that, although there is still progress to be made, at the macro level, social indicators have continuously and significantly improved, often approaching the levels of more developed countries (see Table 2.1). For instance, between 1950 and 2000, life expectancy at birth, an indicator of health conditions, increased by 52 percent, from 49.6 to 75.3 years. Hence, by the year 2000, the number of years a Mexican newborn could expect to live was close to that of a child born in the same year in an industrialised country which is that of 78 years (UNICEF 2001). According to the Human Development Report, Mexico is classified as a country with high level of human development; with a Human Development Index (HDI) of 0.8, placing it 55th out of 175 countries[9][10] (UNDP 2002).

---

[10] The HDI synthesizes in a single measure three important aspects related to development: life-expectancy (health), literacy and schooling (education), and GDP per capita (economic level). The Human Development Report classifies this index into three ranges: high (HDI between 0.80 and 1.0), medium (HDI between 0.50 and 0.79) and low (HDI under 0.50).

Table 2.1
Education and Health Indicators, Mexico 1950-2000

	1950	1960	1970	1980	1990	2000
Illiteracy rate (%)	43.4	34.6	24.7	16.6	12.4	9.1
Average years of schooling	2.1	2.8	3.7	5.4	6.3	7.8
Life expectancy	49.6	57.8	61.7	67.0	71.4	75.3
Under-five mortality rate[1]	126.6	94.5	79.0	53.0	36.6	24.9
Total Fertility Rate	6.6	7.2	6.8	4.7	3.4	2.4

Notes: 1) Deaths per 1,000 births.
Source: Censo de Población y Vivienda INEGI.Estimaciones del Consejo Nacional de Población, CONAPO.

In 2000, the United Nations compiled a set of targets known as the Millennium Development Goals (MDG) aimed at following up and reinforcing the 1990 World Summit[11] and other international conference commitments, and intended to be achieved by the year 2015. One of the main priorities of the MDGs is to reduce extreme poverty by half between 1990 and 2015 (World Bank 2004) as well as to improve children's well-being. The targets that could have a positive influence on child outcomes include:

- halving the proportion of the population that lives in extreme poverty (defined as those living below US $1 per day);
- halving child malnutrition (prevalence of underweight children);
- reducing under-five and infant mortality rates by two thirds;
- reducing maternal mortality by three-fourths;
- achieving universal primary education;
- achieving completion of the first four years of primary education;
- providing universal access to safe water.

Table 2.2 presents Mexico's progress with respect to the MDGs. In order to help identify whether these goals have been met, the last column shows the level that each indicator should reach by 2015. It can be seen that there have been advances in some areas (child malnutrition, vaccination coverage, enrolment in primary

[11] The 1990 World Summit for Children established a set of goals aimed at improving children's survival, health, nutrition, education and protection by the year 2000 (UNICEF 1995). Between 1990 and 2000, some progress was made in improving child health and nutrition indicators, but very few goals were met.

school, access to safe water and sanitation) but that there is still much to be done in others (poverty incidence, maternal mortality, infant and child mortality). The major achievement of the past decade was in reducing child malnutrition by 47 percent, thereby practically achieving the World Summit Goal and by consequence the MDG as well.

However, because of the great inequalities prevailing in Mexico the progress achieved in socio-economic indicators does not represent improvements in the welfare of the whole population. It has been argued that a significant limitation on international goals such as the WSG and the MDG is that health targets may overlook the outcomes of the poor. Health targets are set at the national level; hence, progress may not necessarily reflect gains among the most disadvantaged groups (Gwatkin 2002).

Mexico is a country with enormous inequalities; thus a huge number of Mexican families have been left out of this progress. The income distribution is a clear example of the prevailing disparities. For 2000, estimates of the World Bank indicate that while the poorest 10 percent of families in the country received 1.0 percent of the total income of the country, the 10 percent with the highest income received 43.1 percent (World Bank 2005). In comparison, in Denmark, a country with low inequality, families in the lowest 10 percent of the income distribution received 2.1 percent of the total income and families in the highest 10 percent received 21.3 percent (World Bank 2005). Mexico's unequal distribution is also captured by the Gini coefficient, a measure of income inequality[12], whose value for 2000 was equal to 0.55. This figure is close to the Latin American average, 0.52 (World Bank 2003), which is the region with the highest inequality in the world. Mexico's income inequality is in part explained by its unequal access to education and other basic services.

[12] The Gini coefficient's value ranges between 0 and 1; approaching 1 as inequality increases. Among the 175 countries assessed by UNDP in 2003, the Gini coefficient ranged between .25 in Denmark to .71 in Namibia (UNDP 2002).

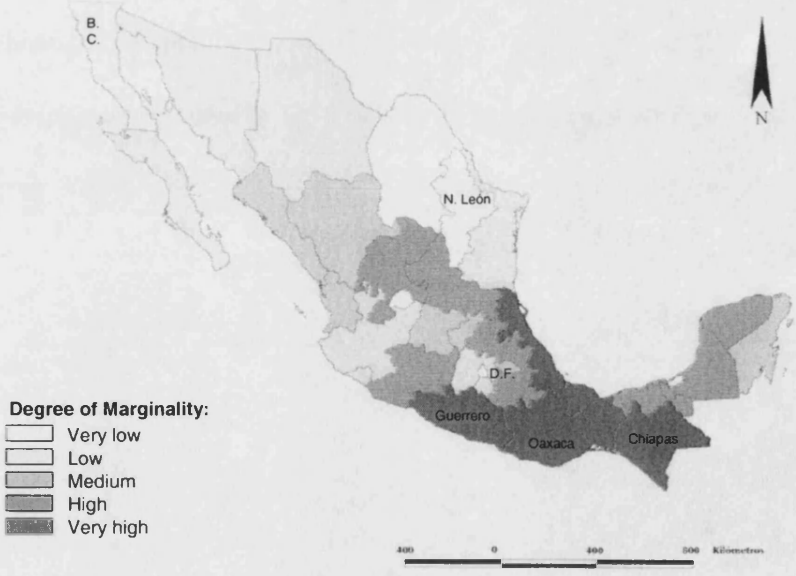
Table 2.2
Millennium Development Goals: Some Indicators Mexico 1990-2000

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	*Goal*
Poverty and hunger												
Proportion population below USD$1 a day	-	-	14.9	-	-	-	17.9	-	15.9	-	13.2	***7.5***
Prevalence of underweight children (under 5 yrs.)	14.2 (1988)	-	-	-	-	-	-	-	-	7.5	-	***7.1***
Child mortality												
Under-five mortality rate1/	44.7	37.0	33.5	32.3	31.8	31.3	30.1	29.1	28.0	26.2	25.2	***14.9***
Infant mortality1/	34.7	30.3	28.0	26.6	26.5	25.9	24.9	24.4	23.6	22.1	21.5	***11.6***
Maternal health												
Maternal mortality rate2/	6.2	5.9	5.9	5.4	6.0	6.3	5.7	5.6	6.4	6.4	6.1	***1.6***
Contraceptive prevalence rate3/	52.7 (1987)	-	63.1	-	-	66.5	-	68.5	-	-	70.8	***n.a.***
Vaccination												
Infants	-	-	-	75.3	87.4	87.9	91.8	89.6	93.5	92	95.5	***n.a.***
Children 1 to 4 years old	46.0	78.0	92.5	91.7	95.3	95.6	97.0	97.1	97.2	97.6	98.3	***n.a.***
Education												
Net enrolment in primary school	-	-	-	-	-	94.1	93.8	93.5	93.7	94.2	94.4	***100.0***
Completion of primary education	70.1	71.6	72.9	74.2	77.7	80.0	82.8	84.9	85.8	84.7	86.3	***95.0***
Environmental sustainability												
Proportion population with access to safe water	77.7	79.0	80.4	81.3	82.2	84.2	85.0	85.7	86.4	87.4	88.5	***100.0***
Proportion population with access to sanitation	61.3	62.4	63.8	64.6	65.7	72.1	72.4	72.4	72.4	73.1	76.5	***100.0***

1/ Deaths per 1,000 children in that age group, adjusted for underregister
2/ Deaths per 10,000 births
3/ Percentage of married women of reproductive age using traditional or modern contraceptive methods. Fuente: La Situación Demográfica de México 1999, Consejo Nacional de Población
Source:(Argáiz et al. 2003).

Additionally, economic and social indicators present remarkable differences between regions and between urban and rural[13] localities. According to the HDI and the marginality index constructed by the National Council of Population (CONAPO)[14], the highest levels of marginality are located in the southern states of the country, specifically in Chiapas, Guerrero and Oaxaca (see Figure 2.2 and Table 2.3). In contrast, the states with the lowest levels of marginality are located in the northern region (Nuevo León and Baja California) and in the Federal District (D.F.), where the capital city is situated. Table 2.3 shows the considerable gap in socio-economic indicators between the three least deprived and the three most deprived states of the country. For instance, the proportion of children in the first year of primary school with low height for their age was almost 10 times higher in Chiapas than in Baja California (44.1 percent and 4.8 percent, respectively). These striking differences are largely explained by the fact that the northern states are much more industrialised, have higher rates of human capital, and enjoy more favourable geographic conditions. In contrast, the southern states have cumulative lags in all these domains.

Figure 2.1 Mexico's States by CONAPO's Marginality Index



Source: CONAPO (1998)

---

[13] Unless otherwise specified, we referred to rural localities as those localities with less than 2,500 inhabitants.

[14] This index is a linear combination of nine socio-economic variables: illiteracy (%), incomplete primary education (%), households without sewage (%), households without electricity (%), households without water (%), households with crowding (%), households with mud floor (%), population living in localities of less than 5,000 inhabitants (%), monetary income below twice the minimum wages (%). It classifies the entities, municipalities and localities in five groups according to their marginality level: very high, high, medium, low, and very low (CONAPO and Progresa 1998).

Table 2.3
Socioeconomic Indicators for the Least/Most Deprived States

	D.F.	Nuevo León	Baja California	Oaxaca	Guerrero	Chiapas
Infant mortality rate[1]	16.6	15.2	15.1	31.3	57.7	36.8
Child malnutrition (%)[2]	7.2	7.3	4.8	43.4	33.7	44.1
Average years of schooling[3]	9.1	8.3	7.8	5.2	5.7	4.8
Children finish primary school (%)[4]	95.9	94.6	96.3	75.0	76.9	65.8
Dwelling with mud floor (%)[5]	2.3	6.5	6.9	43.1	42.8	42.3
HDI[6]	0.91	0.85	0.81	0.60	0.65	0.60
Marginality Index[5]	-1.74	-1.50	-1.27	1.85	1.91	2.36
Degree of Marginality[5]	Very low	Very low	Very low	Very high	Very high	Very high

Notes: 1) Deaths per 1,000 births. Programa Nacional de Acción en Favor de la Infancia, Evaluación 1998
2) Moderate and severe malnutrition according to height for age, children enrolled in 1st of primary. Segundo Censo Nacional de Talla, 1994. SEP
3) XII Censo General de Población y Vivienda, 2000. INEGI
4) Quinto Informe de Gobierno. México, 1999.
5) Indice de Marginación, 1995. CONAPO
6) Informe sobre Desarrollo Humano Mexico 2002

Likewise, social progress has been unequally distributed between rural and urban areas. Although in both kinds of localities there have been improvements, progress in rural localities started later and proceeded at a slower rate. In recent years the urban-rural gap has begun to diminish, but considerable differences still prevail. The indicators shown in Table 2.4 illustrate the less favourable situation in rural areas. Rural children are at a higher risk of dying before reaching their first birthday (46.6 per thousand versus 24.5 per thousand among urban children) and are more than twice as likely to be malnourished during their first five years of life (31.7 percent versus 11.6 percent in urban areas). Among rural families, a higher percentage of children aged 12-15 work in part to contribute to family income (30.6 percent versus 8.3 percent in urban areas); hence, these children are more likely to not complete their basic studies. Members of rural families have a much lower educational level than their counterparts in urban localities (3.6 versus 7.7 years of schooling).

Table 2.4
Socioeconomic Indicators for Urban and Rural Localities

	Urban	Rural	Total
No prenatal care (%)	6.7	15.5	9.5
Infant mortality rate[1]	24.5	46.6	29.8
Child malnutrition (%)[2]	11.6	31.7	17.7
Average years of schooling of household head	7.7	3.6	6.7
Children 12- 15 working (%)	8.3	30.6	16.7
Dwelling with mud floor (%)	5.4	38.5	15.4

Notes: 1) Deaths per 1,000 births,
2) Moderate and severe malnutrition according to height for age.INSP, Encuesta Nacional de Nutrición, 1999
Source: Progresa

In terms of progress in relation to income poverty, during the last half of the 20th century there were also important improvements, dropping from a poverty headcount of 61.8 percent in the 1950s to one of 22.7 percent at the end of the 1980s (Székely 2003). Nevertheless, over the past decade there were no improvements according to this indicator. Table 2.5 shows estimates on the proportion of the population classified as poor according to different studies. Regardless of the discrepancies between estimates, the trend indicates that the incidence of poverty (both moderate and extreme) prevailing in 1989 did not differ much from that observed in the year 2000. During the second half of the 1990s, we observe a decline in the incidence of poverty. However, this slight improvement reflects a recovery from the high poverty levels reached after the 1994-1995 crisis (as the figures corresponding to 1996 show). Despite the small movements in absolute poverty, the relative poverty line shows practically no changes over time. These figures illustrate the significant and persistent levels of inequality prevailing in the country. Overall, one can say that, in terms of income poverty, the 1990s was a decade of stagnation.

2.3. Mexico's poverty estimates

There is no consensus on poverty estimates in Mexico. As in other countries, there is a huge debate on the definition of 'poverty' and on the methodology that should be used for measuring it. In Mexico, the method most frequently used for poverty measurement is the construction of an absolute poverty line, defined using the cost of basic needs method. This approach is different to that applied in developed countries, especially in Europe, where poverty is most commonly measured in relative terms. That is, those whose income falls below a set threshold (usually below half the mean or median of the population income) are classified as poor. The figures in Table 2.5 illustrate the wide variations in poverty estimates in the country. The variation between studies is explained by the different criteria used for constructing their poverty line (e.g. different definitions of the cost of basic needs)[15].

Table 2.5
Estimates of income poverty in Mexico 1989-2000
Share of population below poverty lines (headcount)

	1950	1963	1977	1989	1992	1994	1996	1998	2000
Absolute poverty lines									
Extreme poverty									
Szekely (2003)	61.8	45.6	25.0	22.7	22.5	21.1	37.1	33.9	24.2
Cortés (2002)	-	-	-	22.7	22.5	21.1	37.1	33.9	24.2
ECLAC (2004)	-	-	-	18.7	-	-	22.0	-	15.2
Lustig (1997)	-	-	-	17.1	16.1	15.5	-	-	-
World Bank (2000)/1	-	-	-	-	14.9	-	17.9	15.9	13.2
Moderate poverty									
Szekely (2003)	88.4	75.2	63.8	53.5	52.6	55.6	69.6	63.9	53.7
Cortés (2002)	-	-	-	53.5	52.6	55.6	69.6	63.9	53.7
ECLAC (2004)	-	-	-	47.7	-	-	52.9	-	41.1
Lustig (1997)	-	-	-	32.6	31.3	31.8	-	-	-
World Bank (2000)/2	-	-	-	-	-	-	42.5	-	26.3
Relative poverty line									
Below 50 % median income/3	-	-	-	42.5	-	41.6	-	41.5	38.7

Notes: 1/At one dollar a day; 2/At two dollars a day; 3/Source: ECLAC (2004).
Source for World Bank's estimates in 2000: http://www.worldbank.org/data/wdi2004/pdfs/table2-5.pdf

In the light of this debate, the Ministry of Social Development (SEDESOL is its acronym in Spanish) created a Technical Committee for the Measurement of Poverty (TCMP) comprising both academics and policymakers. This Committee recommended estimating poverty using a unidimensional approach based on a monetary measure (SEDESOL 2002). The methodology consists of specifying a

[15] Notes Table 2.5:
All studies used information collected at the "Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH)", a national survey that collects socio-economic information of the households in the country every 2 yrs.
Szekely (2003) estimates coincide with those of Cortés et al (2002) because the authors used the same data sources and the methodology proposed by the TCMP, which will be explained with more detail in this section.
ECLAC (2004) calculates its poverty lines using the cost-of-basic-needs method. The extreme PL is set according to the cost of a basic basket of food considered minimal for leading a healthy life. The moderate PL accounts as well for a specific allowance for non-food items. The moderate PL is estimated by multiplying the extreme PL by a factor of 2 for urban areas and by a factor of 1.75 for rural areas. The cut-off points for Mexico are: 1) for extreme PL, 1.8 and 2.5 dollars per person a day in rural and urban areas; and 2) for moderate PL, 3.1 and 5 dollars per person a day in rural and urban areas, correspondingly.
Lustig et al. (1997) construct its poverty line using those of the National Statistics Institute (INEGI). Their methodology is very similar to that of ECLAC, but the basic basket of food is different.
The World Bank estimates presented here are those estimated using a one dollar a day line and a two dollars a day line (at 1993 purchasing power parities).

threshold or poverty line based on the cost of a basket of goods, considered to include basic needs, and compares it with households' expenditures. Households with resources below the poverty line are classified as poor. In order to distinguish different levels of poverty, the TCMP has set three poverty lines. The first one identifies those households without access to a basic food basket[16] even when they make use of all their resources; the second threshold distinguishes those households that cannot afford the cost of a basic food basket plus the cost of health, education, clothing, transportation or housing; the third threshold identifies those households that cannot access the previous goods plus other non-food items considered to be essential by the population (SEDESOL 2002).

Following TCMP's approach, the Ministry of Social Development set an additional poverty line to identify those households that cannot afford a basic food basket plus the expenses on health and education. It is equivalent to the TCMP's second threshold, but with a reduced number of needs (Cortés et al. 2002). In Table 2.6 we present the poverty estimates of TCMP's first two levels of poverty (poverty lines 1 and 2) and SEDESOL's additional measure (poverty line 2a). Table A2.1 in the Appendix shows the monetary cut-off points for the three poverty lines under consideration.

Table 2.6
TCMP's Poverty Estimates. Mexico 1998

	Urban	Rural[1]	Total
Poverty Line 1			
Households (%)	16.4	43.8	26.8
Individuals (%)	21.3	52.1	33.9
Poverty Line 2a			
Households (%)	22.8	49.3	32.9
Individuals (%)	29.0	57.6	40.7
Poverty Line 2			
Households (%)	47.7	68.6	55.6
Individuals (%)	55.8	74.9	63.9

Note: 1. Rural inculdes localities with less than 15,000 inhabitants.
Source: (Cortés et al. 2002).

[16] The cost of this food basket is defined by the resources needed to meet a predetermined food energy requirement. This calculation is done separately for urban and rural localities because it is assumed that the necessary nutrient and caloric requirements vary within these groups. For a detailed explanation, consult (SEDESOL 2002).

According to these estimates, around the time Progresa was launched, in 1998, 26.8 percent of Mexican households (or 33.9 percent of individuals) lived in extreme poverty, without the necessary resources to meet their nutritional requirements (see Table 2.6). For the second threshold, 32.9 percent of all households (or 40.7 percent of individuals) did not have access to a basic food basket and essential needs such as health and education. The third threshold shows that 55.6 percent of all households (63.9 percent of individuals) did not have enough resources to cover expenses on food, health, education, clothing, public transport and housing.

Estimates disaggregated by the size of the locality show the striking differences in the levels of poverty between rural[17] and urban areas. While 43.8 percent of rural households are classified as poor according to the first poverty line, among urban households this proportion is much smaller, only 16.4 percent. Even though most Mexican families live in urban areas (63 percent)[18], poverty is highly concentrated in rural areas. Furthermore, if one considers other measures of poverty like depth and severity[19], poverty is much more extreme in rural areas (Cortés et al. 2002).

In this thesis we are interested in assessing the situation of children living in extreme poverty. Thus, it is important to know the incidence of poverty among this age group. Ideally, the measurement of child poverty should account for the multiple dimensions associated with children's healthy growth and development. Micklewright and Stewart (1999) propose using a multidimensional measure of child well-being, which include: material well-being, health and survival, education and personal development, and social inclusion/participation. Unfortunately, in our analysis we cannot provide a multidimensional child-specific measure of child poverty because of lack of data. The latter is a common restriction, thus the most frequently used measures are based on household income or on child-specific social indicators which relate to children's health and educational attainments.

We provide estimates of child poverty using three approaches: 1) based on child specific non-income (or social) indicators; 2) using a household income measure; and 3) using a multidimensional indicator of household poverty. We acknowledge that these approaches are far from ideal because either they provide a uni-

[17] Figures for rural areas correspond to estimates for localities with less than 15,000 inhabitants.
[18] The distribution of households according to the size of the locality is as follows: 63% in urban areas (>=15,000 inhabitants), 13% in semi-urban areas (2,500-14,999 inhabitants) and 24% in rural areas (<2,500 inhabitants).
[19] These poverty measures estimate how far individuals or households locate below the poverty line assigning a higher weight to those located further away from the cut-off point (Foster et al. 1984).

dimensional picture of poverty or they are based on household data, which do not assess child-specific needs. For instance, the household measurements used do not account for a set of factors –like inequalities in intrahousehold resource allocation or equivalence scales– that should be accounted for in order to elaborate more precise estimates. Our methods provide crude measures of child poverty. Nevertheless, due to data constraints, these are our best estimates.

In Table 2.7 we present a set of child-specific non-income indicators for Mexico in the year 2000. For comparison purposes, we also include the average value of each indicator in Canada and U.S.A., as examples of industrialised countries, and a world value, corresponding to the average value of all countries with available information. These non-income measures reflect the actual achievements of the country in these areas of human development. Similar to what we observed for the population as a whole, these average values suggest that Mexican children fare quite well in comparison with the world's figures. Nevertheless, compared with children in more developed countries, Mexican children still lag behind, especially with respect to health-related outcomes. The primary enrolment rates are quite high, yet not all children manage to complete this basic educational level. Furthermore, if we disaggregate these figures by region of residence and/or by size of the locality, we would observe striking inequalities.

Table 2.7
Non-income Child Poverty Measures (in year 2000)

	Mexico	Canada	U.S.A.	World
Infant mortality rate[1]	25	6	7	57
Under-five mortality rate[1]	30	6	9	83
Underweight children (%)	8	n/a	1	27
Stunted children (%)	18	n/a	2	31
Primary net enrolment rates (%)	99	100	93	80
Children reaching grade 5 (%)	90	99	99	79

Notes: 1) Deaths per 1,000 births. Source:www.childinfo.org.
n/a: not available

We estimate the incidence of income child poverty as follows. First, we calculated the absolute number of households in each poverty level by place of residence using the TCMP's estimates on the proportion of poor households (figures on Table 2.6) and census information on the number of households in urban and rural localities (see Table A.2.2 in Appendix) [e.g. the number of urban households classified as poor according to the first poverty line (*PL1*) was obtained by multiplying the proportion of poor urban households in this poverty level by the number of urban households in the country (0.164*13,334,671=2,186,886)]. Once we had this value, for each place of residence and for each poverty level, we calculated the number of poor children by multiplying the average number of children in households of that classification[20] by the total number of households in the corresponding group (e.g. the number of urban children 0 - 5 years old classified as extremely poor (using *PL1*) was obtained by multiplying poor urban households in this poverty level by the number of children in households classified in this poverty category (2,186,886*0.92=2,010,515)). Finally, we estimated the proportion of children in poverty by dividing the number of poor children in each category by the total average number of children in that group (e.g. the proportion of poor urban children 0-5 years old (using *PL1*) was obtained by dividing the number of poor urban children 0-5 by the total number of urban children 0-5 (2,010,515/7,200,722=0.279)).

We present our estimates of child income poverty using the previous approach in Table 2.8. These figures suggest that two out of five (39.3 percent) Mexican children aged 0-12 are growing up in extremely disadvantageous conditions, without the resources to buy the basic food needed to lead a healthy life; almost half of them (48.3 percent) grow up in households that cannot afford to buy a basic food basket and make use of the health and education services; and two out of three (65.8 percent) are brought up in households that lack the economic resources to cover essential needs such as clothing, public transport and housing.

Our second set of estimates were calculated following the same approach, but using a multidimensional measure of poverty, which accounts not only for income, but also for other dimensions of well-being. This measure corresponds to Progresa's methodology for identifying the beneficiary families of the Programme[21]. This approach uses an *a priori* income classification of poverty (defined by a poverty line) and then incorporates other household characteristics into a discriminant analysis to reclassify the population into 'poor' and 'non-poor'. This methodology

[20] These values are presented in Table A2.2 in Appendix 2. The source of this data is (Cortés et al. 2002).

[21] In this thesis we capitalise the word Programme when referring to Progresa, the central anti-poverty policy of our analysis. However, when referring to other interventions, we use lower cases.

includes a two-step process. The first step involves a construction of an income-based poverty line, based on the cost of a basic basket of goods. Household per capita income is compared with this poverty line in order to identify an initial distribution of poor (income below poverty line) and non-poor households (income above or equal to the poverty line). The second step consists of using a set of household characteristics that discriminate best between poor and non-poor households as classified in the previous step. Once these household characteristics are identified, they are used to compute an index (discriminant score) that represents the differences between poor and non-poor households. This index is then used to generate a rule that classifies households into 'poor' and 'non-poor'. For further details on the selection procedure, see Orozco et al. (1999a).

Table 2.8
Child Poverty Estimates. Mexico 1998
Three Poverty Lines using monetary approach

	Absolute			Proportion		
	Urban	*Rural*[1]	*Total*	*Urban*	*Rural*[1]	*Total*
Poverty Line 1						
Households	*2,186,886*	*3,579,714*	*5,766,600*	*16.4*	*43.8*	*26.8*
Children 0 - 5 years	2,010,515	3,105,302	5,115,817	27.9	52.4	39.0
Children 6 - 12 years	2,457,297	3,795,369	6,252,665	29.3	51.3	39.6
Children 0 - 12 years	**4,467,812**	**6,900,671**	**11,368,483**	**28.6**	**51.8**	**39.3**
Poverty Line 2a						
Households	*3,040,305*	*4,029,221*	*7,069,526*	*22.8*	*49.3*	*32.9*
Children 0 - 5 years	2,795,107	3,495,237	6,290,344	38.8	59.0	47.9
Children 6 - 12 years	3,416,241	4,271,956	7,688,198	40.7	57.8	48.7
Children 0 - 12 years	**6,211,348**	**7,767,193**	**13,978,542**	**39.8**	**58.3**	**48.3**
Poverty Line 2						
Households	*6,360,638*	*5,606,584*	*11,967,222*	*47.7*	*68.6*	*55.6*
Children 0 - 5 years	4,678,126	3,890,844	8,568,970	65.0	65.7	65.3
Children 6 - 12 years	5,717,709	4,755,476	10,473,185	68.1	64.3	66.3
Children 0 - 12 years	**10,395,835**	**8,646,320**	**19,042,155**	**66.6**	**64.9**	**65.8**

Note: 1. Rural inculdes localities with less than 15,000 inhabitants.
Source: Household poverty estimates (Cortés et al. 2002). Child poverty estimates own calculations.

The prevalence of poverty using this method provides estimates (presented in Table 2.9) close to those of the first poverty line of the TCMP's approach[22]. Hence, under Progresa's classification, poor households are those living in extreme poverty. This result is not surprising since Progresa's methodology used a monetary measure as basis for the discriminant analysis.. In regard to child

[22] The difference in the estimates for rural areas between Tables 2.7 and 2.8 is explained by the difference in the definition of rural areas.

poverty, using this multidimensional approach we estimate that one third (34 percent) of Mexican children under the age of 13 are extremely poor (see Table 2.9).

Table 2.9
Child Poverty Estimates. Mexico 1998
Poverty line using multidimensional approach

	Absolute			Proportion		
	Urban + Semiurban	*Rural[1]*	*Total*	*Urban + Semiurban*	*Rural[1]*	*Total*
Multidimensional approach						
Households	*1,981,917*	*3,044,509*	*5,026,426*	*12.1*	*59.0*	*23.4*
Children 0 - 5 years	1,822,077	2,641,027	4,463,103	25.0	45.4	34.1
Children 6 - 12 years	2,226,983	3,227,921	5,454,904	26.2	44.5	34.6
Children 0 - 12 years	**4,049,059**	**5,868,948**	**9,918,007**	**25.7**	**44.9**	**34.4**

Note: 1. Rural includes localities with less than 2,500 inhabitants.
Source: Progresa

It can be seen that the incidence of poverty among children is higher than that of the population as a whole. It is common to observe that children are disproportionately represented among the poor (Barrientos and De Jong 2004). One of the reasons for this is that in general fertility rates are higher among the most deprived groups of the population. Additionally, there are certain life stages that are more strongly associated with poverty. It has been highlighted that during childhood and when individuals have children are stages when there are greater chances of experiencing poverty (Rowntree 1902; Sefton and Rigg 2004).

It is worth underlining that our estimates represent those children growing up in poor households. However, because of possible differences in the intrahousehold distribution of resources, which we do not account for, these figures could over- or under-estimate the real levels of child poverty.

Our results suggest that a significant number of Mexican children are growing up in extreme disadvantage. In relative terms, our estimates indicate that the proportion of children without access to basic needs such as food, education and health range from 34.4 percent to 48.3 percent, which in absolute terms corresponds to a range between 9.9 and 13.9 million children[23]. These figures clearly illustrate the magnitude of the problem and the coverage required by a

[23] The total number of Mexican children is presented in Figure A2.1 in Appendix 2.

social programme in order to attend the unmet needs of this population. Moreover, comparisons between the prevalence of poverty in rural and urban areas allow us to identify the location of the most vulnerable groups. Greater improvements could be achieved by implementing effective interventions, targeted at the population at highest risk.

2.4. Mexico's anti-poverty policies: an overview

Mexico has the challenge of reducing its poverty levels via strategies that will guarantee that social progress reaches the most deprived groups. In doing so, economic growth is necessary but not enough. There is an urgent need to concentrate efforts on improving the capabilities of the very poor so they will be able to improve their living standards and will be capable of participating in the progress and development of the country.

Mexico's anti-poverty programmes started during the oil "boom" (1978-1982). Before this period, the proportion of the budget assigned to social development was insufficient and inadequately distributed (Lustig and Székely 1997), with a consequent lag in social progress. In the late seventies, the Mexican Government via *Coplamar* (Coordination for the National Plan for Deprived Zones and Marginal Groups) gave universal subsidies to consumption and support to the price of crops in poor rural areas. After 1983, these subsidies were significantly reduced due to the economic crisis. In 1988, the federal government designed a new programme for poverty alleviation known as Pronasol for its acronym in Spanish "National Solidarity Programme". The main objective of this policy was to invest in infrastructure. The benefits were no longer universal, but were targeted to localities with high levels of marginality. Unfortunately, this programme did not have an evaluation system so little is known about the impact of its actions.

In 1997, the Mexican Government implemented a new policy to alleviate poverty: Progresa, the Education, Health and Nutrition Programme. In 2002, Mexico's present administration transformed Progresa into a new programme named *Oportunidades*. The latter preserved the main characteristics of Progresa, but it broadened its activities and extended the programme to meet the needs of the urban population. *Oportunidades* is part of the government's strategy to improve the living conditions of the poorest population. The new approach to reduce poverty, named the *Contigo* framework, includes different activities[24] such as supply of basic social services, investment in human capital, creation of job opportunities, financial services to promote savings and loans to foster productive projects.

It is worth noting that this thesis examines the outcomes of Progresa; hence, we focus our discussion on the original Programme. In the final sections of this chapter, we present a brief explanation of the new aspects of *Oportunidades* and provide a summary of the results obtained from its evaluations.

2.5. Progresa

Progresa is a nation wide anti-poverty programme whose main objective is to improve the basic capabilities of the poorest and most vulnerable families in the country. It is based on the philosophy that investing in human capital can set the grounds for breaking the intergenerational transmission of poverty in which poor families are immersed. In order to achieve this, the Programme has an integral approach. It gives benefits in three areas that are closely linked to each other: education, health, and nutrition. The positive link between these components should reinforce the effect that each component could have separately, and thus the impact should be multiplied. Progresa gives a set of monetary and in-kind benefits that vary according to the demographic characteristics of each family.

Progresa started operating in August 1997 and its coverage increased throughout several phases. At the end of 2004, *Oportunidades'* coverage had reached 5 million households; that is, 20 percent of all households in the country were receiving benefits from this Programme (see Table 2.10). At present, it operates in 31 of the 32 Mexican states[25], in more than 2,000 municipalities, and over 80,000 localities. The budget allocated to this Programme in 2004 was approximately 2,200 million US dollars, equivalent to 0.35% of GDP (Fox 2004).

---

[24] Mexico's Ministry of Social Development is currently running the following social programmes: *Programa de Abasto Rural* supplies products of basic consumption to marginalised isolated comunites; *Programa de Empleo Temporal* offers employment to agricultural workers during the crop season; *Programa de Habitat* aimed to improve the living conditions of urban marginalised neighbourhoods; *Programa de Microrregiones* aimed to improve the living conditions of the most deprived rural areas; Programa *de Iniciativa Ciudadana 3x1* investing in infrastructure projects funded by the federal government, the local government and the revenues of migrants in the U.S.; and *Programa de Abasto Social de Leche* provides fortified milk to poor children living in urban areas; among others (Argáiz et al. 2003). For detailed information on the programmes covered by the *Contigo* framework consult http://www.contigo.gob.mx.

[25] The Programme operates in all Mexican states except in the Distrito Federal (hereafter D.F.).

Table 2.10
Progresa's Coverage and Budget, 1997- 2004

Year	Municipalities	Localities	Families	Scholarships	Budget (millions pesos)[2]	%GDP[2]
1997	358	6,357	301,262	344,457	465.8	0.01
1998	1,750	40,711	1,930,032	1,719,090	3,398.5	0.09
1999	2,155	53,215	2,306,325	2,338,957	6,890.1	0.15
2000	2,166	53,232	2,476,430	2,485,323	9,586.9	0.17
2001	2,310	67,539	3,116,042	3,325,524	12,393.8	0.21
2002	2,354	70,520	4,240,000	4,355,927	17,003.8	0.27
2003	2,360	70,436	4,240,000	4,577,009	22,331.1	0.33
2004	2,429	82,973	5,000,000	n.a.	25,324.3	0.35
Total[1]	2,436	199,391	22,268,916	8,932,936	-	-

Notes: 1. Total refers to the national number of municipalites, localities, households and number of children in school age (6 - 19 yrs old). Source: (INEGI 2001). 2. Source: (Fox 2004)
Source: Programa de Desarrollo Humano Oportunidades (http://www.progresa.gob.mx)

2.5.1. Components

Education

Progresa's educational benefits try to promote school enrolment and attendance so that children will attain higher educational levels and in the long run will have greater opportunities in the labour market. All children of beneficiary families under the age of 18, enrolled between the third grade of primary and the third grade of secondary school receive a monetary educational grant and monetary support for buying school supplies. These benefits are conditional on children's attendance to school. After 2001, with *Oportunidades*, the grants were extended to high school education (10^{th} to 12^{th} grade). The amount of the grants corresponds to an estimation of the children's contribution to family income or production. It is meant to compensate the opportunity cost that families incur for having children at school.

The educational transfers have two important characteristics. First, the amount given increases as children enrol to higher grades. This is an incentive for keeping children at school. Second, in secondary and high school the grants are slightly higher for girls than for boys. In rural localities, girls tend to drop out at an earlier age than boys. Thus, by having differentiated grants, Progresa intends to promote gender equality in enrolment. In addition, more years of schooling among women will represent improved outcomes for their offspring. In 2004, the amounts of the monthly grants ranged from about PPP US$ 15[26] in the third grade of primary to PPP US$ 84 for boys and PPP US$ 96 for girls in the third year of high school (see Table 2.11).

Health

In the area of health, the Programme provides basic health care through free interventions with special attention to preventive medical care. This component targets its efforts to the most vulnerable population, children under five and pregnant and lactating women (emphasis on prenatal care and growth monitoring). All family members have to attend the health units according to a monthly schedule of visits. The Ministry of Health and *IMSS-Solidaridad*[27] designed this schedule, which sets the frequency of health visits according to the sex and age of the individual (see Table 2.12). Additionally, to improve health care behaviours and promote a preventive culture of health, mothers receive an educational session on different aspects of health, nutrition, and hygiene once a month (see Table 2.13).

Nutrition

The nutrition component includes monetary transfers for food consumption and nutritional supplements. All families receive a fixed monetary transfer of around PPP US$ 20 per month for buying more and better quality food. In addition, children between the ages of four months and two years, and pregnant and breastfeeding women receive nutritional supplements. If children between the ages of 2 and 5 show any signs of malnutrition, nutritional supplements are also provided. These supplements were designed to provide 20 percent of the caloric requirements and 100 per cent of the necessary micronutrients of Mexican children and women (Rosado et al. 2000).

The cash transfers are adjusted every six months using the National Basic Food Basket Price Index published by the Central Bank so that they retain their purchasing power. They have a cap in order to avoid promoting large families as well as to avoid having a negative effect on families' own efforts to overcome their deprived situation. Currently, the cap for the monthly cash transfer is around PPP

[26] For comparison purposes, throughout this thesis, we convert Mexico's currency (pesos) into U.S. dollars using purchasing power parity rates (PPP). We use the PPP rates for Mexico published by the OECD (http:/www.oecd.org/std/ppp/).
[27] IMSS-Solidaridad is a branch of the Mexican Social Security System that provides health services to marginalised groups.

US$ 138, a maximum amount for the total cash transfer (educational grants and nutrition component).

The cash transfers are an important support to the families' budgets. On average, they represent a 20 percent increase in the household's monthly income. Moreover, households with educational grants have a higher increase to their monthly income of around 30 percent. These differentiated grants according to households' demographic characteristics help tackle the severity of poverty as households with more children have higher dependency ratios and thus are likely to have less access to goods and services than households of smaller size.

Table 2.11
Progresa's Cash Transfer

	Pesos		PPP US$	
	1998-2000	*2001-2004*	*1998-2000*	*2001-2004*
Food cash transfer	118	152	21	22
Scholarships				
Primary				
Third	78	102	14	15
Fourth	91	118	16	17
Fifth	118	151	21	22
Sixth	155	202	28	29
Secondary				
First				
Boys	226	296	40	43
Girls	238	313	43	45
Second				
Boys	238	313	43	45
Girls	266	346	47	50
Third				
Boys	252	329	45	48
Girls	290	381	52	55
High school				
First				
Boys	n/a	503	n/a	72
Girls	n/a	578	n/a	83
Second				
Boys	n/a	540	n/a	78
Girls	n/a	616	n/a	89
Third				
Boys	n/a	571	n/a	82
Girls	n/a	652	n/a	94
Grant for School Supplies				
Primary	160	206	29	30
First Semester	107	138	19	20
Second Semester	53	69	10	10
Secondary	200	256	36	37
High school	n/a	256	n/a	37
Cap Total Cash transfers to any family	712	929	127	135
Scholarships' cap	593	777	106	113

Notes: Transfers are adjusted with reference to the National Basic Food Basket Price Index published by the Central Bank.
Pesos converted into PPP US $ using historical PPP published by OECD (http:/www.oecd.org/std/ppp/).
Source: Programa de Desarrollo Humano Oportunidades (http://www.progresa.gob.mx)

Table 2.12 Health check-up schedules

Age Group	Number of Visits	Purpose
0 - 4 months	Three visits: 1) at 7 days old, 2) at 28 days old, and 3) at 2 months old	• Monitor growth, weight and height
4 - 23 months	Eight visits: at 4, 6, 9, 12, 15, 18, 21, and 23 months.	• Immunisations; • Monitor growth, weight and height; • Evaluate signs of illness.
24 – 59 months	Three visits per year: One every 4 months	• Immunisations; • Monitor growth, weight and height; • Evaluate signs of illness.
5 - 16 years	Two visits: One every 6 months	• Immunisations; • Monitor growth, weight and height; • Evaluate signs of illness.
Pregnant Women	Five pre-natal visits beginning in the first trimester	• Nutritional orientation; • Monitor pregnancy; • Monitor iron and tetanus toxoide.
Lactating Women	Two visits	• Family planning; • Nutritional orientation; • Baby care visits.
Others 17 -60 years	One visit	• Family planning ; • Promote healthy reproductive life; • General health check-up.
60 and older	One yearly visit	• General health check-up ; • Evaluate signs of illness.

Source: (Progresa 1999)

Table 2.13 Topics covered in Educational Sessions

1. Progresa's nutrition supplement
2. Nutrition and Health (on preparation of food indicating which items are good for the family)
3. Basic sanitation (handling litter, latrines and unhygienic animals)
4. Social participation (creation of committees in the community)
5. Teenagers and sexuality (children's growth and their changes)
6. Family planning (knowledge and use of contraceptive methods)
7. Prenatal care (care during pregnancy)
8. Delivery and post-partum care
9. Breastfeeding
10. New born health care practices
11. Detection of cervical cancer
12. Infant health care practices
13. Toddler health care practices
14. Vaccination scheme (vaccines child should have according to his age)
15. Oral rehydration therapy (preparation and use of "vida suero oral")
16. Health care of children when sick with diarrhoea
17. Deworming (importance of child and adults' deworming)
18. Acute respiratory infections (attention of adults and children with cough, cold or flu)
19. Tuberculosis (to detect when a person has TB)
20. Hypertension and diabetes (tests for detecting)
21. Prevention of accidents (how to avoid being burnt and other accidents)

2.5.2. Innovative aspects

An innovative aspect of Progresa is that of co-responsibility, i.e. it requires the participation of families in exchange for the benefits received. All the benefits are subject to certain responsibilities that the family has to fulfil. In order to receive the educational grants, children have to attend school on a regular basis, at least 80 percent of classes in the month. The monetary transfer for food is conditional on completion of the family health care visits and on attendance at the educational sessions given at the health centres. The school attendance of children and family health visits are verified monthly through school and clinic records.

An important feature of Progresa is that it promotes greater gender equality in educational participation. Besides giving higher educational grants to girls, the monetary transfer is given directly to the mother of the household. Several studies have suggested that women make better and more efficient use of resources, which translates into a higher impact on family welfare (Haddad et al. 1997; Duflo 2000). Furthermore, the possibility of administering the monetary transfer might give these women greater negotiating power within their households.

2.5.3. Identification of beneficiaries

Progresa's mechanism for identifying its beneficiary families consists of three stages: identification of localities; selection of beneficiary families; and community consensus.

The first stage consists of selecting the rural localities with the highest levels of marginality that have access to health and educational services. Where there are no on-site services, the eligibility of a locality depends on the distance to the nearest locality with services[28]. The reason for restricting the operation of the Programme to areas with access to health and educational services arises from the responsibility scheme of the Programme. Families have to attend the education and health services regularly in order to receive their benefits. If there is no access to these services, families cannot meet their responsibilities. This is an important limitation of the Programme because it excludes households who are likely to be

[28] The criteria to decide whether a locality is eligible or not depends on the distance to the nearest locality with primary school, secondary school and health centre. It also depends on the quality of the roads that need to be used to reach the nearest locality with services. The length of distances vary from 15 kilometres for health centres that can be reached by a paved highway up to 2.5 kilometres for primary schools that can be accessed by a non-paved road. For a detailed explanation on the criteria eligibility consult (Cruz et al. 1999).

among the most deprived. In absolute terms, around 127,000 households cannot be incorporated into the Programme because of lack of education and health services (Cruz et al. 1999).

The second stage consists of identifying the beneficiary households within the selected localities. In order to do so, the Programme carries out a survey (ENCASEH), which collects socio-economic information on all the households within the locality. Once this information is gathered, the households are classified as poor and non-poor using a multidimensional approach that considers not only income but also other indicators of well-being. The statistical technique used to classify the households according to their poverty status is discriminant analysis (Orozco et al. 1999a). The classification procedure includes characteristics such as number of children within the household, dependency ratios, children's school attendance, access to basic services within the household, characteristics of the dwelling, ownership of goods, and presence of disabled individuals.

In the third stage, the community gives its consensus to the final list of beneficiaries. The community gathers in an assembly that gives its feedback about the families included or excluded incorrectly from the Programme. In these cases, Progresa revisits the households to re-evaluate their situation. This final stage is important to amend errors quantitative techniques are liable to incur and it allows families to participate in the process of selection. The latter is a crucial step on the identification process because it buffers possible misunderstandings on the selection of certain households.

An additional strategy to avoid programme dependency is that, after three years in the Programme, the family's situation is assessed in order to determine whether it is still eligible to receive Programme benefits.

2.5.4. Characteristics of beneficiaries

Progresa localities are generally small (between 100 and 499 inhabitants), highly marginal (87 percent of them classified as having either a high or a very high degree of marginality) and with a great percentage of families living in extreme poverty (76 percent) (Hernández et al. 1999a). Table 2.14 presents the socio-economic characteristics of eligible households (poor households living in rural areas) and of the average national household in order to compare and understand the degree of deprivation prevailing among eligible families. These figures show that eligible families have large sizes (on average 5.2 members), high dependency ratios (3.3 dependents), household heads with few years of schooling (2.9 years), very low income levels (which have to be shared by a large number of dependents), and have dwellings with few services (around 60 percent of all households live in dwellings with mud floor and only 11 percent have running water in their dwellings).

These statistics show that eligible households have few capabilities to improve their well-being and that their living conditions are so poor that they are quite vulnerable to shocks from external factors. Moreover, children growing up in these households are exposed to numerous risk factors. For instance, the fact that the household income is very low pushes children into work. Among beneficiary families, more than 30 percent of children between 12 and 15 years old work in order to support the family income. Children's participation in the labour market has a negative effect on the completion of their studies, which in turn affects their future earnings and contributes to keeping them in the vicious circle of poverty. It has been argued elsewhere that completion of secondary school is the minimum level to break the intergenerational transmission of poverty (Castañeda and Aldaz Carroll 1999). Thus, children's labour participation suggests that a considerable number of children are at risk of not completing this educational level. An additional factor associated with children's exclusion is their ethnicity. One third of eligible families are indigenous, who generally do not speak Spanish and whose living standards are even below the average eligible household. Children whose mother does not speak Spanish face greater threats because of restricted access to health care and education.

These statistics show that eligible households have few capabilities to improve their well-being and that their living conditions are so poor that they are quite vulnerable to shocks from external factors. The benefits of Progresa can compensate for the negative effects of poverty and other determinants affecting children's outcomes.

Table 2.14
Characteristics of Eligible Households in Rural Areas
Situation Before Progresa

	Poor Rural	National
Household Characteristics		
Household members (1)	5.2	4.4
Children 0-5 years old (1)	0.9	0.5
Children 6-12 years old (1)	1.1	0.6
Dependecy ratio (1)(3)	3.3	1.7
Crowding index (1)(4)	3.7	1.6(6)
Total Fertility Rate (1)(5)	4.6	2.7
Education and child labour		
Household head's years of schooling (1)	2.9	8.2
Children 6-16 never attended school (2)	7.5	2.8
Children 12-15 working (2)	31.3	16.7
Children 16-17 working (2)	54.6	35.1
Health visits		
Children < 1 year old (1)(5)	1.9	3.5
Children 1-4 years old (1)(5)	3.5	6.3
Pregnancies without prenatal care (2)(5)	18.8	9.5
Indigenous households (2)	35.0	7.2(6)
Income		
Monthly household income (1)	1221.0	3894.4(7)
Monthly household income per capita (1)	248.0	861.0(7)
Dwelling Characteristics		
With water within household or terrain (2)	10.8	85.0(6)
With W.C. (2)	8.9	86.0(6)
With mud floor (2)	58.0	14.8
With electricity (2)	72.4	94.5
With gas stove (2)	30.7	86.0
With refrigerator (2)	15.4	69.3
With TV (2)	41.7	86.3

Source: (Hernández and Vera 1999b)
Notes: 1. Average; 2. Percentage
3. No. of individuals aged < 15 or > 64 divided by no.of individuals aged 15 to 64.
4. Number of individuals per room
5. Estimations using the National Demographic Survey (ENADID 97).
6. XII Censo General de Población y Vivienda 2000, INEGI
7. Income in 1998 pesos (Conapo 1999).

2.5.5. Evaluation

The evaluation of a social programme is crucial for assessing and quantifying the results of its operation, for detecting negative and unexpected impacts in order to modify the course of its actions, and for making the most efficient and effective use of resources in order to reach the programme's goals. Moreover, Progresa's experience showed the importance of evaluating and disseminating programme results since this antipoverty policy was preserved after the change of regime in 2000 and it has also been replicated in other Latin American countries (Rawlings 2004), which we will briefly review in the following section.

Progresa has a rigorous evaluation system to determine if it is accomplishing its objectives. One of its main advantages is that its evaluation was planned in the initial stages of the Programme. Thus, it allows making comparisons before and after the programme was operating. The evaluation scheme includes quantitative and qualitative instruments that allow a better assessment of its results. In addition, administrative records from schools and health clinics managed by the Ministry of Health and the Ministry of Education are also used for monitoring the Programme's performance. These data collection instruments complement each other and can be used for making thorough analyses (see Table 2.15).

Table 2.15 Evaluation Instruments

1. Longitudinal surveys

- ENCASEH (Survey of Households' Socio-economic Characteristics)
- ENCEL (Evaluation Survey)
- ENCASEL (Survey of Localities' Characteristics)
- INSP (Nutrition and Health Survey)
- *Seguimiento* (Follow-up and opinion survey)

2. Operational Surveys

- Survey on education and health resources
- Survey on characteristics, attitudes, and opinions of education and health personnel

3. Institutional records

- Institutional records of national health units
- Clinical health records
- Institutional records of national schools
- Standardised school exams

4. Administrative records

- Enrolment and school attendance records
- Health attendance records
- Reception of cash transfers

5. Qualitative surveys

Progresa's main strategy of evaluation is a longitudinal evaluation survey (ENCEL from its acronym in Spanish) carried out approximately every 6 months through questionnaires that collect information at the household and individual level. The first round of data collection took place before families started receiving benefits (baseline), which allowed precise estimates of the changes after the intervention.

Progresa's evaluation system consisted of a randomised trial at the locality level. That is, a group of treatment and control localities was selected from a sample of localities eligible to participate in the Programme (Orozco et al. 2000). Randomisation was not carried out at the household level because it could have generated problems within communities between treatment and control households. Although randomisation at the locality level avoids creating conflicts within the community, it has the disadvantage that with this selection process it is less likely to provide unbiased estimates of programme impact (discussed below).

Progresa selected a random sample of 506 treatment and control localities (320 and 186 localities, respectively) situated in the seven states[29] in which the Programme was initially implemented[30]. Assignment by randomisation implies that prior to Programme implementation, in principle, the treatment and control localities *on average* had similar observed and unobserved characteristics. However, it is possible that when selecting the treatment and control groups, the treatment localities had different characteristics than the control ones. In theory, this treatment-control design should enable rigorous testing of the effects of the intervention as in principle the only difference between the control and the treatment groups is the presence of the Programme. An assessment of the randomness of the ENCEL sample found randomisation was adequate at the locality level; however, some significant differences at the household and individual level were detected (Behrman and Todd 1999a). Thus, estimates of the programme effect at the household or individual level have to be carried out controlling for these pre-programme differences.

It should be noted that treatment localities were scheduled to receive benefits at the beginning of Progresa (from May 1998), whereas control communities began to receive benefits at a subsequent stage (from December 1999). The later inclusion of the control group has to be kept in mind because in this study the period of analysis included rounds of data collection (waves 5 and 6) during which

[29] The states were Guerrero, Hidalgo, Michoacán, Puebla, Querétaro, San Luis Potosí and Veracruz.
[30] The treatment and control localities were selected using probabilities which were proportional to their size from a universe of 6,396 localities in the seven states.

households in the control group were already receiving Programme benefits (for a more detailed description consult Chapter 3).

The ENCEL questionnaires cover a wide variety of topics (demographic and socio-economic information, sources of income levels, child's school attendance, health utilization, fertility patterns, community characteristics, among others) that allow an integrative analytical approach. A more detailed description of the characteristics of the evaluation instruments will be given in the methodology section in chapter 3.

2.5.6. Main results of the Evaluation

A detailed evaluation of the Programme was carried out by the International Food Policy Research Institute (IFPRI) and Progresa's evaluation team. This evaluation was done using data of the first two years of Programme operation (between October 1997 and November 1999). These results show a short-term positive effect of the Programme in the education, health, and nutrition of the beneficiary families (Skoufias 2000).

Education

In the area of education, enrolment rates increased in localities where Progresa was operating, particularly at the secondary school level. Enrolment in primary school was already high (around 92 percent) before the Programme was launched, thus improvements at this educational level were minor (a relative increase between 0.8 and 1.2 percent for boys and between 0.9 and 1.6 percent for girls (Schultz 2000)). At secondary level, where enrolment rates at baseline were around 70 percent, the rise in enrolment rates represented a proportional increase of 5 to 8 percent for boys and of 11 to 14 percent for girls (Schultz 2000). The greater effect among girls' enrolment is a positive outcome, suggesting that the higher grants for girls are helping reduce the female drop out rates at this level. The major impact of Progresa on the education strand is on increasing the number of children who having completed primary school enrolled in secondary school, with an increase of 20 percent for girls and 10 percent for boys) (Schultz 2000).

Schultz estimates that if children experienced these Programme effects over their schooling years, Progresa's benefits could increase educational attainments by 0.66 years, representing a 10 percent increase in schooling years. Moreover, he argues that as result of increased educational attainment, children from beneficiary families would have wages 8 percent higher in adulthood than they would have had in absence of the Programme (Skoufias 2000). These estimations should be read with caution since they are based on the stringent assumptions that children find a job after completing their studies.

An increase in enrolment rates at secondary level was also found using administrative records from the Ministry of Education. The impact on school enrolment was estimated by comparing trends over time between secondary schools with Progresa beneficiaries (treatment) and schools with no beneficiaries (control). The results from this study show that in the first two years of Programme implementation, school enrolment increased 23 percent in treatment schools, whereas in the control schools enrolment remained unchanged (Orozco et al. 1999b). This study confirms Schultz et al (2000) positive results on girls' enrolment rates. At secondary level, gender inequity in enrolment decreased after Progresa. Before the operation of the Programme, in schools with Progresa beneficiaries there were 82 girls per 100 boys; two years afterwards this ratio changed to 90 girls per 100 boys. In contrast, in schools with no beneficiaries this ratio remained unchanged (Orozco et al., 1999b).

The positive impact on enrolment rates in secondary schools is associated with a positive effect on child labour. Progresa has a significant negative effect on the probability of working for both boys and girls, in both paid and non-paid work (Parker and Skoufias 2000). For children (boys and girls) aged 12 to 15, the probability of participating in the labour market shows reductions between 15 and 25 percent relative to their participation at baseline. In contrast, for children (boys and girls) aged 16 to 17, there is no Programme effect on child labour. These children might have been out of school for a longer period, thus it is more difficult that they return to school. As for the type of work that is more affected by Progresa, it is unclear (Parker and Skoufias 2000). For some age groups, mainly 12 to 13, the greatest reductions occurred in paid work. But, for other age groups, self-employment and unpaid working activities are more likely to be reduced with Progresa's benefits (Parker and Skoufias 2000).

Health

Studies using both administrative records from the health sector (Gertler 2000) and from the ENCEL evaluation survey (Handa et al. 2000) show that the Programme had a positive impact on health care utilisation. The analysis included a study of overall clinic attendance, pre-natal consultations, and nutrition surveillance of children under five. Results show that health units covering the Progresa population had an increase in the overall number of visits. Specifically, child nutritional diagnostics increased by around 30 and 60 percent, and a higher percentage of women (8 percent more) received prenatal care at an earlier pregnancy stage (during their first trimester) (Gertler 2000).

Regarding health status, Gertler (2000) suggests that Progresa beneficiaries of all ages are healthier than control non-beneficiaries. Specifically, children under-five receiving the Programme's benefits have a 12 percent lower prevalence of illness than children in non-beneficiary families (Gertler 2000). This study analyses the impact of Progresa on child health outcomes using as a dependent variable overall illness. However, as will be shown in Chapter 6, overall illness suffered from reporting errors, making this variable a poor indicator of child illness. Moreover, due to the increased risk of infectious diseases, it is important to assess the performance of Progresa in controlling diarrhoea and respiratory infections, the major illnesses that affect children in these communities.

A second evaluation on child health outcomes looked at three indicators to assess Progresa's performance on improving health: mother's reports on child illness, height and anaemia (Gertler et al. mimeo). Morbidity results from this study suggest that, during the experimental period, newborns in treatment areas were 25.3 percent less likely to be ill than newborns in control areas; that children aged under three years old (at baseline) were 22.3 percent less likely to be ill than their peers in control localities; and that treatment children were 25.5 percent less likely to be anaemic than control children. This second study provides a more detailed assessment on children's morbidity since it looks not only at overall illness but also at anaemia and height. Nonetheless, it does not analyse other preventable diseases that are likely to affect the population under study, and it uses the same outcome variable (overall illness) as the previous study, providing a limited picture of child illness. Furthermore, this investigation does not account for the fact that, despite efforts to randomise the sample, treatment and control groups are not balanced in observed and unobserved characteristics. They include some control variables in their models, but it is possible that there is some bias in their estimates.

Nutrition

A study of Progresa's impact on household consumption shows that Progresa beneficiaries have higher expenditures on food (fruits, vegetables, meat, and animal products) than control poor households (Hoddinott et al. 2000). The authors estimated the Programme's effect for a group of "potential" beneficiaries and for a group of "true" beneficiaries (those who actually received cash transfers). Regarding caloric availability, their estimates of the Programme's effect for the "true" beneficiaries was 7.1 percent on November 1999. In contrast, the unconditional impact was 6.3 percent. The authors argue that estimates for the "potential" beneficiaries lead to a downward bias of the Programme effect. The former argument is valid if we are interested in assessing exclusively the impact of cash transfers. However, in the evaluation of a social programme we are interested in its performance on the whole and if households were not receiving their corresponding transfers because of operational issues this has to be considered as well and thus there would not be any downward bias on the estimates.

As for children's nutritional status, an evaluation carried out by Behrman and Hoddinott showed that receiving food supplements has a positive effect on children between the ages of 12 and 36 months of age (Behrman and Hoddinott 2000). Their estimates suggest an increase of about a sixth in mean growth per year, corresponding to approximately one centimetre per year. Their evaluation assessed the impact of the programme during its first year of intervention and concentrated on children who actually received the nutrition supplement. It is important to assess whether this positive effect was also observed during the second year of intervention and to examine the effects of Progresa on all children including those who did not receive supplements. The latter is relevant since we are interested on identifying the overall performance of the Programme and not only the impact of supplements.

Women's status

The effect of Progresa's actions on women's status has been analysed using quantitative and qualitative surveys. Analyses on this topic found that participating in Progresa decreases the probability that the husband is the sole decision-maker in the household, particularly for decisions that affect the children (Adato et al. 2000). This positive result on women's status can in turn have a positive effect on children's well-being since increased decision making is associated with improved caring practices (prenatal care, frequency of child feeding, immunisation of children, quality of substitute caretakers (Smith et al. 2003)).

2.5.7. Oportunidades

In 2002, Progresa changed its name to *Oportunidades.* Although its main objectives and activities to alleviate poverty remained unchanged, it incorporated a new set of actions to ensure the human development of its beneficiaries. The new features of the Programme include: an expansion of its coverage to semi-urban and urban areas[31]; the provision of educational grants to young people enrolled in high school (grades 10th to 12th); and a savings system named *Jóvenes con Oportunidades* that provides a cash transfer when students finish the 12th grade. In addition, *Oportunidades'* benefits are complemented with other government strategies that offer poor households: access to savings, microcredits (loans) for productive projects, monetary supports for housing improvements, education for adults, and a health insurance option called *Seguro Popular.*

Since 2001, there have been continuous evaluations of the performance of *Oportunidades.* In contrast with Progresa's evaluation, the results published have been performed using macro or administrative data instead of a randomised household survey with treatment and control groups. The analyses are carried out by comparing the pre and post Programme situation in municipalities, schools or health centres with and without programme beneficiaries. A drawback from these studies is that they cannot identify the characteristics of the population that is benefiting more/less from this government policy.

Results from the evaluations carried out between 2001 and 2003 have shown some positive effects. Regarding educational outcomes, the greatest impacts have been observed in rural secondary schools. Between 1997 and 2002, enrolment rates at this level increased by 24 percent and the gender gap decreased substantially, from 82 girls per 100 boys to 96 girls per 100 boys (Parker 2003). In primary schools, the Programme has not improved enrolment rates (pre-programme rates were already high, 92 percent (Parker 1999)), but evidence shows that it has had a positive effect on reducing dropout rates (a reduction attributable to the intervention of 10.3

[31] Localities with 2,500-14,999 inhabitants are defined as semi-urban and those with 15,000 inhabitants or more are considered as urban. Although in its initial stages Progresa operated in a few semi-urban areas, its efforts were mainly concentrated in rural areas.

percent in rural areas and 4.5 percent in urban areas) and failure rates (a reduction of 6.4 percent in rural areas and 10 percent in urban localities). In high schools, the educational grants are having a striking effect on the enrolment rates of the 10^{th} grade. In two years, the number of students enrolled in 10^{th} grade increased by 85 and 10 percent in rural and urban areas, respectively (Parker 2003). This suggests that the grants motivate and assist young people to continue their education.

Regarding the impact on health, between 1997 and 2002, there is evidence that in rural areas the use of services had considerably increased. In health centres providing services to beneficiaries, the total number of medical appointments grew by 59 percent, the number of consultations for children's nutritional surveillance grew by 49 percent and the number of prenatal visits increased by 30 percent (Meneses et al. 2003).

In 2003, the distribution of supplements for children under the age of two was of 78 percent, with a considerable fluctuation between states (from 28 percent in Colima to 100 percent in Morelos). In addition, during the same year, the provision of supplements for pregnant and lactating women was slightly higher than that of children, with 88 percent receiving this benefit (Meneses et al. 2003).

Data from health centres indicates that, between 2001 and 2003, the proportion of malnourished children has remained unchanged, with a prevalence of around 16 percent[32] for children under the age of two and of around 26 percent for children between two and four years old (Meneses et al. 2003). In contrast, an evaluation of the impact on infant and maternal mortality found evidence of a small, but positive programme effect. Between 1997 and 2002, the intervention was associated with reductions in infant and maternal mortality of 2 percent and 11 percent, respectively (Hernández et al. 2003). It is worth noting that the authors found a greater programme effect among municipalities of high and very high marginality.

Finally, a qualitative study on the impact of *Oportunidades* in urban localities found that as a result of Programme activities: beneficiary households have made some housing improvements; parents' expectations of children's educational attainments have increased; beneficiary households have greater access to basic

[32] The personnel at health centres assess the nutritional status of children using children's weight for age, thus this value corresponds to the prevalence of underweight.

needs (food and education); women's autonomy in household's resource administration has increased; and social networks have been altered, with a greater cooperation observed between women of the same locality (Escobar and González 2003).

2.6. Conditional Cash Transfers in other Latin American Countries

Results obtained from Progresa's evaluation encouraged its spread into other countries, particularly in Latin America. Similar programmes are now operating in Honduras (PRAF II, *Programa de Asignación Familiar II*), Nicaragua (RPS, *Red de Protección Social*), Brazil (*Bolsa Escola, Bolsa Alimentaçao, Carta Alimentaçao and Bolsa Familia*), Colombia (FA, *Familias en Acción*), Jamaica (*PATH*), Chile (*Chile Solidario*), Bolivia (*Beca Futuro*), Ecuador (*Bono de Desarrollo Humano*), Turkey (Social Fund), and South Africa (Child Support grant).

These programmes share a main objective; that is, to improve the human capital of poor families, so that beneficiary children will have better developmental outcomes and thus greater opportunities in the medium and long term. Their activities aim at improving children's educational attainments, health and nutritional outcomes, and at reducing child labour. The most important characteristics of these programmes are that: they target poor households; they provide cash transfers; benefits are conditional upon households' fulfilling programme's corresponsibilities (sending children to school and visiting health centres for regular check-ups); and most have implemented a system for evaluating performance. Table 2.15 presents the key features of the initiatives with available information.

The target population includes poor families with children. Most initiatives focus their attention on children under five years old and children enrolled in primary school, but others extend their benefits to children enrolled in secondary level (Progresa, PRAF and FA) and high school (*Oportunidades*). They are large-scale programmes, providing benefits to a considerable number of families (up to 5.7 million households by *Bolsa Escola* in Brazil) and with budgets ranging from 0.02 percent (in Nicaragua) to 0.35 percent (in Mexico) of GDP.

In Table 2.16 we show the evaluation schemes of these programmes. It can be seen that most evaluations are based on data from a randomised sample of treatment and control groups. In addition, the evaluations are carried out using longitudinal samples, which among other things allow controlling for the biases which the information is subject to. It is worth highlighting the value of these data, not only for assessing the performance of these interventions, which in itself is crucial, but also for our understanding of the factors associated with child well-being in developing countries.

In the last column of Table 2.16, we present a summary of the evaluation results. A common finding is that most have managed to increase school enrolment rates (FFE, PRAF), mainly for secondary schools where enrolment was relatively low previous to programme operation (Progresa, FA). Similarly, the use of child health services has increased as result of Programme benefits (Progresa, PRAF II, RPS, FA). Thus, the conditionality of Programme benefits has had an important effect on increasing the demand for these basic services.

However, with respect to health outcomes, findings from these evaluations are less consistent. A clear example of these variations is that of improvements on children's nutritional status. Although different studies used different indicators for assessing this outcome, the magnitude and significance of the reported effects present wide variations. The largest and most significant impact is observed in Nicaragua. After three years of programme implementation, RPS benefits were associated with a reduction in the prevalence of stunting (among children 0-5 years old) of 5 percentage points, which in relative terms represents a decline of 12 percent (Maluccio and Flores 2004). Other studies also report a positive effect, but of lesser magnitude. Behrman and Hoddinott (2000) suggest that during its first year of operation Progresa's benefits had a positive influence on children's height. Their estimates imply an increase of around 1 centimetre more among beneficiary children aged between 12 and 36 months in comparison with non-beneficiaries. However, for other age groups there is no evidence of a positive programme effect. Likewise, in Colombia, *Familias en Acción* is linked with a positive impact on children's height of 0.44 cm. However, this positive impact is only valid for young children (children aged up to 12 months old at the beginning of the Programme); older children showed no changes associated with FA's intervention. In contrast, in Honduras there is no evidence of a programme effect. Children receiving different kind of treatments (vouchers and/or supply incentives) showed no improvements in their height for age after PRAFII started operating (Flores et al. 2003). Moreover, in Brazil the available evidence suggests that *Bolsa Alimentaçao* has had a negative impact on children's growth. Six months after the intervention was implemented, beneficiary children gained 18 grams less than children excluded from receiving benefits (Morris et al. 2004). There is a need to investigate this negative result in more detail. Moreover, these differences in results suggest that there is a need to keep monitoring the performance and delivery of these interventions.

It seems that in the short-term these programmes have had a positive impact on increasing service utilization and the latter has in some cases translated into positive effects on the well-being of these families. However, most of these policies are relatively new, thus evidence of medium and long-term effects is still not available.

2.7. Motivation for this study

The evaluation of the performance of Progresa has covered until now analyses on different areas and it has used different methodologies to estimate its results. Previous assessments were more concerned on the findings and the econometric approach used than on the quality of the data and the detail of measurement. Very few studies explored issues related with the sample selection and its attrition. When carrying out studies using longitudinal data this assessment is crucial in order to understand and interpret results. Moreover, there are some aspects that should be analysed in more depth in order to answer whether Progresa is improving the life chances of these families. The aspects that have not been closely analysed and that this research attempts to address are: the pattern of fluctuations over time; the impact at different levels of poverty/deprivation; and the characteristics of those that improve their baseline conditions.

Previous analyses have used a model of differences comparing, in most of the cases, changes between the first and the last observation. This research will look at the fluctuations throughout time in order to assess whether there is a consistent pattern in the movements observed, and whether there are stages when the Programme had greater impact.

Until now, the analyses of Progresa's impact have focused on the effects of the Programme distinguishing their results between the poor households in the treatment and control areas. Little attention has been paid to identify changes according to the depth of poverty. This work will explore if there are differences in the outcomes at different levels of poverty.

Lastly, the previous studies do not identify which groups of the population are benefiting more or less from Progresa's intervention. For social policy implications, it is crucial to analyse more deeply which are the characteristics that enable the population to escape from their vulnerable situation, thus this investigation will pay special attention to the identification of these characteristics.

The fact that these programmes are being implemented in several countries makes it imperative to identify the strengths and weaknesses of Progresa. This was the first programme of this kind so other countries can continue to benefit from its experience. Additionally not all countries have been able to set such a rigorous evaluation system. Therefore, the findings from this rich dataset will contribute to our understanding on how to improve the living conditions of children growing up in extremely disadvantageous situations.

2.8. Summary

This chapter has set the contextual background of the thesis by presenting the important gaps between socio-economic groups, between regions and between urban and rural localities. Mexico is classified as an upper-middle income country, with high levels of human development. What is more, at the macro level, social indicators have had important improvement, approaching the levels of more developed countries. However, this progress has not reached the entire population.

According to estimates of the Technical Committee for the Measurement of Poverty, at the time Progresa was launched, 26.8 percent of households (or 33.9 percent of individuals) lived in extreme poverty. Moreover, extreme poverty was highly concentrated in rural areas (44 percent of rural households and urban 16 percent). Our estimates for child poverty using monetary measures suggest that a significant number of children grow up in extreme poverty. The proportion of children without access to basic needs ranges from 34.4 percent to 48.3 percent, which in absolute terms corresponds to a range between 9.9 and 13.9 million children.

The Mexican government launched in 1997 a nation wide anti-poverty programme, Progresa, whose main objective was to improve the basic capabilities of the poorest families in the country. The Programme had an integral approach, giving benefits in three areas closely linked to each other: education, health, and nutrition. Progresa's monetary and in-kind benefits vary according to the demographic characteristics of the family and are given directly to the mother of the household. In 2001, the Programme broadened its activities and extended to urban localities. Results from its first evaluations encouraged its spread into other countries, particularly in Latin America. Currently there are conditional cash transfer programmes operating in: Honduras, Nicaragua, Brazil, Colombia, Jamaica, Turkey, South Africa, Chile, Bolivia and Ecuador.

Table 2.16 Main Characteristics of Conditional Cash Transfers

Programme	Starting date	Objectives	Benefits	Target Population		Coverage	Annual budget % of GDP
				Education	Nutrition& Health		
Food for Education, **Bangladesh**	1993	• Improve school attendance • Reduce child labour	• Initially ration of food grains (mostly wheat), but changed to monetary grants	• Children 6-12 in primary school	-	Around 2 million families and 2.4 million children (in 2000)	Approx. US $77 million (in 2000)
Progresa, **Mexico**	1997	• Improve educational, health and nutritional status, particularly that of children and their mothers.	• Educational grants, cash transfer or in-kind support for school supplies, basic health package Cash transfer for food • Nutritional supplements Health education • Improve supply and quality of services	• Children 8-18 enrolled in school (from 3rd grade of primary up to 3rd year of secondary[33])	• Cash grants for all eligible households • Supplements for pregnant and lactating women, children 4-24 months old and malnourished children 2-5 years old	5 million households (Dec. 2004)	Approx. US $ 2,250 million in 2004 (0.35% of GDP in 2004)
PRAF II (Programa de Asignación Familiar), **Honduras**	1998	• Increase human capital investments	• Educational, nutritional and health vouchers • Supply incentives for primary school and health centres • Health education	• Children 6-12 who have not completed 4th grade	• Pregnant women • Children 0-2	Around 300,000 individuals 4.7% of population	Approx. US $ 1.2 million (0.019% of GDP)
Red de Protección Social, **Nicaragua**	2000	• Increase human capital investments	• Educational grants and monetary support for school supplies • Cash transfers for food • Basic health care services • Health education Supply incentive	• Children 6-13 enrolled in primary school (1st - 4th grade)	• Cash grants for all eligible households • Health care services for children 0-5	100,000 households 60,000 individuals 1.2% of population	Approx. US $5 million in 2002 (0.021% of GDP)

33 From 2001, children enrolled in medium high schools are also eligible to receive educational grants.

Sources: (Ahmed and Ninho 2002), (Maluccio and Flores 2004),(Rawlings and Rubio 2003), (Rawlings 2004), (Attanasio et al. 2005), (WorldBank 2001). http://www.mec.gov.br/secrie/default.asp; http://www.chilesolidario.gov.cl/publico/que_es.php?art=4;

PETI (Programa de Erradicaçao dao Trabalho Infantil), **Brazil**	1999	• Eradicate child labour, while increasing educational attainment	• Educational grants • After-school programme	• Children 7-14	-	886,000 children (in 2002)	Approx. US$ 175 million in 2002 (0.04 % of GDP)
Bolsa Alimentaçao, **Brazil**	2001	• Reduce nutritional deficiencies and infant mortality among poorest households	• Cash transfers	-	• Pregnant and lactating women • Children 6 months to 6 years	2.5 million hhds 800,000 pregnant and lactating women, and 2.7 million children (target)	Approx. US $ US$300 million (0.05% of GDP) Source IFPRI
Bolsa Escola, **Brazil**	2001	• Increase educational attainment of school-age children	• Educational grants	• Children 6-15	-	5.7 million hhds 8.3 million children	Approx. US $800 million (0.13% of GDP)
Familias en Acción, **Colombia**	2001	• Increase human capital investments	• Educational grants • Cash transfers for food • Health education	• Children 7-17 enrolled in school (2nd - 11th grade)	• Children 0-6 not participating in other programmes	411,387 families (Sept. 2004)	Approx. US $100 million in 2004 (0.12% of GDP)
PATH (Program of Advancement through Health and Education), **Jamaica**	2002	• Increase educational attainments, improve health outcomes, reduce child labour, serve as a safety net	• Educational grants • Cash transfers for food • Health education	• Children 6-17	• Pregnant and lactating women • Children 0-5 • Adults 65+ • Persons w/ disabilities • Poor adults <65	236,000 individuals 128,786 children (Oct. 2003)	US $23 million in 2004 (0.32% of GDP)
Social Fund, **Turkey**	2002	• Improve school attendance and health care of children	• Educational grants • Health support	• Children attending school	• Poor households with children 0-6 years old	22,000 households (in 2003)	US $120 million in 2004 (0.06% of GDP)
Chile Solidario, **Chile**	2002	• Eradicate extreme poverty through integrated services	• Consumption subsidy • Other benefit entitlements Access to services according to hh char.	• All households in extreme poverty willing to participate	• All households in extreme poverty willing to participate	250,000 households	Approx. US $111 million in 2005 (0.04% of GDP)

Table 2.17 Evaluation Scheme of Conditional Cash Transfers

Programme	Evaluation Design	Data Sources	Sample size		Results
			Control	Treatment	
Food for Education, **Bangladesh**	• Random assignment of villages receiving and not receiving benefits	• School surveys • Household survey • Academic achievement test • Qualitative surveys	40 schools	70 schools	• Enrolment rates increased 35%, with greater increase for girls; • Attendance rates increased 21%; • Dropout rates decreased 60%. Source: (Ahmed and Ninho 2002),
Progresa, **Mexico**	• Experimental w/panel data • Random assignment of localities into treatment and control groups	• HH survey (baseline + 5 follow ups) • School and health centres surveys • Locality surveys • Standardised test scores • Administrative data	186 localities (9,221 hhs.)	320 localities (14,856 hhs.)	• Consult Sections 2.3.6 and 2.3.7
PRAF II (Programa de Asignación Familiar), **Honduras**[1]	• Experimental w/panel data • Random assignment of mun. into 4 gps: • G1: Vouchers • G2: Supply incentives • G3: Vouchers+ supply incentives • G4: Control	• Census of G1& G2 municipalities • HH survey (baseline + 2 follow ups) • School and health centres surveys • Standardised test scores	G4:20 mun. (1,600 hhs.)	G1: 20 mun. (1,600 hhs.) G2: 20 mun. (1,600 hhs.) G3:10 mun. (800 hhs.)	• Health service utilization had a positive effect; • Prenatal visits increased by 19.5%in G1 and 18% in G3; • Growth monitoring increased by 21.7%in G1 and 17.4% in G3; • No evidence of a nutritional impact; • Anaemia contrary result to expected. • Source: (Flores et al. 2003)
Red de Protección Social, **Nicaragua**	• Experimental w/panel data • Random assignment of census areas into treatment and control groups	• Census of programme area • HH survey (baseline + 1 follow up) • Institutional assessment schools	21 census areas (812 hhs.)	21 census areas (773 hhs.)	• Enrolment rates increased 18 pp; • Attendance rates increased 23 pp; • Increased use of health services; • Child labour (children 7-13) declined by 5 pp; • Stunting (children 0-5) declined by 5pp. • Source: (Maluccio and Flores 2004)

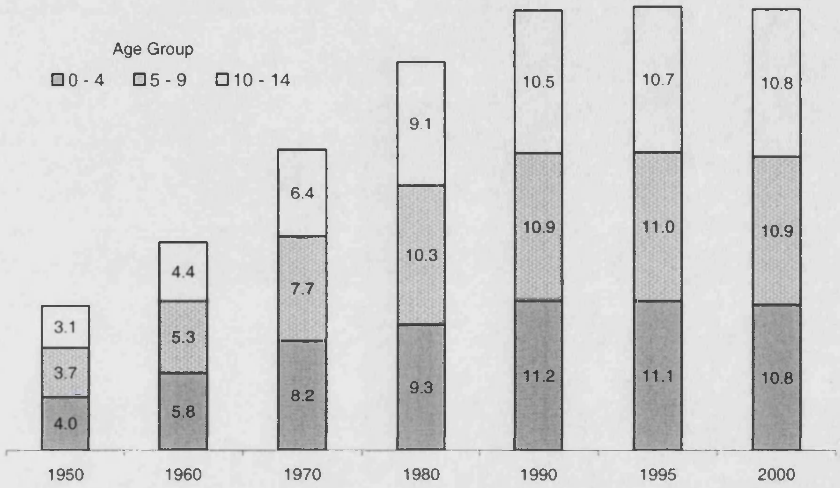
PETI (Programa de Erradicaçao dao Trabalho Infantil), **Brazil**	• Quasi-experimental • Participating municipalities matched w/similar non-participating mun.	• Household survey	9 municipalities	9 municipalities	• Probability of working fell between 4 and 26 percentage points; • Probability of working in high risk activities also decreased. Source:(Rawlings and Rubio 2003)
Bolsa Alimentaçao, **Brazil**	• Pair-matching sample of control and treatment individuals with similar charact.: place of residence (municipality), gender, age and a set of socio-economic variables.	• Household survey 6 months after programme launch plus routinely weight measurements registered on children's health cards.	n.a	n.a	• Beneficiary children (6- 36 months old) gain less weight than excluded comparable children (18 g, less in 6 months). • Negative impact increases up to12 months and then is less marked at older ages. • Effects on child labour inconclusive Source:(Morris et al. 2004)
Bolsa Escola, **Brazil**	-	-	-	-	• Improved educational outcomes • Dropout rates were 0.4% and 5.6% among beneficiaries and non-beneficiaries, respectively; • Promotion rates were 80% and 72% among beneficiaries and non-beneficiaries, respectively; • No difference in learning outcomes; • Effects on child labour inconclusive.
Familias en Acción, **Colombia**	• Experimental w/panel data • Non-random assignment of municipalities into treatment and control groups	• Household survey (baseline in 2002+ 1 follow-up in 2003)	4,562 households	6,722 households	• Increase in children's preventive healthcare visits; • School attendance rates increased by 10.1 and 5.2 pp for children 12-17 yrs old living in rural and urban areas, respectively; • Consumption increased by 19.5% in rural areas and by 9.3% in urban areas; • Diarrhoea prevalence decreased by 11 pp for children <48 mths. in rural areas; • Children's height had a positive impact of 0.44 cm. among children 12 months old. • Source: (Attanasio et al. 2005)

Other sources: Rawlings and Rubio 2003; http://www1.worldbank.org/sp/safetynets/Country%20Presentations.asp

Appendix 2. Additional Tables – Chapter 2

Figure A.2.1

Child Population, Mexico 1950-2000
Millions



Source: INEGI, Estadísticas Históricas de México: CONAPO, Proyecciones de la Población de México, 1990-2030, México 1996.

Table A2.1
Cutt-off points for Poverty Lines

	Poverty Line 1		Poverty Line 2a		Poverty Line 2	
	Pesos per day per person*	*PPP US$** per day per person*	*Pesos* per day per person*	*PPP US$** per day per person*	*Pesos* per day per person*	*PPP US$** per day per person*
Rural	15.4	2.5	18.9	3.1	28.1	4.5
Urban	20.9	3.4	24.7	4.0	41.8	6.8

Source: (Cortés et al. 2002)
Notes: * pesos August 2000,
** pesos converted into PPP US$ using PPP published by OECD (http:/www.oecd.org/std/ppp).

Table A2.2
Household Size and Number of Children according to Poverty Line, Mexico 1998.

	Poverty Lines 1 and 2a			Poverty Line 2			National		
	Urban	*Semiurban + Rural*	*Total*	*Urban*	*Semiurban + Rural*	*Total*	*Urban*	*Semiurban + Rural*	*Total*
Household size	5.5	5.2	5.4	4.9	4.8	4.9	4.2	4.8	4.4
Children 0 - 5 years	0.9	0.9	0.9	0.7	0.7	0.7	0.5	0.7	0.6
Children 6 - 12 years	1.1	1.1	1.1	0.9	0.8	0.9	0.6	0.9	0.7
Children 0 - 12 years	2.0	1.9	2.0	1.6	1.5	1.6	1.2	1.6	1.3

Source: (Cortés et al. 2002)

Chapter 3. Methods of Analysis and Data Quality Assessment

3.1. Introduction

Evaluating the impact of an intervention involves a wide range of methodological issues that need to be accounted for in order to reduce possible bias in the estimations. In this chapter, we describe the characteristics of the data and the methodology followed to answer our research questions. We begin in Section 3.2 by describing the different data sources used for our analyses. Next, in Sections 3.3 and 3.4 we present the conceptual framework and the statistical approaches used in our investigation. In Section 3.5, we describe the construction of the outcome variables and the covariates used in our analyses. In Sections 3.6, we explain the construction of the "working" datasets. And, in Section 3.7, we provide an assessment of the quality of the data. The Appendices of this chapter contain further details of the themes covered in the different household surveys and of other data processing aspects.

3.2. Introducing the data sources

Among all the available instruments used for monitoring and evaluating the operation of the Programme, our analyses are carried out using data from the following surveys:

- ENCASEH (Survey of Households' Socio-economic Characteristics)
- ENCEL (Evaluation Survey)
- ENCASEL (Survey of Localities' Characteristics)
- INSP (Nutrition and Health Survey)

ENCASEH *(Survey of Households' Socio-economic Characteristics)*

This survey was carried out in all the rural localities selected for incorporation into the Programme. Information from all the households living in these localities (census within the community) was collected at the household and individual levels. The topics covered include information on demographic characteristics, family structure, educational level of household members, children's school attendance, working status of all household members, household's income level, possession of land and livestock, and dwelling characteristics.[34] By January 2001, about 5,300 localities and 4 million households had been surveyed. The ENCASEH is one of the most important data collection instruments of the Programme because it provides information with which families are classified as poor or non-poor. This survey was carried out just once in each household. Its information, together with that of the first ENCEL survey, is used to describe the baseline or pre-programme situation[35].

ENCEL *(Evaluation Survey)*

This survey collected periodic information (about every six months beginning in March 1998) from a panel of households residing in 506 localities, distributed across seven states of the country: Guerrero, Hidalgo, Michoacán, Puebla, Querétaro, San Luis Potosí, and Veracruz (see Figure 3.1). Approximately one-third of these localities (186) were randomly chosen to act as a control group, and their entry into the Programme was delayed for two years (some of them began to receive benefits in December 1999). The remaining two-thirds (320) of the localities were incorporated to Progresa at an early stage (began to receive benefits in May 1998). Further details on the randomisation of Progresa's evaluation strategy are provided in Chapter 2 (see pages 56 and 57).

It is worth mentioning that these localities are situated in regions that have been classified by the government as "priority regions of immediate attention". The regions included in the ENCEL sample are: Montaña in Guerrero, Sierra Negra Zongolica Mazateca, Sierra Norte Otomí Tepehua, Sierra Gorda, Altiplano, Huasteca and Tierra Caliente. Although localities in Oaxaca and Chiapas have the highest marginality indices in the country, they are not part of the ENCEL sample because they were not incorporated in the initial stages of the Progresa programme. The reason for this is that these sites were more difficult to access and operate. Their geographic conditions, and conflict in Chiapas, meant their incorporation was delayed until May 1998.

[34] For a complete description of these topics consult Appendix 3.1.

[35] This can be done because the variables collected in the ENCASEH were mostly time-invariant, because the period between both surveys was only four months, and because the first monetary transfer was given after the first round of the ENCEL.

Figure 3.1

ENCEL Sample

1. Guerrero
2. Hidalgo
3. Michoacán
4. Puebla
5. Querétaro
6. San Luis Potosí
7. Veracruz

Given the structure of the evaluation sample, households can thus be divided into 4 groups, according to whether the household is eligible to receive benefits (poor or non-poor), and whether the household resides in a treatment or control locality. The total sample covers approximately 125,000 individuals living in 24,000 households. The topics covered in this survey are related to the possible effects of the policy intervention, so that certain sections were only asked to particular age groups. The questionnaire topics include the following areas: educational attainment, health status, use of health services, household income, consumption, expenditure, changes in family structure, migration, dwelling characteristics, women's status, mortality, fertility and time allocation[36].

During the first stage of the Programme, six rounds of the ENCEL survey were collected:

1. March 1998 (baseline)	ENCEL-98M	Wave 1
2. November 1998	ENCEL-98N	Wave 2
3. May 1999	ENCEL-99M	Wave 3
4. November 1999	ENCEL-99N	Wave 4
5. May 2000	ENCEL-00M	Wave 5
6. November 2000	ENCEL-00N	Wave 6

In October 2003, there was a new follow-up of the ENCEL sample. However, as far as we are concerned, the new dataset has not been released yet.

[36] For a detailed description of the questionnaire topics asked in each round of data collection, consult Appendix 3.2.

ENCASEL *(Survey of Localities' Characteristics)*

This survey collected information on characteristics of the localities where the ENCEL survey is carried out (506 localities: 320 treatment localities and 186 control localities). The fieldwork was conducted at the same time as the ENCEL data was being collected. There is one questionnaire per locality, which is usually answered by someone from the local authority. The interviewee is asked for information on different aspects of the locality such as access to public services, access to and prices of basic products, main economic activities, public programmes operating in the locality, access to transportation and highways, and incidence of natural disasters among others. These data are a valuable complement to the information at the individual and household level.

INSP survey *(Nutrition and Health Survey)*

The main objective of the evaluation carried out by the National Institute of Public Health (INSP for its acronym in Spanish) is to assess the impact of Progresa on the health and nutritional status of beneficiary families. To date, the Institute has conducted three rounds of surveys in which it has gathered both cross-sectional and longitudinal information about children aged under five. The first round was carried out between August and September 1998, the second one between October and December 1999 and the last survey between November and December 2000.

In order to have a baseline survey, the first wave collected information from households that were still not receiving benefits from the Programme, i.e. those that were incorporated into the Programme in September 1998. The sample of localities within this survey was randomly selected from the sample of treatment and control localities included in the ENCEL surveys[37]. After the localities were chosen, a random sample of households with children under five was selected. Unfortunately, as we will explain later on, the treatment and control groups were not perfectly randomised, showing statistically significant differences in observed and unobserved characteristics. For the cross-sectional sample, an independent sample of households was drawn at each of the waves. For the longitudinal sample, the group of children between 0 and 6 months of age at baseline were followed for two subsequent rounds (Rivera et al. 2000). As we will observe later, we found a

[37] The sampling framework was limited to those localities that were incorporated into the Programme after September 1998. Additionally, this study included a disproportionately large sample for control groups in order to have reliable estimates on anthropometric indicators for both treatment and control groups. For further details on the sample selection consult (Rivera et al. 2000).

longitudinal sample quite different from the one established in the longitudinal design strategy. Only a small number of children within this age group were followed over time.

The sample of households within this survey is a sub-sample of the ENCEL survey (3,700 households residing in 374 localities). Special attention is given to the information on women and children; thus certain sections of the questionnaire focused on collecting information on a sample of:

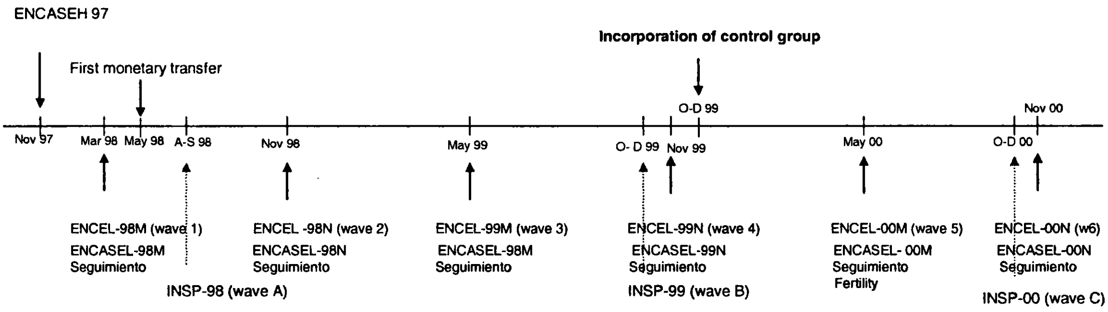
Children under-five		*Mothers*	
Cross-sectional	4,000	Cross-sectional	3,000
Longitudinal	1,000	Longitudinal	500

The questionnaire is divided into the following sections:

- Questionnaire on *household characteristics* (demographic, socio-economic and dwelling characteristics);
- Questionnaire for *pregnant women* (number of pregnancies, number of children born alive, 24 hour consumption recall, blood test and anthropometric measures);
- Questionnaire for *small children* (consumption during the last day with a special set of questions regarding the nutrition supplement given by Progresa, breastfeeding and feeding practices, reported health status, blood test and anthropometric measures(weight, and height or length)).

Figure 3.2 shows the timing of the different evaluation surveys as well as some significant events within the Programme (first monetary transfer and incorporation of the control group into the Programme). As can be seen, in the last two rounds of the ENCEL survey (ENCEL-00M and ENCEL-00N) the control group had already been incorporated into Progresa. Scientifically, this is not the ideal situation for evaluation purposes; however, ethically it was not viable to continue withholding benefits from control families. This has to be considered in the analyses, as it is very likely that the pattern observed in the first four rounds will change from the fifth wave onward, i.e. it is possible that treatment effects will be diluted from this round onwards.

Figure 3.2 Timing of Surveys and other Events



It is worth underlining the value of this information. In developed countries such as the US and Britain there is a long tradition of carrying out panel studies with detailed information on a wide range of areas. Unfortunately, in developing countries, although panel studies exist[38], they are less common because data collection is difficult and expensive. Moreover, it is unusual to have a dataset to evaluate the performance of an anti-poverty governmental policy with the characteristics of the ENCEL. The key features that differentiate it from other panel datasets are: data were gathered before and after the operation of the Programme; it is a longitudinal dataset in sample and in variables; it has a control and a treatment group; it has a very large sample size; it has more than two observations in time; it includes information at three levels: localities, households and individuals; it covers information on a wide range of topics; it is possible to look at interactions; and it can be merged with surveys that collect complementary information. These features make these data unique for understanding in depth the living conditions of the very poor.

3.3. Conceptual framework

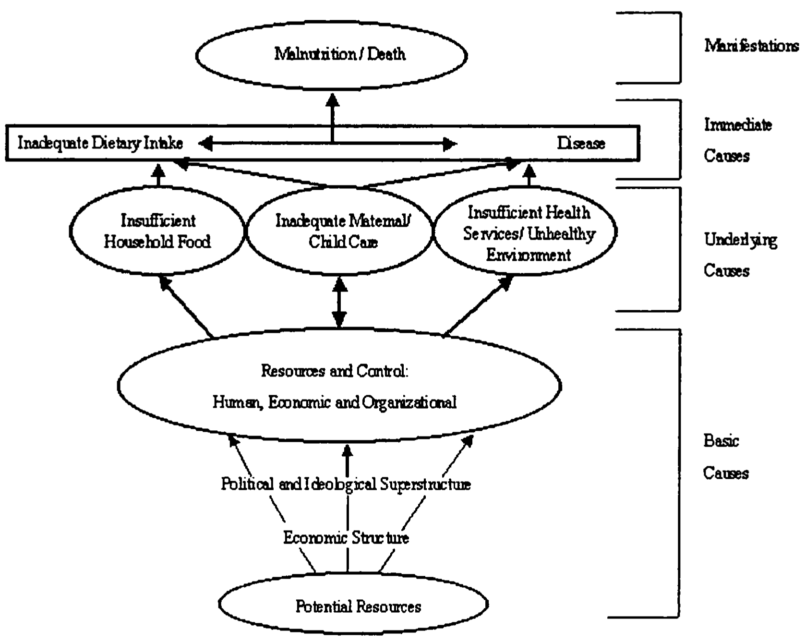
The analysis of this study is based on two conceptual frameworks proposed for the study of child health outcomes. The first is a model developed by UNICEF (UNICEF 1998) for the analysis of the determinants associated with child malnutrition. The second is a general framework for understanding the biological, behavioural and socioeconomic factors that affect child health outcomes formulated by Mosley and Chen (1984). These theoretical frameworks, in conjunction with evidence from longitudinal and cross-sectional studies, conceptualise the flow of processes through which a composite of factors influence children's health status.

[38] Some examples of panel studies carried out in developing countries include: South Africa (Johannesburg), Brazil (Pelotas), Cameroon (Yaounde), Philippines (Cebu), China, Guinea-Bissau, Bangladesh, Senegal (Harpham et al. 2002). Currently, there is a project, Young Lives, following up a sample of poor children over a period of 15 years in four developing countries: Ethiopia, India, Peru and Vietnam (http://www.younglives.org.uk).

In addition, they provide guidelines for specifying the hypothesized relationships between variables, and for selecting the set of independent and dependent variables to include in our models.

UNICEF's framework suggests that there are three levels of causality that influence children's nutritional status: immediate, underlying, and basic causes (Figure 3.3). The immediate causes have a direct influence on malnutrition and include individual level variables. These include dietary intake and health status, which have a reciprocal association (UNICEF 1998). An inadequate dietary intake is associated with a higher incidence of infectious diseases and children who catch a disease lose their appetite and their capacity to absorb nutrients (Martorell, 1984). Underlying causes influence children's nutritional status via the immediate causes. They are grouped into three categories: access to food, adequate maternal and childcare, and healthy environment. Each dimension includes variables associated with household resources that enable or hinder their achievement (UNICEF 1998). Poverty determines the availability of resources within the dimensions of the underlying causes; hence, it has a strong influence on the final outcome (Smith and Haddad 2000). Finally, the basic causes, which include variables at the macro level, have an effect on children's health status through these underlying causes. They encompass the natural, human, and economic resources of a community or region. The proper and efficient use of these resources determines households' access to basic needs (UNICEF 1998).

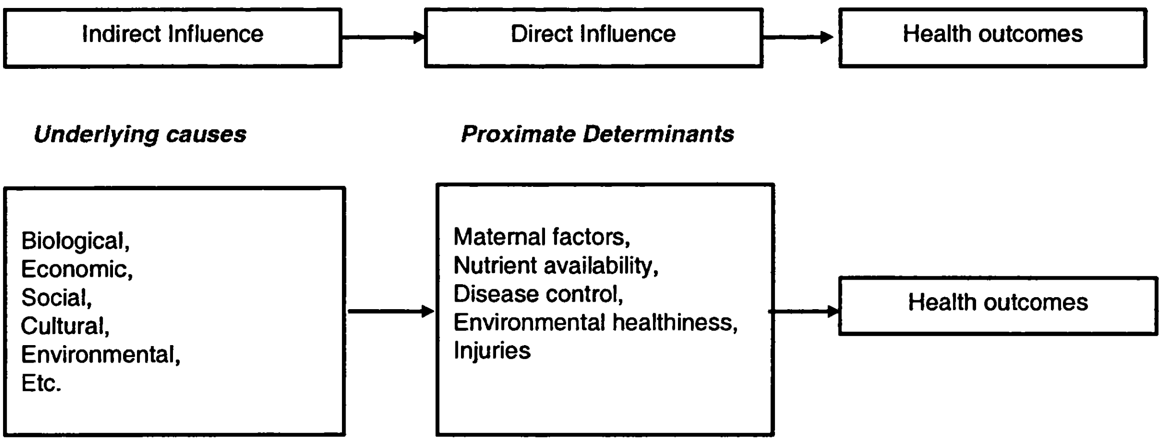
Figure 3.3 UNICEF's framework



Source: (UNICEF 1998)

Mosley and Chen's framework (Figure 3.4) suggests that health outcomes, such as child mortality and morbidity, are directly affected by health inputs, which they named the proximate determinants of health (Mosley and Chen 1984). These factors have a role similar to that of the proximate determinants of fertility, developed by Davis and Blake (1956). That is, they have a direct effect on the outcome, in this case health; and other forces, such as social and economic factors, operate through these to affect children's health. Mosley and Chen suggested grouping the proximate determinants of health into five categories or dimensions: a) maternal factors (age at childbearing, parity and child spacing), b) nutrient availability (dietary intake, breastfeeding and feeding practices), c) disease control (preventive and curative health measures), d) environmental healthiness (water and sanitation), and e) injuries (accidents) (Mosley and Chen 1984). This framework identifies the characteristics that affect health inputs and in turn health outcomes. Nevertheless, one has to be careful when modelling these associations, since these proximate determinants are often linked trough quite complex (and perhaps unknown) pathways to health outcomes (e.g. birth spacing). Thus, they are less proximate or direct than the factors affecting fertility outcomes.

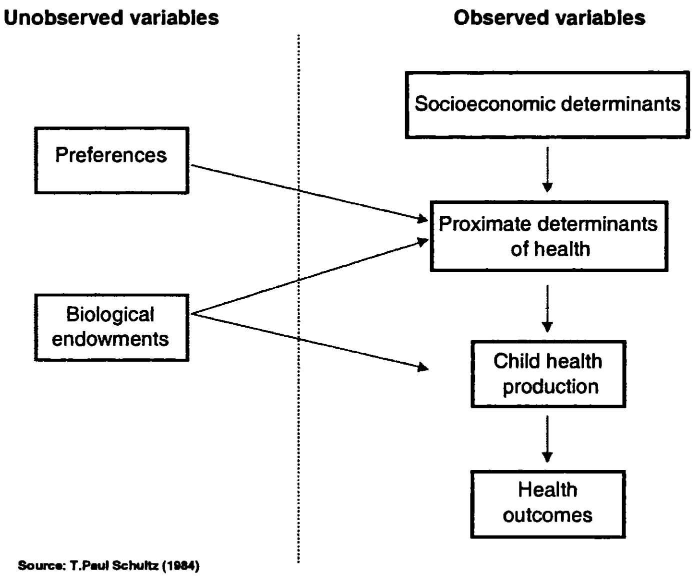
Figure 3.4 Mosley and Chen's framework



Based upon this model, Schultz explained that it is necessary to account for the influence of unobserved factors otherwise estimations are prone to be biased (Schultz 1984). He grouped these unobserved variables into two categories: biological endowments and preferences (see Figure 3.5). The former determine the capability of an individual to recover from a disease; they depend upon the mutual influence of genetic and environmental factors; and cannot be controlled by the individual. These health endowments have a direct effect on the health production of the individual and an indirect effect through the way health inputs are used (a healthy child may receive a different treatment than an unhealthy one) (Schultz 1984). Preferences, in conjunction with economic endowments (including human and non-human capital), determine family behaviours and practices towards the use of health inputs. This approach acknowledges the importance of considering the presence of unobserved health heterogeneity in the analysis of health outcomes and its determinants.

Our study is based on the previous analytical frameworks and uses various statistical approaches to control for possible sources of estimation bias. The data sets include detailed information on background characteristics that allow us to control or assess the influence of those variables identified by the previous frameworks as being related with child health outcomes. We are able to examine the following outcome variables: households' food security, child feeding practices, children's nutritional status, and the incidence of diarrhoea and respiratory infections.

Figure 3.5 Factors determining Child Health



3.4. Measuring Progresa's Impact on Child Health Outcomes

A major aim of this research is to estimate Progresa's effect on a set of outcome variables associated with children's health and nutritional status. Specifically, we want to determine whether Progresa has a positive impact on these outcome variables, whether this effect changes over time, and whether the Programme effect is stronger for certain sub-groups. We centred our analysis on examining the outcomes of the eligible sample only.

The Programme's effect is assessed using a dummy variable with a value of one if an eligible (poor) household (or child) lives in a locality incorporated into the Programme (treatment locality) and zero otherwise. It is worth recalling that the treatment group corresponds to the localities that were scheduled to receive benefits at the beginning of the Programme (from May 1998), and the control group refers to the communities that began to receive benefits at a later stage (from December 1999).

In our study, the period of analysis covered rounds of data collection (May 2000 (wave 5) and November 2000 (wave 6)) during which most households in the control group began to receive Programme benefits. However, our dummy variable for assessing Progresa's effect does not account for the fact that the control group was receiving benefits in the last waves of data collection. The reason for this is that not all localities in the control areas were incorporated by December 1999 and we do not have information that would allow us to identify which localities were receiving benefits. This is clearly a substantive caveat in terms of programme evaluation because comparisons between treatment and control groups are weaker and the intervention effect is more difficult to analyse. The performance of the control group after wave 4 is influenced by Progresa's intervention. Thus, the fact that we do not account for the intervention in control areas may affect our estimations, resulting in a downward bias of the Programme's effect.

Our general model to evaluate Progresa's effect can be expressed as follows:

$$Y_{it} = \alpha + \beta P_{it} + \sum_j \delta_j X_{it} + e_{it} \qquad (1)$$

where i=1, 2,..,n (individuals), t= wave of data collection, Y_{it} is the outcome under study, P_{it} is a dummy variable for living in a treatment locality, and x_{it} is a set of explanatory variables at the individual, household and community level.

The estimated value of β yields the impact of Progresa on the outcome variable Y_{it}. For the treatment group, $P_{it}=1$ and thus the right hand side of equation (1) is equal to $\alpha+\beta+\sum_j \delta_j X_{it} + e_{it}$. In contrast, for the control group, the value of $P_{it}=0$ and its corresponding value for equation (1) is $\alpha+\sum_j \delta_j X_{it} + e_{it}$. The difference between these two expressions is the effect attributed to the intervention, which is β (Ravallion 2001).

In order to assess whether there are stages of the Programme with greater impact, we included in our models an interaction term that provides estimates for the effect of being an eligible child and living in a treatment locality by wave of data collection ($P_{it}.W_{it}$). Estimates from this model should be read carefully because, as mentioned before, comparisons between treatment groups in the last waves are weaker.

$$Y_{it} = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 P_{it}.W_{it} + \sum_j \delta_j X_{it} + e_{it} \qquad (2)$$

where i=1, 2,..,n (individuals), t=waves of data collection.

Finally, to identify possible treatment differences according to household characteristics, our models include interaction terms that estimate the effect of receiving Progresa's benefits by a group of community and household characteristics linked with lack of resources (e.g. parental education, mother's language, number of children under the age of five, region of residence).

$$Y_{it} = \beta_1 P_{it} + \sum_j \delta_j P_{it} X_{it} + e_{it} \qquad (3)$$

In some models, the estimates of the interaction terms did not provide much information. Therefore, to answer whether there is a differential impact of the Programme according to households' resources, we fit our models using household's classification of poverty. That is, we estimate our models separately for each tercile[39] of poverty and compare the magnitude and significance of the coefficients between groups. Additionally, to assess whether differences by poverty level are significant we run our models including an interaction term between participating in Progresa and our poverty measure.

[39] This variable was constructed by categorising Progresa's poverty index into terciles.

Estimation methods

As previously discussed, Progresa's evaluation includes random samples of treatment and control[40] localities. This design should enable rigorous testing of the effects of the intervention as the only difference between the control and the treatment group should be the presence of the Programme. However, as discussed below, randomisation was not perfect.

One approach to estimate the impact of an intervention is to use the double difference method, which consists of comparing a treatment and a control group before and after the intervention. Through this method, the treatment effect can be defined as the difference between the change observed within the control group and that observed within the treatment group (Anderson 1980). The change experienced by the control group is deducted from that of treatment because it is assumed that this change would have occurred even in the absence of the programme and thus cannot be attributed to its intervention. The outcomes of the control group represent what might have happened in the absence of the programme. The difference-in-difference estimator can be expressed as:

$$\text{Double-difference} = (\overline{X}_{T_{i+1}} - \overline{X}_{T_i}) - (\overline{X}_{C_{+1i}} - \overline{X}_{C_i}) \quad (4)$$

where $\overline{X}$ = mean value of outcome X, T= treatment, C= control, and i = wave of data collection.

However, assessing an intervention with a double difference estimator can only be done when assignment to control and treatment groups is random. If there are differences between groups at baseline, then this approach could either overestimate or underestimate the true treatment effect. Because our analyses suggest that the sample was not perfectly randomised (particularly the INSP sample), we use methods that account for the differences (observed and unobserved) in explanatory variables between groups.

One way of controlling for observed differences in covariates is to match the control and treatment groups according to those characteristics that differ significantly across groups. In principle, this procedure allows for comparisons that attribute any remaining observed difference to the intervention (Anderson 1980; Ravallion 2001). We tried constructing a matched sample of treatment and control cases for

[40] The treatment group refers to those eligible children living in communities that were incorporated into the Programme at an early stage. The control group represents children living in localities that were incorporated until the last stages of incorporation (they did not receive any benefits for 2 years).

our INSP sample to control for the observed heterogeneity between treatment groups. Unfortunately, we found that the matching sample had two important limitations: 1) the number of cases decreased dramatically, and 2) this approach eliminates the observed differences between groups, but does not eliminate any differences due to unobserved variables. Thus, we decided to work with our original dataset.

A simpler alternative to control for observed heterogeneity is to include those covariates with different values between treatment and control groups in a multivariate regression model. We follow this approach to control for this source of estimation bias.

In addition to observed differences between groups, it is important to consider differences in unobserved variables, since the latter may introduce an additional bias in the estimations (Anderson 1980). As discussed in the conceptual framework section, when analysing child health outcomes, it is important to account for the influence of unobserved variables (e.g. genetics, endowments and preferences), since they are likely to have an effect on health related behaviours through which they can strongly influence the outcomes under study (Schultz 1984). A method to control for unobserved heterogeneity is to use panel data techniques which account for the fact that observations of the same individual are correlated over time.

Statistical techniques for analysing longitudinal data

There are different panel data techniques that can be used for analysing repeated observations of the same individual: between subject estimation, within subject estimation (or fixed effects) and random effects. The method to use depends, among other things, on the characteristics of the data (e.g. number of follow-up waves, randomised trial, characteristics of the random component). The nature of our data differs between subjects of the study; thus, no single method was always appropriate and the analytical methods vary from chapter to chapter[41].

Initially, the most suitable panel data technique for this analysis seemed to be the random effects model, since it estimates parameters for both time varying and time

[41] Before explaining the methods used, it is worth mentioning that our longitudinal models are estimated using Stata's xt commands. An advantage of this software is that it allows use of unbalanced data (a sample in which the number of subjects fluctuates over time). This enabled us to analyse the information for cases with at least two repeated measures instead of restricting our analysis to the longitudinal sample with complete information in all waves of data collection.

invariant covariates; it allows the specification of different error correlation structures; and it provides more precise estimates than other methods (between and within estimations)[42]. However, random effects models cannot always be used because they require that the random components and predictor variables are uncorrelated. The random effects model, as expressed in equation (5), was suitable only for our analysis of food security indicators at the household level (Chapter 4).

$$Y_{it} = \mu + \beta x'_{it} + \alpha_i + e_{it} \tag{5}$$

where μ is the intercept, β estimates the effect of time varying covariates, and the error term has two components: α_i .an individual specific component that is constant over time, and e_{it} an error term that is uncorrelated over time.

The fixed effects model examines how the variation in each individual response is related to the variation in the predictors (Hsiao 2003). This method concentrates on differences "within" individuals. For any explanatory variables (observed and unobserved) that are constant over time x_{it} is equal to its mean, and thus makes no contribution to the analysis. Regarding omitted variables, if one assumes that they remain constant over time (a potentially strong assumption), they are eliminated from the model as well (α_i). The model can be expressed as:

$$(Y_{it} - \bar{Y}_i) = \beta(x_{it} - \bar{x}_i) + (e_{it} - \bar{e}_i) \tag{6}$$

where the coefficient β estimates the effect of time varying covariates.

As can be seen in equation (6), the fixed effects model can only estimate coefficients for predictors that vary over time. Unfortunately, most of the variables in our dataset are time invariant and are differenced out in a fixed effects model. We use a fixed effects model to estimate Progresa's effect on children's nutritional status (Chapter 7) because we found evidence of unobserved heterogeneity that could be associated with participation in the Programme. A Hausman specification test yielded evidence that a random effects model was not an appropriate method to use because the probability that the unobserved factors were independent of the right hand side variables was low. Thus, the random effects method was not appropriate for this analysis.

[42] The random effects method provides a more precise estimate because it pools the information from which the fixed/within estimate (longitudinal information) is calculated with the information from which the between estimator is calculated (cross-sectional information) (Pickles 2003).

In order to retain the coefficient for participating in Progresa, we transformed it into a time varying covariate by assigning a value of zero at baseline to all observations, since the Programme was not operating at that time, and a value of zero or one at consecutive waves depending upon whether the child was living in a control or treatment community.

When estimating limited dependent variable models with fixed effects a similar problem emerges. The model is only identified using observations for which the outcome varies across waves. For the analysis on children's nutritional status, this is of not great consequence because the outcome variable is continuous. However, for the analysis of morbidity (Chapter 6), this is an important limitation because our outcome variable is binary, hence a considerable number of cases have the same value between waves. By using a fixed effects approach, we would have lost an important number of observations, ignoring the information from those children with fixed outcomes over time.

In Chapter 6, we use an alternative method for repeated binary data that allows us to estimate the changes over time of those individuals whose outcome variable stays constant over time. Since our outcome variable is binary, the appropriate model to fit is a logit. We use a longitudinal discrete method that adjusts for the fact that some observations belong to the same individual. This model initially assumes that all observations are independent, but by specifying that they are clustered within individuals it then adjusts the standard errors[43] to account for the fact that there are repeated observations.

$$\log(M_{it}) = \sum_j \delta_j X_{it} + e_{it} \tag{7}$$

where i=1, 2,..,n (individuals), t= waves of data collection, and M_{it} is the odds ratio $p_{it}/(1- p_{it})$, where p_{it} is the probability that the child is ill with diarrhoea or some respiratory infection.

Finally, for the analysis of feeding practices (Chapter 5) we use retrospective data on the duration of breastfeeding and exclusive breastfeeding. We use survival models that account for the following aspects: the outcome variable of interest is the waiting time for the occurrence of an event (weaning and introducing non-

[43] Stata uses the Huber/White sandwich estimator to adjust the standard errors for the fact that some observations belong to the same individual.

breastmilk food products into the child's diet); observations are censored; and to control or asses the influence of explanatory variables. Hence, we fit a proportional hazard model for each outcome variable. The model can be expressed as follows:

$$\log h_i(t) = \alpha(t) + \sum_j \delta_j X_i + e_t \qquad (8)$$

where i=1, 2,..,n (individuals)

This model estimates Progresa's impact on the risk or hazard that a child will terminate breastfeeding or exclusive breastfeeding [*hi(t)*] controlling for the influence of other covariates.

Hierarchical structure of the data

An additional aspect that has to be considered when specifying our models is the hierarchical structure of the data. In most of our analyses, the outcome variables are subject to group effects at three different levels: community, family and individual. That is, the outcomes under study are liable to three intra-group correlations since children living in the same community are exposed to similar environmental conditions; children in the same family share genetical background and receive similar health care and other resources; and observations of the same individual are closely linked over time. Hence, children in the same cluster tend to be similar in their performance, providing less information than if they belonged to different groups. Ignoring or not accounting for these relationships may lead to estimates of standard errors and confidence intervals that are too small (Goldstein 1995).

In our analyses, we control for the intra-community correlations but not for the intra-familial ones because the software used, Stata, only permits specifying clusters at one level of information. Nonetheless, as will be shown in the methodology section of each chapter, we assessed that this aspect did not alter the significance of our results. We control for the hierarchical structure of the data using Stata's cluster option in combination with the robust procedure (the Huber/White/sandwich estimator of variance) (Stata Corporation 2003). These methods provide correct standard errors by specifying that the observations are independent across groups (communities), though not necessarily independent within groups.

Before discussing the next section, it is worth mentioning that at the beginning of this research one of our main objectives was to include more than one outcome in the models to give a more comprehensive view of the processes of change. Multiple outcomes are jointly involved in the improvement of well-being. Hence, we were interested on having a multidimensional approach as it would have provided a more integrative interpretation to the results. In doing so, we tried using a statistical technique used in social and behavioural sciences named structural equation modelling (SEM).
This is a multivariate technique that combines factor analysis and multiple regression in order to estimate simultaneously a series of interrelated dependent relationships. Like econometric methods, SEM allows fitting simultaneous equations with endogenous variables (Bollen and Long 1993). But, unlike the econometric approach, it permits for more flexible assumptions. Specifically, it allows for measurement error in observed variables (exogenous and endogenous) and for correlation in measurement errors (Bollen 1989). In addition, it is possible to estimate endogenous categorical variables using methods appropriate to their form.

However, we encountered numerous problems in fitting these models. The main reasons for this were that our sample size of longitudinal cases with complete observations was relatively small (347 cases), and that most of our explanatory variables were categorical. The estimation methods appropriate for the characteristics of our data require large sample sizes (at least 500 to 1,000 cases) (Hox and Bechger, 2002). Additionally, SEM models can deal with ordinal categorical variables. However, this kind of data requires other estimation techniques than those employed with continuous variables (Jöreskog, 1993a). It is necessary to assume that, for each ordinal variable, there is a continuous unobserved variable z^* underlying the observed ordinal variable z[44]. However there are some variables that cannot be treated as ordinal (e.g. gender), so no continuous underlying variable could be conceived for them. Jöreskog suggests including them as additional covariates and assume that they do not contain measurement error. The continuity assumptions permit estimating polychoric, polyserial, and tetrachoric correlations[45] for the observed variables (or rather for the underlying continuous variables). The combination of categorical variables and a small sample

[44] For a more detailed explanation consult (Jöreskog 1993).
[45] A polychoric correlation refers to the association between two ordinal variables, a tetrachoric is between to two dichotomous variables, polyserial is between one continuous and one ordinal, and biserial is between one continuous and one dichotomous (Jöreskog and Sörbom 1995)

size made the models difficult to fit since they required many iterations to converge.

3.5. Construction of Variables

As our main interest is to evaluate the impact of Progresa on the well-being of beneficiary children, the outcomes chosen are linked to the activities of the Programme meant to improve child health conditions.

Outcome variables

We examined two indicators at the household level: caloric consumption (as a measure of food availability) and variety in diet (as a proxy for quality in diet). The former was constructed by converting the food quantities of the products consumed during the last week into daily caloric availability at the household level using the Mexican Food Composition Tables of 1999. This household indicator was divided by adult equivalent scales[46] to obtain calories per adult equivalent. Since our interest is to assess children's well-being through this household indicator, it was necessary to adjust not only for the household's size, but also for its age structure and gender composition.

Dietary diversity was constructed using a weighted sum that accounts not only for the number of different food products consumed, but also for the number of days each item was consumed (a measured proposed by Hoddinott (2001). This measure has some limitations to assess dietary quality (explained in Chapter 4). Nevertheless, we preferred using this indicator rather than a simple sum of food products because Progresa's impact on dietary diversity can also take place through increased frequency of consumption.

We also studied child feeding practices by looking at overall breastfeeding and exclusive breastfeeding. We consider exclusive breastfeeding (EBF) as feeding with breastmilk and no other liquid or solid foods. We examined both the prevalence and

[46] The adult equivalent scales used are those recommended by the National Institute of Nutrition in Mexico. These scales assign the following weight to each family member: 0.41 child 0 - 4 years old, 0.80 child 5 - 10 years old, 1.15 male 11 - 14 years old, 1.05 female 11 - 14 years old, 1.38 male 15 - 19 years old, 1.05 female 15 - 19 years old, 1.26 male 20 - 34 years old, 0.92 female 20 - 34 years old, 1.15 male 35 - 54 years old, 0.85 female 35 - 54 years old, 1.03 male aged 55 or more and 0.78 female aged 55 or more (INN-SZ 1987). This system of weights assigns values greater than one to some age groups. The latter seems unusual because, in general, the weights have a value smaller or equal than one because they are converting the needs of children and other family members into a fraction of those of an adult. However, the equivalence scale used converts the family size measured in number of persons into one using these adult equivalent weights.

the duration of these feeding modes. Due to the change in WHO recommendations[47] regarding the period of exclusive breastfeeding, we calculated the prevalence for two cut-off points: EBF < 4 months and EBF < 6 months.

We assessed children's nutritional status by looking at underweight (weight for age) and stunting (height for age). We focused on these anthropometric indicators because they are believed to be good measures of children's well-being (Gross 1997). Furthermore, in Mexico, as in other Latin American countries, the prevalence of these nutritional deficiencies is much higher and more worrying than that of wasting (weight for height).

We studied children's health outcomes by analysing the *incidence of diarrhoeal diseases* and the *incidence of respiratory infections*. Both are binary variables, taking a value of one if a child is ill and zero otherwise. This information is obtained from reports in which mothers were asked about their child's health during the two weeks prior to the survey.

Explanatory variables

The explanatory variables belong to a wide range of domains: demographic, socio-economic, accessibility to services, receiving benefits from Progresa, and others. The conceptual framework discussed in Section 3.2 was used as guideline for selecting the dependent or explanatory variables to include in this study. Most of these variables were grouped into categories, based upon findings of previous studies and on an exploratory analysis, which suggested that certain cut-off points were associated with a higher risk of observing a negative outcome. This categorisation is described below and, when necessary, we explain how the variable was constructed.

Progresa's effect

Our main covariate of interest is the receipt of Programme benefits. Our main covariate of interest is the receipt of Programme benefits. It is examined using a dummy variable with a value of one if an eligible household (or child) lives in a treatment locality and zero otherwise. It is important to highlight that this covariate does not account for the fact that some households in the control group

[47] The current WHO/UNICEF recommendations regarding exclusive breastfeeding is a period of six months. During the 1990s, WHO suggested a period of exclusive breastfeeding of four to six months, but it has now been standardised to a recommended period of at least 6 months.

were receiving benefits in the last waves of data collection (from December 1999). Thus, it can be considered as a time invariant explanatory variable since it has the same value over time. This is the approach followed in all chapters, except Chapter 7. Here, we transformed Progresa's effect into a time varying covariate because of the specification of our model. We assigned a value of zero at baseline to all observations, since the Programme was yet not operating; and a value of zero or one at consecutive waves depending upon whether the child belonged to a treatment or a control locality. Again, the control localities were assigned a value of zero throughout, even though some began to receive treatment after December 1999.

It is important to note that in this analysis we considered as eligible those households that were initially classified as poor (52 percent of households). Due to perceived omissions of certain kinds of poor households (especially those with elderly people and no children), the Programme revised its classification system and incorporated additional households that were originally classified as ineligible. Consequently, the coverage of the Programme expanded (78 percent of households were classified as poor with the new criteria of eligibility) in a second stage, known as densification. We focus our attention only on those households that were classified as eligible in the first phase because they received benefits for a longer period. Thus, they are likely to experience a greater Programme effect. Nonetheless, we replicated the analyses considering as eligible households those that at some point in time were incorporated into the Programme. The results did not differ considerably from the previous ones, thus we only present findings for the first classification of eligibility. It would be wise to use as an alternative classification of eligibility those households that were actually receiving cash transfers. However, these data were not available.

Individual characteristics

Individual variables include the child's *age* and *sex*. Age is grouped in the following intervals: 0-5, 6-11, 12-23, 24-35, 36-47, and 48- 59 months. Additionally, all the analyses were carried out for two different age groups: children between 0 and 23 months old and children between 24 and 59 months of age. The reason for this is that several studies have shown that factors associated with child health outcomes vary according to age (Hobcraft et al. 1984; Bicego and Boerma 1991; Boerma and Bicego 1992; Adair and Guilkey 1997; Sahn and Alderman 1997). Children's needs and susceptibility to diseases change with age; hence, the influence of correlates is likely to change with children's age as well. Moreover, we disaggregated results in these two age categories because evaluations of nutrition interventions have reported differences in treatment effect according to these age groups (Martorell 1995a; Martorell 1995b; Adair and Guilkey 1997; Sahn and Alderman 1997; Schroeder et al. 2002).

Although variations in child health outcomes according to sex seem not to be relevant in Latin American countries (Sastry 1996), we included this covariate in order to corroborate its non-significance among children living in extreme poverty.

Demographic characteristics

Mother's age at birth was grouped into five intervals, *<19, 20-24, 25-29, 30-34* and *35 years and over*, with the first and last groups covering a broader age range because of a smaller proportion of births occurring at these ages. The categorisation of the first group allowed identifying whether teenage motherhood has a negative effect on child malnutrition among these children. Among this set of variables we looked at the number of children of different age groups (under five, between 6 and 12, and between 13 and 18 years old) living in the household. Although these variables are highly correlated with birth interval and birth order[48], we included them for two reasons: 1) to assess the effect of having children close together in age (under five) in the same household; 2) because for older children Progresa's benefits on the educational strand vary according to age, it is worth exploring the effect of having older children within the household. These variables were grouped into three categories: *1, 2,* and *3 and over.*

Mother's characteristics

Mother's socio-economic characteristics are obtained from the ENCEL survey. Because of the matching problems encountered, when merging data at the individual level between the INSP and the ENCEL surveys, mother's socio-economic characteristics have been assigned a value at the household and not at the individual level. That is, in households with more than one mother with children under-five, the value of mother's education was equal to the highest educational level of all mothers with children under five years old within the household. The percentage of cases that had an imputed value for this reason was

[48] Number of children under five years old refers to all children within that age group living in the same household. These children do not necessarily belong to the same mother. However, in the ENCEL sample the proportion of children with more than one mother with children under five in the same household was relatively small, 10 percent.

around 9 percent. Additionally, those children whose mother was not living in the household at the time of interview (about 4 percent) had a value for maternal education equal to that of the most educated mother within the household.

Mother's education is grouped into four levels: *no education, incomplete primary, complete primary* and *secondary level and beyond.* For ethnic background, we distinguished three groups according to the language(s) women spoke: *only an indigenous language, an indigenous language and Spanish* and *only Spanish.*

Socio-economic characteristics

For father's education, we followed the same procedure as for maternal education, assigning a value at the household level instead of a value at the individual level. For this variable, it was more common to find children whose father was not living in the household at the time of interview (around 15 percent) than children living in a household with more than one father with children under the age of five (5 percent) in the same household. When the father was absent, we assigned the value of the head of the household. For this reason, we preferred labelling this variable as the household head's education. The grouping of this variable was the same as that of maternal education: *none, incomplete primary, complete primary,* and *secondary and over.* Regarding household head's occupation, we classified it into two categories: agricultural worker ("*peón*") and others (non-agricultural worker, small land owner (known as "*ejidatario*"), self-employed, worker without receiving payment and unemployed).

Finally, we also include a poverty index constructed by Progresa for classifying households as eligible and ineligible. We divide this index into *terciles* in order to have an indicator of the severity of poverty. This variable was constructed using information on multiple dimensions of deprivation[49], so it is likely to be correlated with a wide number of variables in the analysis. Therefore, in order to avoid problems of multicollinearity, in the multivariate analysis this variable is examined separately.

Household hygienic environment

The variables in this domain refer to characteristics of the dwelling associated with a hygienic environment within the household. The distribution of these variables makes them suitable to be used dichotomously. For instance, type of toilet is

[49] For a detailed description of this index, see Chapter 2.

classified into two groups since the proportion of households with w.c. is very small (only 4 percent of households).

Number of rooms: *one room, more than one room*
Type of floor: *mud, other*
Type of toilet: *none,* and *w.c. or septic tank*
Source of water: *none, piped water within the dwelling's land*

Community characteristics

Among the community characteristics, we include an index of marginality. This variable is a measure of the degree of deprivation within the community, constructed using information on seven variables associated with access to basic services, illiteracy and occupation[50]. The index takes values ranging from -2.57 to 3.27, with higher values representing worse conditions. It is classified into 5 categories: *very low, low, medium, high,* and *very high.* Since Progresa's benefits are targeted to localities with high and very high indices of marginality, we only observe these values in the sample. Distances to the nearest health centre and to the nearest DICONSA[51] store are obtained from Progresa's datasets on information at the locality level. These variables are grouped into three intervals: *less than 1 km.* (health centre or store in site), *1-4.99 km.* (health centre or store at walking distance) and *5 km or more* (health centre or store at a non-walking distance). We also include information on the prices of food items and on the average wage of agricultural workers. Finally, we include a series of regional identifiers because Progresa's classification system (to select eligible households) differs according to region. The regions included in the ENCEL sample are: *Montaña* in Guerrero, *Sierra Negra Zongolica Mazateca, Sierra Norte Otomí Tepehua, Sierra Gorda, Altiplano, Huasteca* and *Tierra Caliente.*

3.6. Data processing

Depending on the outcome variables under study, we used different sources of information: ENCASEL, INSP and/or ENCEL surveys (see Table 3.1). We merged information from these sources using the unique identifiers of localities, households and individuals[52]. For each dataset constructed, we performed a data

[50] The National Population Council (CONAPO) has classified all the localities in the country according to this marginality index. The seven variables used include: percentage of illiterate inhabitants (individuals 15 years of age and above); percentage of the population working in the primary sector; crowding (average number of persons per room); percentage of households with floor made out of mud; percentage of households with access to piped water, sewage, and electricity (CONAPO and Progresa 1998).
[51] DICONSA stores are run by the government. They operate in rural localities with high degree of marginality and their main objective is to provide basic food products at subsidise prices.
[52] Appendix 3.3 describes the process through which the datasets were constructed.

quality assessment. That is, we looked at the methodological aspects that need to be considered when analysing any kind of data, but specially when looking at longitudinal data. This section describes the characteristics of the constructed datasets and the results obtained from a data quality assessment.

Table 3.1 Data sources used per outcome variable

Outcome	Data source		
	INSP	*ENCEL*	*ENCASEL*
Food security	n/a	Waves: 1, 2, 3, 4 and 6	Waves: 1, 2, 3, 4 and 6
Feeding practices	n/a	Wave 5	Wave 5
Health outcomes	Waves: 2 and 3	Waves: 2 and 4	Waves: 2 and 4
Anthropometric outcomes	Waves: 1, 2 and 3	Waves: 1, 2 and 4	Waves: 1, 2 and 4

Note: Waves 1, 2 and 3 of the INSP survey took place around the same time of Waves 2, 4 and 6 of the ENCEL survey (see Figure 3.2)

3.6.1. Dataset for Food Security Outcomes

The data sources used for analysing the food security indicators are the ENCEL and the ENCASEL surveys. These outcome variables were analysed at the household level, looking exclusively at eligible households with children under the age of five. We used information from four waves of data collection because, as explained below, there were some variations in the questionnaires over time.

Information on expenditures and on consumption of food products was collected in five out of six rounds of data collection (all except wave five (ENCEL-00M)). However, the number and type of questions on consumption from the first wave (ENCEL-98M) differed from that of other rounds. In the first wave, expenditures on food items were collected for broad categories only; from the second round onwards, more detailed data was collected (34 food items). Additionally, the ENCEL survey only gathered information on the quantity of food products consumed during the last week from the second wave onwards. The difference in the number of items constrains our analysis over time to four waves: October 1998 (ENCEL-98O), May 1999 (ENCEL-99M), November 1999 (ENCEL-99N) and November 2000 (ENCEL-00N). Nevertheless, we also used the data at baseline (ENCEL-98M) in a preliminary analysis to verify that at the beginning of the Programme the pattern of consumption of control and treatment groups was similar.

Table 3.2 presents the samples size of the ENCEL survey at each round of data collection. At wave one, 24,077 households were interviewed: all cases had complete interviews and information on Progresa's classification of poverty. Among these households, around 50 percent (12,203 households) had at least one child under the age of five among its members. At wave two, the survey gathered information from households that were not present at baseline (1,769 households), increasing the total number of households in the sample to 25,846. However, not all households had complete questionnaires or information on Progresa's poverty classification; thus, the usable sample size was reduced to 24,073 households. At consecutive waves, an additional, though smaller, number of new households was added into the sample (in total there is information on 2,806 households not surveyed at baseline). An important limitation of the information on households not surveyed at baseline is that most of them did not have information on Progresa's poverty classification; therefore, we had to exclude them from our analyses. Overall, there were 24,077 households with information on eligibility (poverty) interviewed over time, from which 16,185 reported having a child under five years old at some point in time[53].

Table 3.2
Characteristics of the Encel Sample by Wave of Data Collection

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Total
Total sample size	24,077	25,846	26,022	26,972	26,832	27,023	27,023
New Households (not interviewed at baseline)		1,769	228	979	71	14	2,806
Households with complete interviews	24,077	24,073	22,334	23,268	22,627	22,366	26,883
Households with complete interviews and classification of poverty	24,077	24,073	22,106	22,116	21,615	21,359	24,077
Households with Children < 5 years old with complete interviews and classification of poverty	12,203	12,785	12,714	10,594	11,274	12,143	16,185

Note: The last column represents the total number of cases that were interviewed at least once.

53 The last column in Table 3.2 represents the total number of cases that were interviewed at least once. The total number of households with complete information refers to those households for whom we have a complete questionnaire and that were interviewed in at least one wave of data collection. The total number of households with complete interviews and classification of poverty indicates the cases with a complete questionnaire and with a classification.

3.6.2. Dataset for Feeding Practices

Information on child feeding practices is drawn from a special questionnaire used at the fifth wave of data collection (ENCEL-00M). This questionnaire was administered to women between 15 and 49 years of age. It included information on fertility patterns, knowledge and use of contraceptive methods, prenatal care, breastfeeding and introduction of complementary foods. For the last two topics, the information was collected for the two last children born alive (if still alive) between January 1995 and the date of interview (aged less than 5 years old[54]). Regarding complementary food products, mothers were asked about the timing and type of food products first given to the child. This information was obtained for the first three non-breastmilk products provided. Progresa's supplements were included in the list of complementary food products first given to the child in order to evaluate the timing of its introduction and its possible effect on crowding out other food items.

This survey also collected data on 13,296 children born alive between January 1995 and May 2000[55]. This sample includes both eligible and ineligible children and some cases with missing data; thus, the working sample used is somewhat smaller. Among the missing data, we found that 11.4 percent of cases (1,520 cases) had no information on eligibility status or on some household characteristics. These households were not interviewed in the first ENCEL round, when this information was gathered. Additionally, a further 8.3 percent of observations (1,109 cases) either did not have data on feeding practices or the information given had some reporting errors (e.g. duration of breastfeeding larger than age); thus, we exclude them from the analysis. From the sample with complete information (10,667 cases), we have a working sample of 3,198 ineligible cases and 7,469 eligible ones (5,147 cases corresponding to the last child and 2,322 to the previous to last child). Once again, the sample was limited to eligible children only.

3.6.3. Dataset for Health and Anthropometric Outcomes

The INSP conducted three rounds of surveys approximately every 12 months: the first round was carried out between August and September 1998; the second one

[54] The month of interview was May 2000, therefore there is information on children aged 5 years or more (those born between January 1995 and May 1995). The reason for including children born during these months was to facilitate interviewers' work. The fieldwork guidelines were to collect information on the last two born alive children from January 1995 onwards.

[55] This sample corresponds to information from 9,325 cases of the last born alive child and 3,971 cases of the previous to last child.

collected data between October and December 1999; and the last survey was conducted between November and December 2000. These surveys collected both cross-sectional and longitudinal information about children aged under five. For the cross-sectional data, the INSP selected an independent sample of households at each of the waves. For the longitudinal data, the strategy was to follow the group of children aged between 0 and 6 months at baseline during the two subsequent rounds (Rivera Domarco et al. 2000).

The INSP sample contains information for around 15,000 cases (corresponding to around 11,000 children) from its three rounds of data collection. However, it is not possible to link the information of all these cases to their ENCEL information. After a thorough data screening, we merged the information from both sources (ENCEL and INSP) and obtained a final "working" sample of 6,181 eligible children who were interviewed at least once. Of these children, 4,261 were interviewed just once, 1,433 children were surveyed at two waves and only 487 were measured in all waves (see Table 3.3). For a description of the problems encountered while trying to merge both datasets and the information between waves of data collection, see Appendix 3.3. It is worth mentioning that the sample sizes could have been larger, allowing us for more robustness in our analyses, if the identification variables at the individual level had been better monitored.

Table 3.3
Number of observations per children
INSP final working sample

	Frequency	Percentage
Observations		
One	4,261	68.9
Two	1,433	23.2
Three	487	7.9
Total	*6,181*	*100.0*

For the longitudinal data, the strategy was to follow the group of children aged between 0 and 6 months at baseline during the two consecutive rounds (Rivera et al. 2000). However, in this study, we consider as longitudinal cases those with information for more than one wave. The reason for this is that, while constructing the datasets, we found a considerable number of cases labelled as longitudinal, who were not surveyed in at least one of the follow-up waves. On the other hand, we also found children labelled as cross-sectional, who were covered in more than one round. Thus, in order to maximise the sample size in our longitudinal analyses we included all individuals with repeated observations, irrespective of the INSP labelling.

This study includes only information on eligible children because the sample size of the ineligible cases was very small (especially, the longitudinal sample, which had less than 100 cases per round). Moreover, ineligible children had a less unfavourable situation than eligible ones. Hence, their inclusion would have only confounded our estimated effects. Ineligible children live in dwellings with a smaller exposure to inadequate hygienic conditions (e.g. 26 percent live in dwellings with mud floor compared with 68 percent of eligible children); have greater access to health services (e.g. 73 percent of ineligible mothers receive prenatal care and delivery attention compared with 51 percent of their eligible counterparts); and have a reduced likelihood of having a mother who is stunted (14.5 percent of non-eligible children had a stunted mothers in comparison with 30.4 percent of eligible children).

3.7. Data Quality Assessment

Studies with repeated measurements for the same individual have numerous advantages in comparison with cross-sectional studies. For instance, they allow analyses with a dynamic approach, provide a better understanding of changes over time, allow controlling for the effects of unobserved or missing variables (Hsiao 2003), and can provide useful insight into causal relationships (Bijleveld et al. 1998; Hsiao 2003). In other words, it "offers a dimension of understanding that simple 'snapshots' cannot provide" (Bradbury and Jäntti 2001). However, a major drawback of longitudinal data is that of sample attrition. If observations lost over time are not missing at random, then estimates are likely to be affected by "selection bias". Although recent studies looking at longitudinal surveys in both developed and developing countries have argued that biases in coefficient estimates due to attrition are relatively small (Lillard and Panis 1998; Alderman et al. 2001), it is necessary to test for attrition because if it is selective, then it is important to control for this possible bias in our models.

Findings from attrition analyses looking at longitudinal studies in developed and developing countries have suggested that, even when attrition rates are relatively high (up to 50 percent), biases in coefficient estimates are not as large as might be expected (Fitzgerald et al. 1998; Alderman et al. 2001). Furthermore, the authors note that the attrition bias tends to be model specific and recommend assessing not only the differences in background characteristics between attritors and non-attritors at the univariate and the multivariate level, but also verifying for each outcome under study whether the coefficient estimates differ for those who have complete observations over time and those who have missing observations (Alderman et al. 2001).

3.7.1. Dataset for Food Security Outcomes

The most common cause of attrition is related to the mobility of households. In Table 3.4, we observe that the main reasons for incomplete interviews were that, at the time of interview[56], dwellings were either temporarily vacant (more than 30 percent) or uninhabited (an additional 30 percent). In rural marginal localities, a significant number of agricultural workers migrate according to the seasonality of crops (“*jornaleros agrícolas*”). It is likely that households who are temporarily absent belong to this sector of the population. In contrast, the proportion of lost cases due to refusal was much smaller. In general, this reason accounted for less than 10 percent of incomplete interviews, except for the last wave of data collection, for which refusal was much higher (20 percent). It is worth noting that the number of households refusing to be interviewed was greater among ineligible households than eligible ones. The reason for this is that the former were tired of providing information without receiving Programme benefits.

Table 3.4
Reasons for incomplete interviews
Encel Sample (all households)

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6
Percentage w/complete inteviews	100.0	93.1	85.8	86.3	84.3	82.8
Observations	24,077	25,846	26,022	26,972	26,832	27,023
Reasons for incomplete interviews		(%)	(%)	(%)	(%)	(%)
Temporarily absent		42.7	38.3	40.5	40.0	28.5
Uninhabited		29.9	22.9	25.2	32.1	38.1
Refusal		8.9	15.8	14.6	11.9	21.2
Others		18.6	23.0	19.7	16.0	12.1
Total		*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

[56] The interviewers had to revisit dwellings with no respondents at the moment of interview at least three times before registering the interview as incomplete.

Table 3.5 presents the attrition rates between consecutive waves, per year and at the end of the survey[57] for the original 24,077 households. These figures show that the proportion of households lost was: 8.7 percent (on average), 13.1 percent and 34.4 percent, respectively. These values are located around the midrange of attrition values observed in panel studies conducted in developing countries. Reviews of attrition in these settings have shown that there is an important variation in the proportion of cases lost over time, ranging from 6 to 50 percent between consecutive rounds (Alderman et al. 2001), from 1.5 to 23.2 percent per year (Alderman et al. 2001), and from 3 to 50 percent at the end of the survey (Hill 2002).

Table 3.5
Attrition Rates Encel Sample
All Households

	W1-W2	**W2-W3**	**W3-W4**	**W4-W5**	**W5-W6**	**Average**
Attrition between consecutive waves	6.3	10.1	7.7	10.0	9.2	8.7
	W1-W2	**W1-W3**	**W1-W4**	**W1-W5**	**W1-W6**	
Attrition with respect to wave one	6.3	13.3	13.2	14.9	16.0	
	W1-W2-W3-W4-W5-W6					
Attrition at last wave	34.4					
Attrition per year	13.1					

Note: The attrition rates are estimated with respect to those households interviewed at baseline (24,077).
The annual attrition rate is estimated as 1-(1-q)^(1/T), where q is the overall attrition rate and T is the number of years of the study (Alderman, 2001).

Although the magnitude of the rates suggests moderate attrition, it is necessary to perform some tests to examine whether attrition is selective on observable characteristics. We conducted three tests used by Alderman, et al. 2001 in their analysis of attrition of three longitudinal surveys. The first test consists of comparing the means of background characteristics and outcome variables between those who were lost at some round (attritors) and those who had complete information at all waves of data collection (non-attritors). The second test estimates a logit for the probability of attrition including as explanatory variables household's background characteristics and the outcome variables under study. The third test consists of examining whether the coefficient estimates for the

[57] This attrition rate refers to the proportion of households that were not interviewed in at least one of the rounds.

outcomes we are interested in have a significantly different value for those lost at some round and those with complete observations.

We estimated the attrition tests for eligible households with children under five years old. Before doing so, we calculated the attrition rates for both the eligible and ineligible groups (see Table 3.6). At the last wave of data collection, attrition rates were somewhat smaller among eligible households[58] than those of ineligible households with children (28.5 percent versus 35.6, respectively). This point is explained by the fact that eligible households were less likely to refuse answering the questionnaire.

Table 3.6
Distribution of Encel Sample by Eligibility and Attrition
Households with Children under the Age of Five

	Non-Attritors	Attritors	*Total*
Non-eligible			
Frequency	4,012	2,213	6,225
Row (%)	*64.4*	*35.6*	*100.0*
Column (%)	*36.0*	*43.8*	*38.5*
Eligible			
Frequency	7,117	2,843	9,960
Row (%)	*71.5*	*28.5*	*100.0*
Column (%)	*64.0*	*56.2*	*61.5*
Total			
Frequency	11,129	5,056	16,185
Row (%)	*68.8*	*31.2*	*100.0*
Column (%)	*100.0*	*100.0*	*100.0*

Attrition assessment

Table 3.7 displays the comparisons of means between attritors and non-attritors. Our results show that for almost all of the variables analysed the difference in means between groups is highly significant (at the 1 percent level). The exceptions, which are worth pointing out, are treatment and the outcome variables associated with food security (monthly expenditure per capita[59] and dietary diversity). One possible reason for observing highly significant differences is because with the large sample size the test rejects differences in means as small as 0.1 (e.g. number of children <5 and marginality index). Nevertheless, these figures suggest a

[58] Attrition rate per year for eligible households with small children was 10.6 percent.

[59] In the attrition analysis, we looked at monthly expenditures per capita instead of calories per adult equivalent (one of the outcome variables we analysed in Chapter 4) because calorie information was not collected at baseline.

selective attrition since households that are not followed up are in general worse off than their counter parts with complete observations (e.g. higher proportion of uneducated parents, living in dwellings in worse conditions and residing in localities situated further away from basic services). The figures corresponding to "Region" show the distribution of households according to this explanatory variable for attritors and non-attritors. In the absence of an attrition pattern by location we would observe a similar distribution between groups. However, the chi-squared test for testing independence indicates that attrition and region are not independent, i.e. the observed attrition rates by region of residence differ from the expected ones.

Table 3.7
Difference in Means between Attritors and Non-Attritors using ENCEL sample
Eligible Households with Children under the Age of Five

Variable	Attritors		Non-attritors				
	Mean	Std. Err.	Mean	Std. Err.	Diff.	P>|t|	
Progresa	64.0	0.9	62.3	0.57	1.7	0.11	
Household's characteristics							
Mother's education							
Without education (%)	36.5	0.90	30.4	0.55	6.1	0.00	***
Mother's language							
Indigenous (%)	39.6	0.90	43.5	0.58	-3.9	0.00	***
Household head's education							
Without education (%)	35.0	0.89	27.4	0.53	7.5	0.00	***
Household head's occupation							
"Peon" (%)	54.0	0.94	59.8	0.58	-5.8	0.00	***
Household head's age (years)	37.9	0.25	40.4	0.16	-2.6	0.00	***
Household size (number)	6.7	0.16	7.1	0.09	-0.4	0.04	**
Children <5 (number)	1.6	0.02	1.5	0.01	0.1	0.00	***
Dwelling's characteristics							
Floor material mud (%)	73.4	0.83	72.6	0.53	0.8	0.42	
Without septic tank or wc (%)	57.0	0.93	43.5	0.59	13.5	0.00	***
Without access to water (%)	72.7	0.84	69.3	0.55	3.4	0.00	***
Only one room (%)	64.6	0.90	58.0	0.59	6.6	0.00	***
Community characteristics							
Marginalty index	0.7	0.01	0.6	0.01	0.1	0.00	***
Distance to health centre (km.)	3.7	0.05	3.4	0.03	0.3	0.00	***
Distance closest head of muncipality (km.)	9.4	0.11	9.2	0.07	0.2	0.06	*
Regions[1]						0.00	***
Montaña (Guerrero) (%)	17.7	0.70	9.3	0.34	8.4		
Sierra Negra-Zongolica-Mazateca (%)	11.1	0.60	13.6	0.40	-2.5		
Sierra Norte-Otomí-Tepehua (%)	20.6	0.76	18.4	0.45	2.2		
Sierra Gorda (%)	34.5	0.89	43.5	0.59	-9.0		
Altiplano y Huasteca (SLP) (%)	2.6	0.74	3.5	0.38	-0.9		
Tierra Caliente (%)	13.5	0.60	11.5	0.40	2.0		
Outcome variables							
Monthly expenditure per capita (pesos)	134.4	2.4	137.7	1.3	-3.3	0.20	
Dietary diversity (weighted average)	64.4	0.4	64.7	0.2	-0.2	0.61	

Note: Statistical significance: ***:p<.01, **:p<.05, *:p<.1

1. For this variable, we calculated a Pearson's chi-squared for testing the null hypothesis of independence.

In a second test, we estimated a logit model for the probability of attrition. Results in Table 3.8 indicate that, once we control for background characteristics, some of the associations observed at the univariate level are no longer significant. The few explanatory variables that remain significant are: household head's age, household's size, access to water and wc, and distance to the health centre. The odds ratios for household head's age and household's size suggest that younger, smaller families are more likely to be lost. Migration to urban centres or to the United States takes place mainly among young people (predominantly males) in search of employment opportunities. Thus, it is not surprising that the households that are observed in all waves of data collection are headed by older members.

On the other hand, it is important to notice that the odds ratios for treatment are not statistically significant, indicating that Programme benefits are not associated with a higher or smaller probability of attrition. Furthermore, for the outcome variables, the odds ratios are not significant either, suggesting that attrition is not associated with the outcomes under study (food security and dietary diversity).

Finally, findings from the third test show that the coefficient estimate for attrition is not significantly associated with dietary diversity[60] and that its association with expenditure per capita is only mildly significant (at the 10 percent level (see Table 3.9)). These results are similar to those of Alderman et al. (2001) for Bolivia, Kenya and South Africa. Although attrition is selective for some background characteristics, the estimates of outcome variables are not substantially affected by this attrition bias. Thus, it seems that for observable variables the attrition bias should not be of great concern for the variables associated with households' consumption and dietary diversity. Moreover, all three tests confirmed that there was no difference in the attrition of control and treatment households, so that our comparisons between these two groups should not be affected to a great extent by the attrition patterns previously observed.

[60] These regressions were estimated for the natural logarithm of both dietary diversity and expenditure per capita.

Table 3.8
Logit for Attrition Rate controlling for background characteristics and food security outcomes
Eligible Households with Children under the Age of Five

Variable	Attrition model 1				Attrition model 2			
	Odd Ratios	Robust Std. Err.	z	P>|z|	Odd Ratios	Robust Std. Err.	z	P>|z|
Outcome variables								
Expenditures per capita								
First quartile	0.93	0.1	-0.7		-	-	-	
Second quartile	1.24	0.1	2.0	*	-	-	-	
Third quartile	1.22	0.2	1.6		-	-	-	
Dietary Diversity								
First quartile	-	-	-		1.09	0.1	1.1	
Second quartile	-	-	-		1.09	0.1	1.1	
Third quartile	-	-	-		1.14	0.1	1.5	
Progresa	0.90	0.1	-0.96		0.90	0.1	-0.92	
Household's characteristics								
Mother's education								
Without education	1.0	0.1	0.5		1.0	0.1	0.4	
Incomplete primary	0.9	0.1	-0.9		0.9	0.1	-0.9	
Mother's language								
Indigenous	0.9	0.1	-1.1		0.9	0.1	-1.1	
Household head's education								
Without education	1.3	0.1	3.4	***	1.3	0.1	3.4	***
Incomplete primary	1.0	0.1	0.2		1.0	0.1	0.1	
Household head's age								
30-44	0.7	0.1	-5.3	***	0.7	0.1	-5.2	***
45-59	0.7	0.1	-4.4	***	0.7	0.1	-4.5	***
60+	0.6	0.1	-4.1	***	0.6	0.1	-4.2	***
Household size								
5-7	0.9	0.1	-1.7	*	0.8	0.1	-2.7	***
8+	0.8	0.1	-1.9	*	0.7	0.1	-3.5	***
Dwelling's characteristics								
Floor material mud	1.0	0.1	-0.5		1.0	0.1	-0.6	
Without septic tank or wc	1.4	0.1	3.6	***	1.4	0.1	3.7	***
Without access to water	1.3	0.1	2.4	**	1.3	0.1	2.4	**
Only one room	1.1	0.1	0.9		1.1	0.1	0.8	
Community characteristics								
High marginalty index	0.8	0.1	-1.5		0.8	0.1	-1.6	
Distance to health centre								
1-4 km.	1.3	0.2	1.8	*	1.3	0.2	1.7	*
>=5 km.	1.6	0.3	2.3	**	1.6	0.3	2.2	**
Distance closest head of muncipality								
1-4 km.	0.9	0.1	-0.8		0.9	0.1	-0.8	
>=5 km.	1.2	0.2	1.1		1.2	0.2	1.2	
Regions								
Montaña (Guerrero)	0.7	0.2	-1.1		0.8	0.2	-1.0	
Sierra Negra-Zongolica-Mazateca	1.2	0.3	0.6		1.1	0.3	0.6	
Sierra Norte-Otomí-Tepehua	0.8	0.2	-1.0		0.8	0.2	-1.1	
Sierra Gorda	1.4	0.4	1.0		1.4	0.4	1.1	
Altiplano y Huasteca (SLP)	0.8	0.3	-0.6		0.8	0.3	-0.6	
Wage peon								
First quartile	0.89	0.21	-0.49		0.90	0.21	-0.47	
Second quartile	0.76	0.17	-1.24		0.75	0.17	-1.26	
Third quartile	0.91	0.19	-0.45		0.90	0.19	-0.48	
Natural Disaster	1.02	0.19	0.13		1.01	0.19	0.06	

Notes: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
Reference categories: Education: complete primary +; Language: non-indigenous; HHH age: 15-29 years old; HH size <5; Marginality index: very high; Distance: <1 km; Region: Tierra Caliente.

Table 3.9
Attrition's effect on household and community background characteristics and food security outcomes
Eligible Households with Children under the Age of Five

Variable	Expenditures per capita Coeff.	Robust Std. Err.	z	P>|z|	Dietary Diversity Coeff.	Robust Std. Err.	z	P>|z|
Attrition	0.04	0.0	1.9	*	0.7	0.6	1.3	
Progresa	0.01	0.03	0.4		0.00	0.9	0.0	
Household's characteristics								
Mother's education								
Without education	-0.05	0.0	-2.2	**	-2.0	0.7	-2.7	***
Incomplete primary	-0.03	0.0	-1.5		-0.5	0.6	-0.8	
Mother's language								
Indigenous	-0.02	0.03	-0.6		-2.86	0.98	-2.9	***
Household head's education								
Without education	-0.05	0.02	-2.6	***	-1.81	0.67	-2.7	***
Incomplete primary	-0.04	0.02	-2.5		-1.69	0.62	-2.7	***
Household head's age								
30-44	0.00	0.02	0.0		1.00	0.63	1.6	
45-59	-0.02	0.02	-0.9		1.83	0.72	2.5	**
60+	-0.03	0.03	-1.1		0.77	0.99	0.8	
Household size								
5-7	-0.44	0.02	-22.5	***	-0.08	0.55	-0.1	
8+	-0.81	0.02	-37.2	***	-1.03	0.66	-1.6	
Dwelling's characteristics								
Floor material mud	-0.09	0.02	-4.8	***	-2.70	0.59	-4.6	***
Without Septic tank or WC	0.00	0.02	0.2		-2.27	0.59	-3.9	***
Wihtout Access to water	0.02	0.03	0.6		0.18	0.83	0.2	
Only one room	-0.06	0.02	-3.7	***	-1.77	0.48	-3.7	***
Community characteristics								
Very high marginality index	-0.06	0.03	-2.1	**	1.35	1.12	1.2	
Distance to health centre								
1-4 km.	0.04	0.05	0.8		3.67	1.86	2.0	**
>=5 km.	0.03	0.05	0.6		4.51	1.94	2.3	**
Distance closest head of muncipality								
1-4 km.	0.06	0.03	1.9	*	1.88	1.18	1.6	
>=5 km.	0.08	0.03	2.4	**	1.03	1.09	0.9	
Regions								
Montaña (Guerrero)	0.23	0.06	3.7	***	0.42	2.13	0.2	
Sierra Negra-Zongolica-Mazateca	0.00	0.05	-0.1		2.00	1.73	1.2	
Sierra Norte-Otomí-Tepehua	-0.03	0.05	-0.7		1.17	1.57	0.7	
Sierra Gorda	0.07	0.07	1.0		-11.39	2.16	-5.3	***
Altiplano y Huasteca (SLP)	0.10	0.07	1.5		10.95	2.62	4.2	***
Wage peon								
First quartile	-0.06	0.05	-1.2		-1.73	1.65	-1.1	
Second quartile	-0.07	0.05	-1.4		-0.58	1.63	-0.4	
Third quartile	0.00	0.04	0.0		0.78	1.48	0.5	
Natural Disaster	0.01	0.04	0.3		1.52	1.25	1.2	
Constant	5.42	0.07	77.0		64.35	3.04	21.1	

Notes: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
Reference categories: Education: complete primary +; Language: non-indigenous; HHH age: 15-29 years old; HH size <5; Marginality index: very high; Distance: <1 km; Region: Tierra Caliente.

Missing values and outliers

Another aspect that has to be considered when examining longitudinal data is missing information on dependent and independent variables. With respect to the outcome variables, we excluded those cases with missing information and/or with outlier values. As most of our explanatory variables are categorical, for each variable we generated an additional category for cases with missing information. This strategy allowed us to include as many cases as possible. For example, respondents with missing values on consumption might not have been willing to answer or might not have correct information on consumption. We did not impute any value into these observations and because they were a small number of cases (fewer than a 100 cases in each wave) we did not include them in the analysis. Additionally, we excluded those cases with outlier values for caloric availability: cases with values greater than 5,000 (around 340 cases per round) or smaller than 500 calories (around 140 cases per round). These adjustments lead to a final working sample equal to 8,489 eligible households at wave one.

3.7.2. Dataset for Feeding Practices

Attrition assessment

For this dataset, we looked for a possible selection bias by examining whether the characteristics of the households interviewed at the fifth round of data collection (ENCEL-00M) were different from those of households with children under the age of five surveyed at baseline (ENCEL-98M). Ideally, this analysis should be carried out using data at the individual level because feeding practices are studied using data at this level. Unfortunately, at baseline there is no information on the outcome variables and some children were still not born at this point of time. Thus, we carried out this assessment at the household level.

Associations at the univariate level yielded similar findings to those for the previous dataset. That is, for most of the characteristics, differences between groups were highly significant. Here, we present only results from our multivariate logit model (see Table 3.10). It should be mentioned that these models include observations with missing values in the explanatory variables. These were included as an additional category of the explanatory variables in our models. However, the parameter estimates for missing categories are not shown in Table 3.10 because they were not significant. The odds ratios for the probability of having no information at the fifth wave show some significant differences between the characteristics of both type of households. In general, we observed similar results to those obtained for the previous dataset. That is, households that were not surveyed at the fifth wave of data collection were worse-off in some background variables (parental education, distance to health centre, region and degree of marginality) than those that were surveyed at both points in time. Moreover, once again we observed that households headed by younger people and with fewer members in the family had higher chances of dropping out. We were not able to carry out the third attrition test, which examines whether the coefficient estimates for the outcome under study has a different value for attritors and non-attritors, because we do not have information on the outcome variables (e.g. exclusive breastfeeding) at baseline.

Missing data

Using information from the fifth wave of data collection, we examined whether the characteristics of those cases with missing data on feeding practices were significantly different from those with complete information and found evidence of statistical differences for some variables (father's education, number of children under the age of five and region of residence) (see Table 3.11). Thus, for some explanatory variables data are not missing at random. To control for a possible bias in our estimations due to this non-randomness, we include as explanatory variables in our models those covariates with a value significantly different between the sample with data present and the sample with missing data.

Heaping

The data on breastfeeding and child feeding practices come from retrospective reports, which are likely to suffer from recall bias. Therefore, we looked at the responses on duration of breastfeeding and exclusive breastfeeding[61] to assess for possible digit preferences (at months 3, 6, 9, 12, 18 and 24). As expected, heaping was more common among children born further away from the date of survey than among those born closer to the date of interview. For instance, among the former, the pattern of responses on durations of breastfeeding showed marked peaks at durations of 12, 18, and 24 months. In contrast, among the latter, responses were concentrated mainly on 12 months. This difference in heaping is explained in part because it is more likely that mothers forget the exact duration of events that occurred in earlier periods, and because an important proportion of children born more recently are still being breastfed. For our analysis, a possible bias due to heaping should not be of great concern as our main objective is to assess the Programme's effect on these practices and this heaping pattern was similar between children living in treatment and control localities.

[61] Exclusive breastfeeding is estimated using the timing at which food products other than breastmilk were first introduced into the child's diet.

Table 3.10
Logit for Information on Feeding Practices controlling for background characteristics
Eligible Households with Children under the Age of Five

Variable	Odd Ratios	Robust Std. Err.	z	P>|z|
Progresa	0.9	0.1	-1.3	
Household's characteristics				
Mother's education				
Without education	1.3	0.1	3.9	***
Incomplete primary	1.1	0.1	2.4	
Mother's language				
Indigenous	1.0	0.1	-0.5	
Household head's education				
Without education	1.6	0.1	6.7	***
Incomplete primary	1.3	0.1	3.7	***
Household head's age				
30-44	1.7	0.1	8.6	***
45-59	4.0	0.3	16.1	***
60+	3.3	0.3	12.3	***
Household size				
5-7	0.9	0.1	-1.9	*
8+	0.6	0.0	-6.6	***
Dwelling's characteristics				
Floor material mud	0.9	0.1	-1.0	
Without septic tank or wc	0.9	0.0	-3.0	***
Without access to water	1.1	0.1	0.9	
Only one room	0.9	0.0	-1.9	*
Community characteristics				
Very high marginality index	0.8	0.1	-2.1	**
Distance to health centre				
1-4 km.	1.1	0.1	0.8	
>=5 km.	1.2	0.2	1.7	*
Distance closest head of muncipality				
1-4 km.	1.0	0.1	0.1	
>=5 km.	1.1	0.1	1.1	
Regions				
Montaña (Guerrero)	0.8	0.1	-1.3	
Sierra Negra-Zongolica-Mazateca	0.9	0.1	-0.9	
Sierra Norte-Otomí-Tepehua	0.8	0.1	-2.0	*
Sierra Gorda	0.9	0.1	-0.9	
Altiplano y Huasteca (SLP)	0.8	0.2	-1.1	
Wage peon				
First quartile	0.9	0.1	-1.4	
Second quartile	0.9	0.1	-0.9	
Third quartile	0.9	0.1	-0.9	
Natural Disaster	1.0	0.1	0.4	

Notes: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
Reference categories: Education: complete primary +; Language: non-indigenous; HHH age: 15-29 years old; HH size <5; Marginality index: high; Distance: <1 km; Region: Tierra Caliente.

Table 3.11
Logit for Missing Information on Feeding Practices controlling for background characteristics
Eligible Children under the Age of Five covered in Encel-00M

Variable	Odd Ratios	Robust Std. Err.	z		P>|z|
Progresa	1.0	0.1	0.4	0.7	
Household's characteristics					
Mother's education					
Without education	1.2	0.1	1.4	0.2	
Incomplete primary	1.1	0.1	0.7	0.5	
Mother's language					
Indigenous	1.1	0.1	1.0	0.3	
Household head's education					
Without education	1.4	0.2	2.7	0.0	***
Incomplete primary	1.2	0.1	2.0	0.0	**
Number of children <5					
2	0.7	0.1	-3.5	0.0	***
3+	0.6	0.1	-4.7	0.0	***
Number of children 6-12					
1	1.2	0.1	1.6	0.1	
2+	1.2	0.2	1.5	0.1	
Number of children 13-16					
1	1.2	0.1	1.8	0.1	*
2+	1.6	0.4	2.1	0.0	**
Dwelling's characteristics					
Floor material mud	0.9	0.1	-1.0	0.34	
Without septic tank or wc	0.9	0.1	-0.9	0.4	
Without access to water	0.9	0.1	-0.9	0.4	
Only one room	1.0	0.1	-0.3	0.8	
Community characteristics					
Very high marginality index	1.1	0.1	0.6	0.5	
Distance to health centre					
1-4 km.	1.2	0.2	1.5	0.1	
>=5 km.	1.2	0.2	0.9	0.3	
Regions					
Montaña (Guerrero)	0.3	0.1	-6.1	0.0	***
Sierra Negra-Zongolica-Mazateca	0.7	0.1	-2.3	0.0	**
Sierra Norte-Otomí-Tepehua	1.4	0.2	1.9	0.1	*
Sierra Gorda	0.9	0.1	-1.1	0.3	
Altiplano y Huasteca (SLP)	0.7	0.2	-1.4	0.2	
Wage peon					
First quartile	0.9	0.1	-1.4	0.15	
Second quartile	0.9	0.1	-0.9	0.35	
Third quartile	0.9	0.1	-0.9	0.38	
Natural Disaster	1.0	0.1	0.4	0.66	

Notes: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
Reference categories: Education: complete primary +; Language: non-indigenous;
HHH age: 15-29 years old; HH size <5; Marginality index: high; Distance: <1 km;
Region: Tierra Caliente.

3.7.3. Dataset for Health and Anthropometric Outcomes

Data considerations

To assess the quality of the INSP dataset, we looked at its representativeness with respect to the ENCEL survey, at the randomisation of the treatment and control groups, and at the differences between the longitudinal and the cross-sectional sample (attrition analysis).

First, we compared the mean value of different background characteristics of ENCEL households with small children interviewed in the INSP survey with their counterparts not interviewed in the INSP survey[62], which we refer to as the Non-INSP sample. This group corresponds to those households with children under the age of five interviewed in the first round of the ENCEL survey, but not covered at any of the INSP cross-sectional surveys (see Table 3.12).

The first noticeable difference is the smaller percentage of treatment cases in the INSP sample in comparison with those of the Non-INSP sample (56 percent versus 66 percent, respectively). This is an intended consequence of the INSP sample design, as more control cases were desirable in order to make accurate comparisons between groups (Rivera Domarco et al. 2000). Next, we observe that for most household characteristics there are differences between both groups, which indicate some selection bias in the INSP sample. That is, households surveyed in the INSP study were less disadvantaged than those interviewed only at the ENCEL survey. The INSP sample is selected for households: with more educated parents; with a smaller proportion of mothers speaking an indigenous language; with a smaller percentage in the first quartile of expenditure per capita; and with dwellings with better infrastructure (except for number of rooms). Another important difference is that the INSP sample included households with more children under the age of five. This difference is also the result of the INSP sample design because the aim of this study was to collect information of children under the age of five. With respect to community characteristics, variables with a different distribution between groups included distance to the heath centre and region of residence. These results clearly show that the INSP sample obtained is not representative of the ENCEL survey. It is important to keep these results in mind, as children in the sample to be analysed are a less disadvantaged group.

[62] The ENCEL households considered here were only those eligible households surveyed during the first wave of data collection with children under five years old. Additionally, the INSP cross-sectional data refers to our final working sample; that is, those eligible cases that matched between the ENCEL and the INSP samples, excluding outliers.

Table 3.12
Difference in Means between ENCEL Households with and without information collected at INSP survey
Eligible Households with Children under the Age of Five

Variable	INSP Mean	INSP Std. Err.	Non-INSP Mean	Non-INSP Std. Err.	Diff.	P>|t|	
Progresa	55.9	0.9	65.8	0.6	-9.9	0.0	***
Household's characteristics							
Mother's education							
Without education (%)	22.1	0.8	30.9	0.6	-8.7	0.0	***
Mother's language							
Indigenous (%)	39.6	1.0	44.9	0.8	-5.3	0.0	***
Household head's education							
Without education (%)	21.6	0.8	27.1	0.6	-5.4	0.0	***
Household head's occupation							
"Peon" (%)	60.4	0.9	58.3	0.7	2.0	0.0	***
Household head's age (years)	37.0	0.2	38.7	0.2	-1.7	0.0	***
Household size (number)	7.0	0.1	7.1	0.0	0.0	0.6	
Children <5 (number)	2.0	0.0	1.7	0.0	0.3	0.0	***
Expenditure per capita [1]						0.0	***
First quartile	23.7	0.8	34.0	0.6	-10.3		
Second quartile	30.6	0.9	28.9	0.6	1.7		
Third quartile	28.1	0.8	23.5	0.6	4.6		
Fourth quartile	17.6	0.7	13.5	0.5	4.0		
Dwelling's characteristics							
Floor material mud (%)	69.5	0.9	74.1	0.6	-4.5	0.0	***
Without septic tank or wc (%)	48.0	0.9	48.1	0.7	0.0	1.0	
Without access to water (%)	67.0	0.9	71.8	0.6	-4.9	0.0	***
Only one room (%)	63.0	0.9	59.6	0.7	3.3	0.0	***
Community characteristics							
Marginalty index	0.6	0.0	0.6	0.0	0.0	0.1	
Distance to health centre (km.)	3.6	0.0	3.4	0.0	0.2	0.0	***
Distance closest head of muncipality (km.)	9.4	0.1	9.2	0.1	0.2	0.2	
Regions [1]						0.0	***
Montaña (Guerrero) (%)	12.4	0.6	11.9	0.4	0.5		
Sierra Negra-Zongolica-Mazateca (%)	11.2	0.6	14.4	0.5	-3.2		
Sierra Norte-Otomí-Tepehua (%)	26.7	0.8	14.8	0.5	11.9		
Sierra Gorda (%)	45.0	0.9	37.7	0.6	7.3		
Altiplano y Huasteca (SLP) (%)	4.6	0.3	2.3	0.2	2.3		
Tierra Caliente (%)	0.0	0.0	19.1	0.6	-19.1		
Observations	*2,887*		*5,602*				

Note: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
1. For these variables, we calculated a Pearson's chi-squared for testing the null hypothesis of independence.

In addition, we estimated a logit model in order to assess whether the associations observed at the univariate level prevailed once we control for the influence of other variables. Results presented in Table 3.13 indicate significant and pervasive selectivity for advantage among those households interviewed in the INSP sample. We were not able to test for differences using outcome indicators (e.g. anthropometric indicators) because this information is only available for children in the INSP sample.

Table 3.13
Logit for probability of being interviewed in INSP sample
Eligible Households with Children under the Age of Five

Variable	INSP sample Odd Ratios	Robust Std. Err.	z	P>|z|
Progresa	0.56	0.07	-4.51	***
Household's characteristics				
Mother's education				
Without education	0.6	0.1	-5.4	***
Incomplete primary	0.9	0.1	-2.2	**
Mother's language				
Indigenous	0.7	0.1	-2.7	***
Household head's education				
Without education	0.8	0.1	-2.2	**
Incomplete primary	0.9	0.1	-2.3	**
Household head's age				
30-44	0.8	0.1	-3.9	***
45-59	0.5	0.0	-8.1	***
60+	0.7	0.1	-2.7	***
Household size				
5-7	1.1	0.1	1.1	
8+	1.3	0.1	2.9	***
Expenditure per capita				
First quartile	0.5	0.0	-7.4	***
Second quartile	0.7	0.1	-4.3	***
Third quartile	0.8	0.1	-3.0	***
Dwelling's characteristics				
Floor material mud	0.8	0.1	-3.1	***
Without septic tank or wc	1.1	0.1	0.9	
Without access to water	0.6	0.1	-5.0	***
Only one room	1.1	0.1	1.8	*
Community characteristics				
High marginalty index	1.1	0.2	0.7	
Distance to health centre				
1-4 km.	1.5	0.3	2.0	**
>=5 km.	1.7	0.4	2.1	**
Distance closest head of muncipality				
1-4 km.	1.2	0.2	0.8	
>=5 km.	1.3	0.2	1.4	
Regions				
Montaña (Guerrero)	1.2	0.2	1.0	
Sierra Negra-Zongolica-Mazateca	0.5	0.1	-2.8	***
Sierra Norte-Otomí-Tepehua	1.5	0.2	2.7	***
Altiplano y Huasteca (SLP)	1.1	0.3	0.2	
Wage peon				
First quartile	0.78	0.19	-1.0	
Second quartile	0.70	0.16	-1.5	
Third quartile	0.69	0.15	-1.7	*
Natural Disaster	0.82	0.17	-1.0	

Notes: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
Reference categories: Education: complete primary +; Language: non-indigenous; HHH age: 15-29 years old; HH size <5; Marginality index: very high; Distance: <1 km; Region: Sierra Gorda; Expenditure per capita: Fourth quartile.

Second, we examined whether the control and treatment groups in the INSP sample were randomly allocated. Table 3.13 shows that for some household and community characteristics the differences between groups cannot be attributed to sampling error. Specifically, we found statistical differences in characteristics such as parent's education, mother's language, dwelling's services, distance to the health centre and region of residence. Differences in household characteristics between treatment and control groups were also observed in Behrman and Hoddinott's study (2000) on the randomisation of the ENCEL sample. We did not identify a clear pattern suggesting a more favourable or unfavourable situation among children living in treatment areas. While some characteristics indicate a more disadvantageous situation for children in treatment localities (a higher proportion of mothers without education, a smaller proportion of dwellings with septic tank or w.c., a larger number of households with mud floor); other variables suggest a less vulnerable situation (a smaller proportion of indigenous mothers[63], a higher percentage of children living in dwellings with access to water and closer to a health centre (less than 5 kms.)).

We compared the distribution of these variables between treatment groups in the three cross-sectional samples and corroborated that the differences observed at baseline prevailed in the consecutive waves (see Table 3.14). These findings suggest that it is not possible to assess the impact of Progresa on reducing child malnutrition just by looking at the difference over time between treatment and control groups. In the analysis of changes over time, it is important to control for these observed differences, as these background characteristics are likely to be associated with the outcome under study, producing a confounding effect on the estimations (Anderson 1980; Ravallion 2001). However, controlling for observed differences might not be enough because an additional source of bias may be attributed to unobserved differences, for which we are unable to completely control.

[63] In general, indigenous families live in a more deprived situation than their non-indigenous counterparts.

Table 3.14
Differences in the Distribution of Explanatory Variables between Treatment and Control Groups across Rounds
INSP sample

Variable	Round 1 Treatment Mean (%)	Round 1 Control Mean (%)	Round 1 P>|t|	Round 2 Treatment Mean (%)	Round 2 Control Mean (%)	Round 2 P>|t|	Round 3 Treatment Mean (%)	Round 3 Control Mean (%)	Round 3 P>|t|
Individual characteristics									
Age (months)			0.52			0.35			0.87
0-11	15.7	13.7		12.0	15.2		15.2	17.0	
12-23	19.1	20.3		20.1	19.1		19.1	19.4	
24-35	18.7	20.6		22.5	21.9		21.9	19.5	
36-47	24.1	22.9		22.5	20.1		20.1	23.0	
48-59	22.5	22.5		23.0	23.7		23.7	21.1	
Sex			0.48			0.19			0.49
Boy	48.2	47.4		51.9	50.8		52.0	51.9	
Girl	51.8	52.6		48.1	49.2		48.0	48.1	
Size at birth			0.41			0.90			0.08 *
Small	25.3	26.5		27.1	27.1		26.2	29.3	
Medium	52.1	53.0		54.6	53.8		52.2	47.7	
Big	22.6	20.4		18.3	19.1		21.7	23.0	
Household's characteristics									
Mother's education			0.00 ***			0.00 ***			0.01 **
Without education	23.3	16.8		25.0	21.6		24.6	21.7	
Incomplete primary	43.2	45.6		42.4	38.4		42.2	39.6	
Complete primary	26.5	28.6		26.7	29.6		27.1	30.1	
Secondary +	7.0	9.0		5.9	10.4		6.1	8.6	
Mother's language			0.00 ***			0.00 ***			0.00 ***
Non-indigenous	72.5	59.9		65.5	55.6		66.2	55.5	
Some Spanish	22.6	32.7		25.3	33.3		23.4	33.3	
Spanish	4.9	7.4		9.2	11.1		10.4	11.2	
Household head's education			0.14			0.74			0.46
Without education	19.7	20.8		20.6	20.3		21.8	23.5	
Incomplete primary	45.4	43.1		43.6	41.8		42.4	42.0	
Complete primary	26.2	25.1		25.9	28.0		27.6	25.3	
Secondary +	8.7	11.0		9.9	9.9		8.2	9.2	
Number of children <5			0.56			0.28			0.01 **
1	22.4	24.4		16.8	19.5		19.3	20.7	
2	42.8	42.4		37.0	36.2		38.6	32.2	
3+	34.8	33.2		46.2	44.3		42.1	47.1	
Expenditure per capita			0.59			0.77			0.21
First quartile	24.5	23.6		24.1	22.8		23.1	24.3	
Second quartile	31.1	32.2		29.8	30.2		33.1	28.7	
Third quartile	25.9	27.2		27.6	29.4		26.6	28.9	
Fourth quartile	18.5	17.0		18.5	17.6		17.2	18.1	
Dwelling's characteristics									
Floor material other than mud	27.8	33.8	0.00 ***	28.4	31.6	0.10	24.5	28.9	0.01 ***
Without septic tank or WC	50.1	44.4	0.00 ***	51.7	52.7	0.69	52.4	50.5	0.03 **
Without access to water	60.1	73.7	0.00 ***	61.3	75.0	0.00 ***	65.0	74.8	0.00 ***
Community characteristics									
High marginalty index	28.4	26.6	0.37	24.0	27.0	0.11	24.5	28.9	0.38
Distance to health centre			0.00 ***			0.00 ***			0.04 **
<1 km.	6.9	7.6		10.8	8.2		8.7	8.6	
1-4 km.	75.6	66.1		70.8	65.3		71.6	67.5	
>=5 km.	17.5	26.3		18.4	26.5		19.7	23.9	
Regions			0.00 ***			0.14			0.00 ***
Montaña (Guerrero)	12.4	6.3		15.9	13.8		15.4	9.7	
Sierra Negra-Zongolica-Mazateca	12.1	13.9		10.0	12.0		10.5	11.8	
Sierra Norte-Otomí-Tepehua	28.0	26.1		26.0	23.4		26.7	23.9	
Sierra Gorda	43.4	48.8		43.7	46.8		42.5	50.5	
Altiplano y Huasteca (SLP)	4.1	4.9		4.4	4.0		4.9	4.1	
Number of observations	***1,270***	***1,055***		***1,242***	***844***		***1,416***	***1,129***	

Note: Statistical significance: ***:p<.01, **:p<.05, *:p<.1
We calculated a Pearson's chi-squared for testing the null hypothesis of independence.

Third, it was important to assess whether there was a selection bias among the longitudinal cases as the analysis on changes over time is mainly carried out using this information. In order to do so, we compared the characteristics of the longitudinal samples (with information in 3 waves and with information in at least 2 waves) with those of the cross-sectional group at baseline (see Table 3.15). Comparisons with respect to the longitudinal cases with information in at least 2 waves were carried out for two age groups: children under 24 months old and children between 24 and 59 months old.

The differences in distribution of explanatory variables were corroborated using a logit model, where the dependent variable had a value of one if the child belonged to the longitudinal sample under study and zero otherwise. These models were estimated three times, once for each of the longitudinal samples investigated. Figures in **bold** indicate whether the estimated coefficient of the explanatory variable was statistically significant. That is, it shows whether the background variables of each longitudinal sample are significantly different from those of the cross-sectional group.

The main difference between the three longitudinal samples examined and the cross-sectional one was that the former comprised a younger group of children than the latter. This result is not surprising as the sampling scheme was to follow up very young children. Additionally, children with more than one observation were younger at the start of observation because once a child reaches age five it is excluded from the sampling frame.

Regarding household and community characteristics, the longitudinal sample with three repeated observations was quite similar to the cross-sectional one except for two household characteristics: mother's education and mother's language. Children in this longitudinal sample were more likely to have a mother with at least primary education and a mother who did not speak an indigenous language. This result suggests that children who were most successfully followed up belonged to a more advantaged group. Probably, these children were easier to monitor because their mothers were more aware of the survey going on in the locality, and were more inclined to take their child to the school or health centre to be weighed and measured repeatedly.

In addition, figures on Table 3.15 show no differences between the household and community background variables for the younger age group (<24 months old) that was followed up at least twice and the cross-sectional sample. However, children in the older age group who were covered in more than one survey lived in households with more children under the age of five than those who were interviewed just once. This result might be explained by the fact that interviewers were following younger children, so once they had gathered information on a young child, if there was an older child less than 5 years old, it would also be included.

Table 3.15
Differences in the Distribution of Explanatory Variables between Cross-sectional and Longitudinal Samples at Round 1

Variables	Cross-sectional Round 1		Longitudinal (3 waves)		Longitudinal (at least 2 waves <24 months)		Longitudinal (at least 2 waves >=24 months)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Benefits								
Progresa	54.6	1.0	58.1	0.0	56.2	1.8	56.6	0.0
Household's characteristics								
Mother's education								
Without education	20.3	1.0	19.8	2.5	19.3	1.5	19.1	1.7
Incomplete primary	44.1	1.0	40.7	2.6	41.7	1.8	44.1	2.2
Complete primary +	35.6	0.9	**39.6**	2.5	39.0	1.7	36.7	2.0
Mother's language							69.6	2.0
Indigenous	33.3	1.0	28.7	2.4	33.9	1.7	29.2	1.9
Non-indigenous	66.7	1.0	**71.3**	2.4	66.1	1.8	3.9	0.9
Household head's education								
Without education	20.0	1.0	17.8	2.5	21.9	1.5	16.0	1.6
Incomplete primary	44.3	1.0	42.9	2.6	41.5	1.8	47.3	2.2
Complete primary +	35.7	0.9	39.3	2.4	36.6	1.6	36.7	2.0
Number of children <5								
1	22.8	1.0	23.8	2.6	27.0	1.7	**16.5**	1.6
2	42.8	1.0	43.5	2.6	38.6	1.8	**47.7**	2.2
3+	34.4	1.0	32.7	2.5	34.4	1.8	**35.9**	2.1
Quartiles of expenditure per capita								
1	24.1	0.9	22.9	2.4	22.8	1.6	25.6	1.9
2	31.6	1.0	26.9	2.3	29.6	1.7	32.4	2.1
3	26.5	0.9	30.0	2.4	28.3	1.7	27.6	2.0
4	17.8	0.8	20.2	2.1	19.3	1.5	14.4	1.5
Dwelling's characteristics								
Floor material other than mud	31.1	1.0	31.3	2.5	30.9	1.7	30.3	2.0
Septic tank or WC	52.5	1.0	45.4	2.6	47.8	1.9	52.7	2.2
Access to water	33.8	1.0	33.5	2.5	33.7	1.8	34.0	2.1
Community characteristics								
High marginalty index	27.5	0.9	31.1	2.4	30.4	1.7	25.8	1.9
Distance to health centre								
<1 km.	7.2	0.5	6.0	1.3	7.4	1.0	6.8	1.1
1-4 km.	71.3	0.9	70.4	2.4	71.8	1.7	70.2	2.0
>=5 km.	21.5	0.7	23.6	1.8	20.8	1.5	23.1	1.9
Regions								
Montaña (Guerrero)	9.7	0.6	10.0	1.6	7.6	1.0	11.0	1.4
Sierra Negra-Zongolica-Mazateca	12.9	0.7	12.4	1.7	14.1	1.3	11.6	1.4
Sierra Norte-Otomí-Tepehua	27.2	0.9	24.4	2.3	25.8	1.6	28.7	2.0
Sierra Gorda	45.9	0.7	47.1	1.7	47.3	1.9	45.0	2.2
Altiplano y Huasteca (SLP)	4.3	0.4	6.0	1.3	5.1	0.8	3.7	0.8
Individual characteristics								
Age (months)								
0-11	14.8	0.7	**46.7**	2.6	**52.7**	1.9	-	-
12-23	19.7	0.8	**32.1**	2.4	**47.3**	1.9	-	-
24-35	19.6	0.8	**21.2**	2.2	-	-	**62.8**	2.1
36-47	23.6	0.8	-	-	-	-	**34.3**	2.3
48-59	22.3	0.8	-	-	-	-	**2.9**	0.8
Sex								
Boy	47.8	0.0	51.3	2.6	51.2	1.9	47.5	2.5
Girl	52.2	0.0	48.7	2.6	48.8	1.9	52.5	2.5
Number of observations	***2,325***		***358***		***721***		***516***	

Note: In **bold** those characteristics that were signifincat after using a logit.

We can conclude that the group of children that were measured on more than one occasion were younger and somewhat better-off than those who were interviewed just once. This difference is largely explained by the sampling scheme used to follow up children.

Finally, an important aspect that needs to be considered when analysing anthropometric data is that of survivor bias. Anthropometric analyses are done using information collected from children who lived long enough to be surveyed. For this reason, it has been argued that there is a survivor bias effect in trends analyses and comparative studies because information from deceased children is omitted (Boerma et al. 1992). For instance, if mortality rates decrease abruptly over time, it is possible that surviving children, who would have died if mortality trends had not changed, have a poor nutritional status. The latter, hence, would yield a negative effect on malnutrition rates. However, Boerma and others (1992), using data from longitudinal studies[64] and from 17 DHS surveys, evaluated this potential bias and concluded that, unless there are large differences in the levels of mortality between countries or across the periods of time under study, the effect of excluding deceased children on the estimation of malnutrition levels is insignificant. In order to assess for a potential survivor bias in the Progresa sample, we looked at the retrospective data on child mortality collected at the ENCEL survey and did not find major changes in child mortality trends for the period under study. Therefore, a survivor bias effect is unlikely to affect our analyses.

Missing values and outliers

For the assessment of children's nutritional status, it is crucial to have high coverage and accuracy of the three variables needed for the construction of the anthropometric indices: age, weight and height. Errors in age reporting can have a negative effect on the analysis of these indices, specifically on height for age and weight for age. The INSP surveys collected information on both date of birth and age at the time of interview. This allowed controlling for the common errors found among age data: digit preference or heaping at 6, 12, 24, and 36 months of age. However, we found different values for dates of birth between the INSP rounds and between the INSP and the ENCEL data. We modified the dates that did not coincide, using those collected in the birth history data. The reason for this is that the data belonged to chronological records of pregnancies, thus their value might be closer to the real one (only if these had not been flagged previously because of omission or misplacement). A total of 723 cases had the year of birth modified and 1,028 cases had the month of birth adjusted. These cases were flagged for further analysis.

The anthropometric indices were calculated using version 1.02 of ANTHRO, software developed by the Centers for Disease Control and Prevention (CDC) for calculating the WHO/CDC international growth reference (CDC 1999). The advantage of this software is that it has a mechanism for flagging those records that have extreme values (ANTHRO Documentation, Version 1.02). That is, when

[64] These longitudinal studies included anthropometric data for children who subsequently died.

the Z-scores for weight for age, height for age, and weight for height are calculated and compared with the reference population, they might result with improbable values (either too high or too low for what is expected). If this occurs, these values are automatically assigned a flag by the software. The percentage of flagged scores for each of the anthropometric indices was relatively low (5 percent) (see Table 3.16).

The coverage of weight and height is disaggregated by wave of data collection in order to assess whether the quality of the data was similar over time. Table 3.16 shows that the number of cases with missing values for these variables was between 8 and 11 percent. This coverage is within the range observed among DHS surveys in Latin America, where the percentage of missing data on anthropometric data varies between 3 and 20 percent (Sommerfelt and Boerma 1994). Children without a measurement for both height and weight were excluded from the analysis (around 10 percent of the sample). One of the main problems with the values of height and weight is that their recordings are likely to suffer from heaping. We looked at possible measurements ending in 0.0 or 0.5 and did not find a substantive digit preference that would bias our estimations. The heaping ratios are also in line with those found in Sommerfelt and Boerma's study. For height the median value is of around 1.58 and that of weight is of 1.26 (see Tables 3.17 and 3.18).

Table 3.16
Quality of Anthropometric Data by Wave of Data Collection, INSP working sample

Wave	Missing values weight (%)	Missing values height (%)	Flagged values (%)	*Total* (%)
One	11.9	12.4	6.5	*18.4*
Two	10.1	10.4	6.1	*16.2*
Three	7.6	7.5	3.0	*10.5*
Total	*9.9*	*10.1*	*5.1*	*15.1*

Table 3.17
Heaping of height measurements,
INSP working sample

Wave	Height ending on .0 (%)	Height ending on .5 (%)	Heaping ratio (%)
One	18.1	16.6	1.73
Two	14.9	15.6	1.52
Three	13.6	13.8	1.37
Total	*15.5*	*15.3*	*1.54*

Table 3.18
Heaping of weight meaurements
INSP working sample

Wave	Weight ending on .0 (%)	Weight ending on .5 (%)	Heaping ratio for .0 (%)
One	14.5	3.1	1.45
Two	11.6	1.2	1.16
Three	12.4	1.5	1.24
Total	*12.8*	*1.9*	*1.28*

Cases with missing or extreme values on age, weight or height[65] were excluded from the analysis (around 14 percent of all cases). Additionally, we excluded those cases which showed odd changes between waves: specifically, those cases with negative difference in age between waves and those cases whose Z-score value changed +/- 4 standard deviations between waves (around 5 percent of cases).

3.8. Summary and Implications

This chapter looked at the characteristics of the datasets used in our study. Our data quality assessment pointed out certain aspects that need to be accounted for in the following chapters in order to control for possible bias due to the selectivity of the sample that was followed up over time.

Estimates of attrition rates for the ENCEL survey show that the proportion of households lost was around the midrange of attrition values observed in panel studies conducted in developing countries (13.1 percent per year and 34.4 percent at the last wave of data collection).

65 The cases excluded were those that the software has automatically flagged as outliers and also those with Z-score values <-5 or >5.

Results from our attrition analyses suggest that attrition is selective of worse-off households. However, tests for difference in outcome variables according to attrition (only for food security indicators) indicate that, controlling for background characteristics, our coefficient estimates are not substantially affected by this attrition bias. We were not able to assess whether attrition distorts analysis for other outcome variables because of lack of data at baseline. Yet, in all our tests we observed that there is no difference in the attrition of treatment and control households, thus our comparisons between these two groups should not be affected by the attrition patterns previously observed.

With respect to our dataset for health and anthropometric outcomes, we found that households surveyed on the INSP study are less disadvantaged than those interviewed only at the ENCEL survey. Differences between treatment and control groups are larger than those one would expect by chance. Therefore, it is not possible to assess the impact of Progresa on child health outcomes just by looking at the difference between treatment and control groups. The models have to control for these differences in observed variables. Finally, the main difference between the longitudinal and the cross-sectional sample in the INSP survey is the age of the child, with the former being a younger sample than the latter.

This chapter has also shown the richness of these datasets in terms of their sample sizes and in the range of variables that can be included in our analyses. It is worth pointing out the importance of having tracking procedures of respondents, not only when collecting data in the field, but also when capturing the variables that identified households and individuals. Moreover, our sample sizes could have been larger if these key variables had been better monitored.

Appendix 3.1. Themes of ENCASEH (Survey of socioeconomic characteristics)

Theme:	Variables:
Demographic Structure of household	
Presence of male members in working age	– number of men 24 to 45 years of age
Household head	– household head (male or female)
Dependency ratio	– number of children 0 to 5 years of age – number of children 6 to 11 years of age
Literacy	– knows how to read and write (persons 5 yrs +)
Education	– completed years of education (persons 5 yrs +)
Indigenous language	– speaks an indigenous language (persons 5 yrs +)
Marital status	– marital status (persons 12 yrs +)
Working status	– activity conditions (persons 8 yrs +) – number of days worked during last week (persons 8 yrs+) – occupation – income from work and other sources
Migration for temporary work	– place and date of move out (persons 8 yrs +) – monetary transfers sent (last year)
Migration	– place move out during last five years – characteristics of migrant: age and sex – monetary transfers sent (last year)
Health services and disabled members	
Health services	– access to social security – use of health services by family members
Disabled members	– number of family members with disability and kind of disability
Housing	
Dwelling characteristics	– material of floor, ceilings, walls – number of rooms – access to services (water , w.c., electricity)
Housing tenure	– owns, owns with mortgage or loan, rents, rents free
Possession of commodities	– vehicles (cars, trucks, vans), household appliances such as blender, refrigerator, stove, boiler, radio, TV, VHS,
Land and animal property	
Land	– land for agricultural use – land extension (hectares)
Animals	– property of livestock (number and kind)

Appendix 3.2. Themes of ENCEL

ENCEL98M	ENCEL98O	ENCEL99M	ENCEL99N	ENCEL00M	ENCEL00N
	IDENTIFICATION OF HOUSEHOLD MEMBERS AND CHARACTERISTICS OF NEW MEMBERS -Sociodemographic characteristics of the members (name, age, and place of residence) -Verification of the number of household members -Characteristics of new residents (date of birth, sex, relationship and parent's presence in the household)	**IDENTIFICATION OF HOUSEHOLD MEMBERS AND CHARACTERISTICS OF NEW MEMBERS** -Sociodemographic characteristics of the members (age and place of residence) -Verification of the number of household members -Characteristics of new residents (date of birth, sex, relationship and parent's presence in the household)	**IDENTIFICATION OF HOUSEHOLD MEMBERS AND CHARACTERISTICS OF NEW MEMBERS** -Sociodemographic characteristics of the members (age and place of residence) -Verification of the number of household members -Characteristics of new residents (date of birth, sex, relationship and parent's presence in the household)	**IDENTIFICATION OF HOUSEHOLD MEMBERS AND CHARACTERISTICS OF NEW MEMBERS** -Sociodemographic characteristics of the members (age and place of residence) -Verification of the number of household members -Characteristics of new residents (date of birth, sex, relationship and parent's presence in the household)	**IDENTIFICATION OF HOUSEHOLD MEMBERS AND CHARACTERISTICS OF NEW MEMBERS** -Sociodemographic characteristics of the members (age and place of residence) -Verification of the number of household members -Characteristics of new residents (date of birth, sex, relationship and parent's presence in the household)
	CURRENT HH HEAD -Possible change of household head and thus relationship of all members with new household head		**CURRENT HH HEAD** -Possible change of household head and thus relationship of all members with new household head		
EDUCATION (6-16 yrs.) -Reasons of absenteeism -Opinions of educational services, parents' participation in school activities -Expectations	**EDUCATION (6-16 yrs.)** -School attendance -Level of education and educational attainments (failing, quitting, lagging behind) -Opinions and expectations	**EDUCATION (6-16 yrs.)** -School attendance -Reasons of absenteeism -Selection of school -Educational attainments (failing, quitting, lagging behind) -Opinions and expectations	**EDUCATION (6-18 yrs.)** -School attendance -Reasons of absenteeism -Educational attainments (failing, quitting, lagging behind) -Opinion of educational services	**EDUCATION (6-18 yrs.)** -School attendance -Reasons of absenteeism	**EDUCATION (6 + yrs.)** -School attendance -Reasons of absenteeism -Level of education and educational attainments (failing, quitting, lagging behind, starting and finishing age)

ENCEL98M	ENCEL98O	ENCEL99M	ENCEL99N	ENCEL00M	ENCEL00N
FOOD CONSUMPTION -Consumption during the last seven days of products from the basic basket -Household expenditure in food during the week previous to the interview	**FOOD CONSUMPTION** -Consumption during the last seven days of products from the basic basket -Auto consumption -Household expenditure in food during the week previous to the interview	**FOOD CONSUMPTION** -Consumption during the last seven days of products from the basic basket -Auto consumption -Household expenditure in food during the week previous to the interview	**FOOD CONSUMPTION** -Consumption during the last seven days of products from the basic basket -Auto consumption -Household expenditure in food during the week previous to the interview	**FOOD CONSUMPTION** -Household expenditure in food during the week previous to the interview	**FOOD CONSUMPTION** -Consumption during the last seven days of products from the basic basket -Auto consumption -Household expenditure in food during the week previous to the interview
NON FOOD EXPENDITURES -Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies	**NON FOOD EXPENDITURES** Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies	**NON FOOD EXPENDITURES** Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies	**NON FOOD EXPENDITURES** Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies	**NON FOOD EXPENDITURES** Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies	**NON FOOD EXPENDITURES** Weekly expenses in transportation and alcoholic beverages -Monthly expenses in medicines, clinic visits, and household articles -6 month expenses in clothes, shoes & school supplies
HEALTH CARE (children < = 5) -Vaccination scheme -Incidence & duration of illness -Nutrition surveillance -Breastfeeding	**HEALTH CARE (children < = 5)** -Vaccination scheme -Incidence & duration of illness -Nutrition surveillance -Breastfeeding	**HEALTH CARE (children < = 5)** -Incidence & duration of illness -Nutrition surveillance -Vaccination scheme (<2 yrs) -Breastfeeding (<2 yrs) -Weight at birth (<2 yrs)	**HEALTH CARE (children < = 5)** -Incidence & duration of illness -Nutrition surveillance (<2 yrs) -Weight at birth (<2 yrs)	**HEALTH CARE (children < = 5)** -Incidence & duration of illness -Nutrition surveillance	**HEALTH CARE (children < = 5)** -Incidence & duration of illness -Nutrition surveillance
HEALTH AND USE OF HEALTH SERVICES -Opinion of health services and its providers -Use of health services -Preventive care	**HEALTH AND USE OF HEALTH SERVICES** -Use of health services -Preventive care -Prenatal care and delivery -Health status, illness, treatment (ind. 6 yrs. +)	**HEALTH AND USE OF HEALTH SERVICES** -Health status (possibility of realising different activities) -Use of health services -Preventive care	**HEALTH AND USE OF HEALTH SERVICES** -Health status (possibility of realising different activities) -Use of health services -Preventive care	**HEALTH AND USE OF HEALTH SERVICES** -Health status (possibility of realising different activities) -Use of health services -Preventive care	**HEALTH AND USE OF HEALTH SERVICES** -Health status (possibility of realising different activities) -Use of health services -Preventive care

ENCEL98M	ENCEL98O	ENCEL99M	ENCEL99N	ENCEL00M	ENCEL00N
FERTILITY AND PRENATAL CARE -Number of born alive children -Number of pregnancies -Prenatal care (pregnancies during the last 5 yrs.), delivery -Contraceptive use				**FERTILITY AND PRENATAL CARE** (women 15 – 49 yrs.) -Historic table of pregnancies (children born alive, stillbirths, abortions, dead children) -Prenatal care, delivery, breastfeeding (last 2 pregnancies during 5 yrs previous to interview) -Contraceptive knowledge & use	
			MORTALITY -Number and characteristics (age, sex) of household members dead during the last 5 yrs. -Maternal mortality		
	MIGRATION -Characteristics of sons and daughters of the household head who do not live in the household -Characteristics of other permanent migrants (last 5 yrs)		**MIGRATION** -Characteristics of sons and daughters of the household head who do not live in the household -Characteristics of other permanent migrants (last 5 yrs)		**MIGRATION** -Characteristics of household members who do not live in the household (last 5 yrs): sex, age, education, marital status, work status, occupation, income, place of residence, monetary transferences
		FAMILY BACKGROUND (women ever married or in union) -Marital status -Place of residence before marriage			

ENCEL98M	ENCEL98O	ENCEL99M	ENCEL99N	ENCEL00M	ENCEL00N
		-Age at first marriage -Working status before marriage -Possessions before marriage -Characteristics of parents and in-laws (alive, place of residence, literacy, level of education, indigenous language)			
WOMEN STATUS -Allocation of duties by sex -Decision making by household members -Female autonomy	**WOMEN STATUS** -Allocation of duties by sex -Decision making by household members -Female autonomy	**WOMEN STATUS** -Allocation of duties by sex -Decision making by household members -Female autonomy	**WOMEN STATUS** -Decision making by household members		
	WORK STATUS, INCOME, LOANS AND CREDITS (persons 8 yrs +) -Working status -Occupation -Inactivity -Number of hrs & days worked -Income -Income decisions	**WORK STATUS, INCOME, LOANS AND CREDITS (persons 8 yrs +)** -Working status -Occupation -Inactivity -Number of hrs & days worked -Income -Income decisions	**WORK STATUS, INCOME, LOANS AND CREDITS (persons 8 yrs +)** -Working status -Occupation -Inactivity -Number of hrs & days worked -Income -Income decisions	**WORK STATUS, INCOME, LOANS AND CREDITS (persons 8 yrs +)** -Working status -Occupation -Inactivity -Number of hrs & days worked -Income -Income decisions	**WORK STATUS, INCOME, LOANS AND CREDITS (persons 8 yrs +)** -Working status -Occupation -Inactivity -Number of hrs & days worked -Income -Income decisions
	GOVERNMENT BENEFITS -Benefits of social programs -Monetary support -Progresa benefits	**GOVERNMENT BENEFITS** -Benefits of social programs -Monetary support -Progresa benefits	**GOVERNMENT BENEFITS** -Benefits of social programs -Monetary support -Progresa benefits	**GOVERNMENT BENEFITS** -Benefits of social programs -Monetary support -Progresa benefits	**GOVERNMENT BENEFITS** -Benefits of social programs -Monetary support -Progresa benefits
	MONETARY TRANSFERENCES and SUPPORT BETWEEN HOUSEHOLDS		**MONETARY TRANSFERENCES and SUPPORT BETWEEN HOUSEHOLDS**		

ENCEL98M	ENCEL98O	ENCEL99M	ENCEL99N	ENCEL00M	ENCEL00N
	-Characteristics of supports, donors and beneficiaries		-Characteristics of supports, donors and beneficiaries		
	HOUSEHOLD POSESSIONS -Possession of electrical appliances and tools for agriculture	**HOUSEHOLD POSESSIONS** -Possession of electrical appliances and tools for agriculture			**HOUSEHOLD POSESSIONS** -Possession of electrical appliances and tools for agriculture
	DWELLING IMPROVEMENTS Improvements realised to the dwelling during the last 6 months	**DWELLING IMPROVEMENTS** Improvements realised to the dwelling during the last 6 months			
	AGRICULTURAL and FARMING ACTIVITIES -Possession and/or use of land -Expenses on and sale of agricultural products -Possession, purchase and sale of animals	**AGRICULTURAL and FARMING ACTIVITIES** -Possession and/or use of land -Expenses on and sale of agricultural products -Possession, purchase and sale of animals	**AGRICULTURAL and FARMING ACTIVITIES** -Possession of land -Possession, purchase and sale of animals		**LAND TENURE** -Possession of land
		ALLOCATION OF TIME (persons 8 yrs +) -Time allocated to different activities			**ALLOCATION OF TIME (persons 8 yrs +)** -Time allocated to different activities
	NATURAL DISASTERS -Incidence of natural disasters and its consequences	**NATURAL DISASTERS** -Incidence of natural disasters and its consequences	**NATURAL DISASTERS** -Incidence of natural disasters and its consequences		**NATURAL DISASTERS** -Incidence of natural disasters and its consequences

Appendix 3.3 Construction of Datasets

This appendix describes the process through which the working datasets were constructed. Our aim was to construct a dataset with information on a wide range of outcomes and explanatory variables from two different sources of information: the household evaluation survey (ENCEL) and the nutrition and health survey (INSP survey). However, there were several difficulties encountered throughout this task. The main problems were associated with linking individual data across rounds and between the two sources of information.

Health and Nutrition Survey (INSP)

The INSP survey gathered information for around 15,000 observations[66] in its three rounds of data collection. However, some cases lacked anthropometric measures and others could not be successfully linked to their ENCEL sample record. In this section we describe the process through which the final dataset was constructed.

The INSP conducted three surveys, each approximately 12 months apart: the first round was carried out between August and September 1998; the second between October and December 1999; and the last between November and December 2000. These surveys collected both cross-sectional and longitudinal information on children aged under five.

The INSP data was divided into different files, each containing information from different sections of the questionnaire. The first step was to merge all these files into a single dataset. This procedure was straightforward for the first two waves because we had access to the original datasets. However, for the third wave, the dataset that we had access to did not contain all the variables included in the questionnaire. Files from this last round were also divided by sections of the questionnaire (morbidity, anthropometry, supplements), but not all of them had the same number of children.

Once we had constructed a single dataset for each of the three rounds, we appended these to form a single file. At this stage, we needed to identify the number of observations per individual in order to detect those cases with repeated observations (longitudinal sample). The latter was not a simple task because the

[66] One child may have more than one observation.

possible variables that could be used for identifying information belonging to the same individual had different values across rounds. For instance, the variable "integran", which allows identifying every person within a household, did not coincide between surveys (747 children with a different value for "integran" between rounds). Moreover, this identifier did not coincide with the child identifier of the ENCEL surveys. Therefore, we could not use this variable for our purpose; instead, we decided to use date of birth.

This approach did not solve our problem completely because for some cases the date of birth also had a different value at different rounds. In order to maximize the number of matching dates, we used only month and year of birth to match the information from the same individual[67]. The previous variables had some errors that were easy to detect: same day and month of birth, but different year (07/06/1996 and 07/06/1997); same day and year but different month (07/06/1996 and 07/09/1996); or exchanging day for month (07/06/1996 and 06/07/1996). For the first type of error, we considered that the data belonged to the same child when the difference in years was not larger than one year. For the second one, this rule applied only if the difference in months was greater/smaller than three months. And, for the last kind of error, we considered all these cases as belonging to the same individual. The information on twins was excluded from our analyses because handling it adequately meant cleaning it manually, and the number of cases should not affect our estimations (between 80 and 100 cases at each wave).

For the observations with different values on date of birth across waves, we kept the value reported the first time they were interviewed. The latter was a crude, but pragmatic solution as we did not have enough information in order to know which of the waves had the correct value on date of birth. However, in a later stage these dates were assessed using information from the birth history data collected at the ENCEL and when it was necessary to modify them because of inconsistency a dummy variable was generated.

The individuals across INSP rounds in principle should not match completely because the sample had information on both cross-sectional and longitudinal cases. The datasets of the two follow-up surveys included a categorical variable (*tipocues* and *tiposuj*, respectively) that distinguished longitudinal children from cross-

[67] While 1,195 children had different day of birth across waves, only 234 children had different year of birth and 327 had different month of birth.

sectional ones. However, we found a considerable number of children labelled as longitudinal not surveyed in at least one of the follow-up waves. We also observed children labelled as cross-sectional who were covered in more than one wave. Thus, for our analysis we decided to use as longitudinal children those that had information in more than one wave, regardless of the INSP classification.

Table A.3.1 presents the number of cases that were lost in our data screening process. In its three rounds of data collection, the INSP gathered information for around 14,293 cases[68]. However, 14 percent of these observations (2,096 cases) did not have complete or accurate information on anthropometric data[69] (either they did not have complete information on weight and height or they had improbable values that were flagged by the software).

When matching the remaining INSP data with the ENCEL, the first problem we encountered was matching cases at the locality level. Among the INSP cases with complete information on anthropometric outcomes, 9 percent (1,163 cases) correspond to children living in localities that were not part of the ENCEL sample (32 localities in Veracruz[70], and 14 localities in Morelos, state which is not an entity included in the ENCEL sample). After excluding these observations, our sample size was reduced to 11,664 cases.

The next step was to join the INSP data with the ENCEL information at the household level. Using the household identifier ("folio"), we found a large number of observations (566 households and 823 cases) that did not match between sources[71]. Thus, at the household level we lost an additional 7 percent, reducing the sample to 10,841 cases. Subsequently, we merged both sources at the individual level using the household identifier number ("folio"), and the child's month and year of birth as link. Initially, only 7,054 cases matched correctly. A large number of cases did not match because of differences in date of birth similar to those found when matching the three INSP waves (same year different month or same month different year). However, we recovered an important number of observations (1,767) by using the

[68] These 14,000 cases correspond to the observations of 11,000 children.
[69] The quality of the anthropometric indicators is explained with more detail in Chapter 3.
[70] These 32 localities were included as part of the INSP sample because the rest of the localities within Veracruz state were already receiving benefits when the INSP team collected their baseline information. However, we had to exclude them from our analysis as they did not match the ENCEL data.
[71] Around 10 percent of the cases that did not match could have matched with the ENCEL information, but these cases belonged to households that were not surveyed at round one or five.

same mechanism as that used when matching children between rounds[72]. Thus, we obtained a dataset, matched at the individual level, of 9,636 cases[73]. Finally, we excluded from the analysis those cases with missing or extreme values on age, weight or height[74] as well as those cases with odd changes between waves (505 cases). Specifically, those observations with negative difference in age between waves and those cases whose Z-score value changed +/- 4 standard deviations between waves. Thus, the final "working" sample contains information of 9,131 cases of which 6,994 were eligible for benefits. These observations (6,994 cases) correspond to 5,176 eligible children who were interviewed at least once.

Table A.3.1
Cases Lost in Matching Process and Data Cleaning

	Observations	Cases lost	
		Frequency	Percentage
INSP[1]	14,923	-	-
INSP (w/out measurement problems)	12,827	2,096	14.0
INSP match with ENCEL (at locality level)	11,664	1,163	9.1
INSP match with ENCEL (at household level)	10,841	823	7.1
INSP match with ENCEL (at individual level)	9,636	1,205	11.1
W/out missing values or outliers	9,131	505	5.2
Final Sample Eligible cases	*6,994*		

Note: 1.It includes the 3 waves of data collection.

Of these 5,176 eligible children, 3,716 were interviewed just once, 1,102 children were surveyed at two waves, and only 358 were measured in all waves (see Table A.3.2). The second part of Table A.3.2 shows the pattern of observations of children interviewed on more than one occasion. As these figures show, there is information on around 700 children with at least two observations at waves one and two (754 cases), two and three (775 cases), one and three (647 cases), and one, two and three (358 cases).

[72] Within each household, we considered observations belonging to the same individual if the errors on birth of date were minor. That is, those cases that had the same month of birth but only one year difference, and those that had the same year of birth but a difference of three months.
[73] From which 5,622 had information on prenatal care.
[74] The cases excluded were those that the software has automatically flagged as outliers and also those with Z-score values <-5 or >5.

Table A.3.2
Number of observations per children
INSP final working sample

	Frequency	Percentage
Children		
One	3,716	71.8
Two	1,102	21.3
Three	358	6.9
Total	*5,176*	*100.0*

Pattern of obs. of longitudinal sample

Waves	Frequency
1 - 2	754
2 - 3	775
1 - 3	647
1- 2 - 3	358

Household Evaluation Survey (ENCEL)

The ENCEL questionnaire had a specific section covering children's health status and use of preventive health services. These outcomes were monitored throughout the whole period. In the six rounds of data collection, respondents were asked about children's incidence and duration of illnesses (diarrhoea and respiratory infections) and on visits to the health centre for nutrition surveillance. At some waves, this information was supplemented with additional data on health issues such as vaccination schemes, duration of breastfeeding and weight at birth.

Additionally, data on prenatal care, delivery care, and breastfeeding practices were obtained at the first and fifth waves of data collection. At the first round, this information was asked for the most recent birth of each respondent if it occurred during the five years before the survey (children born after January 1993)[75]. At the fifth wave, this information was collected for the last and previous to last living births occurring between January 1995 and the date of the interview. Moreover, this round included a special questionnaire in order to collect retrospective data on the pregnancies of each woman between 15 and 49 years of age.

Due to operational costs, birth histories were not collected for all women within the ENCEL sample. A random sub-sample of around 68 percent of the total number of women within this age group were interviewed, around 20,000 women (see Table A.3.3). Among these, more than three quarters (76.6 percent) had ever been

[75] The interval was not exactly five years, but a few more months. The reason for extending the period was to make it easier for interviewers when asking and when filling out this question.

pregnant with a mean number of pregnancies of 4.43. These records gathered information of 66,588 pregnancies, of which 98 percent were reported to have been born alive (see Table A.3.4).

Table A.3.3
Sample Size ENCEL Birth History Data

	ENCEL 2000m	Birth History
Localities	499	499
Households	26,196	16,546
Women	29,766	20,135

Table A.3.4
Type of Pregnancy

	Frequency	Percent (%)
Born alive	65,430	98.3
Abortion	896	1.3
Still birth	155	0.2
Unidentified	107	0.2
Total	*66,588*	*100*

Data Quality

When constructing the bio-demographic variables, we assessed the accuracy of dates of birth, as problems with this variable could affect the value of the rest of the bio-demographic variables (birth order, preceding birth interval, mother's age at birth). Previous research has shown that the collection of birth history data is complicated, particularly in low-literacy populations. The main difficulties are omission and misplacement of events (Potter 1977). Aware of these problems, we analysed for possible errors in age reporting.

Among the birth history records, we found a small number of cases with missing values on the date of birth: 975 cases (1.5 percent of the total number of pregnancies). The great majority of these cases were pregnancies classified as abortions or as still-births. It is more likely that women do not remember the date this kind of pregnancy ended than the day a living child was born. Only 198 children born alive had missing values on their date of birth. We assigned a date of birth to all those cases with missing values by using the dates of birth of the preceding and following pregnancies. When the missing value belonged to an intermediate birth, we randomly allocated a date of birth between 7 months plus the date of birth of the preceding sibling and 7 months less the date of birth of the following sibling. In the case of last births, we allocated a date of birth between 7 months plus the date of the preceding birth and 7 months less the date of interview. Finally, for first births, we only subtracted 7 months from the date of birth of the following sibling, as we did not have other information (for example, age at marriage) to use as the lower limit. After this procedure, we still had some pregnancies with missing information on date of birth (or termination of pregnancy) (485 cases). However, once we had minimized the number of cases with missing data on date of birth, we sorted the births of each woman in chronological order and generated the rest of the bio-demographic variables.

Next, in order to assess for misplacement of births, we explored the length of the preceding birth intervals. We found 1,043 cases with birth intervals shorter than 7 months (excluding first births and twins), and 423 cases with birth intervals longer than 120 months. We adjusted the dates of birth of those children with very short preceding birth intervals following the same procedure as the one used for omission of dates. The dates of birth of children with very long birth intervals were not adjusted. However, theses observations were flagged for further analysis.

The next step was to link the information on birth history with that of prenatal care and feeding practices. As mentioned previously, this information was collected at the first and the fifth rounds of the ENCEL. For the first wave, this information was asked regarding the last birth, if it occurred within five years of the survey (children born after January 1993). For the fifth wave, this information was collected for the last and previous to last live birth, assuming each occurred within five years of the survey (children born after January 1995). Information on 9,259 children was collected at the first wave (not shown here) and on 10,667 children at the fifth wave (see Table A.3.5).

Table A.3.5
Children with Information on Feeding Practices and others
Birth History Data ENCEL

	Total	**W/ info. on feeding practices**
Born alive before January 1995	*52,134*	*0*
Born alive after January 1995	*13,296*	*10,667*
Last child	9,325	7,481
Previous to last child	3,971	3,186
Total	***65,430***	***10,667***

For joining the previous data with the bio-demographic variables, we first matched that of the fifth wave, as it was a quite straightforward procedure. We simply merged the information of the last and previous to last living birth of the birth history records with that of the file containing the information on prenatal care and feeding practices. As the information came from two different files, we assumed that the prenatal care and feeding practices information belonged to those children born after January 1995 reported as the last and previous to last births on the birth history records[76].

Matching the birth history records with the variables on the first wave was a bit more complicated. In order to do so, we used as child identifier both the id of the household ("folio") and the month and year of birth[77]. From this merge, the information of 4,362 children matched correctly, i.e. data for these children had been collected at both waves. We cross-tabulated some of the variables and found a few inconsistencies (while at wave one the mother of the child had received prenatal care, at wave five she reported she had not received any). Thus, we decided to use the information collected at the first wave as the event of interest was more recent thus less liable to confusion or forgetfulness. On the other hand, we found 3,294 children with information only from the first wave. These children belonged to households that were not interviewed at the fifth wave. Additionally, there were 1,603 cases that had information on the birth history records of the fifth wave, and information on prenatal care from March 1998. Most of these children

[76] We assessed that this assumption was correct using date of delivery (reported on prenatal care file). For most of the cases this assumption was valid, but a few dates of delivery did not match with the date of birth. We confirmed that this data did not belong to another child within the family.
[77] The birth history records did not include the usual child identifier ("número").

were either born before January 1995 or were not the last or previous to last child within the household. With the data collected at the first wave included information on prenatal care of around 5,000 children more. In sum, with data from both rounds we were able to construct a dataset of 18,565 children with information on bio-demographic and prenatal care variables. This dataset was merged with that of the INSP in a subsequent stage.

Chapter 4. Household Food Security

4.1. Introduction

A household is said to be food secure if at all times it has access to enough food to lead an active and healthy life (WorldBank 1986). Poor households are likely to be food insecure as they have scarce resources to ensure sufficient food for a nutritious diet. A diet poor in quantity and quality has a negative influence on child health outcomes. Progresa provides monthly cash transfers to its beneficiary families to improve the quantity and quality of the food products consumed. In this chapter, our aim is to assess whether Progresa has had a positive impact on family's access to food as improvements in this area are likely to promote children's well-being.

In Section 4.2 we review the importance of household food security and its influence on child well-being. Section 4.3 briefly summarizes the benefits of Progresa that can positively influence households' access to food, and then discusses the findings from other evaluations of Progresa's effect on food consumption and dietary diversity. Section 4.4 describes the characteristics of the data used in this analysis. Section 4.5 presents the methodology used to answer our research questions. In Section 4.6 we explain our descriptive and confirmatory results. Section 4.7 discusses the conclusions drawn from this analysis.

4.2. Household food security and nutrition

Household food security has a direct effect on children's dietary intake after the weaning period, once children start consuming the family food products. Nevertheless, before this stage, household's access to food also has an important influence on child health outcomes through mother's dietary intake. Maternal nutritional status before, during and after pregnancy has a strong effect on children's health. If a woman is not well fed during pregnancy, there is a high probability that she will deliver a baby with low birth weight (Galloway and Anderson 1994; Greiner 1994; Merchant 1994; Norton 1994; Rivera et al. 2002), with higher chances of neonatal mortality and morbidity (Galloway and Anderson 1994; Greiner 1994; Merchant 1994; Norton 1994; Rivera et al. 2002), or with impaired brain development and other dysfunctions (Singer and Ryff 2001). During the breastfeeding period, it is important that women receive an adequate diet in order to avoid maternal depletion, inadequate production of breastmilk[78] and early weaning. Once weaned, children gradually adopt the family's diet. Thus, food security of households with children is a necessary factor to guarantee that children achieve adequate nutrition.

It is universally accepted that not only the quantity, but also the quality of the diet is important. Dietary diversity is an important component of dietary quality because it increases the chances of consuming a balanced healthy diet. A review of studies of dietary diversity in developing countries found a consistent positive association between a varied diet and the recommended intakes of energy and nutrients (Ruel 2002). Additionally, evidence from developing countries[79] shows that variety in the diet has a positive effect on children's growth (Allen 1991; Ruel 2002). For instance, evidence from a study carried out in Mexico indicates that children who eat more monotonous diets (tortillas and beans only) show significantly poorer growth than those consuming a more diverse diet (animal products, fruits, vegetables, cereals) (Allen 1991).

The association between indicators of dietary diversity and child outcomes could be in part explained by the strong relationship between food security and socioeconomic status. However, the little evidence that exists shows that even after controlling for the influence of socioeconomic characteristics the association between dietary diversity and child outcomes remains significant (Allen 1991; Ruel 2002). Furthermore, it seems that this relationship is stronger among children in deprived environments. Findings from a study looking at child-feeding practices show that the type of complementary food products first introduced into a child's diet is more important for children of lower socioeconomic groups than for those of less disadvantaged households (Ruel and Menon 2002).

It should be noted that food security is a necessary but not sufficient factor to guarantee children have adequate nutrition. Appropriate care practices, a healthy environment and use of health services also play an important role in achieving

[78] However, it has been argued that there is not enough evidence of a substantial effect of maternal nutritional status on lactation. Furthermore, it is believed that this physiological process is only compromised when maternal malnutrition is extremely severe (Greiner 1994; Shetty and James 1994; ACC/SCN 2000).

[79] The studies cited here analysed data from the following countries: Ethiopia, Mali, Kenya (Ruel 2002) and Mexico (Allen 1991; Ruel 2002).

positive child health outcomes (UNICEF 1998). Therefore, it is only one of the many mechanisms associated with children's welfare.

Ideally, when studying child-related outcomes, one would prefer to examine children's actual food intake instead of household food consumption. However, it is not common to have this kind of data in large scale surveys. Therefore, household food consumption has been used as a proxy to estimate children's access to food. Nevertheless, using an indicator at the household level to estimate individual outcomes has its limitations.

Children living in Progresa localities are at risk of having inadequate diets not only in terms of quantity but also in terms of quality. Household food insecurity is one of the multiple factors associated with their poor health and growth. Through the cash transfers and the information on care feeding practices, Progresa can improve the quantity, quality and safety of food items available at the household level. Improvements in these areas should in turn have a positive impact on child nutrition and health.

4.3. Progresa's benefits on food consumption

Progresa beneficiary families receive a monthly monetary grant to improve the quantity and quality of the food products they consume. This grant is a fixed monthly amount of around PPP US$20[80], given to all beneficiary families regardless of their size and composition. It is adjusted every six months to account for the increase of prices due to inflation (see Table 4.0). This cash transfer is conditional upon the fulfilment of health related activities: families must visit the health centre according to a monthly schedule set by the characteristics of the family members, and mothers must attend the monthly educational sessions.

Additionally, families with children of school age receive a monetary grant for promoting school attendance. The aim of this cash transfer is to support families' expenditures, especially the purchase of food products and other child related items. The value of these grants varies according to children's school grade and children's sex (for details on Progresa's scholarships, see Chapter 2). To avoid discouraging families from working or encouraging them to have more children, the

[80] For comparison purposes, we converted Mexico's currency (pesos) into US dollars using the PPP rates for Mexico published by the OECD (OECD 2002).

total amount of these transfers has a maximum limit set at around PPP US$125 per month.

Table 4.0
Progresa's Cash Transfers

	Jan-June, 1998	*July-Dec, 1998*	*Jan-June, 1999*	*July-Dec, 1999*	*Jan-June, 2000*	*July-Dec, 2000*
Food cash transfer						
Pesos	95	105	115	125	130	135
PPP US$[1]	19	21	20	22	21	22
Cap						
Pesos	585	630	695	750	790	820
PPP US$[1]	118	127	123	133	128	133

Notes: Transfers are adjusted w/reference to the National Basic Food Basket Price Index published by Central Bank.
1. Pesos converted into PPP US $ using PPP published by OECD (http:/www.oecd.org/std/ppp/).
The values for the PPP's are 4.95 for 1998, 5.63 for 1999 and 6.18 for 2000.
Source: Progresa (http:/www.progresa.gob.mx)

On average, beneficiary families receive a monthly cash transfer of PPP US$ 45 (around 280 pesos), equivalent to around 20 percent of their monthly income. Furthermore, this grant is somewhat higher for those beneficiaries with children of school age, who receive on average a cash transfer of PPP US$64 (around 400 pesos), representing around 30 percent of their monthly income. Thus, these cash transfers are an important support to family's income.

It is worth noting that the monetary support is given directly to the mother of the household. Several studies have suggested that women are more likely to spend their income on child nutrition and health than men. Duflo (2000) finds that pensions received by women had a significant impact on the anthropometric status of South African girls. In contrast, the author does not find the same effect for pensions received by men. Therefore, it is likely that the gender of Progresa's cash transfers recipient leads to positive impacts on family's food expenditure.

Additionally, Progresa provides monthly educational sessions where mothers learn, among other health related issues about food consumption. In these sessions, it is emphasized to mothers that Progresa's monetary transfers are meant to buy food products and that they should not be spent on items such as alcohol or cigarettes. Additionally, the importance of consuming a varied diet, the safe preparation of food, and how to make better use of regional food products are explained to mothers.

4.4. Evaluations of the Impact of Progresa on Food Consumption

Previous studies evaluating Progresa's impact on consumption have looked at the Programme's effects on household expenditure, caloric availability and dietary diversity. These analyses have concentrated on the first 18 months of Programme operation and have observed some positive effects. In this section we review the main findings of these studies and discuss the limitations, which our study aims to address. We first discuss the results of the studies on food consumption and then we review the findings on dietary diversity.

Consumption

One detailed study investigating Progresa's impact on household consumption examined its performance during the first 18 months of operation, up to November 1999[81] (Hoddinott et al. 2000). The authors estimated the Programme's effect for a group of "potential" beneficiaries and for a group of "true" beneficiaries. They distinguish between these two groups because they find that 27 percent of eligible households living in treatment localities had not received any monetary transfer by March 2000 (Hoddinott et al. 2000). Regarding caloric availability, their estimates of the Programme's effect conditional on cash transfers was an increase on calories of 4.3 percent in May 1999 and 7.1 percent in November 1999. In contrast, the unconditional impact was 3.5 percent and 6.3 percent, correspondingly. The authors argue that estimates for the "potential" beneficiaries lead to a downward bias of the Programme effect. The former argument is valid if we are interested in assessing exclusively the impact of cash transfers. However, in the evaluation of a social programme we are interested in its performance on the whole and if households were not receiving their corresponding transfers because of operational issues this has to be considered as well and thus there would not be any downward bias on the estimates.

Another study on household food security examined whether Progresa had a differential effect from Procampo[82] –a cash transfer programme directed primarily

---

[81] The authors exclude the first ENCEL survey (ENCEL98-M) because the data on consumption for this round is not comparable with that of consecutive waves.

[82] Procampo (Programme for Direct Assistance in Agriculture) is a programme of the Mexican government that was implemented in 1994 after the outset of NAFTA. Its objective is to provide

at men, aimed to improve consumption through agricultural production (Ruiz-Arranz et al. 2002). This analysis does not look at changes over time; it only uses information from the second wave of data collection (ENCEL-98O). Results from this study show that, in spite of differences in gender of beneficiary and in programme requirements or objectives, both policies augment consumption and caloric acquisition, with an impact of similar proportion: for each peso transferred, expenditure on food increases 30 cents and caloric acquisition increases one caloric unit. According to these estimates, if Progresa's beneficiaries receive on average 280 pesos per month, the Programme should increase caloric acquisition by 280 kilocalories per person per day, which represents a relative impact of around 14 percent (based on an average number of kilocalories at wave two of 2,132).

An important drawback with this evaluation is that it estimates the impact of these transfer programmes by using the theoretical payments households should receive according to their characteristics. The authors explained that they used the theoretical payments instead of the real ones in order to avoid endogeneity. However, this indicator is not evaluating the actual performance of the Programme because it is not accounting for possible administrative failures or for households not complying with Programme's requirements. Thus, this evaluation assesses the theoretical impact (the "intention to treat" as they refer to it) of cash transfers and not their real performance.

Finally, results from a qualitative study on Progresa's performance suggest that the great majority of beneficiary families allocate the monetary grants to the purchase of food products and clothing (López R. 2000). The author explains that families receiving cash transfers only for the food component reported using this money almost exclusively for buying more food. However, if the household also receives monetary grants for sending children to school, this extra money is said to be used for buying other articles such as children's clothes and shoes.

Dietary diversity

Hoddinott et al. (2000) carried out a descriptive analysis on dietary diversity. They observed that households participating in the Programme are more likely to

eligible agricultural producers a fixed monetary grant per hectare in order to offset the expected decline in prices (for a more through explanation of the characteristics of this Programme consult (Sadoulet et al. 2001)).

consume a more varied diet[83] than their counterparts living in control communities (Hoddinott et al. 2000). However, this study did not control for a possible bias due to differences in household characteristics between treatment and control groups. Hence, to obtain unbiased estimates of the Programme's effect on variety in the diet it is necessary to corroborate this finding using a multivariate analysis that accounts for the nonrandomness of households characteristics.

Similarly, Ruiz-Arranz *et al.* (2002) found evidence that, at the second wave of data collection, beneficiaries from both Progresa and Procampo shifted their consumption from foods common to their diet (cereals and grains) to foods not previously consumed (vegetables, fruits and products of animal source). Additionally, the authors indicate that beneficiaries who receive benefits only from Progresa or from both Progresa and Procampo have a more diverse diet than those who only receive Procampo's monetary grants. The authors explain that this differential effect is due to the information provided at Progresa's educational sessions (Ruiz-Arranz et al. 2002). However, the greater effect among households receiving Progresa's supports could also be explained by differences in the gender of beneficiary, with Progresa's beneficiaries making a better use of them. Likewise, Hoddinot *et al.* (2000) suggest that the effect of the Programme in this strand is through both the cash transfers and the educational sessions. It seems that the information given at these sessions is an important channel through which cash transfers affect food consumption and dietary diversity.

In this study, our main aim is to assess the Programme's effect on the food security of households with children under the age of five. We want to examine the influence of Progresa's benefits on both the quantity and the quality of the diet and to assess possible changes in the Programe's effect over time. We are also interested in evaluating whether the Programme is reducing the gaps between groups, hence we want to examine if there is a differential effect according to household's severity of poverty.

4.5. Data

In this section we describe the construction of the outcome variables under study, explaining the different factors that were accounted for in this process; and provide

[83] Dietary diversity was measured using the number of unique food products consumed during the last week and the proportion of households consuming the different food items.

a brief summary of the quality of the data already covered in Chapter 3. The data source for this chapter is the ENCEL evaluation survey[84]. We do not use information from all rounds of data collection because, as explained previously, there were some variations in the questionnaires over time. This lack of information restricted our analyses to four waves: ENCEL-98O (wave 2), ENCEL-99M (wave 3), ENCEL-99N (wave 4) and ENCEL-00N (wave 6). Despite incomparability, we used data at baseline, ENCEL-98M (wave 1), to verify that at the beginning of the Programme the pattern of consumption of control and treatment groups was similar.

Results from our attrition analysis in Chapter 3 suggest that, although attrition is selective for some background characteristics, the estimates of outcome variables should not be substantially affected by this attrition bias. Findings from our attrition tests showed that the coefficient for attrition was not significantly associated with dietary diversity and that its association with expenditure per capita was only mildly significant. Additionally, we observed no difference in the attrition of control and treatment households. Therefore, the selectivity observed should not be of great consequence for our evaluation of Progresa's effect on households' consumption and dietary diversity.

Another aspect we looked at in the data cleaning process was that of missing information and outliers on dependent and independent variables. With respect to the outcome variables, we excluded those cases with missing information and/or with outlier values. Regarding our explanatory variables, as most of them are categorical, we generated an additional category per variable where we assigned those cases with missing information.

Outcome variables

In our descriptive analysis, we looked at a set of outcome variables associated with households' accessibility to food and other consumer goods: food expenditures, non-food expenditures, consumption of home-produced food items, caloric consumption, and dietary diversity. However, for evaluating the impact of Progresa on food security at the household level, we used caloric consumption (as a measure of food

[84] To remind the reader, the ENCEL surveys include six waves of data collection: 1) March 1998 (Encel-98M), 2) October 1998 (Encel-98O), 3) May 1999 (Encel-99M), 4) November 1999 (Encel-99N), 5) May 2000 (Encel-00M), 6) November 2000 (Encel-00N).

availability) and variety in diet (as a proxy for quality in diet) only. The reason for this is that, as explained below, the other variables had some constraints.

The food expenditure indicator was constructed using information about purchases of food items. Households were asked how much they spent in total during the last seven days and then they were asked specifically about the amount spent on 34 different items. These expenditures were grouped into four categories: fruits and vegetables, cereals and grains, products of animal origin, and processed food products. The sum of these groups gave total food expenditure[85]. This indicator does not include products which the households produced, thus it is an indicator of expenditure and not of consumption. We were unable to add up the value of home-produced food items because information for this variable was not collected at all rounds (waves one and four do not include a specific question on home production). This is a major limitation because among poor households an important share of total food consumption comes from home production. Nevertheless, to explore the contribution of home-produced food items to households' consumption we estimated its monetary value by using information of the second wave of data collection (ENCEL-98O). For doing so, we multiplied the quantity consumed of each food item produced by its corresponding price at the locality level[86]. Information on non-food expenditures[87] was also collected and added to the total value of food expenditure to obtain total monthly expenditure. For comparison purposes, we converted nominal prices to real ones. All expenditures were converted into November 1997[88] prices using the national consumer price index data.

Caloric consumption was constructed following the method used by Hoddinott *et al.* (2000). That is, we converted the food quantities of the products consumed during the previous week into daily caloric availability at the household level using the

[85] With respect to the total value of food, the interviewee reported its total value as well. However, we observed a smaller figure than the one calculated by adding up the value of the four different food categories. Other studies have found that a shorter list of products usually leads to a reduced estimate on expenditures (Deaton, 1987). Therefore, we preferred using the value of expenditures calculated as our estimate of food expenditure.

[86] Prices at the locality level were estimated from household's information on expenditures and quantities bought. Once the price at the household level was obtained, we estimated the average value at the locality level, excluding outliers (cases with values above or below the mean price plus 3 times the standard deviation).

[87] Expenditure on non-food items included expenses on: transportation, tobacco, personal hygiene items, household cleaning supplies, medicine, visits to health centres, school tuition and supplies, home utensils, clothes, shoes, toys, and special events.

[88] The first round of surveys, the ENCASEH survey, was collected at this date; hence, converting prices into its real value at this point in time.

Mexican Food Composition Tables of 1999[89]. In contrast with food expenditure, caloric consumption does include food items of own production[90]. It is worth underlining that caloric consumption is only a proxy of caloric intake because the ENCEL questionnaires did not collect data on actual intake. However, this proxy is likely to be close to the real value. Surveys with information on both caloric availability and caloric intake for poor populations in developing countries[91] have shown that the difference between these measures is very small (Smith 2002). Therefore, we favoured this indicator instead of food expenditures as we believe it is a more reliable indicator of food security.

We assessed caloric consumption using a continuous variable, the daily amount of kilocalories (kcal.). Additionally, in the descriptive analysis, we looked at this outcome variable in its discrete form to identify the proportion of households classified as food insecure or undernourished –those whose caloric values are below their caloric requirements. The cut-off point for energy requirement is controversial because it depends on numerous factors (e.g. age, sex, activity levels, among others). Different institutions provide different cut-off points with a range between 1,885 and 2,500 kcal (Hoddinott and Yohannes 2002). In this study, we use the United Nations' estimates for Mexico's 1998 average minimum caloric requirement of 1,890 kcal[92].

Finally, to examine the impact of Progresa on the quality of the diet we analysed dietary diversity. Up to now there has been no consensus on how this should be measured. The most common method used is a simple sum of foods or food groups consumed over a specific time period (Ruel 2002). Other measurements include weighted indicators that account for the number of recommended servings based on dietary guidelines, or the nutrient density of the food products (Ruel 2002). The construction of these weighted indicators requires detailed data which, as in our case, is not always collected. We could use alternative methods to identify some key dietary problems such as lack of fruits and vegetables, or lack of meat and products of animal origin. This could be done using a logit in which the outcome variable

---

[89] In order to do so, we first converted different units of measurement (litres and pieces) into kilograms. Then, food items were converted into edible food (multiplying by the percentage weight of the food considered to be edible). Next, using conversion tables the edible kilograms of the 34 food items were converted into kilocalories per family per day.

[90] What caloric consumption does not include is the kilocalories corresponding to the food consumed outside the household. However, an exploratory analysis showed that its value was almost negligible, thus excluding it should not affect our calculations.

[91] The countries included in this analysis are Kenya, Philippines and Bangladesh.

[92] Source: http://unstats.un.org/unsd/cdb/cdb_help/cdb_quick_start.asp

takes a value of one if the household did not consume a specific food group (or food item) over the previous week (or a certain number of times over the given period) and zero otherwise. This approach is useful for identifying whether the intervention contributes to improving the consumption of certain food categories (or food products) which, as will be shown in Section 4.7.1, was in most cases quite low at baseline. However, it does not show whether the diet is more varied because food consumption is more frequent during the period of reference.

In this study, we use a measure proposed by Hoddinott (2001), which takes into consideration the frequency of consumption. We prefer to use this indicator because Progresa's effect on this outcome variable can occur not just through an increase in the number of different food items consumed but also through an increase in the number of days of consumption. The measure used is a weighted sum of the different food products consumed during the previous week[93], where the weights represent the number of days that individual food items were consumed over the reference period. The formula used to construct this variable is the following:

$$DD = \sum_{i=1}^{34} F_i * D_i$$

where F_i takes a value of one if the household consumed the *ith* food item during the previous week and zero otherwise. D_i is the number of days the *ith* food product was consumed during the given period.

Table 4.1 displays the different score values that could be obtained using a simple count of food items versus using a weighted sum. For instance, households 2 and 3 have the same value of dietary diversity for fruit consumption when measured using a simple sum (a value of 3); in contrast, household 3 has a greater diversity when assessed using a weighted sum because its fruit consumption during the reference period was more frequent than that of household 2 (a value of 19 versus 3, correspondingly). This example illustrates that with a simple sum of unique food items we would not be able to identify an improvement in dietary diversity if it took place through an increase in the number of days of consumption.

---

[93] The list of food items included in the questionnaire was selected using data from national surveys which showed that these products are the ones with greater consumption in rural areas. It includes: tomatoes, onions, potatoes, carrots, leafy vegetables, oranges, plantains, apples, lemons, chicken, beef/pork, goat/sheep, fish, sardines/tuna, eggs, milk, lard, maize tortillas, maize grains, white bread, sweet bread, loaves of bread, wheat flour, noodles, rice, biscuits, beans, breakfast cereal, cupcakes, soda, coffee, sugar, and vegetable oil.

Although our preferred diversity measure has some advantages in comparison with a simple count, it also has some limitations: it does not fully assess changes in frequency intake[94]; and it does not account for the nutrient content or the quantity of the food items consumed. Despite these limitations, we believe our indicator provides some insight into Progresa's impact on dietary quality.

Table 4.1.1
Sample Data and Measures of Dietary Diversity for Fruit Products

Household ID	Number of days food item consumed				Dietary Diversity Measures	
	Oranges	Plantains	Apples	Lemons	Simple Sum	Weighted Sum
1	7	6	4	2	4	19
2	1	1	0	1	3	3
3	7	5	0	7	3	19
4	1	1	0	0	2	2
5	5	0	0	3	2	8

Note: Reference period corresponds to the week previous to interview (7 days)

To show the range of values that our diversity measure can take, Table 4.1.2 presents some descriptive statistics on the sample's dietary diversity at baseline. For presentation purposes, we grouped the 34 food items into four food categories: fruits and vegetables; products of animal origin; cereals and grains; and processed foods[95]. The range of values our indicator of dietary diversity (weighted sum) can take fluctuates from 7 to 238 (from 1 item consumed seven days to 34 items consumed seven days). The average value for the sample under study is around 65 (95% C.I.= 64.1 - 65.0). Although it is not clear whether this value is close to a desirable level, the location in the range of values it can take suggests that the variety of food consumed is limited. The width of the confidence intervals suggests that there is reduced variation about the mean. Nevertheless, it is worth noting that the standard deviations show greater variation in the diversity scores of fruits and vegetables and cereals and grains (SD of 8.8 and 8.0, respectively) than that of meat and industrialised foods (SD of 5.0 and 5.3, correspondingly). The

[94] It cannot identify changes in the frequency of consumption if they occur on a daily basis. That is, a household consuming a food item over the same number of days but with a higher (or lower) daily consumption would not be detected.

[95] The composition of the four groups is as follows:
1) Fruits and vegetables: oranges, plantains, apples, lemons, tomatoes, onions, potatoes, carrots, and leafy vegetables;
2) Products of animal origin: chicken, beef/pork, goat/sheep, fish, sardines/tuna, eggs, milk, and lard;
3) Cereals and grains: maize tortillas, maize grains, white bread, sweet bread, loaves of bread, wheat flour, noodles, rice, biscuits, and beans;
4) Processed foods: cakes, soda, coffee, sugar, and vegetable oil.

consumption of meat and processed foods may show less variation than that of other food groups because these food products are, on average, less accessible among poor households than fruits and vegetables or cereals and grains.

Table 4.1.2
Descriptive Statisitcs Dietary Diversity by Food Group
Eligible households with children under five at baseline

	Treatment and Control				
Variable	**Mean**	**Std. Dev.**	**Std. Err.**	**[95% Conf. Interval]**	
Dietary Diversity (sum of different items)					
Total food	*17.9*	*4.7*	*0.05*	*17.8*	*18.0*
Fruits and vegetables	5.3	2.0	0.02	5.3	5.3
Cereals and grains	6.5	1.8	0.02	6.4	6.5
Meat and animal products	2.8	1.5	0.02	2.8	2.8
Processed food	3.4	0.8	0.01	3.4	3.4
Dietary Diversity (weighted sum)					
Total food	*64.6*	*19.5*	*0.22*	*64.1*	*65.0*
Fruits and vegetables	17.3	8.8	0.10	17.1	17.5
Cereals and grains	21.2	8.0	0.09	21.0	21.4
Meat and animal products	7.4	5.0	0.06	7.3	7.5
Processed food	18.7	5.3	0.06	18.6	18.8

Before describing the explanatory variables, it is worth noting that food expenditure, total expenditure and caloric consumption were divided by adult equivalent scales[96] to obtain expenditures and kilocalories per adult equivalent. In our analysis, we are interested in assessing children's well-being through these household measures; thus, we need to account not only for the household's size, but also for its age structure and gender composition. Thus, we preferred using adult equivalent scales instead of using a per capita measure. An important limitation of our food security indicators is that we assume that resources are equally distributed per adult equivalent. Although the adult equivalent scales adjust for the patterns of consumption of the different family members, if resources are not distributed according to this scale, they are likely to estimate incorrectly our ultimate outcome, children's well-being.

Explanatory variables

Our main covariate of interest is Progresa's effect. We examine it by using a dummy variable with a value of one if an eligible household lives in a locality

[96] The adult equivalent scales used were provided in Chapter 3.

incorporated into the Programme in the initial stages and zero otherwise. We also incorporate dummy variables for wave of data collection to assess whether there are differences in Progresa's effect over time.

We include a set of background characteristics at the household and community level to control for possible differences between treatment and control groups, and to control for the possible influence these characteristics might have on the outcome variables under study. The explanatory variables at the household level include: mother's education, mother's language, household head's age, household head's education, number of children under the age of five, number of children 6 to 12 years old, number of children 13 to 18 years old, and dwelling characteristics (number of rooms, access to water and wc availability). We also control for variables at the locality level that could be associated with food security such as locality's degree of marginality, distance to the nearest DICONSA store, incidence of natural disasters (flood, frost and drought), average wage of agricultural workers and region of residence.

Finally, in order to assess whether there is a differential impact of the Programme according to households' severity of poverty we estimated our models using a categorical variable based on Progresa's poverty index. This variable was constructed categorising this index by its terciles, with households in the first tercile being the poorest and those in the third tercile being closer to Progresa's cut-off point or poverty line.

We examine only eligible households with children under the age of five because our main objective is to assess the Programme's impact on children's vulnerability to food access. The reader should bear in mind that we consider as eligible households those that were initially classified as poor. We did replicate the analyses considering as eligible households those that at some point in time were incorporated into the Programme and results were not considerably different (Progresa's impact was slightly smaller). Therefore, we only present here findings with the first classification of eligibility.

4.6. Methodology

We carry out our analysis in two stages. To begin with, we perform a descriptive analysis to have an initial insight into our outcome variables at baseline and to identify a possible effect of the Programme over time. Subsequently, we confirm these results accounting for the longitudinal nature of the data and controlling for the possible influence of covariates.

4.6.1. Descriptive analysis

Firstly, we used baseline information to understand the patterns of expenditure and consumption at the beginning of the Programme, and to assess whether food access of treatment and control groups differed from each other at this initial stage. Secondly, we used information from the subsequent rounds to examine changes in our outcome variables among eligible treatment and control households. This first assessment was done without controlling for a possible covariate effect. Furthermore, to have a preliminary insight into the influence of Progresa, we estimated statistical tests to assess whether the differences between treatment and control groups occurred by chance. We performed these tests for each wave of data collection.

4.6.2. Multivariate analysis

Thirdly, we estimated the Programme's effect on households' food security using a multivariate framework that accounts for the longitudinal nature of the data and controls for some of the bias introduced by the differences in household characteristics between treatment and control groups.

We used a random effects approach because in this analysis the value of our explanatory variable of interest, treatment, did not change over time and could not be estimated using a fixed-effects approach. In this chapter, the value of the dummy variable for treatment is always one because for the four rounds under study children living in treatment areas were receiving Programme benefits (no information at baseline, when the value of treatment is zero). After verifying that the estimates from the fixed-effects model provided similar coefficients than that of the random effects, we preferred using the latter method and present the estimates of the fixed-effects approach in Table A.4.2 in Appendix 4.

Models for Caloric Availability

In order to assess Progresa's effect on caloric availability over time we specified two models. The first one estimates Progresa's effect on the logarithm of household's caloric availability $log\ (C_{it})$ by using a dummy variable for living in a treatment locality (P_{it}) and a dummy for wave of data collection (W_{it}). In this model, the coefficient for living in a Progresa locality provides estimates for the overall effect of Progresa over time. This model also includes a set of variables X_i at the individual, household, and community level that control for differences in the outcomes not associated with Progresa's intervention. Model (1) can be expressed as follows:

$$\log C_{it} = \beta_1 P_{it} + \beta_2 W_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (1)$$

where i= 1, 2,..,n (individuals), t= 2, 3, 4 and 6 (waves of data collection).

In a second model, we include an interaction term that provides estimates for the effect of living in a treatment locality by wave of data collection ($P_{it}.W_{it}$). These coefficients allow us to identify the trend of the Programme's effect over time. This second model can be written as:

$$\log C_{it} = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 P_{it}.W_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (2)$$

where i= 1, 2,..,n (individuals), t= 2, 3, 4 and 6 (waves of data collection).

Additionally, to examine whether the Programme had a differential effect according to the household's severity of poverty, we estimated model one for three different categories of poverty (terciles of Progresa's poverty index). Estimates from these models help us to answer whether the Programme had an influence on reducing the gap between the most vulnerable groups and the less vulnerable ones. Additionally, to corroborate whether the differences from the stratified models were statistically significant we estimated model (3) which includes interaction terms between our poverty indicator and Progresa's intervention.

$$\log C_{it} = \beta_1 P_{it} + \beta_2 Pov_{it} + \beta_3 P_{it}.Pov_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (3)$$

where i= 1, 2,..,n (individuals), t= 2, 3, 4 and 6 (waves of data collection) and Pov_{it} represents households' tercile of poverty.

Models for Dietary Diversity

In order to evaluate Progresa's impact on food variety we estimated the same models used for examining caloric availability. The parameters from the first model provide estimates of the overall Programme effect on dietary diversity and the patterns of change for the sample as a whole. It is worth recalling that the outcome variable is a weighted average of the number of food products consumed during the last week and the frequency of consumption. Thus, we estimated this outcome variable using a linear regression as its distribution was close to a normal one.

$$\mathrm{DD}_{it} = \beta_1 P_{it} + \beta_2 W_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (1)$$

The second model includes an interaction term for living in a treatment locality and wave of data collection $(P_{it}.W_{it})$ that allows us to assess whether the Programme had a differential effect on dietary diversity over time.

$$\mathrm{DD}_{it} = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 P_{it}.W_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (2)$$

To better isolate the Programme effect both models control for the influence of a set of household and community characteristics. In addition, we fitted model (1) for the different categories of poverty. Lastly, to identify the impact of Progresa by food category we estimated model (1) for each of the four food categories created: vegetables and fruits, products of animal origin, cereals and grains, and processed foods. Like with the previous outcome variable, we estimated model (3), which includes interaction terms between our poverty indicator and Progresa's treatment variable, to verify whether possible differences between poverty terciles were statistically significant.

$$\log \mathrm{C}_{it} = \beta_1 P_{it} + \beta_2 Pov_{it} + \beta_3 P_{it}.Pov_{it} + \sum_j \delta_j X_{it} + e_{it} \quad (3)$$

where i= 1, 2,..,n (individuals), t= 2, 3, 4 and 6 (waves of data collection) and Pov_{it} represents households' tercile of poverty.

4.7. Results

4.7.1. Descriptive Results

Table 4.2 presents household monthly expenditures at baseline for both eligible and ineligible households living in treatment and control localities. It can be seen that, before the Programme's operation, eligible households had on average a monthly expenditure of PPP US$188 (933 pesos) or PPP US$38 per adult equivalent per month (188 pesos). It should be noted these figures represent expenditures and not consumption because, as explained before, they do not include home production. Therefore, they are likely to underestimate households' food security.

However, in order to compare these figures with the World Bank's classification of poverty, we estimated the value of home production from information at wave two. Our calculations show that food products of own production represent around 20 percent of a household's food consumption and around 15 percent of total consumption. Thus, after adjusting for home production, we observe a value for total consumption of PPP US$221 (1,096 pesos) or PPP US$46 per adult equivalent per month (221 pesos). These figures indicate that the average eligible household falls into the World Bank's classification of extreme poverty, with around PPP US$1 per day. With respect to ineligible households, we observe that these families have on average higher food and non-food expenditures than their more disadvantaged counterparts. Nevertheless, average total expenditure per adult equivalent after adjusting for home production is still below the PPP US$ 2 per day cut-off point of moderate poverty. The latter indicates that ineligible households, although somewhat better-off than eligible ones, are still at risk of not meeting food and other basic needs.

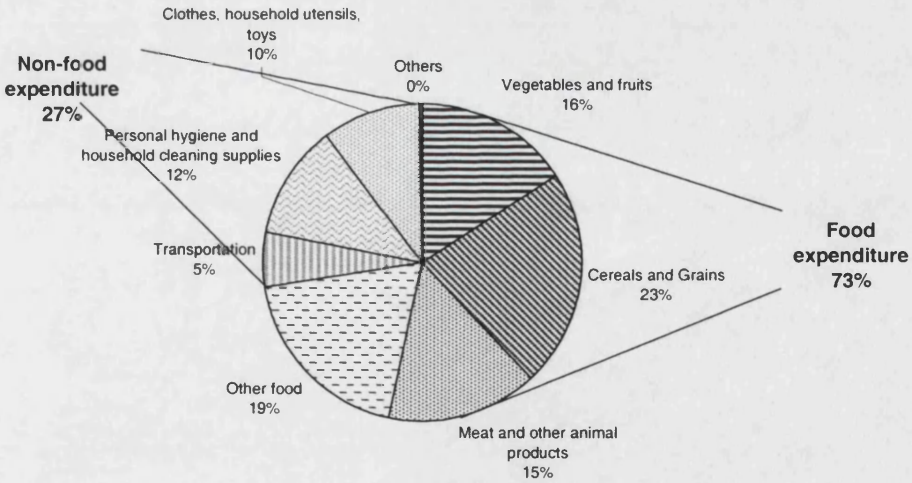
Table 4.2
Household's monthly expenditure at baseline
Households with children under five years old

	Eligible households				Non-eligible households		
	Total	**Treatment**	**Control**	**P>|t|**	**Total**	**Treatment**	**Control**
Food expenditure	675.9	680.9	667.8		784.9	780.5	791.5
Vegetables and fruits	148.3	150.9	143.9	*	186.6	190.6	180.7
Cereals and Grains	206.7	207.2	205.9		228.6	225.1	233.9
Meat and other animal products	141.1	142.4	139.1		174.6	172.7	177.5
Other food	179.8	180.4	178.9		195.1	192.1	199.4
Non-food expenditure	256.6	257.7	254.6		334.1	332.3	336.8
Transportation	51.2	50.2	52.9		74.9	72.3	78.8
Personal hygiene and household cleaning supplies	109.3	109.8	108.5		142.8	141.6	144.6
Clothes, household utensils, toys	92.7	94.3	90.0		113.2	115.5	109.8
Others	3.3	3.4	3.1		3.2	2.9	3.6
Total expenditure	***932.5***	***938.6***	***922.4***		***1,119.0***	***1,112.8***	***1,128.3***
Total expenditure per adult equivalent	192.2	193.5	190.1		244.5	247.1	240.8
Total consumption [e]	***1096.2***	***1103.6***	***1084.1***		***1279.8***	***1272.7***	***1290.4***
Total consumption per adult equivalent[e]	226.0	227.5	223.5		279.6	282.5	275.4
Total consumption PPP US$ [e]	***221.0***	***222.5***	***218.6***		***258.0***	***256.6***	***260.2***
Total consumption per adult equivalent PPP US$[e]	45.6	45.9	45.1		56.4	57.0	55.5
Number of households	*7,720*	*4,813*	*2,907*		*3,504*	*2,103*	*1,401*

Note: e) Estimated value based on the vlaue of own production as a share of food consumption at wave two (19.5%)
Pesos adjusted to November 1997 pesos using the National Basic Food Basket Price Index.
Pesos converted into PPP US $ using 1998's PPP published by OECD (http:/www.oecd.org/std/ppp/).
Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

An additional indicator that identifies household's vulnerability to food insecurity is the percentage of total expenditure allocated to food. This is because households that spend a high proportion (70 percent or more) of their expenditure on food have a small margin left for other expenses. Figure 4.1 illustrates the distribution of expenditure of eligible households at baseline. Before Progresa, eligible households spent almost three quarters (73 percent) of their expenditure on food, a pattern observed among poor families in developing countries (e.g. in India and Pakistan a substantial fraction of households spend three quarters or more of their expenditures on food (Deaton 1997)). Furthermore, this figure shows that eligible households assigned the highest proportion of their resources to the purchase of cereals and grains (23 percent). These staples are more affordable, but in general provide less nutritional value than items from other food categories (e.g. fruits and vegetables, products of animal origin).

Figure 4.1 Household Monthly Expenditure, Eligible Households with Children <5 at Baseline.



In Table 4.3 we present three indicators of dietary diversity at baseline: proportion of households consuming each of the 34 different food items; number of days of consumption during the last week; and a weighted sum of dietary diversity. Results from this table together with Figure 4.2 allow us to identify the products that constitute the diet of these families. It is clear that there is not much diversity. The products consumed by the majority of households are also those consumed with higher frequency (almost daily): tortillas, sugar, coffee, oil, onions and tomatoes[97]. Other food products consumed more sporadically but by more than 80 percent of households include beans, eggs, noodles and rice. It is worth noting that an important number of the food products consumed belong to the cereals and grain category. This food category is the main source of calories for these families; around 75 percent of the caloric consumption comes from this category (see Table 4.6). In contrast, products from animal source (lamb, fish, sardines and lard) and from the fruit and vegetable category (leafy vegetables, apples and carrots) are consumed occasionally and by less than a third of families.

Table 4.3
Consumption availability during the last week at baseline
Eligible households with children under five years old

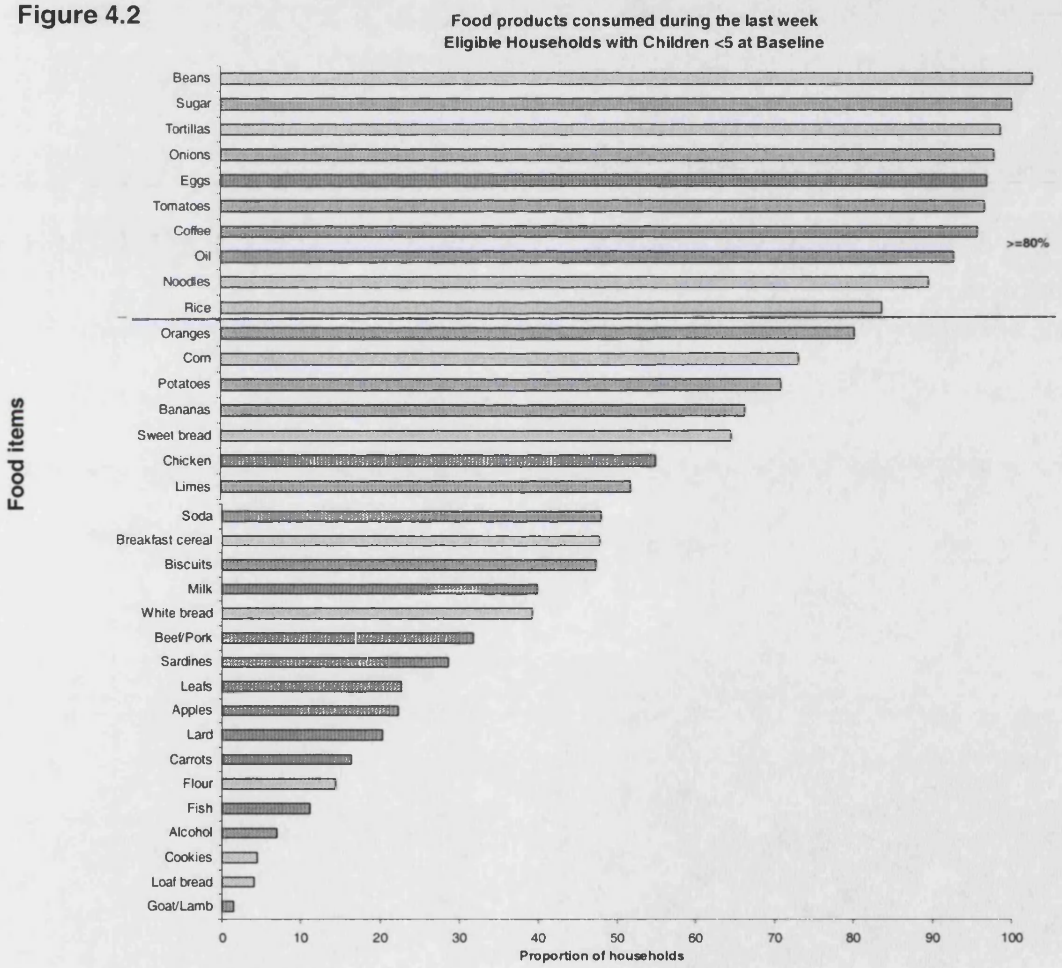
Products	Proportion of households consuming			Number of days consuming			Dietary diversity indicator		
	Treatment	Control	P>|t|	Treatment	Control	P>|t|	Treatment	Control	P>|t|
Vegetables and Fruits							*17.1*	*17.5*	*
Onions	94.3	94.0		4.7	4.8				
Tomatoes	92.8	93.4		4.3	4.1	***			
Potatoes	68.9	67.2		1.5	1.5				
Leafs	23.3	21.5		0.4	0.3				
Carrots	16.2	16.5		0.3	0.3	*			
Oranges	78.7	75.1	**	2.8	2.7				
Bananas	64.1	63.3		1.5	1.5				
Limes	50.0	49.9		1.5	1.6				
Apples	22.1	22.7		0.4	0.4				
Cereals and grains							*21.2*	*21.1*	
Beans	98.8	99.0		1.7	1.8	*			
Tortillas	95.1	94.7		6.6	6.5				
Noodles	86.5	85.8		2.0	1.9	*			
Rice	80.9	80.0		1.4	1.4				
Corn	71.2	69.2		4.7	4.5				
Sweet bread	62.5	61.8		1.5	1.4				
Breakfast cereal	47.5	48.4		0.9	1.0				
Biscuits	47.0	47.7		1.1	1.1				
White bread	39.7	38.6		0.9	0.9				
Flour	14.5	14.5		0.3	0.4				
Loaf bread	3.6	4.7	*	0.1	0.1				
Meat and animal products							*7.3*	*7.6*	**
Eggs	94.0	92.5	*	3.3	3.3				
Chicken	51.9	54.6	*	0.7	0.7	*			
Milk	40.1	39.3		1.5	1.7	*			
Beef/Pork	31.3	32.3		0.4	0.4				
Sardines	29.9	26.6	**	0.4	0.3	**			
Lard	19.8	21.2		0.9	1.0	*			
Fish	9.8	13.3	***	0.1	0.2	***			
Goat/Lamb	1.6	1.2		0.02	0.01				
Processed food							*18.7*	*18.7*	
Sugar	96.3	96.5		6.2	6.2				
Coffee	92.3	91.9		5.6	5.7				
Oil	90.0	88.2		5.6	5.6				
Soda	48.5	47.3		1.0	1.0				
Alcohol	6.8	7.3		0.2	0.2				
Cookies	4.4	4.5		0.1	0.1				

Note: Statistical significance: * $p<0.05$; ** $p<0.01$; *** $p<0.001$

[97] Chilis (hot peppers) is another item that around 20 percent of households reported consuming it in a regular basis (almost daily). This item was among the category of other vegetables and fruits, thus these values might be underreported.

The problem with the diet of these families is not that they consume cereals and grains. Literature on nutrition indicates that cereals and grains are not only a source of energy but they also contribute other nutrients needed in the diet. It is also recognised that the combination of maize and beans complement each other providing an important source of proteins (FAO 1993). The inadequacy of their diet is due to the fact that it is not varied. It lacks other food products that children and adults need for obtaining proteins, vitamins and minerals.

Figure 4.2



The average value for dietary diversity of the eligible households under study is around 64. As previously mentioned, although it is not clear whether the values obtained are close to a desirable level, its location in the range of values the indicator can take suggests that the variety of food consumed is limited. Therefore, all the indicators previously examined show that these households have a poor and inadequate diet both in quantity and in quality.

Before moving to the next section, it is important to highlight that the results in this section show that at baseline there were no substantial differences in the patterns of consumption between treatment and control households (as indicated by figures in Tables 4.2 and 4.3). The values in Table 4.3 show some statistical differences between treatment and control groups, but with no pattern indicating a higher consumption among one group. Moreover, differences are very small, especially for the number of days consuming each food item. Therefore, these figures show the effective randomisation of the sample with respect to these outcome variables.

In sum, before the Programme's implementation, eligible households with young children were highly vulnerable to food insecurity as shown by the proportion of expenditure allocated to food and by the monotony of their diet. Additionally, among the food security indicators analysed, we did not observe differences at baseline between treatment and control groups. This suggests that, if the treatment and control areas were perfectly randomised, we could estimate the impact of Progresa from the post-programme differences.

Changes over time

Next, we examine changes over time using data from the second wave onwards. As mentioned before, we exclude data for the first round because the questions on food consumption were different, making this round incomparable with the rest. We first discuss the results on caloric availability and then we look at indicators of variety of food.

The first thing to notice from Table 4.4 is the vulnerability of these households in relation to caloric availability. The continuous indicator shows that at wave two households with children consumed on average around 2,100 kilocalories per adult equivalent. To have a better idea about the severity of the problem, the discrete indicator shows that only half of these households were classified as food secure, i.e. above the minimum energy requirement of 1,890 kcal.

If we look cross-sectionally at these results, we observe that, at all waves of data collection, households receiving Progresa's benefits have a better performance than those not receiving support. Moreover, these differences are highly significant (with p-values<0.001) in most rounds, except in the last one, when all eligible households were already receiving Programme benefits. The largest difference is observed at wave four, two years after Programme operation, suggesting a cumulative effect.

Table 4.4
Caloric Consumption Indicators
Households with children under five years old

	Eligible households			
	Wave 2	**Wave 3**	**Wave 4**	**Wave 6**
Calories per day per adult equivalent				
Treatment	2,132.1	2,184.6	2,042.0	1,837.0
Control	2,051.7	2,050.6	1,793.8	1,777.0
P>|t|	***	***	***	**
Food-secure (% of households[1])				
Treatment	54.2	55.4	50.6	39.1
Control	50.1	50.2	38.0	37.6
P>|t|	***	***	***	
Number of households				
Treatment	*4,787*	*4,625*	*4,058*	*4,401*
Control	*2,806*	*2,672*	*2,521*	*2,712*

Note: 1. Above the minimum caloric requirement of 1,890 kcal.
Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

On the other hand, if we look at the trends over time, we notice that the number of kilocalories per day per adult equivalent actually decreased between waves two and six (from 2,132 kcal. to 1,837 kcal., respectively). Similarly, the proportion of households classified as food secure also reduces, especially at wave six, with only 40 percent of households covering their minimum requirements. This is an unanticipated result, as we would expect cash transfers to result in higher food expenditures and thus higher caloric intake (as measured by availability). Studies on income elasticities of calories suggest that as income increases, there might be a substitution for products of higher quality, which does not necessarily lead to an increase in caloric intake (Alderman, 1993). The latter might explain the pattern observed among our sample of households. However, this trend was observed not only among the treatment households which could be the ones having this behaviour, but also among the rest of the sample (eligible households in control localities and ineligible households in treatment and control localities (shown in

Table A.4.3 in Appendix 4)). Therefore, it is more likely that this reduction in caloric availability is due to exogenous factors.

Hoddinott's study of Progresa's impact on household consumption also observed a downward trend on household's expenditure. They argued that this reduction was explained by a smaller increase in the prices of food products in these localities in comparison with the increase of the consumer price index; therefore, the real value of expenditures fell over time (Hoddinott et al. 2000). However, our calculations of caloric availability, which also show a reduction over time, are not influenced by prices. Hence, we need to examine the drop of caloric availability in more detail.

In order to do so, we explored different possibilities. First, we checked that there were no problems in the quality of data (under-reporting quantities in the last waves as interviewees and interviewers might have been tired of answering this section of the questionnaire) and did not observe any patterns of missing data on quantities. Next, we examined which products were consumed less and found that among all the food products there was a considerable decrease in the consumption of maize. On average, between waves two and four there was a decline of 230 kilocalories per day per adult equivalent of maize. As this is one of the main food products in the diet of these households and it is a product with a high caloric value (3,500 calories per kilogram)[98], changes in its value have an important effect on total caloric consumption.

A decrease in the accessibility of maize might be explained by macro factors such as a decline in the production of this crop, occurrence of natural disasters, a reduction in the purchasing power, among others. We consulted national data on agricultural production and observed a decrease in the production of maize of around 4 percent between 1998 and 1999[99]. These localities, which have a high dependency on this product, were likely to be affected. Furthermore, data from the ENCASEL survey, which contains information at the locality level, indicate that at wave three (ENCEL-99M) more than 70 percent of the localities in the sample suffered from drought. An important share of the consumption of maize (and tortillas) comes from home production (around 55 percent). Hence, the incidence of natural disasters could have had an impact on accessibility to this crop, affecting the outcomes at subsequent waves. As we will see next, substitution of cereals and

[98] See Table A.4.4 in Appendix 4.
[99] Source: Ministry of Agriculture (SAGARPA 2000).

grains by other products was an additional factor (although not as important) explaining this downward trend in calories.

To explore changes in the variety of diet in Table 4.5, we looked at shifts in the allocation of expenditure by food category, at variations in caloric shares across food groups, and at changes in our indicator of dietary diversity (weighted sum of the number of food products consumed by category). In general, these indicators show some positive results over time.

Table 4.5
Dietary Diversity Indicators
Eligible households with children under five years old

	Treatment				Control			
	Wave 2	Wave 3	Wave 4	Wave 6	Wave 2	Wave 3	Wave 4	Wave 6
Food expenditure shares (percent)								
Fruit and vegetables	18.0	15.7	17.2	19.0	16.6	13.5	15.2	19.1
Cereals and grains	40.5	39.9	38.8	32.9	42.5	43.3	41.6	33.6
Meat and animal products	20.8	22.7	23.4	27.3	18.9	19.9	21.5	26.2
Processed food	20.8	21.8	20.5	20.8	22.0	23.2	21.7	21.0
Total food	*74.6*	*70.4*	*70.0*	*70.2*	*74.2*	*69.8*	*68.8*	*68.7*
Calorie shares (percent)								
Fruit and vegetables	2.1	2.0	2.5	2.8	2.0	1.6	2.2	2.7
Cereals and grains	76.3	77.4	73.8	72.6	76.0	78.3	73.1	72.9
Meat and animal products	5.9	5.2	6.2	6.1	5.4	4.7	5.8	5.9
Processed food	15.6	15.4	17.5	18.5	16.7	15.4	18.9	18.4
Tortilla	34.9	30.8	33.4	36.6	34.4	32.3	40.6	39.5
Maize	26.6	33.1	24.7	20.2	27.4	33.4	16.7	18.4
Chicken	0.9	0.9	1.2	1.3	0.7	0.7	1.0	1.3
Diet diversity (weighted number of unique foods consumed)								
Vegetables and Fruits	15.1	15.5	18.8	18.8	13.9	13.6	17.1	18.7
Cereals and grains	19.8	19.7	20.3	19.5	19.2	18.3	18.7	18.8
Meat and animal products	6.0	6.0	7.0	6.8	5.4	5.1	6.0	6.5
Processed food	16.4	16.6	18.1	16.9	16.1	16.3	17.4	16.9
Total food	*57.3*	*57.7*	*64.2*	*62.0*	*54.6*	*53.3*	*59.1*	*60.9*
Own-production (percent)								
Tortillas	55.4	54.2	36.3	56.1	52.6	47.8	36.6	53.5
Oranges	15.5	5.6	18.9	29.0	15.0	4.6	19.3	27.3
Limes	11.8	7.5	12.8	12.4	11.0	7.3	12.3	11.4
Maize	16.2	17.5	10.9	11.2	15.4	15.8	9.4	10.4
Eggs	10.9	11.2	7.4	10.8	10.2	9.7	6.9	9.9
Own-production as a share of total caloric availability (percent)								
Total food	*30.5*	*28.9*	*24.5*	*31.3*	*31.0*	*29.3*	*25.9*	*32.9*

Note: Maximum value per food item: vegetable and fruits 63; meat & other prod. animal origin 56; cereals & grains 77, other food prod. 42.

Cross-sectionally, it can be seen that at waves two, three and four beneficiary households had allocated a slightly higher share of their expenditure on fruits and vegetables and products of animal origin than their control peers. Yet, at wave six, both groups had similar food expenditure shares. Comparisons over time show a higher expenditure share allocated to products of animal source (from 20.8 percent at wave two to 27.3 percent in wave six). By contrast, there is a decrease in the proportion of expenditures allocated to the purchase of cereals and grains (from 40.5 percent to 32.9 percent).

As for the share of calories obtained from the different food groups, we do not observe major differences between beneficiary and non-beneficiary households. It is worth noting that the share from cereals and grains decreased over time for both groups (from 76.3 percent to 72.6 percent). In contrast, the proportion of calories available from groups with higher nutrient value (fruits and vegetables and meat) did not show important changes. The share of expenditure on more nutritious food items rose, yet this is not reflected in calories because these items have a lower caloric composition. Therefore, it is important to look at changes in the variety of food items.

Regarding dietary diversity[100], it can be seen that, at all waves of data collection, eligible households receiving Programme benefits have higher values than comparable households not receiving support. Between waves two and six, the variety of the diet increased for both treatment and control households. Yet, disaggregating by food category, the only noticeable increase in variety is for the vegetable and fruit category.

A more varied diet among beneficiary families could be attributed to higher income via the monetary transfers, or to more information on nutritional issues via the monthly educational sessions. On the other hand, a higher number of food products consumed could be attributed to an increase in consumption of home-produced items, as a consequence of insufficient resources either to produce other food products or to purchase them. To check that the latter is not the case, we examined changes in home-produced items (see the last section of Table 4.5). We only present those items, which are consumed out of own production by more than 10 percent of the households. These results do not show drastic changes. Overall, home produced food items represent around 30 percent of the total caloric consumption of these households, with this percentage staying relatively constant over time. The exception is at wave four, when this proportion dropped to 25 percent. The latter is mainly influenced by a decrease in the proportion of tortillas and corn consumed

[100] These values are smaller than those obtained at baseline due to differences in the questionnaire.

from own production. This result is linked with our previous finding of a lower production of maize at this wave of data collection. Therefore, the higher number of food products seems to be due to an increase in the purchase of food items and not to a higher consumption from home produced items.

Our exploratory analysis of changes over time suggests some positive Programme effects. Regarding caloric availability, Progresa's benefits seem to have had a protective effect against the downward trend in the levels of this outcome. As for dietary diversity, there is a positive trend over time for both beneficiary and non-beneficiary households, with higher values for variety among households receiving supports. The food categories with increased values for dietary diversity are vegetables and fruits and products of animal source. However, these findings need to be corroborated in a multivariate framework in order to control for a possible bias due to observed differences in household characteristics between treatment and control groups.

4.7.2. Multivariate Analysis

We present the results from our multivariate analysis in two subsections. First, we show our estimates for the impact of Progresa on caloric availability, disaggregating our results by Progresa's poverty index. In the second subsection, we present the corresponding results for dietary diversity. For this second outcome, we also examine whether the intervention has a different effect on dietary diversity according to food category. We only discuss the parameters that are statistically significant at a 5 percent level.

In these models, the Programme's impact is calculated as follows. The parameter estimates of model (1) provide the overall impact of living in a Progresa locality as well as the trend over time for both treatment and control households. In model (2), we add an interaction term that gives estimates of Progresa's effect by wave of data collection. In this second model, the reference group represents the situation of the control group at wave two, which we could think of as the situation prevailing without intervention. We assume the latter because households in control localities at wave two were not receiving Programme benefits; hence, all things being equal, their outcomes may represent the baseline conditions. The parameter for the main effect of *Progresa* indicates the influence of the Programme at wave two. The coefficients for the main effect of *wave* show the trend over time of households in the control group. And, the sum of the main effect of *Progresa* and the interaction term indicate the Programme's effect at each wave. The effect of *Progresa* is equal to the sum of the main effect of *Progresa* and the interaction term. To calculate the Programme's impact, we subtract from the total effect of *Progresa* the value of the control group, which is the main effect of *wave* of data collection.

Results on Caloric Availability

Table 4.6 presents the results for caloric availability obtained from the different model specifications. The first section of Table 4.6 presents the estimates obtained from model (1) for all eligible households; the second part presents the corresponding results for model (2); and the third part presents the findings from model (1) disaggregated by terciles of poverty. Before describing these estimates, it is worth recalling that the dependent variable is expressed in log terms; thus, the coefficients for the explanatory variables can be interpreted as percentage changes of the outcome variable.

Results from model (1) show that the Programme has an overall impact on caloric availability of 7 percent (0.07, 95% confidence interval (C.I.): 0.058, 0.083). In addition, the coefficients for wave of data collection show a downward trend at waves four and six among all eligible households. These results suggest that the Programme had a positive effect since the situation of eligible households in treatment localities did not worsen to the levels experienced by the control group, but that the early overall improvements were not sustained.

Model (2) provides information for evaluating Progresa's effect by wave of data collection. These results suggest important changes in the Programme's impact over time: at wave two, beneficiary households have 6 percent more caloric availability than non-beneficiary households; at wave three, there is an improvement of 7 percent; at wave four, the caloric consumption of households receiving benefits is 13 percent higher than that of their control counterparts; and, at wave six, when the control sample had also been in receipt of benefits for almost one year, the impact is only of 3 percent (for calculations consult Table 4.7). These results suggest an improved situation among beneficiaries. Yet, it is also important to look at the coefficients for wave of data collection. These estimates show a downward trend on caloric availability from the fourth wave of data collection onwards (of around 13 percent). Thus, the Programme benefits have a protective effect against this negative change on caloric availability.

Table 4.6
Estimates of Progresa's Effect on Caloric Availability using Random Effects
Eligible Households with Children under Five

	Model 1 All eligible households			Model 2 All eligible households			Model 1 by Terciles of Poverty: First tercile			Second tercile			Third tercile		
	Coef.	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**
Progresa's benefits															
Progresa	0.07	11.1	***	0.06	5.2	***	0.09	8.4	***	0.06	5.3	***	0.06	5.2	***
	(0.01)			(0.01)			(0.01)			(0.01)			(0.01)		
Wave															
Three	0.00	0.4		-0.01	-0.7		0.01	0.6		0.03	2.1	*	-0.01	-0.5	
	(0.01)			(0.01)			(0.01)			(0.01)			(0.01)		
Four	-0.08	-10.0	***	-0.13	-10.4	***	-0.10	-7.8	***	-0.08	-5.5	***	-0.04	-3.0	**
	(0.01)			(0.01)			(0.01)			(0.01)			(0.01)		
Six	-0.14	-18.1	***	-0.12	-9.8	***	-0.15	-10.8	***	-0.13	-9.6	***	-0.12	-8.2	***
	(0.01)			(0.01)			(0.01)			(0.01)			(0.01)		
Progresa*Wave															
Progresa*Wave 3				0.02	1.1										
				(0.01)											
Progresa*Wave 4				0.08	5.3	***									
				(0.01)											
Progresa*Wave 6				-0.03	-2.1	*									
				(0.01)											
Controls:															
Household's characteristics															
Dwelling characteristics															
Community characteristics															
Constant	7.69	419.7	***	7.70	402.2	***	7.71	219.5	***	7.69	230.6	***	7.73	190.6	***
	(0.02)			(0.02)			(0.04)			(0.03)			(0.04)		
sigma_u	0.14			0.14			0.13			0.13			0.13		
sigma_e	0.40			0.40			0.40			0.40			0.40		
rho	0.11			0.11			0.09			0.10			0.09		
R-sq:															
within	0.03			0.03			0.03			0.04			0.02		
between	0.24			0.24			0.28			0.28			0.29		
overall	0.14			0.14			0.14			0.15			0.15		
Number of observations:	26,437			26,437			8,356			7,884			7,483		
Number of groups (households):	8,517			8,517			2,489			2,381			2,298		

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

Table 4.7
Progresa's Impact on Caloric Availability
Coefficient Estimates Model 2

	Treatment	Control	Impact (%)
Wave 2	0.06 (0.04, 0.07)	0.0 (0.0, 0.0)	*6*
Wave 3	0.06 (-0.01, 0.14)	-0.01 (-0.03, 0.02)	*7*
Wave 4	0.01 (-0.06, 0.08)	-0.13 (-0.15, -0.10)	*13*
Wave 6	-0.09 (-0.17, -0.02)	-0.12 (-0.14, -0.09)	*3*

Note:Figures in parethesis are 95% confidence intervals

The third part of Table 4.6 presents separate models fitted by terciles of poverty. Comparisons of the coefficient for the dummy variable for Progresa indicate a greater impact among households in the lowest tercile, that is among the most deprived households. For these households the intervention has an overall impact of 9 percent (0.092, 95% confidence interval (C.I.): 0.070, 0.113), for households in the second and third terciles the overall effect is of 6 percent (0.061 for second tercile, 95% confidence interval (C.I.): 0.038, 0.084; and 0.063 for third tercile, 95% confidence interval (C.I.): 0.039, 0.086). These results are corroborated with figures in Table 4.8, which correspond to the model with an interaction term between Progresa's intervention and the dummies for poverty terciles. The parameter estimates of this model corroborate that the greatest effect took place among the poorest group. Moreover, though not shown here, a t test on equality of coefficients suggests that the first tercile is statistically different from the rest. It is worth highlighting that the households in the first tercile experienced a greater decline over waves than household in other groups. Hence, the larger impact of the Programme among the poorest households represents a greater protective effect. It is possible that, with increased income, households with more resources will shift their consumption to food products of less caloric value and hence we observe smaller changes on caloric availability among households in the upper terciles.

Table 4.8
Estimates of Progresa's Effect on Caloric Availability using Interactions between Progresa and Terciles of Poverty Eligible Households with Children under Five

	Model 3					
	Coef.	Std. Err.	z	P>|z|	[95% C.I.]	
Progresa * Poverty terciles						
Progresa* First tercile	0.08	0.01	8.2	***	0.06	0.10
Progresa* Second tercile	0.06	0.01	6.4	***	0.04	0.08
Progresa* Third tercile	0.06	0.01	6.1	***	0.04	0.08
Control* First tercile	-0.01	0.01	-0.6		-0.03	0.02
Control* Second tercile	0.03	0.01	2.3	*	0.00	0.05
Control* Third tercile	(Reference)	-	-	-	-	-
Controls:						
Wave						
Household's characteristics						
Dwelling characteristics						
Community characteristics						
Constant	7.69 (0.02)	0.02	426.3	***	7.59	7.66
sigma_u	0.14					
sigma_e	0.41					
rho	0.10					
R-sq:						
within	0.03					
between	0.24					
overall	0.14					
Number of observations:	26,437					
Number of groups (households):	8,517					

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Results on Dietary Diversity

The Programme's effect on dietary diversity was estimated by converting the absolute values provided by the coefficients into relative terms. That is, we estimated the relative increase of dietary diversity in relation to the mean value observed for the reference group (the value of the constant term). We calculated these relative terms because they allow us to understand better our results than the absolute terms, which have no meaningful interpretation.

The first model in Table 4.9 shows that Progresa's beneficiaries have dietary diversity 4.3 units higher than that of non-beneficiaries (4.3 units, 95% confidence interval (C.I.): 3.8, 4.8). The latter in relative terms represents a Programme effect of 7.3 percent (i.e. 4.3/58.6=0.073). Regarding changes over time, contrary to the trend observed for caloric availability, results suggest a positive trend at waves four and six. Although all households have attained more variety in their diets, the increase among those receiving Programme benefits was larger. This positive outcome may be attributed to the monetary grants that allow households towards shifting to products not common to their diets. Additionally, increased variety could be associated with the information provided at the educational sessions, where mothers are encouraged to incorporate nutritious food items into their diets.

Model (2) adds an interaction term that shows how the Programme effect on variety of food changed over time. First, the sign of most coefficients indicate positive changes with respect to the baseline situation. The exceptions are the non-beneficiary households at wave three and the beneficiary households at wave six. The latter suggests that, at wave six, the intervention did not improve upon the achievements gained at wave two. Regarding the magnitude of these changes, our calculations show that Progresa's impact by wave of data collection is: 6.1 percent (3.6 in absolute terms) at wave two; 9.5 percent (5.6 in absolute terms) at wave three; 10.6 percent (6.3 in absolute terms) at wave four; and 3.2 percent (1.90 in absolute terms) at wave six (see Table 4.10). On the other hand, for this outcome variable, households in the control group also showed improvements on the variety of their diet at waves four and six (of 7 and 10 percent, respectively). The fact that some control households were receiving benefits at this point in time (from December 1999 some control localities were incorporated into the Programme) might explain these results.

Table 4.9
Estimates of Progresa's Effect on Dietary Diversity using Random Effects
Eligible Households with Children under Five

	Model 1 All eligible households			Model 2 All eligible households			Model 1 First tercile			Model 1 Second tercile			Model 1 Third tercile		
	Coef.	z	P>|z|	Coef.	z	P>|z|	Coef.	z	P>|z|	Coef.	z	P>|z|	Coef.	z	P>|z|
Progresa's benefits															
Progresa	4.3	18.0	***	3.6	9.4	***	5.6	13.5	***	4.2	9.5	***	3.7	8.3	***
	(0.24)			(0.38)			(0.41)			(0.45)			(0.45)		
Wave															
Three	-0.3	-1.1		-1.6	-3.9	***	-0.3	-0.7		-0.6	-1.4		-0.1	-0.2	
	(0.25)			(0.40)			(0.44)			(0.45)			(0.47)		
Four	5.9	22.4	***	4.2	10.1	***	5.6	12.5	***	6.4	13.6	***	5.6	11.2	***
	(0.26)			(0.42)			(0.45)			(0.47)			(0.50)		
Six	4.8	18.0	***	5.9	14.1	***	4.9	10.5	***	4.9	10.1	***	5.1	9.9	***
	(0.26)			(0.42)			(0.46)			(0.48)			(0.51)		
Progresa*Wave															
Progresa*Wave 3				2.0	4.0	***									
				(0.49)											
Progresa*Wave 4				2.7	5.2	***									
				(0.51)											
Progresa*Wave 6				-1.7	-3.4	**									
				(0.50)											
Controls:															
Household's characteristics															
Dwelling characteristics															
Community characteristics															
Constant	58.6	86.5	***	59.0	83.9	***	61.1	46.7	***	56.4	44.9	***	59.9	40.0	***
	(0.68)			(0.70)			(1.31)			(1.26)			(1.50)		
sigma_u	6.3			6.3			6.0			6.6			5.7		
sigma_e	14.2			14.2			14.2			14.1			14.3		
rho	0.16			0.17			0.15			0.18			0.14		
R-sq:															
within	0.06			0.06			0.06			0.07			0.05		
between	0.28			0.28			0.32			0.30			0.33		
overall	0.18			0.18			0.19			0.19			0.20		
Number of observations:	27,573			27,573			8,704			8,241			7,822		
Number of groups (househ	8,559			8,559			2,492			2,387			2,307		

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

Table 4.10
Progresa's Impact on Dietary Diversity
Coefficient Estimates Model 2

	Treatment	Control	Impact	
			Absolute	Relative (%)
Wave 2	3.6 (2.9, 4.3)	0.0 (0.0, 0.0)	3.6	*6.1*
Wave 3	4.0 (2.3, 5.8)	-1.6 (-2.3,-0.8)	5.6	*9.5*
Wave 4	10.5 (8.7, 12.3)	4.2 (3.4, 5.0)	6.3	*10.6*
Wave 6	7.8 (6.0, 9.6)	5.9 (5.0, 6.7)	1.9	*3.2*

Note:Figures in parethesis are 95% confidence intervals

Likewise, results by household's severity of poverty, suggest that Progresa had its greatest influence among the most disadvantaged households. The second part of Table 4.9 displays the differences in the Programme's effect by tercile of Progresa's poverty index. Our calculations show that the intervention's effect on dietary diversity is: 9.2 percent for the first tercile (95% C.I. =: 7.8 - 10.5), 7.4 percent for the second tercile (95% C.I. =: 6.0 - 9.1) and 6.2 percent for the third tercile (95% C.I. =: 4.7 - 7.7). In addition to this stratified analysis, the parameter estimates in Table 4.11 corroborate that the greatest effect took place among households in the bottom tercile. Moreover, results from a t test (not shown here) indicate that the coefficient corresponding to households in the poorest group was significantly different than the rest. The fact that for this outcome variable we also observe the greatest impact among the most deprived households does not support our argument that with additional cash less deprived households invest in variety over caloric density.

Table 4.11
Estimates of Progresa's Effect on Dietary Diversity using Interactions between Progresa and Terciles of Poverty Eligible Households with Children under Five

	Model 3					
	Coef.	Std. Err.	z	P>|z|	[95% C.I.]	
Progresa * Poverty terciles						
Progresa* First tercile	3.03	0.38	8.0	***	2.29	3.78
Progresa* Second tercile	2.58	0.37	7.0	***	1.85	3.30
Progresa* Third tercile	2.43	0.36	6.7	***	1.71	3.14
Control* First tercile	-2.47	0.43	-5.8	***	-3.31	-1.64
Control* Second tercile	-1.58	0.43	-3.7	***	-2.41	-0.75
Control* Third tercile	(Reference)	-	-	-	-	-
Controls:						
Wave						
Household's characteristics						
Dwelling characteristics						
Community characteristics						
Constant	62.78 (0.67)	0.67	3.1	***	61.47	64.09
sigma_u	6.02					
sigma_e	14.29					
rho	0.15					
R-sq:						
within	0.02					
between	0.27					
overall	0.16					
Number of observations:	26,437					
Number of groups (households):	8,517					

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Finally, in order to identify the food groups with the largest improvements Table 4.12 shows results of model (1) disaggregated by food group. It can be seen that among the four categories analysed, the Programme has a positive effect. However, the magnitude of these coefficients is not comparable since the number of food items in each category is different. We adjust for the latter using the relative increase with respect to the mean value of each category. These results suggest some differential effects. It seems that the greatest impact on variety of food was observed for the category of animal products (10.1 percent; with a 95% C.I.= 8.0 – 11.4), followed by vegetables and fruits (8.8 percent; 95% C.I.= 7.5 – 10.0), then cereals and grains (6.5 percent; 95% C.I.= 5.9 – 7.5) and finally processed foods (4.8 percent; 95% C.I.= 3.4 – 5.9).

Table 4.12
Estimates of Progresa's Effect on Dietary Diversity by Type of Food
Eligible Households with Children under Five

	Model 1 Vegetables and Fruits					Model 1 Products of Animal Origin					Model 1 Cereals and Grains					Model 1 Processed Foods				
	Coef.	z	P>|z|	[95% C.I.]		Coef.	z	P>|z|	[95% C.I.]		Coef.	z	P>|z|	[95% C.I.]		Coef.	z	P>|z|	[95% C.I.]	
Progresa's benefits																				
Progresa	1.6	14.2	***	1.4	1.8	0.8	11.1	***	0.6	0.9	1.3	16.0	***	1.2	1.5	0.6	7.5	***	0.4	0.7
	(0.11)					(0.07)					(0.08)					(0.08)				
Wave																				
Three	0.2	1.5		-0.1	0.4	-0.1	-0.7		-0.2	0.1	-0.5	-5.1	***	-0.7	-0.3	0.1	1.3		-0.1	0.2
	(0.12)					(0.07)					(0.10)					(0.08)				
Four	3.5	27.3	***	3.2	3.7	0.8	11.3	***	0.7	1.0	-0.1	-0.6		-0.3	0.1	1.6	19.9	***	1.5	1.8
	(0.13)					(0.07)					(0.11)					(0.08)				
Six	3.9	30.2	***	3.6	4.1	0.8	10.7	***	0.6	0.9	-0.6	-5.2	***	-0.8	-0.3	0.6	7.6	***	0.5	0.8
	(0.13)					(0.07)					(0.11)					(0.08)				
Constant	18.2	56.5	***			7.9	40.4	***			20.0	81.9	***			12.4	56.8	***		
	(0.32)					(0.20)					(0.24)					(0.22)				
sigma_u	5.7					2.9					1.9					1.6				
sigma_e	14.3					6.9					4.0					5.8				
rho	0.14					0.15					0.19					0.07				
R-sq:																				
within	0.05					0.10					0.02					0.00				
between	0.33					0.26					0.20					0.18				
overall	0.20					0.19					0.12					0.09				
No.of observations:	27,573					27,573					27,573					27,573				
No. of gps (households):	8,559					8,559					8,559					8,559				

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

4.8. Conclusions

This chapter examined Progresa's impact on improving the food security of eligible households with young children. Specifically, we analysed whether Progresa had a positive effect on improving the caloric availability and the dietary diversity of beneficiary families. In doing so, we were interested in examining whether improvements in these household outcomes may influence our ultimate outcome of interest: children's well-being.

Our descriptive analysis showed that, before Progresa, eligible households with young children were highly vulnerable to food insecurity. These families had limited resources to ensure enough food for leading a healthy and active life. Their total consumption per adult equivalent per day was around PPP US$ 1.5, close to the international poverty line of PPP US $1. Moreover, they allocated 73 percent of their expenditure on food, leaving them with few resources for other expenses. In addition, their diet is not varied. The essential food products these families consume are tortillas, sugar, coffee, oil, onions and tomatoes. This diet is lacking other food items (e.g vegetables, fruits, milk) children need to have healthy growth and development.

We observed no pre-programme differences between treatment and control groups on the food security indicators under study. This suggests that, if the treatment and control areas were perfectly randomised, we could have estimated the impact of Progresa by comparing the post-programme differences. However, our data quality analysis indicated that this was not the case. Therefore, we assessed the Programme's impact on food security using a multivariate framework.

Regarding caloric availability, our estimates suggest an overall Programme effect of 7 percent (95% C.I.= 5.8 - 8.3). This positive effect showed an increasing value over time, with beneficiary households having access to 13 percent more calories than non-beneficiary households at wave four. At the last round of data collection, we observed an impact of only 3 percent. The fact that households in the control group were already receiving benefits might explain this minor effect. We also observed a differential effect according to household's severity of poverty, with Progresa having a greater impact among the most deprived families (9 percent with 95% C.I.= 7.0 - 11.0). Furthermore, our results show that the impact among households in the bottom of the distribution was significantly different from that of the top tercile.

It is important to highlight that our results show that Progresa had a positive but protective effect on access to calories. This is because caloric availability reduced substantially over time in both treatment and control localities. The positive Programme effect indicates that the caloric availability of beneficiary households did not decrease as much as that of the control group; thus, providing a protective effect. Findings from our exploratory analysis suggest that this drop in calories was mainly due to a lower consumption of maize, a food product with high caloric value, traditionally greatly consumed in these localities. We also observed increased consumption of products of higher quality (e.g. vegetables and fruits) but less caloric value. However, this shift was not enough to explain the downward trend in calories. This finding is of utmost relevance because negative changes in this outcome variable imply increased vulnerability to covering minimum caloric requirements and higher risks of undernutrition.

As for dietary diversity, our estimates show an overall positive Programme effect of 4.3 units, which in relative terms represents an increase of 7.3 percent (95% C.I.= 6.5% - 8.6%). Similarly, we observed that Progresa's effect increased over time, reaching a value of 10.6 percent at wave four and decreasing to 3.2 at wave six. In contrast to caloric availability, dietary diversity showed a positive trend in both treatment and control localities. Therefore, the positive programme effect indicates that beneficiary households incorporated more diverse products into their diet than their control peers. Furthermore, our estimates of Progresa's impact on this food security outcome by severity of poverty suggest as well a larger effect among the poorest households (9.2 percent increase with 95% C.I.= 7.0 -11.3). This positive effect was significantly different from that experienced by households in the top two terciles. Results by food category show a greater impact on improving the variety of products of animal source (10.1 percent increase, with a 95% C.I.= 8.0 – 11.4) followed by that of vegetables and fruits (8.8 percent; 95% C.I.= 7.5 – 10.0). This shift towards food products not common to beneficiaries' diets represents a positive impact, however we do not know if the magnitude of this effect is enough to come close to desirable levels for a nutritious diet.

Appendix 4. Additional Tables – Chapter 4

Table A.4.1
Estimates of Progresa's Effect using Fixed Effects, Model 1.
Eligible Households with Children under Five

	Caloric Availability			Dietary Diversity		
	Coef.	**z**	**P>|z|**	**Coef.**	**z**	**P>|z|**
Progresa's benefits						
Progresa	-	-	-	-	-	-
Wave						
Three	0.00	0.2		-1.39	-3.3	**
	(0.01)			(0.42)		
Four	-0.13	-10.1	***	4.35	10.0	***
	(0.01)			(0.43)		
Six	-0.13	-9.6	***	6.19	13.8	***
	(0.00)			(0.45)		
Progresa*Wave						
Progresa*Wave 3	0.01	0.7		1.80	3.5	***
	(0.01)			(0.51)		
Progresa*Wave 4	0.07	4.9	***	2.78	5.3	***
	(0.02)			(0.52)		
Progresa*Wave 6	-0.04	-2.7	**	-1.66	-3.2	**
	(0.02)			(0.52)		
Controls:						
Household's characteristics						
Dwelling characteristics						
Community characteristics						
Constant	7.51	254.2	***	55.97	55.4	***
	(0.03)			(1.01)		
sigma_u	0.34			12.7		
sigma_e	0.40			14.2		
rho	0.41			0.44		
R-sq:						
within	0.04			0.06		
between	0.00			0.01		
overall	0.01			0.04		
Number of observations:	26,437			26,437		
Number of groups (households):	8,517			8,517		

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

Table A.4.2
Caloric Consumption Indicators
Households with children under five years old

	Non-eligible households			
	Wave 2	**Wave 3**	**Wave 4**	**Wave 6**
Calories per day per adult equivalent				
Treatment	2,114.4	2,107.8	2,050.7	1,889.0
Control	2,128.0	2,132.6	1,946.4	1,869.7
P>|t|			***	
Food-secure (% of households)				
Treatment	53.9	53.2	53.0	41.6
Control	54.4	53.4	45.7	41.2
P>|t|			***	
Number of households				
Treatment	*2,247*	*2,397*	*1,772*	*2,327*
Control	*1,490*	*1,580*	*1,330*	*1,659*

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Table A.43
Calories per edible kg.

Vegetables and Fruits	Calories per edible kg.	Cereals and grains	Calories per edible kg.	Animal Products	Calories per edible kg.	Processed food	Calories per edible kg.
Leafy vegetables	130	Tortillas	2,140	Milk	630	Coffeee	361
Tomatoes	180	Loaf bread	2,850	Fish	1,060	Alcohol	460
Limes	240	White bread	2,920	Eggs	1,580	Soda	460
Onions	400	Beans	3,220	Chicken	2,150	Sugar	3,560
Carrots	440	Flour	3,330	Beef/Pork	2,750	Cookies	3,840
Oranges	470	Noodles	3,400	Lamb/Goat	2,750	Biscuits	4,030
Apples	650	Corn	3,500	Sardines	2,930	Oil	8,840
Potatoes	760	Sweet bread	3,840			Lard	9,020
Bananas	860	Rice	3,850				
		Breakfast cereal	3,890				

Source: (Munoz de Chavez, 1999)

Chapter 5. Child Feeding Practices

5.1. Introduction

Child feeding practices are a key determinant of child nutrition, health and survival. Their influence on health outcomes takes place through a complex interplay of mechanisms, among which dietary intake plays a vital role. During the first two years of life, children's diet depends on breastfeeding and complementary food products. Children whose mothers have better feeding practices show better outcomes than comparable children who are fed less optimally (Ruel and Menon 2002). Poor children are exposed to multiple risk factors, making them more vulnerable to experiencing inadequate health care behaviours. To improve children's health and nutrition, Progresa provides monthly educational sessions on important aspects associated with child feeding practices, and delivers nutritional supplements to women and young children.

In this chapter, we look at the patterns of child feeding practices and assess a possible impact of Progresa's interventions on improving these health care behaviours. In the next section, we review some of the evidence on the benefits associated with optimal feeding practices. In Section 5.3, we present the activities of Progresa that can result in more favourable (or unfavourable) child feeding practices, and we present results from previous evaluations on Progresa's performance in this area. In Section 5.4, we explain the characteristics of the data, and describe the outcome variables and the covariates used in our analysis. In Section 5.5, we present the methodology used. In Section 5.6 we present our results and in section 5.7 we discuss the conclusions drawn from our study.

5.2. Importance of Child Feeding Practices

It is recommended that during the first six months of life mother's milk should be the sole source of nutrition since it covers all the nutrient requirements of this period[101]. However, from six months onwards, although breastmilk continues to be

[101] Over several years there have been different recommendations regarding exclusive breastfeeding. During the 1990s, while WHO suggested a period of exclusive breastfeeding of four to six months, UNICEF and some ministries of health recommended a period of at least 6 months. In order to standardise the optimal duration of exclusive breastfeeding, a group of experts, convened by WHO,

an important part of children's diet, exclusive breastfeeding is not enough for optimal growth[102], thus other sources of energy must be incorporated into the diet (Brown et al. 1998). Yet, lactation should continue up to at least the second year of life complemented with solid and liquid foods appropriate for children's age and developmental stage (WHO/NCD 2001). As can be seen, gradually children incorporate into the family's diet; thus, increasingly, household food security becomes a key factor in covering children's nutritional needs.

It is widely acknowledged that breastfeeding has multiple benefits for the healthy development of young children. The reason for this is that breastmilk provides not only the nutrients and energy needed in children's diet, but also the antibodies for protecting children against infectious diseases (Brown et al. 1998). Furthermore, several studies have shown that it has an indirect effect on child survival and health through its suppressing effect on fecundity (Huffman and Lamphere 1984; VanLandingham et al. 1991).

Children who have been breastfed for even a short period of time (at least one month) have better health outcomes than those who have never been nursed (Huffman and Lamphere 1984; Palloni and Millman 1986; Palloni and Tienda 1986; ACC/SCN 2000). Several studies have shown that breastfeeding's positive effect takes place even after controlling for environmental factors that could be confounding this association (Palloni and Millman 1986; Palloni and Tienda 1986; Boerma and Bicego 1992). Moreover, some studies reporting a negative association between breastfeeding and health outcomes (in particular, children's growth) have found that the latter is due to a reverse causality between breastfeeding and child health (Marquis et al. 1997). That is, feeding modes are dependent on child health outcomes: children who are perceived as weak/small are breastfed for longer periods than their healthier peers.

Evidence from prospective studies in developing countries suggest that infants who have been breastfed during the first six months of life suffer less from diarrhoeal diseases than non-breastfed children (Martorell and Habicht 1986). These findings

---

came to the conclusion that children should be exclusively breastfed during the first 6 months of life (WHO/NCD 2001).

[102] Evidence from recent studies has suggested that mother's milk is a complete source of nutrition during the first six months of life, that it provides half of all nutrient requirements during the second semester of life, and one third of the requirements needed during the second year of life (ACC/SCN 2000).

are corroborated by those from a more recent review looking at the relationship between child feeding practices and health outcomes in developing countries[103] (Huttly et al. 1997). Results from this review indicate that breastfeeding provides an important defense against diarrhoea: children who have been breastfed are less likely to die from diarrhoea and are less likely to experience severe diarrhoeal episodes. In addition, health interventions (reductions in prevalence of low birth weight, reductions in prevalence of undernutrition and reductions of non-breastfed infants) in Latin America have shown that the promotion of breastfeeding is likely to have a positive impact on reducing the deaths associated with pneumonia and acute lower respiratory infections (Victora et al. 1999). The benefits of breastfeeding are also evident on children's growth. In general, children who were breastfed during infancy show faster growth than those who were not breastfed during this period (Eckhardt et al. 2001).

Moreover, research shows that exclusivity of breastfeeding and increased duration enhance the protective effect (Huttly et al. 1997; Eckhardt et al. 2001; Kramer 2003). Exclusively breastfed infants have lower morbidity rates, and have a better and more rapid recovery from diseases than those who are partially breastfed or not breastfed at all (Huffman and Lamphere 1984; Brown et al. 1989; Brown et al. 1998). Additionally, children who have been breastfed beyond 12 months continue to receive the nutritional and non-nutritional benefits from this practice, resulting in lower incidence and duration of infections and improved nutritional outcomes (Brown et al. 1998).

It is important to note that the beneficial effect of breastfeeding can be observed in more affluent societies as well. Evidence from the United Kingdom indicates that children who had been breastfed for 13 weeks had reduced gastrointestinal illnesses during the first year of life; and those who were exclusively breastfed for at least 15 weeks had lower probabilities of respiratory illnesses during the first seven years of life (Wilson et al. 1998). In addition, results from the Avon study suggest that breastfeeding has a positive impact on reducing blood pressure at the age of 7 years. (Martin et al. 2004). The authors suggest that this effect could increase with age, representing larger benefits in adulthood.

[103] The countries examined in this study include: Brazil, Bangladesh, Guinea-Bissau, Ethiopia, India, Rwanda.

Nevertheless, breastfeeding is particularly important for children living in poor settings where there is a greater likelihood of exposure to risk factors such as: limited access to food products (e.g. infant formulas); inadequate hygienic conditions; and restricted access to health services (Huffman and Lamphere 1984; Palloni and Millman 1986; Brown et al. 1998; Kramer 1998). In this kind of setting, introducing food complements at an early stage is likely to be hazardous for children's health as it exposes them to contaminants in the environment. For instance, data from studies in the Philippines and Peru show that the risk of diarrhoea in impoverished populations is 2 to 13 times higher among breastfed infants who received complementary feeding than among exclusively breastfed infants (ACC/SCN, 2000).

Among poor children, the benefits of breastfeeding have an important effect in several domains. Breastmilk is a food product of low cost and high quality that allows families with scarce economic resources to feed their children adequately without great expense. Additionally, breastfeeding is associated with a suppressing effect on fecundity, which is particularly beneficial to poor families, who have limited access to contraceptives. The latter, in turn, has a favourable effect on both maternal and child outcomes: maternal health is likely to improve with more recovery time between births, and children born into smaller families compete with fewer siblings for the scant household resources.

Child feeding practices are determined by biological, cultural and socio-economic factors. Thus, changing health care behaviours is not an easy task. In Mexico, despite important achievements in increasing the prevalence of breastfeeding during the mid 1990s, early feeding practices still deviate considerably from international recommendations. The latter is particularly true for exclusive breastfeeding. Findings from the most recent Nutrition Survey in Mexico report that on average only 20 percent of children are exclusively breastfed for the first six months of life (González-Cossio et al. 2003). In rural areas and among low socioeconomic groups this proportion is around 33 percent, higher than the national average but still well below the recommended level. Improved care giving practices are likely to have a greater impact on the health and development of disadvantaged children since they lack the mechanisms that compensate for a shorter duration of breastfeeding and/or exclusive breastfeeding. Thus, increased efforts to promote proper feeding practices should be targeted at children from disadvantaged groups.

5.3. Progresa's interventions on child feeding practices

Through the health sector, Progresa provides monthly educational sessions where mothers learn, among other health related issues, important aspects associated with food consumption and child feeding practices (see Table 5.1). In these sessions, mothers are instructed that Progresa's monetary transfers are meant to buy food products and that these grants should not be spent on items such as alcohol or cigarettes. Additionally, mothers are alerted to the benefits of breastfeeding, the importance of providing a varied diet, the safe preparation of food and how to make better use of regional food products.

Table 5.1 Educational sessions related to child feeding practices and food consumption

1. Food and health ("how to prepare food and which food products are good for the family")
2. Breastfeeding
3. Infant health care practices
4. Toddler health care practices
5. Progresa supplements

In addition, to improve children's dietary intake, Progresa provides nutritional supplements to pregnant and breastfeeding women, and to children under the age of five. These supplements are given to women when they are pregnant as a way to prevent malnutrition before the child is born, to breastfeeding women in order to fortify both mother's and child's health status, and to children between the ages of four months and two years to complement their diet. They are not provided before the fourth month of life[104] in order to avoid having a negative effect on the incidence and duration of exclusive breastfeeding during this period. In addition, supplements are given to children between two and five years old with any sign of malnutrition in order to fortify their diet.

Evaluations of the Impact of Progresa on Child Feeding Practices

Analyses on the effect of Progresa on the prevalence and duration of breastfeeding have shown that, during the first months of the Programme, the introduction of supplements did not have a negative impact on breastfeeding (Vázquez and Huerta 1999; Hernández and Huerta 2000b). That is, after the first six months of Programme operation (between Encel-98M and Encel-98O), the percentage of ever breastfed infants (95 percent) and the median duration of lactation (15 months) remained at pre-programme levels and there was no difference between treatment and control groups. This first evaluation looked at the impact of Progresa during

[104] Progresa's guidelines followed the previous recommendations of WHO of exclusive breastfeeding for a period of four months.

this short period and estimated its effect without controlling for the possible effect of other household and community characteristics. Although controlling for the latter might not change the results substantially, doing so better isolates the Programme's effect. Moreover, it is necessary to monitor the intervention's effect on the patterns of exclusive breastfeeding and on the type of food products first introduced into children's diet. As mentioned before, exclusive breastfeeding has significant benefits for the health outcomes of poor children; therefore, it is relevant to monitor whether the educational sessions are achieving a higher incidence of this practice and whether or not the supplement is having a negative effect on it. Additionally, it is important to identify the timing and type of products that are first introduced into the diet since inadequate practices predispose infants to infection, malnutrition, growth retardation and mortality.

One of our aims is to identify the agreement of these practices with WHO/UNICEF's recommendations in order to assess the appropriateness of these care-giving behaviours. However, our main goal is to examine Progresa's possible influence on improving these practices. Both the Programme's food supplements and educational sessions could have a positive impact. Specifically, we look at a possible Programme effect on breastfeeding, exclusive breastfeeding and the type of food products first introduced into children's diet. We examine whether there are different impacts according to households' severity of poverty. Finally, to distinguish the characteristics of children with the highest risk of experiencing inappropriate feeding practices, we identify the factors associated with these outcomes.

5.4. Data

In this section, we describe the characteristics of the data used in our analysis. We explain the construction of the outcome variables under study, describe the sample used, and provide a brief description of the data quality issues. Further details can be found in the methodology chapter (Chapter 3).

Information on child feeding practices is drawn from a special questionnaire used at the fifth wave of data collection (Encel-00M), which included information on breastfeeding and introduction of complementary foods. This survey collected data on feeding practices from 8,296 eligible children born alive between January 1995 and May 2000[105]. After a thorough data cleaning process, we obtained a working sample of 7,469 eligible children. This sample corresponds to the two most recent births of all women interviewed in this survey, with 5,147 cases belonging to the most recent live birth and 2,322 corresponding to the penultimate live birth.

We examined data for all births since the feeding practices for the last child and the previous to last child are likely to differ. The former has higher chances of being in a longer birth interval than the latter. In settings where the length of birth intervals is associated with the duration of breastfeeding (as it is in our case), then the duration of this practice is likely to be longer for the last live birth than for the next to last live birth (Page et al. 1982). The implication of restricting the analysis to one of these groups is that one can introduce large selection bias into the estimates. Therefore, we use data for all births.

We assessed the quality of the data by carrying out an attrition analysis; by examining whether the cases without information on feeding practices were missing at random; and by looking at the responses on durations to assess for a possible digit preference. The results from our attrition analysis indicate some sample selectivity: our working sample is a more favourable group than the baseline sample. As for the patterns of missing data on feeding practices, we found evidence of some statistical differences between the sample with complete information and the sample with missing data. Finally, our data quality assessment showed that data on breastfeeding and child feeding practices suffer from some recall bias. The pattern of responses on durations of these practices (especially that of breastfeeding) showed marked peaks at durations of 12, 18 and 24 months. Nevertheless, the previous findings were similar between children living in treatment and control localities; hence, a possible bias due to attrition, missing values or heaping should not be of great concern in our analysis.

Outcome variables

The main outcome variables analysed in this chapter are overall breastfeeding (BF) and exclusive breastfeeding (EBF). Because the definition of exclusive breastfeeding varies across studies, it is worth pointing out that here we consider exclusive breastfeeding as feeding with breastmilk and no other liquid or solid foods. We are interested in examining both the prevalence and the duration of

[105] The total number of cases covered in this survey was 13,296, from which 11,776 had an eligibility status (8,296 eligible children and 3,840 non-eligible children.)

these feeding modes. The prevalence was estimated by dividing the number of children breastfed or exclusively breastfed by the total number of children regardless of their feeding practice. Due to the change in recommendations regarding the period of EBF, we calculated the prevalence for two cut-off points: EBF < 4 months and EBF < 6 months. To estimate the duration of these outcome variables we used survival analysis, with duration measured to the end of BF (and EBF) or to interview and a censoring indicator corresponding to current BF (and EBF).

Explanatory variables

In order to evaluate the impact of Progresa, we control for a set of explanatory variables (at the individual, household and community level) that might influence the outcome variables under study. The covariates that we include in our multivariate analyses are: the child's cohort and sex, mother's age at birth, mother's education, mother's language, household head's education, number of children under the age of five, number of children 6 to 12 years old, number of children 13 to 18 years old, distance to the nearest DICONSA store, distance to the health centre, degree of marginality, and region of residence. We considered controlling for variables at the locality level that could be associated with access to food (natural disasters and average wage of agricultural workers), but they did not contribute to explaining the variation in our models; hence they were left out from the final models.

The construction of the covariates included in our models is explained in the methodology chapter. Here we only describe the construction of dummy variables generated explicitly for this analysis. The first dummy indicates whether the child is the last live birth of the mother. We include this covariate in order to control for the possible differences in durations of these feeding modes between the last live birth and its preceding sibling. The second set of dummies identify the cohort to which the child belongs. We classified children into three different birth cohorts: 1) children born between January 1995 and June 1996, 2) children born between July 1996 and June 1998, and 3) children born between July 1998 and May 2000. The inclusion of these dummy variables in our models allowed us to identify the situation before and after Progresa was implemented. The first cohort represents the pre-programme situation since these children were more than two years old when the Programme was launched. The second cohort represents an intermediate phase. The outcomes of this cohort could be influenced by the Programme since some of these children were less than two years old when Progresa started operating. Finally, the third cohort represents the post-programme situation since children in this cohort were born after Progresa was implemented. If this intervention has an effect on child feeding practices, it should be mainly observed in the outcomes of this last cohort.

It is useful to bear in mind that some control localities started receiving benefits from December 1999 onwards. Hence, the feeding practices of control children born after this month could be positively influenced by the intervention, introducing a downward effect in our estimations. We disaggregated the information of children in cohort 3[106] to assess whether this was the case and did not observe a downward bias. Therefore, we only examine differences between the three cohorts previously defined. Table 5.2 presents the distribution of cases according to birth cohort and age group (with age corresponding to that at the fifth wave of data collection).

Table 5.2.
Distribution of Cases by Age Group and Cohort
Eligible Children

Age in months at Encel-00M	Cohort 1	Cohort 2	Cohort 3	Total
0-23	-	79	2,288	*2,367*
24-47	83	2,910	-	*2,993*
48-65	2,109	-	-	*2,109*
Total	*2,192*	*2,989*	*2,288*	*7,469*

5.5. Methodology

First, we carried out a descriptive analysis to compare the summary measures of child feeding practices between eligible children living in treatment localities and eligible children living in control localities. Next, we examined changes over time by disaggregating our analysis for the three birth cohorts previously described.

For the descriptive analysis, we calculated the prevalence and median duration of breastfeeding and exclusive breastfeeding and constructed a child feeding profile according to the specific foods first introduced into the child's diet. The median duration of these practices was estimated using a life table and summary statistics

[106] Children born after October 1999 represent 28 percent of children in cohort three.

from a survival analysis. The first approach, a breastfeeding life table, shows the proportion of children being breastfed (or exclusively breastfed) at exact ages. Thus, we estimate the median duration by looking at the age at which 50 percent of all children were still being breastfed (or exclusively breastfed). For estimates of the life table, we used the log-rank test for identifying possible differences between treatment and control groups. The median duration estimated by survival analysis was done by looking at the 50th percentile of survival time. In this context, the term survival refers to the continuation of breastfeeding or the continuation of exclusively breastfeeding.

Second, we estimated the Programme's effect on the duration of BF and EBF using multivariate models that account for the possible influence of other explanatory variables on our outcome variables. In order to do so, we fitted two proportional hazard models for each outcome variable. The first model can be expressed as follows:

$$\log[h_i(t)] = h(t) + \beta_1 P_i + \beta_2 C_i + \sum_j \delta_j X_i + e_t \qquad (1)$$

where i=1, 2,..,n (individuals).

This is a semi-parametric Cox proportional hazard model which makes no assumptions about the actual distribution of h(t) - the log of the baseline hazard function. The data is sorted by duration times and then parameterised in terms of a set of covariates. That is, the Cox model exploits only information on the ordering of individuals (i.e. which children have shortest/longest durations of BF and EB) and not on the interval between successive durations. Thus, the β coefficients can be estimated without making any assumptions of the form of the hazard function. In this study we are interested in the parameter estimates and not in the shape of the hazard, hence it is a suitable model for our goal[107].

Model (1) estimates Progresa's impact on the risk or hazard that a child will terminate breastfeeding or exclusive breastfeeding $h_i(t)$ controlling for the influence of a set of covariates. We estimate the Programme's effect using a dummy variable for living in a treatment locality (P_i). We were unable to include a dummy

[107] We estimated the Cox proportional hazard models using the *stcox* command of Stata. We used the Breslow method for dealing with the ties in the dataset produced by the heaping of our data.

variable for receiving supplements because this information was not collected in the ENCEL questionnaire. We examine the changes over time using the dummy variables for the child's cohort (C_i). And, we include a set of variables X_i at the individual, household and community level to control for the possible effect of these explanatory variables.

In a second model we include an interaction term ($P_i.C_i$) that provides estimates for the effect of living in a treatment locality by cohort. The parameters from these interaction terms indicate whether there is a differential treatment effect over time.

$$\log[h_i(t)] = \alpha(t) + \beta_1 P_i + \beta_2 C_i + \beta_3 P_i.C_i + \sum_j \delta_j X_i + e_t \qquad (2)$$

In addition, to investigate whether the Programme had a differential effect on child feeding practices according to the household's severity of poverty, we estimated model (1) for three different categories of poverty (terciles of Progresa's poverty index). This desegregation allows us to answer whether Progresa has a greater influence among the most deprived (or advantaged) groups. In this chapter, we do not estimate models with an interaction term between our poverty measure and Progresa's intervention because, as shown below, we did not observe differences between poverty levels.

It should be noted that, to control for the correlation between observations of children living within the same household or in the same community, we adjust the standard errors in our models by using the robust option of Stata (Huber/White/Sandwich estimate of variance). However, this command allows controlling for the clustered data (data not independent within groups) at one hierarchical level only. We estimated the models using either household or community clustering and did not find significant differences in the standard errors. Moreover, the conclusions regarding the significance of coefficients were the same with either option. Due to this software restriction, we present only the estimations obtained after adjusting for a possible intracommunity clustering.

5.6. Results

We present our results in two subsections. In the first we show our estimates from a descriptive analysis. Here we examine the impact of Progresa on the prevalence and duration of breastfeeding and exclusive breastfeeding by comparing the outcomes of children from three different cohorts living in treatment and control areas. In addition, we present an exploratory analysis of children's feeding profile, which allow us to identify the appropriateness of the timing and type of complementary food products given to these children. In the second subsection we discuss the results obtained from our multivariate analysis, using the proportional hazards model described in the previous section.

5.6.1. Descriptive Results

Table 5.3 shows that breastfeeding is practically universal in these rural localities. Around 97 percent of eligible children are breastfed for at least a short period of time (at least one month). This high incidence is observed independently of treatment category or of cohort under study. Additionally, the fact that, at the time of interview, more than 70 percent of the younger cohort (under 24 months old) were still being nursed (only around 30 percent had been weaned) corroborates that breastfeeding is a widespread custom in these localities. Furthermore, duration of breastfeeding is relatively long and it increased moderately over time. Results from the two methods used, life table and survival analysis, provide very similar results. They suggest that, between the cohorts under study, duration of lactation rose from around 13 months to approximately 18 months. The survival curves presented in Figure 5.1 illustrate this shift in duration. For instance, while for the first cohort the proportion of children surviving (still being breastfed) at nine months is 75 percent, for the third cohort this proportion is 82 percent. This increase was observed among children of both treatment and control localities and the Log-rank tests did not show evidence of differences in the duration of breastfeeding between treatment and control groups. Thus, it is not possible to attribute this improvement to Progresa's intervention.

Table 5.3
Breastfeeding Patterns by Treatment group and Cohort
Eligible Children

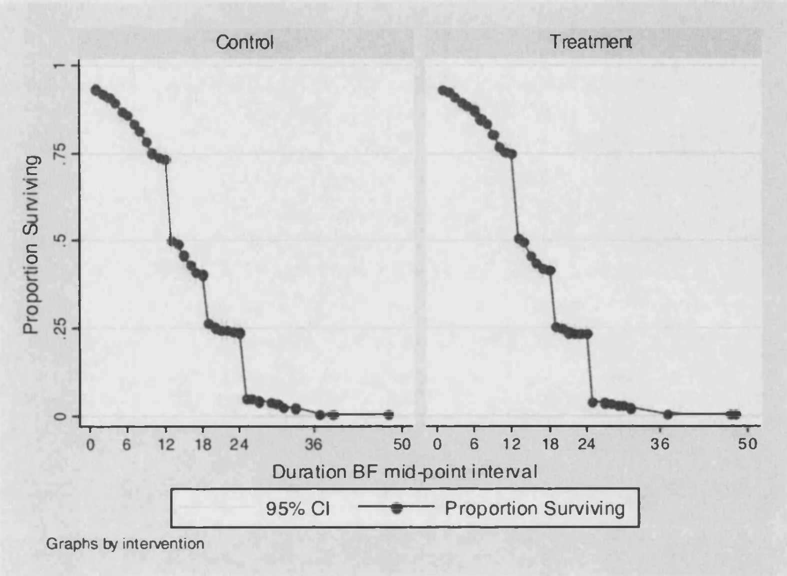
	Cohort 1			Cohort 2			Cohort 3		
	Control	Treatment	P>|t|	Control	Treatment	P>|t|	Control	Treatment	P>|t|
Breastfeeding									
Ever-breastfed (%)	96.0	96.3	0.74	97.2	97.5	0.56	96.7	97.8	0.10
Wean (%)	99.9	99.9	0.90	88.9	88.4	0.62	30.1	27.4	0.15
Duration (months)									
Life table	13.0	13.1	0.92	15.0	14.7	0.72	18.3	18.7	0.11
Survival time	12.5	13.5		15.5	14.5		18.5	18.5	
Exclusive breastfeeding									
< 4 months (%)	44.0	40.7	0.15	44.6	41.2	0.07	41.5	39.5	0.27
< 6 months (%)	21.5	18.7	0.12	21.1	19.3	0.25	18.5	16.5	0.24
First food already introduced (%)	100.0	100.0		99.5	99.4	0.75	83.4	84.4	0.42
Duration (months)									
Life table	3.7	3.5	0.29	3.7	3.5	0.18	3.8	3.6	0.85
Survival time	3.5	3.5		3.5	3.5		3.5	3.5	
Number of children	*798*	*1,394*		*1,132*	*1,857*		*893*	*1,395*	

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

Regarding exclusive breastfeeding, our data shows that among the population under study it is a rather rare practice. Estimates in Table 5.3 show that the proportion of children exclusively breastfed during the first six months of life is very small, with a value of around 20 percent. What is more, at the age of four months a considerable proportion has already received some kind of complementary food (only around 40 percent are exclusively breastfed by this age). Likewise, our estimates on duration show that children are exclusively breastfed for a fairly short period of time, with a median duration of around 3.5 months (see Table 5.3). The survival curves shown in Figure 5.2 illustrate the steep decline in the proportion of children still exclusively breastfed during the first months of life. We observe no differences between treatment and control groups, and no changes over time either. Thus, Progresa's benefits have had no effect on increasing or reducing the duration of this practice. This suggests that on one hand the supplements are not offsetting exclusive breastfeeding, but on the other that the educational sessions are not managing to promote its benefits.

Figure 5.1 Survival Curves for Duration of Breastfeeding

Cohort 1



Cohort 3

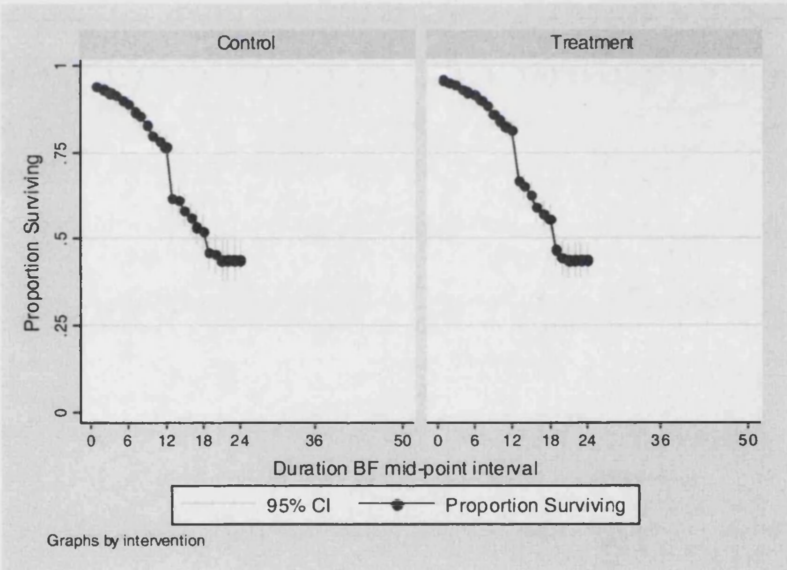
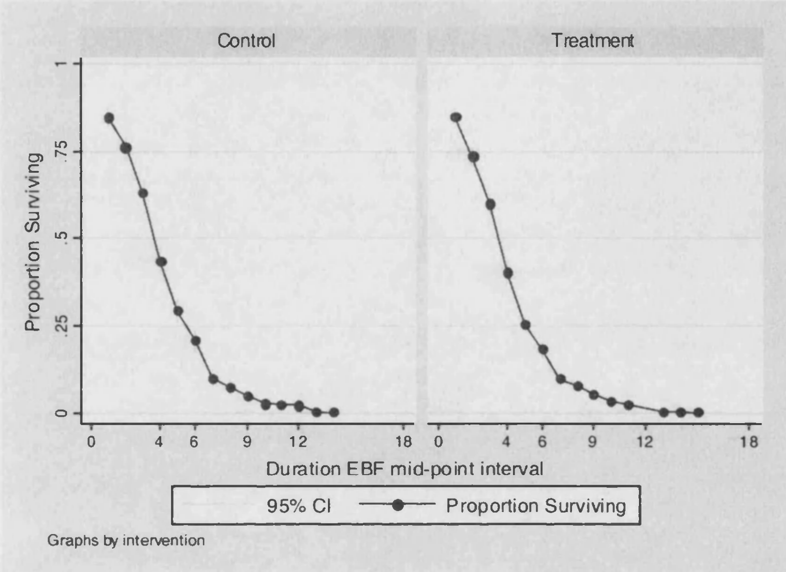
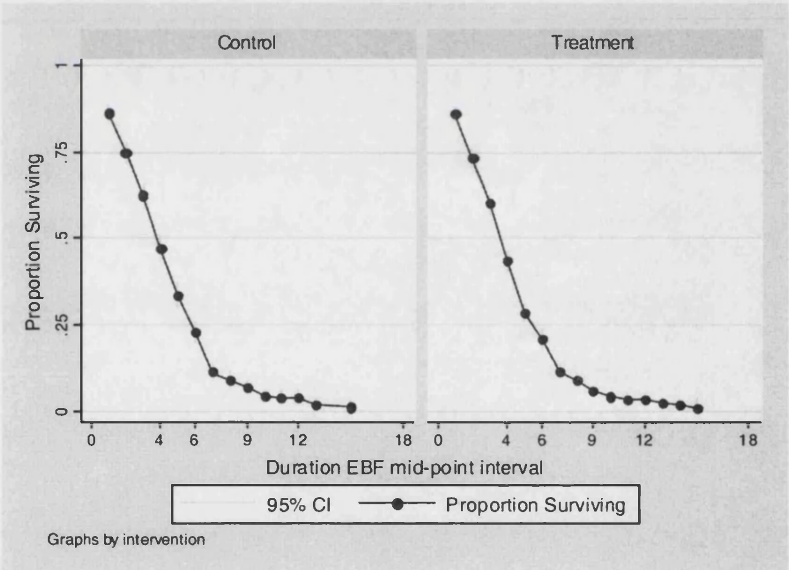


Figure 5.2 Survival Curves for Duration of Exclusive Breastfeeding

Cohort 1



Cohort 3



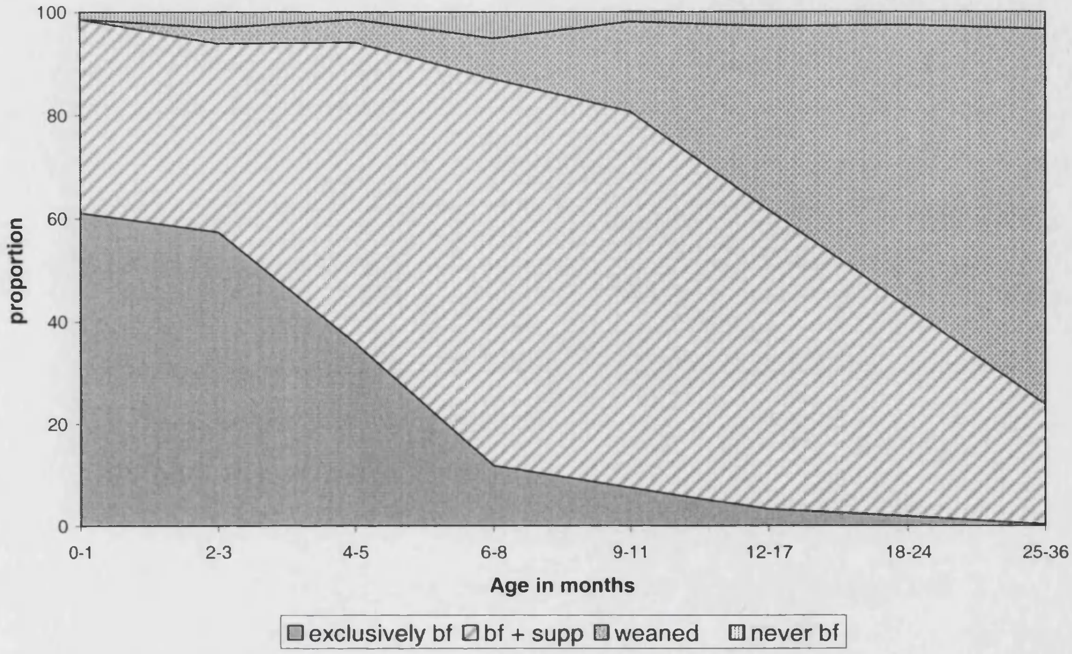
The proper time at which to introduce food complements is crucial for the physical growth and intellectual development of the child (Nelson 2000). The discussion of the optimal timing of exclusive breastfeeding turns around the "weanling's dilemma", which compares the increased risk of disease associated with an early introduction of non-breastmilk food products with the increased risk of malnutrition associated with a delay in the introduction of complementary feeding (ACC/SCN 2000). The current WHO/UNICEF recommendations (exclusive breastfeeding for the first six months of life) are based on evidence from numerous studies that have shown a greater risk of infections when food products other than mother's milk are introduced before the sixth month of life (Brown 2000) as well as on findings from several studies that have found no significant benefit for health and growth of delaying the introduction of food complements until this age (WHO/NCD 2001).

Figure 5.3 presents an overview of child feeding practices at the moment of survey among eligible children born after Progresa's implementation (third cohort)[108]. This figure includes data for both children living in treatment and control localities as we did not observe differences between the feeding patterns of these groups. We grouped children according to their age at interview and then we classified them into different feeding categories: never breastfed, weaned, breastfed with some complementary food and exclusively breastfed. This diagram corroborates our previous results; that is, breastfeeding is practically universal and the introduction of food products into children's diet takes place at a much earlier stage than that recommended by WHO/UNICEF. Furthermore, it can be observed that a small (around 12 percent), but nontrivial percentage of children aged six months or more are not given any complementary food. By this age, maternal milk alone no longer covers children's nutritional needs; thus, these children are at an increased risk of malnutrition.

Figure 5.3 also illustrates that although a reasonable proportion of children are still being breastfed by the age of 24 months, considerable improvements could still be made. As previously mentioned, different studies have shown the numerous benefits of long-term breastfeeding on child health outcomes. Moreover, long-term breastfeeding also has advantages for maternal health. In settings with low use of contraception, as is the case with this population, lactation has an indirect effect on child and maternal health through its suppressing effect on fecundity (Huffman and Lamphere 1984; VanLandingham et al. 1991). Longer durations of breastfeeding are associated with longer intervals between births (Brown et al. 1998), which, in turn, reduce the risk of mother's depletion and sibling competition. Thus, increasing the proportion of children nursed until the age of two could represent important benefits for this population.

[108] We only construct this child feeding profile for children born after June 1998 (third cohort) because the great majority of those born before this period had already been weaned (around 95 percent).

Figure 5.3 Child Feeding Practices, Eligible Children (after Progresa)



In addition to proper timing, the type of food products first provided to infants and young children can influence child health outcomes. During this stage, a complete and varied diet favours healthy growth and development (Ruel and Menon 2002). Table 5.4 presents the first, second and third food products given to eligible children in these localities[109]. The first thing to notice is that for the three cohorts under study there are few differences between treatment and control groups. Moreover, it seems that suboptimal feeding practices have remained practically unchanged after Programme implementation.

Overall, more than two thirds of children receive some kind of liquid as their first complementary food. Although both types of food are given at a very early age, it is clear that liquid foods are introduced at a much earlier stage than solid ones. Before 4 months of age, more than 70 percent of children have already received liquid foods and around 30 percent have been given some kind of solid food. There are no differences between treatment and control groups (neither before nor after Progresa) on the timing at which first foods are introduced. However, it should be noted that our estimates suggest that between cohorts there was a slight reduction in the age at which liquids are first given, a result contrary to our expectations.

[109] These figures correspond only to the sample of children who had already received some non-breastmilk product at the time of the survey.

Table 5.4
Child Feeding Practices by Treatment group and Cohort
Eligible Children who have already received non-breastmilk products

	Cohort 1			Cohort 2			Cohort 3		
	Control	Treatment	P>|t|[1]	Control	Treatment	P>|t|[1]	Control	Treatment	P>|t|[1]
Type first food[2]						*			**
Liquid	67.4	69.1		64.5	68.4		64.8	69.9	
Solid	32.6	30.9		35.5	31.6		35.2	30.1	
Timing First Liquid Food (age in months)									
0	23.9	20.4		21.1	18.6		25.5	22.6	
1	12.1	17.4		14.8	17.2		19.6	20.8	
2-3	32.5	32.6		35.0	36.1		32.3	33.9	
4-5	18.1	17.4		18.1	16.6		14.7	14.8	
6+	13.5	12.1		11.1	11.5		7.9	7.9	
Mean	*2.8*	*2.8*		*2.6*	*2.7*		*2.2*	*2.3*	
Timing First Solid Food (age in months)									
0-1	2.9	1.3		2.7	3.3		2.6	2.5	
2-3	32.0	33.8		26.9	29.8		23.5	26.9	
4-5	30.7	33.5		34.9	34.3		40.2	40.2	
6	21.6	17.13		23.1	19.1		22.2	18.6	
7+	12.9	14.4		12.4	13.5		11.6	11.8	
Mean	*4.7*	*4.7*		*4.8*	*4.6*		*4.8*	*4.6*	
First complementary food			**			**			*
Water or tea	32.0	37.0		33.2	35.6		38.8	41.3	
Any kind of milk	19.2	19.4		18.4	18.0		15.7	17.9	
Chicken or bean broth	12.0	12.5		14.6	13.1		13.9	10.9	
Corn gruel	10.5	6.9		7.6	8.8		5.8	5.8	
Fruit or vegetable purees	9.5	9.7		8.9	8.8		8.2	8.2	
Tortilla	4.0	5.0		3.9	4.9		3.3	4.3	
Fruit juice	3.5	2.3		4.2	2.2		3.4	2.1	
Progresa supplement	0.8	0.9		0.9	1.9		2.7	4.4	
Egg	1.0	1.2		1.3	0.6		1.6	0.8	
Other	6.0	3.6		5.3	4.7		5.1	3.4	
Second complementary food			**			*			
Chicken or bean broth	31.7	30.8		30.5	31.3		27.3	28.1	
Fruit or vegetable purees	15.1	15.1		14.8	12.9		12.1	14.0	
Corn gruel	14.3	13.2		11.5	13.0		10.4	12.6	
Any kind of milk	6.6	10.0		7.9	8.8		8.6	7.7	
Tortilla	7.4	6.0		9.5	8.1		8.2	6.8	
Fruit juice	7.0	7.9		7.7	7.9		7.7	7.3	
Egg	5.5	5.3		5.9	5.0		6.5	6.1	
Water or tea	3.6	2.7		3.7	3.2		4.5	3.2	
Progresa supplement	0.4	1.7		1.1	2.4		4.1	4.2	
Other	3.7	2.5		3.8	3.2		3.4	2.0	
Second food already introduced (%)	97.2	97.7		97.1	97.6		93.1	92.9	
Third complementary food						***			
Chicken or bean broth	23.4	27.0		24.9	25.3		25.5	24.5	
Tortilla	21.4	20.6		19.8	21.1		16.1	16.8	
Fruit or vegetable purees	14.1	13.0		10.9	12.1		12.7	11.9	
Egg	6.0	7.0		9.8	6.2		6.6	5.7	
Progresa supplement	1.2	2.1		2.6	6.2		5.6	6.7	
Corn gruel	5.1	5.5		5.3	4.9		5.5	3.7	
Fruit juice	5.1	4.4		4.7	5.0		4.2	4.1	
Any kind of milk	3.6	4.0		3.6	3.4		2.0	2.9	
Water or tea	1.7	1.6		2.8	1.2		1.8	1.1	
Other	5.9	4.2		4.5	4.0		3.5	4.0	
Third food already introduced (%)	86.9	89.9	*	89.0	89.6		83.8	81.9	
Number of children	*782*	*1,373*		*1,106*	*1,813*		*709*	*1,131*	

Notes: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001

1.We calculated a Pearson's chi-squared for testing the null hypothesis of independence.

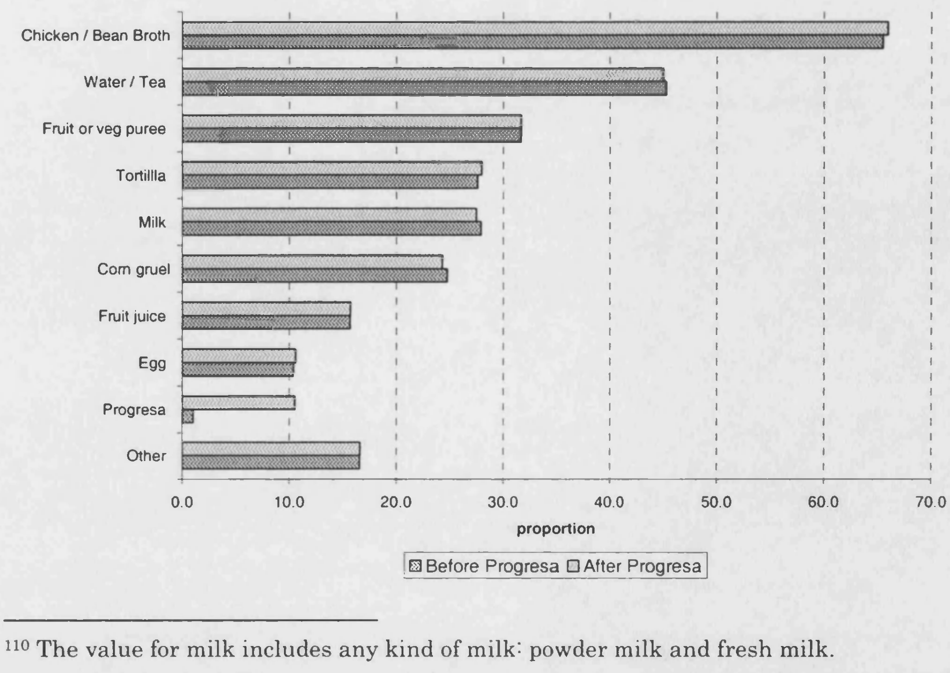
2.Liquids include: Water or tea, any kind of milk, fruit juices, corn gruel and other liquids.

Solids include: Chicken or bean broth, friut or vegetable purees, tortilla, egg, Progresa supplement and others.

From Table 5.4 it can be seen that the most common food first introduced into the diet is plain water or tea. This result is of concern because these products have no nutritional value and, given the environmental conditions in which these children live (households with high loads of infection due to crowding and to exposure to contaminated water and food), introducing these items at an early age exposes the child to hazardous contaminants. Other food products frequently given as a first complement include milk[110] and chicken or bean broth. The latter are more nutritious products than water and tea, but similarly their preparation and storage may increase the risk of illness. Furthermore, providing non-breastmilk products may result in reduced suckling and, thus an earlier termination of breastfeeding (WHO/NCD 2001). The statistical tests indicate a few significant differences between treatment groups; however these cannot be attributed to the intervention because most were observed at pre-programme stages (cohort 1).

In order to identify the main complementary food products given to these children, we summed the responses for each food item (either the first, second or third item introduced) and divided them by all children who had already received a non-breastmilk product at interview. Results are shown in Figure 5.4. The main foods supplied are largely chicken or bean broth, water or tea, and fruit or vegetable purees. Tortillas and corn gruel are also used for complementing children's diet and they are used in the same proportion as milk. The latter reflects the lack of resources of these families, which impedes them from providing more appropriate complementary foods. Furthermore, this figure shows that children's diet consists of the same monotonous diet as the one consumed by the rest of the family: beans, tortillas and corn.

Figure 5.4 Complementary Food Products, Eligible Children



[110] The value for milk includes any kind of milk: powder milk and fresh milk.

Finally, we examined in more detail the introduction of Progresa's supplements into children's diet to have an insight into its effect on feeding practices. From Figure 5.4 we observe that, after the introduction of the Programme, around 10 percent of eligible children were given these supplements as one of their first complementary foods. The guidelines of the Programme establish that the supplement should be given from the fourth month of age onwards. However, our results show that some children are receiving the supplement before the period stipulated. Among the 10 percent of children receiving Progresa's supplements as one of their first complementary foods 17 percent received it before they turned four months old. Although this figure is not alarming, greater efforts should be allocated to promote the use of supplements according to Progresa's guidelines. What is more, in order to improve health outcomes and to follow the international recommendations concerning EBF, the age at which the supplement is given should be raised to six months.

5.6.2. Multivariate Results

Table 5.5 presents the estimates of Progresa's effect on the duration of breastfeeding and exclusive breastfeeding after controlling for the possible effect of other explanatory variables. These results were obtained using the proportional hazards models described in the methodology section. The parameters in this table are presented as hazard ratios, obtained by exponentiating the log of the hazard rate. When the covariates are categorical and represented by dummy variables, as in our case, the hazard ratio can be interpreted as the risk for a set category relative to that of the reference category (given that other characteristics remain constant). In this study, hazard ratios with a value smaller than one indicate that the risk of weaning (terminating BF) or of introducing the first non-breastmilk food (terminating EBF) for that specific category is smaller than that of the reference category. On the contrary, values larger than one indicate that the relative risk of weaning for that category is higher than that of the reference group.

The first section of Table 5.5 shows the results for the two models fitted for duration of breastfeeding. In the first model, the parameter for Progresa is one and it is not statistically significant, suggesting that the risk of terminating breastfeeding for children living in localities receiving Progresa's benefits is similar to that of children living in control communities (reference group). On the other hand, it can be observed that the parameters for the dummy variables of cohort are significantly smaller than one. What is more, it seems that with every younger cohort the duration of overall breastfeeding is longer (the value for cohorts two and three are 0.93 (95% C.I.= 0.89, 0.98) and 0.78 (95% C.I.= 0.71, 0.86), respectively). Although not shown here, this model controls for the possible bias effect of the last born child, who is likely to be the sample with longer durations. Hence, the longer durations for the younger cohorts are observed even after controlling for this sampling effect.

Additionally, model (2), which accounts for a possible interaction between Progresa and cohort, shows that the Programme has a differential effect on the duration of breastfeeding by cohort. The interaction terms indicate that Progresa has a somewhat positive influence on the length of this practice for children in the youngest cohort, i.e. children born after the Programme was implemented. This group of children have weaning rates 0.75 times[111] (significant at the 10 percent level) that of non-beneficiary children born before the Programme was launched (reference group). In contrast, the weaning rates for non-beneficiary children in the youngest cohort were 0.86 (95% C.I.= 0.73, 1.02) that of the reference group. The latter implies that for the youngest cohort children receiving Programme benefits are at 0.87 of the risk (or 13 percent less likely) of weaning than comparable children in the control group.

The second part of Table 5.5 presents the models fitted for assessing Progresa's effect by terciles of poverty. The coefficients for the dummy variable for Progresa are all close to one and are not statistically significant, indicating no Programme effect on duration of breastfeeding irrespective of the household's level of poverty. We fitted model (2) to verify whether the positive effect for the youngest cohort observed for the sample as a whole was stronger for one of these groups, but did not observe a differential effect.

[111] This value corresponds to the multiplicative effect of the main effects and the interaction term. That is, Progresa(1)*Cohort(3)*(Progresa(1).Cohort(3)).

Table 5.5
Estimates of Progresa's Effect on Duration of Breastfeeding
All Eligible Children born after January 1995

	Model 1 All children					Model 2 All children					Model 1 First tercile					Model 1 Second tercile					Model 1 Third tercile				
	Hazard ratio	z	P>|z|	[95% C.I.]		Hazard ratio	z	P>|z|	[95% C.I.]		Hazard ratio	z	P>|z|	[95% C.I.]		Hazard ratio	z	P>|z|	[95% C.I.]		Hazard ratio	z	P>|z|	[95% C.I.]	
Progresa's benefits																									
Progresa	1.00	-0.1		0.92	1.08	1.02	0.4		0.93	1.13	0.99	-0.2		0.88	1.11	1.05	0.9		0.94	1.17	0.93	-1.4		0.84	1.03
	(0.04)					(0.05)					(0.06)					(0.06)					(0.05)				
Cohort																									
Two	0.93	-2.5	*	0.89	0.98	0.94	-1.4		0.86	1.03	0.91	-2.0	*	0.84	1.00	0.99	-0.2		0.90	1.09	0.91	-2.2	*	0.83	0.99
	(0.03)					(0.04)					(0.04)					(0.05)					(0.04)				
Three	0.78	-4.9	***	0.71	0.86	0.86	-1.7		0.73	1.02	0.79	-2.8	**	0.68	0.93	0.78	-2.9	**	0.65	0.79	0.76	-3.5	***	0.65	0.89
	(0.04)					(0.07)					(0.07)					(0.07)					(0.06)				
Progresa*Cohort																									
Progresa*Cohort 2						0.99	-0.2		0.82	1.04															
						(0.05)																			
Progresa*Cohort 3						0.85	-1.5		0.96	1.05															
						(0.09)																			
Controls:																									
Individual Characteristics	√					√					√					√					√				
Household Characteristics	√					√					√					√					√				
Community Characteristics	√					√					√					√					√				
Number of observations	7,340					7,340					2,373					2,481					2,475				
Number of failures	5,354					5,354					1,756					1,792					1,798				

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

Table 5.6 displays the results for the duration of exclusive breastfeeding. As with the results observed for overall breastfeeding, the parameter for Progresa shows that beneficiary children have similar risks (1.04 times higher) of terminating EBF as their control peers. In addition, the hazard ratios for cohort corroborate that the duration of this practice has remained unchanged over time. Moreover, estimates from model (2) show that the duration of EBF among beneficiary and non-beneficiary children has not been altered for any of the cohorts under study, as indicated by the hazard ratios for the interaction term of Progresa and cohort (beneficiaries' situation) and by the hazard ratios for the main effect of cohorts (non-beneficiaries' situation). Likewise, results by household's severity of poverty, suggest no changes in this feeding mode. Thus, the risk of receiving non-breastmilk products at an early age is a persistent health risk factor in these communities.

An important limitation of our study is that we do not have information on the reasons for introducing complementary food products or on those for terminating breastfeeding. Factors such as children's illness, size and growth may influence mothers' decision on whether to introduce other food products, to continue or to stop breastfeeding. Several studies provide evidence of changes in feeding practices in response to children's size (Eckhardt et al. 2001; Kramer 2003). Studies in Peru and Sudan found that children of larger size were given complementary foods at an earlier age than those perceived as small or weak (Kramer 2003). This could partly explain the longer duration of these feeding modes among the most deprived groups in our study. However, other studies have shown that infants of smaller size are more likely to be weaned at an earlier age than children of larger size (Eckhardt et al. 2001). These findings indicate that the interpretation of our results is not straightforward. There are other factors affecting the relationship between breastfeeding and growth that could be explaining our results. Feeding practices might also be influenced by inappropriate advice from peers or health workers. The early introduction of liquid foods could be attributed to the use of herbal teas to relieve stomach aches such as colic, which is done following the advice of other peers and of the personnel at the health centre. Unfortunately, we do not have information on these issues that could allow us to assess with more detail these care-giving behaviours. Nonetheless, our data clearly show that these practices could be significantly improved and that these in turn would probably yield important benefits for child health outcomes.

Table 5.6
Estimates of Progresa's Effect on Duration of Exclusive Breastfeeding
Eligible Children born after January 1995

	Model 1 All children				Model 2 All children				Model 1 First tercile				Model 1 Second tercile				Model 1 Third tercile			
	Hazard ratio	z	[95% C.I.]	P>|z|	Hazard ratio	z	[95% C.I.]	P>|z|	Hazard ratio	z	[95% C.I.]	P>|z|	Hazard ratio	z	[95% C.I.]	P>|z|	Hazard ratio	z	[95% C.I.]	P>|z|
Progresa's benefits																				
Progresa	1.04	1.0	0.96 1.12		1.04	0.8	0.94 1.15		0.99	-0.2	0.89 1.10		1.06	1.1	0.95 1.18		1.08	1.3	0.96 1.20	
	(0.04)				(0.05)				(0.05)				(0.06)				(0.06)			
Cohort																				
Two	1.02	0.7	0.97 1.07		1.02	0.4	0.94 1.10		1.04	0.9	0.96 1.13		1.00	0.1	0.92 1.10		1.01	0.2	0.93 1.09	
	(0.03)				(0.04)				(0.04)				(0.04)				(0.04)			
Three	0.96	-1.3	0.90 1.02		0.96	-0.8	0.87 1.06		0.95	-0.9	0.85 1.06		0.93	-1.3	0.83 1.04		1.01	0.1	0.90 1.13	
	(0.03)				(0.05)				(0.05)				(0.05)				(0.06)			
Progresa*Cohort																				
Progresa*Cohort 2					1.00	0.1	0.91 1.11													
					(0.05)															
Progresa*Cohort 3					0.99	-0.1	0.88 1.12													
					(0.06)															
Controls:																				
Individual Characteristics	√				√				√				√				√			
Household Characteristics	√				√				√				√				√			
Community Characteristics	√				√				√				√				√			
Number of observations	7,051				7,051				2,277				2,386				2,379			
Number of failures	6,707				6,707				2,185				2,260				2,253			

Note: Statistical significance: * p<0.05; ** p<0.01; *** p<0.001
Robust standard errors in parenthesis.

Before going to the next section, it is worth recalling that our attrition analyses had indicated that our working sample is a more favourable group than the baseline sample. Therefore, our assessment might be slightly biased if children from non-attritor households have better feeding practices than children from households that were not followed over time. However, the fact that the attrition pattern was similar between households in treatment and control localities suggests that our evaluation of Progresa's performance on improving child feeding behaviours is unlikely to be affected by this selectivity.

5.7. Conclusions

In this chapter, we assessed Progresa's effect on improving child feeding practices by looking at the prevalence and duration of breastfeeding and exclusive breastfeeding, as well as examining the time and type of complementary food products given to the child. We estimated the Programme's impact by comparing the outcomes of eligible children living in treatment and control localities disaggregated for three cohorts born at different periods of Programme implementation. Our results show that early feeding practices among beneficiaries and non-beneficiaries deviate considerably from international recommendations and that Progresa has managed to bring about some small changes in duration to weaning.

The indicators for overall breastfeeding show that it is practically universal (97 percent of eligible children being ever breastfed) and that its duration is relatively long (on average around 15 months). Our estimates indicate an increase in the length of breastfeeding for both beneficiary and non-beneficiary children, with the lasrgest increase among the youngest cohort. Moreover, Progresa's educational sessions seemed to have had a positive influence on this practice since beneficiary children born after Programme implementation are at 0.87 of the risk (or 13 percent less likely) of weaning than comparable children in the control group. This is a positive Programme result, but the benefits of long-term breastfeeding in disadvantaged populations justify investing additional efforts to increase its duration even further.

On the other hand, exclusive breastfeeding is a rare practice among these mothers and both its prevalence (around 40 percent for EBF<4 months and around 20 percent for EBF<6 months) and duration (around 3.5 months) has remained unchanged across the period under study. Our multivariate models show no Programme effect on the duration of this feeding mode even after controlling for a set of explanatory variables at the individual, household and community level. There is an urgent need to increase exclusive breastfeeding since it has remained unaltered and it is this behaviour which, in disadvantaged settings, is most associated with health and survival.

This analysis also revealed the type of complementary food products introduced into children's diet. Liquid foods such as water and tea, which have no nutrient value, are given at a very early age. These products are hazardous for child health since it exposes them to contaminants in the environment. We lack information on the reasons for giving these food products, but complementary foods, in particular water and tea, should be avoided during the first six months of life since they compromise breastfeeding and place children at greater risk of morbidity and mortality. The latter applies as well to the introduction of Progresa's supplements. They can have a greater impact on children's health and nutritional status if they are introduced after the sixth month of age. A special emphasis should be given at the health centres and at Progresa's educational sessions to encourage exclusive breastfeeding for the first sixth months of life.

Inadequate feeding practices are an important risk factor associated with the major diseases affecting children in these communities: diarrhoea and respiratory infections. During weaning, diarrhoea is at its peak, thus it is vital to promote adequate feeding practices to reduce the risk of catching this disease. Additionally, breastfeeding is likely to have a positive impact on reducing the deaths associated with pneumonia and acute lower respiratory infections. Thus, improvements in these practices are fundamental to improve children's well-being.

Chapter 6. Child Health

6.1. Introduction

Poor health in early life has negative consequences that translate into subsequent unfavourable outcomes. Children with ill health have increased chances of missing more days of school, obtaining low educational achievements in school, attaining limited human capital and having adverse achievements later in life. Children growing up in poverty are at risk of experiencing frequent and severe episodes of illness because they are highly exposed to the factors associated with catching infectious diseases. In developing countries, diarrhoea and acute respiratory infections are still the two leading causes of child mortality and remain among the most common childhood diseases. Progresa's intervention includes a set of activities aimed at improving child health and its related health care behaviours.

In this chapter, we examine whether Progresa is reducing the morbidity rates of beneficiary children. In Section 6.2, we set the background of this chapter by looking at the importance of child health, describing the international goals set to improve child health outcomes, and explaining the progress achieved in Mexico during the 1990s. In Section 6.3, we present the activities of Progresa aimed at improving child health and explain the results from previous evaluations on Progresa's impact in this area. In Section 6.4, we present the characteristics of our data, explain the reasons for selecting the sample used, and describe the outcome variables and the covariates included in our analysis. In Section 6.5, we present the methodology used, explaining the different models fitted for answering our research questions. In Section 6.6 we present our descriptive and confirmatory results, and in section 6.7 we review the conclusions drawn from this assessment.

6.2. Child health

The literature on child health suggests that children's heath status is not only linked to future health outcomes, but also to educational achievements, accumulation of human capital, employment opportunities, earnings and social status (Case et al. 2004). There is evidence both from developed and developing countries showing that children's health status is positively associated with family's socio-economic background (Singer and Ryff 2001; Case et al. 2002; Burgess et al. 2004; Gwatkin et al. 2004). Children from poorer backgrounds are more likely to have poor health outcomes because they have greater constraints to access health care and are more exposed to the hazards associated with ill health. Therefore, it is believed that child health has a decisive role in the transmission of poverty and health over the life course and between generations (Wolfe and Behrman 1982; Mata 1995; Case et al. 2004).

In developing countries, children living in impoverished environments are likely to catch infectious diseases because they are exposed to a complex interplay of risk factors (e.g. undernutrition, poor diet, bad feeding practices, lack of maternal knowledge on treatment of diseases, unhealthy environments, inadequate access to health services and incidence of natural disasters), which make them less resistant to disease. For instance, it is well recognized that any kind of infection worsens children's nutritional status (Scrimshaw 2003). This is so because children who catch a disease lose their appetite and their capacity to absorb nutrients (Martorell and Ho 1984). In consequence, children's nutritional status is negatively affected. Similarly, the severity and duration of an infection depends on children's prior nutritional status and the diet consumed during the recovery period (Scrimshaw 2003). This synergistic effect makes children more susceptible to a pattern of frequent and severe illnesses, which, in turn, affects their growth and development.

Diarrhoea and acute respiratory infections (ARI) are still the two leading causes of child mortality in developing countries and remain among the most common childhood diseases. Diarrhoea is caused by different etiological agents such as bacteria, viruses and parasites[112]. It is transmitted through ingestion of contaminated food or water or through person to person contact (Black 1984). Acute respiratory infections include mild symptoms as cold, cough and more severe ones like pneumonia, bronchitis, whooping cough, diphtheria and streptococcal infections. The etiological agents of this disease are mostly viral[113] and to a lesser extent bacterial (Benguigui et al. 1999).

The risk factors associated with these illnesses are more likely to prevail in deprived contexts. For diarrhoeal diseases, they include: low weight at birth,

[112] The most common etiological agents include: bacteria (escheriachiacolli and shigella), viruses (rotavirus) and parasites (entamoeba histolytica and giardia lambia) (Black 1984).

[113] The viruses responsible for ARI include: rhinoviruses, coronaviruses, influenza, parainfluenza, RSV and andenoviruses (Benguigui et al. 1999)

undernutrition, inadequate feeding practices (e.g. a short duration of breastfeeding), poor hygienic conditions, lack of maternal knowledge on treatment of diseases, among others (Secretaría de Salud 2004). The set of risk factors associated with ARI is similar to that of diarrhoea, but also includes other environmental aspects (crowding, pollution inside and outside the household, and changes of temperature) (Secretaría de Salud 2004), which are as well more likely to prevail in disadvantaged settings. Nevertheless, as the progress over the last decade has shown, morbidity and mortality from these diseases can be substantially curtailed through appropriate preventive measures.

International goals

The 1990 World Summit for Children included specific goals aimed at reducing, by the year 2000, major childhood diseases, such as diarrhoea and acute respiratory infections. To tackle diarrhoea, three targets were set: 1) decrease the number of child deaths attributable to this illness by 50 percent; 2) reduce its incidence rate by 25 percent; and 3) attempt an 80 percent coverage of Oral Rehydration Therapy[114] (ORT) (UNICEF 1995). To bring down ARI, one target was set: 1) to reduce the number of child-related deaths by one third (UNICEF 1995).

Between 1990 and 2000, global trends indicate some progress regarding the control of these infectious diseases. WHO estimates that, during this ten year period, deaths from diarrhoeal diseases declined by 50 percent, from around 3 million deaths a year to 1.5 million (WHO 2001). Hence, at the international level, the 1990 World Summit Goal (WSG) for this cause of death was achieved. This improvement implies that, at present, diarrhoea is no longer the number one cause of child mortality. Yet, despite lower mortality from diarrhoeal diseases, morbidity from this infectious disease has remained relatively stable over time. It is estimated that, in the last twenty years, the number of episodes per child per year has remained at around 2.6 (Parashar et al. 2003; WHO 2003).

In contrast, during this ten year period, reduction in deaths from ARI did not show positive results. There is no accurate data to assess the performance of countries in this area, but WHO's perspective is that there was a shortfall since in many countries ARI remains the most common cause of child death (WHO 2001).

[114] The activities associated with oral rehydration therapy include: providing oral rehydration salts (ORS), avoiding antidiarrhoeics, increasing liquid consumption, continuing to feed, and training to recognise symptoms (UNICEF 1995).

Furthermore, it is estimated that in many countries it is currently the most common childhood disease. According to the Pan American Health Organisation (PAHO), on average Latin American children living in rural localities have between 5 and 8 ARI episodes per year (Benguigui et al. 1999).

The progress achieved in reducing deaths due to diarrhoeal diseases is largely attributed to an increased use of oral rehydration salts (ORS). This effective and affordable treatment has managed to control dehydration, the main diarrhoeal complication that results in death[115]. In addition, advances in this area are also due to improvements in health care behaviours for the detection and home treatment of diseases, improvements in breastfeeding practices, improvements in hygiene and sanitation, and provision of zinc and vitamin A (WHO 2001; Jones et al. 2003; Parashar et al. 2003). On the other hand, interventions with some evidence of success in reducing ARI include the promotion of improved nutrition (exclusive breastfeeding in first 6 months of life and complementary infant feeding), provision of HIB[116] vaccine, zinc, and affordable antibiotics for pneumonia (Jones et al. 2003). The deaths associated with this infection can be avoided if symptoms are opportunely recognised and children are treated promptly.

In the year 2000, the Millennium Development Goals (MDG) included a set of targets aimed at reinforcing the 1990's World Summit commitments. The main goal related to child health is to reduce under-five mortality rates by two thirds between 1990 and 2015 (World Bank 2004). In contrast with the World Summit for Children, the MDGs have no specific targets to attack and control infectious diseases. Although decreasing child mortality is necessary for improving children's well-being, it is not sufficient. Children living in poverty still spend many days sick, with diseases that hinder their growth and development. Hence, efforts should be targeted specifically at addressing child morbidity, and measurable goals should be set to monitor progress.

Mexico's performance

In Mexico, child mortality has shown substantial reductions, mainly because of a decline in the deaths due to diarrhoeal diseases. Between 1990 and 2000, mortality rates related to this illness decreased by 82 percent (from 125.6 deaths per 100,000

[115] It is estimated that about half of the deaths attributable to diarrhoea are from dehydration (Ryland and Raggers 1998).

[116] Vaccination to prevent Haemophilus Influenzae type B disease.

children under the age of five to 22.1) (see Table 6.1). By 1996, the World Summit Goal (reduction by 50 percent) had already been reached[117]. With respect to diarrhoeal morbidity, estimates from national surveys indicate that some positive rapid changes were achieved between 1990 and 1993. During this brief period, the prevalence rate[118] decreased almost 50 percent, from 16.8 to 9 percent; the number of diarrhoeal episodes per child per year dropped from 3.5 to 2.2; and the use of ORT increased from 66 to 80 percent (UNICEF 1995). However, this trend did not show further improvements. Estimates from the most recent National Nutrition Survey (ENN 1999) indicate that, in 1999, the proportion of children sick with diarrhoea was 12.3 percent (Hernández et al. 2003), slightly larger than estimates for 1993. It seems that once the most severe cases were controlled, further advancements were more difficult to attain.

Table 6.1
Summary Measures of Child Health, Mexico 1990-2000

	1990	1995	2000 p/	% Change (1990 - 2000)
Mortality				
Infant Mortality 1/	34.7	25.9	21.5	-38
Child Mortality (under 5 years old) 1/	44.7	31.3	25.2	-44
Mortality due to diarrhoeal deases among children < 5 yrs old 2/	125.6	43.7	22.1	-82
Mortality due to accute repiratory infections among children < 5 yrs old 3/	115.7	77.8	44.7	-61

1/ Deaths per 1,000 children in that age group, adjusted for underregistration.
2/ Number of deaths for infectious intestinal diseases per 100,000 children < 5 yrs old.
3/ Number of deaths for respiratory infections per 100,000 children < 5 yrs old.
e/ Preliminary figures.
Source: SSA. EZPL,VI Informe de Gobierno, México, 2000.

Additionally, there were important reductions in the number of deaths attributed to ARI. Between 1990 and 2000, deaths associated with this cause decreased by 61 percent (from 115.7 deaths per 100,000 children to 44.7) (see Table 6.1). In contrast to the international results, the World Summit Goal for this disease (reduction by one third of child related deaths) was also surpassed[119]. Regarding morbidity, ARI is currently the most common child illness among Mexican children (Secretaría de Salud 2004). According to the last national nutrition survey (ENN 1999), the proportion of children sick with ARI is around 20 percent. Unfortunately, we did not find information on past prevalence in order to assess possible improvements in morbidity.

[117] By 1996, the WSG for diarrhoea had already been reached. Thus, it was reset to a reduction of 85 percent by the year 2000. As figures in Table 6.1 show, this new goal was practically achieved.
[118] This prevalence rate refers to the proportion of children sick in the two weeks prior to the survey.
[119] Likewise, by 1996, the WSG goal for deaths related to ARI had been reached. Thus, the Mexican Government re-established this goal to a reduction of 70 percent. However, this ambitious goal was not achieved at the national level.

In spite of the notable achievements discussed above, the number of child deaths due to diarrhoea and respiratory infections is still high, exceeding 6,500 deaths per year[120]. These child deaths are concentrated among the poorest segments of the population. Moreover, children from disadvantaged groups who survive these diseases are at higher risk of being undernourished and ill during much of their infancy and preschool years. As previously argued, these factors have a negative effect on children's growth and development. Hence, further efforts have to be implemented so positive impacts reach those with greatest needs.

6.3. Progresa's benefits on child health

Progresa, in conjunction with "*Arranque Parejo en la Vida*[121]" and "*Programa de Salud y Nutrición de los Pueblos Indígenas*[122]", is the main strategy the Mexican government has implemented to reduce the health gaps in the country. Progresa has a health component through which it provides basic health care to all members of the family. These services have a particular emphasis on preventive health care and are provided by the Ministry of Health and by *IMSS-Solidaridad*, a branch of the Mexican Social Security System that provides health services to marginalised groups. The activities of Progresa aiming to improve children's health status include: improving access to medical treatment by promoting regular visits to the health centre; improving health care practices through monthly educational sessions; and improving children's nutritional status through a monetary grant for food consumption and nutritional supplements.

Children, as well as other family members, must attend the health centre on a regular basis according to a schedule based upon their age (see Table 6.2). The purpose of children's visits to the health centres is to evaluate their health and nutritional status and to receive immunisations. According to this calendar, before reaching age two, children should have had 11 visits to the health centre. This regular attention during the most vulnerable period of children's growth should facilitate prevention as well as opportune detection and treatment for any sign of illness or growth failure. At the same time, these numerous visits should have a positive impact on maternal health care behaviours since they may raise mother's

[120] This figure was estimated from data on number of child deaths by cause (Zedillo 2000). We should be cautious with these figures as they are estimated using official statistics, which are liable to underreporting.
[121] Programme for Equal Opportunities since the Beginning of Life.
[122] Health and Nutrition Programme for the Indigenous Population.

awareness on the importance of preventive measures, such as vaccinations and growth surveillance.

Table 6.2 Health check-up schedules for children under five years old

Age Group	Number of Visits	Purpose
0 - 4 months	Three visits: 1) at 7 days old, 2) at 28 days old, and 3) at 2 months old	• Monitor growth, weight and height
4 - 23 months	Eight visits: at 4, 6, 9, 12, 15, 18, 21, and 23 months.	• Immunisations; • Monitor growth, weight, and height; • Evaluation signs of illness.
24 – 59 months	Three visits per year: One every 4 months	• Immunisations; • Monitor growth, weight, and height; • Evaluation signs of illness.

Source: (SEDESOL 1999)

Health care givers, mainly mothers, attend monthly educational session at the nearest health centre. These sessions, known as "*pláticas*", are provided by health personnel and include 25 different themes on education and promotion of health. The great majority of topics provide guidance on aspects related to child health outcomes (see Table 6.3). Moreover, there are specific sessions aimed at improving the recognition and treatment of diarrhoea and respiratory infections.

Table 6.3 Educational sessions related with child health outcomes

1. New born health care practices
2. Infant health care practices
3. Toddler health care practices
4. Breastfeeding practices
5. Vaccination scheme (Immunisations child should have according to age)
6. Oral rehydration therapy (preparation and use of ORS, "*vida suero oral*")
7. Health care of children when sick with diarrhoea
8. Deworming (importance of children and adults' deworming)
9. Acute respiratory infections (recognition and treatment of ARIs)
10. Tuberculosis (to detect when a person has TB)
11. Basic sanitation (handling litter, latrines and unhygienic animals)

Improved nutritional status should also have an effect on children's overall health since it is associated with lower morbidity and mortality rates (Mata 1995; Scrimshaw 2003). Beneficiary families are provided a monetary grant (equal to about PPP US$ 20) for the purchase of food products, as well as nutritional supplements given to the members of the family who are at most risk of malnutrition –children between the ages of four months and two years, pregnant and breastfeeding women, and children between the ages of two and five with any signs of malnutrition.

Evaluations of the health component of Progresa

There have been two assessments of Progresa's performance on improving child health outcomes, but neither has examined the effect of the Programme on reducing specific infectious diseases.

A first evaluation assessing the Programme's impact during its first two years of operation indicates that illness rates in both treatment and control groups fell over time, but fell faster in treatment areas compared to control areas (Gertler 2000). Findings from this study suggest that, after 23 months of Programme intervention, Progresa lowered illness rates for beneficiaries aged 0 to 2 years old by about 4.7 percentage points (or 12 percent lower than at baseline) and for beneficiaries aged between 3 and 5 years old by about 3.2 percentage points (or 11 percent lower than at baseline). This study analyses the impact of Progresa on child health outcomes using overall illness as the dependent variable. However, due to the substantial risk of infectious diseases in these communities, it is important to assess the performance of Progresa on controlling diarrhoea and respiratory infections. Moreover, as will be shown later, the measure of overall illness suffered from reporting errors, making this variable a poor indicator of child illness.

A second evaluation on child health outcomes looked at three indicators to assess Progresa's performance on improving health: mother's reports of child illness (using ENCEL data waves one to four), height (using INSP data waves one and two), and anaemia (using INSP data waves one and two) (Gertler et al. mimeo). Morbidity results from this study suggest that, during the experimental period, newborns[123] in treatment areas were 25.3 percent less likely to be ill than newborns in control areas; that children aged under three years old (at baseline) were 22.3 percent less likely to be ill than their peers in control localities; and that treatment children were 25.5 percent less likely to be anaemic than control children. This second study provides a more detailed assessment of children's

[123] This group of children refers to the cohort of children who were born after Progresa started operating.

morbidity since it looks not only at overall illness but also at anaemia and height. Nonetheless, it does not analyse other preventable diseases that are likely to affect the population under study. Moreover, this evaluation uses the same outcome variable (overall illness) as the previous study, which provides a limited picture of child illness.

In this chapter, our aim is to assess whether Progresa had a positive impact on reducing the major childhood diseases that affect children under the age of five: diarrhoea and respiratory infections. To complement these findings we examine whether Progresa reduces the duration of illness and whether it improves health care practices. In addition, we analyse whether Progresa's activities reduce health gaps between groups. For this objective, we use two approaches. First, we examine whether Progresa has a differential effect according to the household's severity of poverty. In addition, we investigate whether this intervention has a positive (or negative) interaction with some background characteristics.

6.4. Data

Both the ENCEL and the INSP surveys gathered information on health related issues for children under the age of five. Initially, we wanted to use data from the ENCEL survey because it had more waves of data collection (six versus three); it had a baseline measure (the INSP data does not have information on morbidity at wave one); and the sample size was much larger (around 10,000 children at each wave versus around 2,600 children). However, after examining the quality of the data, we decided instead to use the INSP data because it seemed to be less prone to reporting errors.

One of the limitations of the data is that health outcomes may suffer from reporting errors. There is concern that estimates from self-reported health or, as in our case, from reports in which mothers are asked about their child's health, suffer from measurement error because the concept of health varies across individuals. In a recent study, Case et al (2003) report that perceptions of illness are likely to vary systematically according to the characteristics of the respondent. Furthermore, they argue that illness reports are commonly subject to biases that confound estimated relationships between socio-economic status and health (Case et al. 2003). However, this reporting bias is not always observed. A DHS comparative study on child morbidity in 34 developing countries[124] examines differentials on morbidity rates (diarrhoea, fever and cough) according to selected socioeconomic characteristics (place of residence, maternal education, presence of radio in the household) and finds that children in better-off categories have better outcomes than those in more deprived groups (Ryland and Raggers 1998). Although the randomisation of our sample allows controlling for systematic variations on reports of illness, it is necessary to carry out a data quality analysis to understand what the indicators are measuring and provide a meaningful interpretation of our results.

An additional reporting bias that our data may present is that perceptions of illness may change over time as a result of Progresa's intervention. On one hand, because respondents know they are being studied, they may provide answers they believe interviewers want them to give; hence, reporting lower morbidity rates than the true ones. On the other hand, it is possible that Programme's activities –e.g. increased visits to the health centre and educational sessions– raised mothers' awareness and perceptions of illness; hence, reporting higher morbidity rates than those at baseline. In the first case we would overestimate the intervention effect and in the second we would underestimate it. Although having a longitudinal sample and a treatment and control groups allows controlling for these reporting biases, it is important to understand what indicators are measuring. If the outcome is a poor measure of health, inferences from the data will likely be poor (Duncan Thomas, et al. 2000).

To assess the quality of the data, first we examine the accuracy and consistency of morbidity reports by comparing the prevalence estimates of diarrhoea and respiratory infections (ARI) with those from other international and national sources. Second, to assess whether these illness reports were influenced by the respondent's living conditions we looked at morbidity differentials according to a set of household and community characteristics. We performed these analyses for data in both surveys –ENCEL and INSP– to identify which was more adequate for our purposes.

Table 6.4 shows the prevalence of illnesses observed in other international and national surveys. We only present estimates from those groups that we consider to

[124] The 34 DHS surveys on which this study is based include countries in Sub-Saharan Africa, Asia, Near East, North Africa, Latin America and the Caribbean.

be analogous to Progresa's sample (i.e. children living in rural areas in Latin America, children living in extreme poverty in Mexico and children attending *IMSS-Solidaridad* health centres). Before comparing these figures, it is worth noting three points. First, as mentioned above, these data reflect mothers' perception of illness rather than medical evaluations. Second, all surveys were carried out at the respondent's household, except the IMSS survey that was conducted at the health centres. Thus, the IMSS sample is likely to suffer from selection bias, with estimates likely to be lower (if children who visit the health centre attend on a regular basis for check-ups) or higher (if children who visit the heath centre are those who are ill) than those of the other sources presented here. Third, the period of recall varies among surveys. While DHS, ENN and INSP surveys gathered information on those episodes that occurred in the two weeks prior to the survey, the IMSS and ENCEL surveys covered a four week recall period.

Table 6.4 Prevalence of Illness among children under five years old

	Diarrhoea (%)	ARI (%)	Illness[1/] (%)
Latin America			
DHS: Children in rural areas[2/] (two week recall)	18.0	30.8	-
Mexico			
ENN: Children extreme poverty[3/] (two week recall)	15.3	23.3	-
IMSS Solidaridad (four week recall)[4/]	10.9	33.4	46.3
Progresa			
ENCEL (four week recall)[5/]	4.5	20.3	29.7
INSP (two week recall)[6/]	13.2	43.5	47.7

Notes:

1. Proportion of children who were ill in the recall period.
2. Source: DHS Stat-compiler. Surveys carried out in Latin America between 1995 and 2000.
3. Source: Estimates of (Hernández et al. 2003) based on ENN 1999.
4. Source: Estimates of (Flores and Martínez 2004) based on a study carried out in IMSS health centres between May 2000 and May 2002.
5. Eligible children at baseline.
6. Eligible children at INSP's wave two.

Regarding estimates of diarrhoeal prevalence, these figures indicate that the INSP reports provide an estimate much closer to that of other surveys. While INSP data yield an estimate (13.4 percent) within the range of values of other surveys (between 10.9 and 18.0 percent), ENCEL reports provide a figure considerably lower (4.5 percent) than that of other sources. Even after taking into account the differences in the reference period, it seems that the ENCEL data on diarrhoea suffer from under-reporting.

Concerning respiratory infections (ARI), the assessment is not as clear because there are greater variations between sources. For simplicity, we compare the estimates of surveys with similar recall period (ENCEL versus IMSS and INSP versus ENN). The prevalence of ARI using ENCEL reports presents an estimate clearly lower (20.3 percent) than that of children going to *IMSS-Solidaridad* health centres (33.4 percent). As previously mentioned, the methodology of the latter survey is likely to yield biased estimates of the prevalence of ARI because its sample is a selective group. Hence, the difference observed between ENCEL and IMSS reports could even be larger (or smaller). On the other hand, the prevalence of ARI using the INSP reports (45.5 percent) is much higher than that of children in extreme poverty interviewed at the ENN (23.3).

We examined some of several possible explanations for the differences mentioned above; however, the different methods used in each survey for collecting data seem to be the most likely[125]. First, while DHS, ENN, and INSP questionnaires included a specific question for each kind of illness, the ENCEL instrument included only one question regarding overall illness[126]. When there was a positive response, this question was followed by one asking the mother what kind of illness the child had had. Not addressing each illness explicitly may have led to less accurate reports. Second, the recall period covered in the ENCEL questionnaire was longer (4 weeks) than that of other sources (2 weeks[127]). It would seem plausible that a longer period should provide a higher prevalence, but this is not necessarily the case. Other studies have shown that underreporting of illnesses is relatively higher when the length of time between the occurrence of the disease and the interview increases (Boerma et al. 1994; Heuveline and Goldman 2000).

We also explored whether differences in prevalence estimates were explained by the time of the year data was collected. The baseline ENCEL survey was carried out between March and April of 1998; the second wave of INSP was conducted between October and December of 1999; and the ENN 1999 survey was collected

[125] For the following comparisons, we exclude the IMSS study because its characteristics (location, recall period, time of the survey) were somewhat different from that of other surveys.
[126] See Appendix 6. for a detailed description of the questions used in each survey.
[127] At present, it is recommended to use a two week recall period for questions on morbidity because it seems to offer the best balance between recall error and maintaining a feasible sample size of cases (Heuveline and Goldman 2000).

between October 1998 and March 1999. We should find a greater incidence of diarrhoeal diseases during the rainy period (which for Mexico takes place between June and October). ARI peaks during the coldest months (which for Mexico are from November to February). We do not find substantive differences in the period of data collection that would explain the patterns observed. Regarding diarrhoea, all surveys we consider[128] were carried out at periods of low prevalence. Hence, differences in periods of data collection do not explain the strikingly low estimates obtained from the ENCEL reports. Regarding ARI, the INSP and the ENN 1999 were conducted at periods of similar prevalence, in this case at months when this disease is more likely to occur. Thus, the time of the year surveys took place does not explain the higher estimates of ARI obtained using INSP data.

The question addressed in the ENCEL survey to retrieve information on illness is likely to have led mothers to report the most recent or most severe illness their child had during the previous month. This in conjunction with the time of year the data was collected might explain why we observe a low prevalence of diarrhoeal diseases. On the other hand, we do not find a clear explanation for the higher estimates of ARI from the INSP data. The morbidity questions used in INSP and ENN are similar; the time of the year at which surveys were carried out was similar; the algorithm used to group the symptoms that are considered as ARI is also the same. Nevertheless, the figure from the IMSS study suggests that the prevalence of ARI may well be higher than that estimated using ENN data.

Regarding morbidity differentials, we looked at the associations between reports of illness (overall, diarrhoea and ARI) and a set of household and community characteristics using again data from both ENCEL and INSP surveys. Results in Table 6.5 indicate that ENCEL reports on overall illness show implausible relationships with variables associated with socioeconomic status. That is, there is a higher prevalence of sick children among those whose mother or father has secondary or higher education; those who live in households classified in the highest quartile of food expenditure; and those whose mother does not speak an indigenous language. Therefore, although randomisation controls for this reporting bias, it seems that these reports are poor indicators of children's health status. This analysis was replicated for reports of diarrhoea and respiratory infections and we

[128] We did not look at the time of the year the DHS surveys were carried out because at different countries the rainy and cold seasons may take place at different months of the year making comparisons more complicated.

obtain different results by type of illness. The implausible pattern observed for overall illness was also present in reports of respiratory infections. This is true not only for the ENCEL reports of this illness (not shown here), but also for the INSP reports. In contrast, diarrhoeal reports and background variables did not show this systematic pattern. Except for expenditure per capita, there is no clear association between diarrhoea and other explanatory variables.

It is possible that variations in morbidity differentials by type of sickness are associated with the recognition of signs and symptoms of diseases. The widespread campaigns of diarrhoeal treatment in the country have increased the knowledge of how to deal with diarrhoeal episodes, yet these efforts have not been as successful with respect to managing respiratory infections. From our datasets, there is evidence that before Progresa started operating there was extensive knowledge on activities related to diarrhoea (almost 90 percent of mothers knew how to prepare oral rehydration salts and around 70 percent had used this treatment the last time the child was sick with diarrhoea[129]). This greater awareness may have contributed to reduced gaps between groups (both on incidence and on the subjectivity of the definition of this illness). In contrast, identifying respiratory infections is more subjective because the symptoms are more difficult to recognise, they have a longer duration and their degree of severity may have greater variation. Parents from more deprived backgrounds –e.g. parents with fewer years of schooling– may be less able to assess their children's health status. Additionally, the fact that infectious diseases are frequent among children from deprived groups could lead to an adaptation effect. People who are chronically sick get used to this situation and report themselves in better health than those who are sporadically sick (Case et al. 2003).

Despite these difficulties with the data, reports of illness are our only source of information on child morbidity; hence, we examine such data aware of its possible measurement errors. The previous analyses suggest that the INSP reports are better indicators of diarrhoeal morbidity than those of the ENCEL survey. Thus, in our study we examine this illness using INSP data. With respect to respiratory infections, both surveys present values that are either too high or too low with respect to those observed elsewhere; and both show reporting biases by household characteristics. Nonetheless, we examine this health outcome taking into account

[129] These figures are estimated using ENCEL reports on treatment behaviour at baseline.

that this variable might be measuring mother's perception of illness rather than illness per se. We examine this illness using INSP data as well.

Table 6.5
Differentials in Proportion Sick by Explanatory Variables
Eligible Children

	ENCEL Wave 1 Sick		INSP Wave 2 Diarrhea		INSP Wave 2 Resp. infections	
Variable	**Mean (%)**	**SE.**	**Mean (%)**	**SE.**	**Mean (%)**	**SE.**
Individual characteristics						
Age (months)						
0-5	34.6	2.5	8.0	2.7	30.6	4.4
6-11	42.9	2.1	19.3	3.1	54.5	3.7
12-17	44.4	2.0	25.7	2.9	46.1	3.3
18-23	34.5	1.8	21.6	2.7	50.7	3.3
24-35	31.0	1.2	14.1	1.6	49.0	2.2
36-47	27.7	1.1	9.6	1.4	41.2	2.2
48-59	24.0	1.0	6.7	1.0	42.9	2.2
Sex						
Boy	32.1	0.7	13.5	1.0	43.3	1.5
Girl	28.8	0.7	13.0	1.0	44.4	1.5
Number of children <5						
1	33.5	1.8	14.7	1.8	45.1	2.5
2	33.4	1.0	13.3	1.2	44.6	1.7
3+	29.5	0.7	12.2	1.1	42.0	1.6
Household's characteristics						
Mother's education						
Without education	29.1	1.0	13.5	1.6	40.9	2.2
Incomplete primary	30.6	0.8	12.1	1.1	43.3	1.7
Complete primary	30.0	1.0	13.7	1.4	44.4	2.0
Secondary +	**36.0**	2.0	12.4	2.6	**52.2**	3.9
Mother's language						
Indigenous	28.6	0.8	**14.9**	1.3	40.5	1.7
Spanish	**31.8**	0.7	11.4	0.9	**45.1**	1.4
Household head's education						
Without education	29.9	1.1	12.7	1.6	42.5	2.3
Incomplete primary	30.2	0.8	12.4	1.1	46.3	1.6
Complete primary	30.4	1.0	15.1	1.5	43.7	2.1
Secondary +	**33.7**	1.8	11.5	2.2	**49.1**	3.4
Quartiles of expenditure per adult equivalent						
First quartile	24.3	1.0	12.2	1.5	42.0	2.3
Second quartile	29.7	0.9	11.5	1.3	43.2	2.0
Third quartile	32.4	1.0	14.0	1.4	43.4	2.1
Fourth quartile	**37.2**	1.3	**15.8**	2.0	**46.1**	2.6
Community characteristics						
Marginalty index						
High	31.9	1.0	12.3	1.5	42.9	2.1
Very high	29.9	0.6	15.0	0.8	44.1	1.2
Distance to health centre						
<1 km.	30.0	0.8	15.4	2.4	33.0	3.1
1-4 km.	30.4	1.0	13.7	0.9	45.4	1.3
>=5 km.	26.7	1.1	13.4	1.5	49.6	2.2
Regions						
Montaña (Guerrero)	37.2	1.5	17.1	2.0	49.0	2.7
Sierra Negra-Zongolica-Mazateca	27.1	1.2	17.7	2.4	40.7	3.1
Sierra Norte-Otomí-Tepehua	27.5	0.8	11.8	1.4	54.8	2.1
Sierra Gorda	33.8	1.9	12.5	1.0	41.0	1.5
Altiplano y Huasteca (SLP)	37.6	5.1	18.6	4.0	34.0	4.8
Number of observations	***7,941***		***2,606***		***2,606***	

Outcome variables

The main outcome variables of interest are the *incidence of diarrhoeal diseases* and the *incidence of respiratory infections*. Both are binary variables, taking a value of one if a child is ill and zero otherwise. These outcome variables are examined using mother's reports of the illnesses that took place during the two weeks prior to the survey. The occurrence of diarrhoea is determined by mother's response on whether the child experienced any episode of "diarrhoea" over the reference period (see Appendix 6). No specific symptoms were asked. If the respondent did not understand the term "diarrhoea", the interviewer explained it meant "having frequent runny stools during one day". In contrast, to identify the occurrence of respiratory infections mothers were asked whether the following symptoms occurred over the specified period: cold, cough, angina bronchitis or pneumonia.

We also look at *duration of illness* using information from the INSP survey. Analysing the Programme's effect with respect to this outcome is of interest because it allows identification of whether the Programme contributes to reducing the severity of illness. We wanted to include this outcome variable in the multivariate framework; however an exploratory analysis showed that this variable is not exempt from the measurement errors observed with incidence. Moreover, the number of longitudinal cases with information on duration of illness is relatively small since this data was only collected for those cases reported as ill. Hence, we only look at this outcome at the descriptive level.

Additionally, we examine whether Progresa is associated with changes in *treatment behaviour*. The Programme's conditioned cash transfers on visits to the health centre and on attendance to the educational sessions should produce positive changes in health related practices. We analyse this aspect with three questions included in the ENCEL survey: 1) the kind of treatment mothers provide when the child is ill, 2) the person or institution which they seek advice from when the child is ill and 3) the reason for not seeking advice when the child is ill. These questions were only asked at three rounds of data collection: waves one, two and six. Despite the fact that it is not possible to examine the trend at all points in time, we can assess the changes between the first and last waves of data collection.

Explanatory variables

In order to isolate the intervention effect from the possible effect of other background variables, we include a set of explanatory variables at the individual, household and community level. The independent variables selected were those that previous analyses[130] have shown to be significantly different between treatment and control groups. The latter include: mother's education, mother's language, access to water, distance to the health centre and region of residence. In addition, we control for two individual characteristics: age and sex of the child; and for variables at the locality level that could be associated with health outcomes: degree of marginality, region of residence, natural disasters (flood, frost and drought) and average wage of agricultural workers. The models also control for some risk factors associated with these diseases: number of children under the age of five (proxy for crowding), access to w.c (sanitation), and indoor air pollution.

Although Progresa's strategies aim to improve several risk factors associated with ARI (e.g. birthweight, nutrition, child care practices), there is an important factor that is not addressed by the Programme's activities: domestic air pollution. Studies of this subject have found a strong and significant increase in the incidence of acute lower respiratory infections among children living in households that are exposed to indoor cooking fires (Victora 1999; Smith et al. 2000). In our study, 80 percent of families live in dwellings without a gas stove and 60 percent of them live in one room dwellings. Hence, indoor smoke exposure for these children is high. To control for a possible influence of this risk factor, the models fitted for respiratory infections include two additional covariates: a dummy variable for dwellings without a gas stove, and a dummy variable for dwellings with one room only.

We only look at information on children classified as eligible to receive Programme benefits because the sample size of the ineligible group with repeated observations over time was relatively small (less than 100 cases per round). We carry out most analyses for two age categories children aged between 0 and 23 months, and children aged between 24 and 59 months because the incidence of infectious diseases varies according to age and thus the Programme's impact may differ with respect to this variable. Children are more susceptible to diarrhoeal diseases during weaning, a period when they have a greater exposure to environmental

[130] Consult Chapter 3 for a detailed explanation of the differences between treatment and control groups in the INSP data.

contaminants. On the other hand, respiratory infections are more frequent and serious among infants. We include those cases with missing information on athropometric indicators or with outlier values in these indicators, flagging them with a dummy variable.

6.5. Methodology

Descriptive analysis

We first looked at Progresa's impact on the outcomes of interest (prevalence and duration of illness, and treatment behaviour) by examining the cross-sectional data for eligible children receiving and not receiving Programme benefits. In order to assess differences between groups, we estimate a test of equality of proportions between treatment and control groups at the different waves of data collection. We do not estimate Progresa's effect by computing a difference-in-difference estimator because we do not have information on morbidity rates at baseline. However, we compute rough estimates of the Programme's impact by comparing changes over time between treatment and control groups. This procedure will be explained in more detail in the next section.

Multivariate models

The multivariate models in this chapter are estimated using those cases with repeated observations over time. We estimated all models for the sample of children with observations in waves two and three (because these are the rounds when data on morbidity was gathered), and also for the sample of children with observations in all three waves of data collection. For the former sample, we disaggregated results by the two age groups under consideration (children 0-23 months and children 24-59 months) since it is likely that the intervention has a different effect according to age. In order to group them into these categories, the age of the child was set as the age they had at wave two (see Table 6.6).

Table 6.6
Age at Wave 2 by Type of Sample
INSP sample

Age at Wave 2 (months)	Children in Wave 2	Children in Waves 2 & 3	Children in Waves 1, 2 & 3
0-11	371	183	-
12-23	513	249	133
24-35	571	304	182
36-47	569	267	165
48-59	610	-	-
Total	*2,634*	*1,003*	*480*

Table 6.7 presents the age of children with complete observations over time. It can be seen that at wave two these children were aged between 12 and 47months[131]. Hence, when comparing results it is important to keep in mind that this group of children are between the two age categories under study (i.e. between children 0-23 months and children 24-59 months).

Table 6.7
Age across Time
INSP Longitudinal Sample with Information at Waves 1, 2 and 3

Age (months)	Wave 1	Wave 2	Wave 3
0-11	174	-	-
12-23	166	133	-
24-35	140	182	128
36-47	-	165	180
48-59	-	-	172
Total	*480*	*480*	*480*

Estimation methods

From previous analyses, we know that the treatment and control groups in the INSP sample were not perfectly randomised. Hence, we need a method that controls for the differences in observed and unobserved characteristics between groups. A fixed effects model removes any time-invariant, unobserved individual effect. However, it also removes time-invariant observed effects. Since our outcome variable is binary, this longitudinal technique does not provide estimates for those

[131] The number of members in each cohort varies slightly across waves because the surveys were not collected at exactly the same months of the year.

cases whose outcome variable remains constant across waves (in this analysis, those cases who were ill or who were healthy at both surveys). By using a fixed-effects approach, we would have lost an important number of observations and would have ignored the information from those children with fixed outcomes over time. Thus, we decided to use an alternative method for repeated binary data that would allow us to estimate the changes over time including those individuals whose outcome variable remains unchanged.

We used a longitudinal discrete method that adjusts for the fact that some observations belong to the same individual. This model initially assumes that all observations are independent from each other, but by specifying that they are clustered within individuals it then adjusts the standard errors to account for repeated observations[132]. We use logits for our estimates of child illness because the outcome variable is binary. The software used for estimating our models allows controlling for a single cluster or hierarchical level. Thus, it is not possible to adjust the standard errors for the correlation between observations of children living in the same household or of children living in the same locality. To control for household effects we fitted all models including only one child per family[133]. Yet, we did not find differences that would alter our results; therefore we present here results for the sample with more than one child per household. As for community clustering it is likely that there is some correlation among individuals within the same community, however we expect this intracommunity effect to be smaller than the intrafamily one. Therefore, the fact that we are not able to control for the former type of clustering should not represent an important drawback in our findings.

The purpose of this chapter is to estimate Progresa's effect on reducing morbidity rates of infectious diseases. Specifically, we want to answer whether Progresa had a positive effect on reducing the chances of catching diarrhoea and respiratory infections, on whether this effect was stronger among children who received nutritional supplements, and whether the Programme had greater effects among certain groups of the population.

[132] Stata uses the Huber/White sandwich estimator to adjust the standard errors for the fact that some observations belong to the same individual.
[133] In these models, we selected one child per household at random.

For the first objective, we specify model (1). This model estimates Progresa's effect on (M_{it}) child's morbidity status (probability of being ill with diarrhoea or with ARI) using a dummy variable for living in a treatment locality (P_{it}), a dummy for wave of data collection (W_{it}), and an interaction term that provides estimates for the effect of living in a treatment locality by wave of data collection ($P_{it}.W_{it}$). Additionally, we include a set of variables X_{it} at the individual, household, and community level to control for differences in the outcomes that are not associated with Progresa's intervention.

$$\log(M_{it}) = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 P_{it}.W_{it} + \sum_j \delta_j X_{it} + e_{it} \tag{1}$$

where i=1, 2,..,n (individuals), t=2, 3 (waves of data collection for INSP) and M_{it} is the odds ratio $p_{it}/(1- p_{it})$, where p_{it} is the probability that the child is ill with diarrhoea or some respiratory infection.

In a second model we include three additional terms to evaluate whether children receiving nutritional supplements had better outcomes than those who did not receive this benefit. For ethical reasons, health centres provided supplements to malnourished children irrespective of whether they belonged to a control or a treatment community. Therefore, children in both treatment and control localities could receive this in-kind benefit. We include this variable in our models because, if the supplement is consumed according to guidelines, it is expected to have a beneficial effect on children's morbidity rates. It is well accepted that the severity and duration of an infection depends, among other things, on children's prior nutritional status and the diet consumed during the recovery period (Scrimshaw 2003). We therefore examine whether there is a supplement effect and investigate whether it has a cumulative effect over time. Model (2) includes a term for estimating the main effect of receiving supplements (S_{it}), the conjoint effect of receiving supplements and living in a treatment locality ($P_{it}.S_{it}$), and the conjoint effect of receiving supplements and wave of data collection ($S_{it}.W_{it}$).

$$\log(M_{it}) = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 S_{it} + \beta_4 P_{it}.W_{it} + \beta_5 P_{it}.S_{it} + \beta_6 S_{it}.W_{it} + \sum_j \delta_j X_{it} + e_{it} \tag{2}$$

Furthermore, to control for the fact that we do not have a baseline measure we estimate the previous models controlling for children's anthropometric status (height for age[134]) at time t-1. Models (3) and (4) are carried out only for the longitudinal sample with three observations over time since it is the only one that includes information on nutritional status at baseline.

$$\log(M_{it}) = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 P_{it}.W_{it} + \beta_4 N_{it-1} + \sum_j \delta_j X_{it} + e_{it} \quad (3)$$

$$\log(M_{it}) = \beta_1 P_{it} + \beta_2 W_{it} + \beta_3 S_{it} + \beta_4 P_{it}.W_{it} + \beta_5 P_{it}.S_{it} + \beta_6 N_{it-1} + \sum_j \delta_j X_{it} + e_{it} \quad (4)$$

To assess whether Progresa had a greater effect among specific groups we estimated a model with interactions of living in a Progresa locality and a group of household and community characteristics linked with lack of resources (parental education, mother's language, distance to the health centre and region). It is possible that children from the most deprived families are able to benefit more from this intervention because the Programme's benefits may substitute for their lack of resources. But, on the other hand, it is also possible that children with parents with greater capabilities (e.g. education) are able to benefit more because they can make better use of the Programme's benefits. We tested the inclusion of other household characteristics linked with this policy intervention (e.g. number of children within the household), but in the final model we include a reduced number of covariates to have a more parsimonious model. The selection of these variables was based on a step-wise regression that indicated which covariates had a greater association with the outcome variables under study.

$$\log(M_{it}) = \beta_1 P_{it} + \beta_2 W_{it} + \sum_j \delta_j P_{it}.X_{it} + e_{it} \quad (5)$$

Finally, to investigate whether the Programme had a differential effect on child morbidity according to the household's degree of poverty, we estimated model (1) for three different categories of poverty (terciles of Progresa's poverty index). This approach allows us to examine whether Progresa has a greater influence among children from the most disadvantaged (or advantage) groups. As part of this

[134] We include height-for-age because, as we will observe in the following chapter, at baseline this health outcome showed variations between treatment and control groups.

analysis, we fitted model (1) with an interaction term between the dummies for the terciles of our poverty index and Progresa's treatment variable.

6.6. Results

Our results are presented in three subsections. We first examine the impact of Progresa on the incidence of diarrhoea and respiratory infections. This assessment is done using a descriptive analysis and the set of logistic regression models described above. Next, we look at the changes over time with respect to duration of illness. Finally, we explore whether the Programme is associated with possible improvements in treatment behaviour.

Descriptive results

Table 6.8 shows estimates of the prevalence of diarrhoea and respiratory infections for both treatment and control groups at waves two and three of the INSP survey. Estimates are given for children in all age groups (0 to 59 months), as well as for children aged between 0 and 23 months and for children aged between 24 and 59 months. This descriptive analysis corresponds to children in the cross-sectional sample, i.e. children with at least one observation over time.

The first thing to notice from these figures is that in these rural localities a considerable proportion of children were reported to be ill in the past two weeks: 13.2 percent were reported as having been ill with diarrhoea and 43.5 percent as having been ill with some kind of respiratory infection. Furthermore, though not shown here, 47.7 percent of children under the age of five were reported as having been ill from at least one of these diseases[135] (see Table 6.4). The fact that almost half of eligible children in these rural localities were reported as sick suggests high levels of morbidity.

Figure 6.1 shows the prevalence of diarrhoea and ARI by children's age. It can be seen that at the youngest age groups (0-5 months) prevalence rates were high (9.3 and 31.2 percent, correspondingly), but substantially lower than at older ages. The proportion of children with diarrhoea reaches its peak at around 12 to 17 months and from this age onwards prevalence rates decline. The prevalence peak coincides with the typical weaning period, i.e. when the infant is introduced to food products

[135] ENCEL estimates for overall illness are lower than those obtained using the INSP data. Reports from the former indicate that around 30 percent of all children were ill in the past month. Even with this lower estimate, the proportion of ill children is considerable.

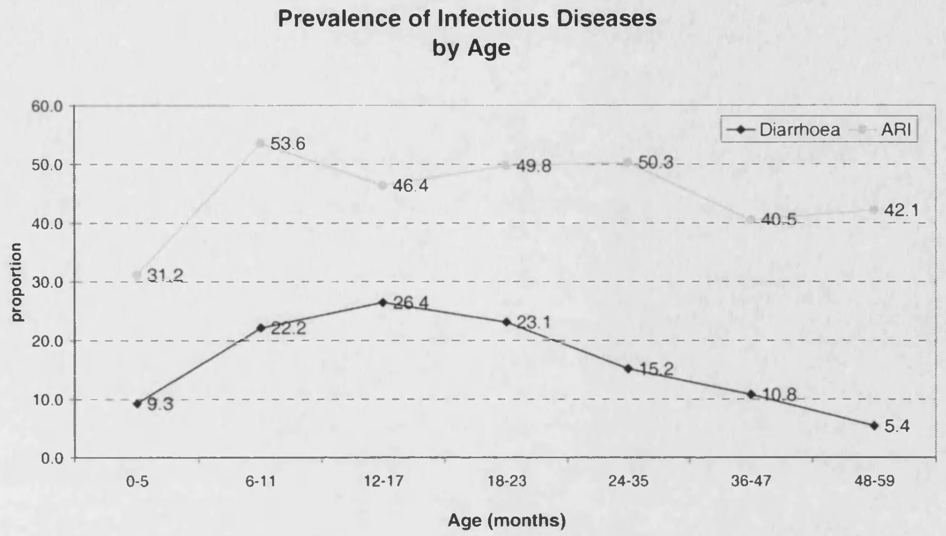
other than the mother's milk. This pattern is similar to that observed in other countries (Ryland and Raggers 1998). In contrast, prevalence rates for ARI show a different relationship with age. The percentage of children ill reaches its peak between 6 and 11 months. After the first year of age it shows a slight decline, but with some fluctuations. Other studies point out that ARI is more frequent and serious among children less than one year old, but afterwards it decreases moderately as the age of the child increases (Ryland and Raggers 1998).

Table 6.8
Prevalence of Diarrhoea and Respiratory Infections
Eligible Children in Treatment and Control Groups
INSP Cross-sectional sample

	Proportion Sick with Diarrhoea			Diff. in proportions ($P>\|t\|^2$)	Proportion Sick with Respiratory Infections			Diff. in proportions ($P>\|t\|^2$)
	Wave 1	Wave 2	Wave 3	(w2 vs w3)	Wave 1	Wave 2	Wave 3	(w2 vs w3)
All children	-	*13.2*	*12.7*	0.57	-	*43.5*	*43.5*	*0.97*
Control	-	16.4	13.5	0.05 *	-	45.7	42.8	0.17
Treatment	-	11.2	12.1	0.41	-	42.1	44.0	0.28
$P>\|t\|^1$	-	0.00 ***	0.28		-	0.07 *	0.54	
Children 0-23 mths.		*19.6*	*17.7*	0.28		*44.7*	*43.6*	*0.65*
Control	-	23.9	17.9	0.04 **	-	45.9	42.3	0.32
Treatment	-	16.8	17.5	0.76	-	43.9	44.7	0.79
$P>\|t\|^1$	-	0.01 ***	0.86		-	0.57	0.45	
Children 24-59 mths.		*10.0*	*10.1*	0.94		*42.9*	*43.4*	*0.61*
Control	-	12.6	11.2	0.37	-	45.6	43.1	0.33
Treatment	-	8.3	9.3	0.45	-	41.2	43.6	0.27
$P>\|t\|^1$	-	0.00 ***	0.18		-	0.07 *	0.84	

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
1.Test equality on proportions (Control vs Treatment)
2.Test equality on proportions (Wave 2 vs Wave 3)

Figure 6.1

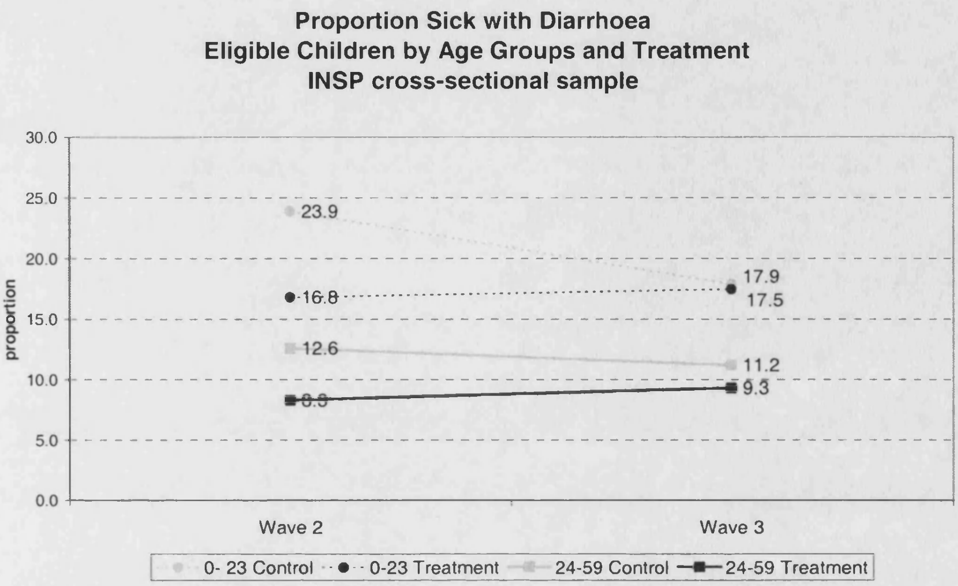

Prevalence of Infectious Diseases
by Age
Diarrhoea
ARI
proportion
60.0
50.0
40.0
30.0
20.0
10.0
0.0
53.6
46.4
49.8
50.3
40.5
42.1
31.2
9.3
22.2
26.4
23.1
15.2
10.8
5.4
0-5
6-11
12-17
18-23
24-35
36-47
48-59
Age (months)

Diarrhoea

The first part of Table 6.8 shows that at wave two, a bit more than a year after Programme's implementation, there is a significant difference in the proportion of children ill with diarrhoea between treatment and control groups. While in localities receiving Progresa's benefits the prevalence of diarrhoea is 11.2 percent, the corresponding prevalence in control communities is 16.4 percent. Moreover, this lower prevalence among children living in treatment localities is statistically significant among children of both age groups. At wave three, however, as Figure 6.2 illustrates, differences between treatment and control groups are no longer significant. It is worth recalling that between waves two and three some control localities were incorporated into the Programme. Hence, not observing differences between groups could indicate that children in control localities who started receiving benefits achieve a catch-up with their treatment peers. If we look at changes in prevalence over time, the proportion of sick children in control localities decreases between waves two and three and this improvement is statistically significant. In contrast, the proportion of children sick with diarrhoea in treatment localities remains relatively constant over time. These preliminary results suggest a positive Programme effect on reducing the incidence of diarrhoea, with a stronger effect at the initial stage of the intervention.

It is difficult to quantify Progresa's impact with these data not only because we lack a baseline measure, but also because differences in background characteristics between treatment groups could introduce an additional bias. We do not estimate the Programme's effect by computing a difference-in-difference estimator because we do not have information on morbidity rates at baseline. Nonetheless, if we assume that at baseline all children had similar morbidity rates as well as similar household characteristics, then the Programme's effect can be roughly estimated from the difference between groups at wave two or by the control group's change between waves two and three. The former approach suggests a Programme effect on the prevalence of diarrhoea of 5.2 percentage points (or 31.9 percent lower than at baseline) for children under the age of five. Disaggregating by age group, these rough estimates represent a reduction of 7.1 percentage points (or 29.8 percent lower than at baseline) for children aged between 0 and 23 months and of 4.3 percentage points (or 34.1 percent lower than at baseline) for children between 24 and 59 months old. These are crude estimates, but if anything, they may underestimate Progresa's effect because the treatment group at baseline was in general worse-off than the control group.

Figure 6.2



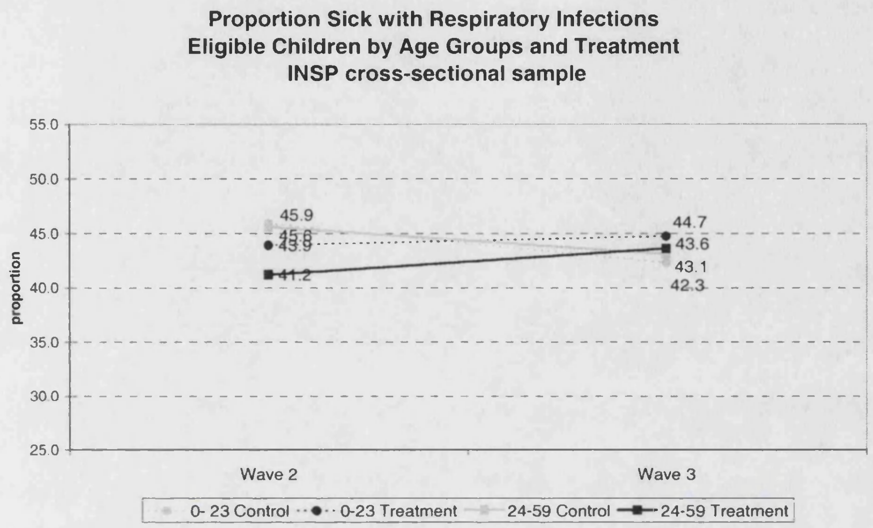
Respiratory infections

The second part of Table 6.8 shows that at wave two, the proportion of children sick with respiratory infections is somewhat smaller in treatment localities than in control communities, 42.1 percent versus 45.7 percent, respectively. The magnitude of this difference as well as the p-value for the equality of proportions (p< 0.07) suggest a positive Programme effect, but not as strong as that observed for diarrhoea. Similarly, at wave three the difference between groups is no longer evident. As for changes over time, the p-values do not indicate that the variations observed are significantly different.

The values in Figure 6.3 illustrate that differences in the prevalence of ARI between age groups and between treatment groups are rather small. What is more, results by age group indicate a positive Programme effect only at wave two and only among children in the older age category (p-values significant at the 0.07 level). Regarding changes over time, there is no evidence of differences in morbidity rates between waves two and three.

Following the same procedure as that for diarrhoea, from the difference between treatment groups at wave two, we calculate rough estimates of the Programme's effect. These calculations indicate a reduction in the prevalence of ARI of 3.6 percentage points (or 7.8 percent lower) for children between 0 and 59 months old and of 4.4 percentage points (or 9.6 percent lower) for children between 24 and 59 months old. We do not present an estimate for children in the younger age group since there is no evidence of a Programme effect for this age group.

Figure 6.3



These descriptive results provide a first insight into changes over time. However, as mentioned above, it is necessary to control for factors that could be introducing important bias in these estimations. From previous analyses, we know that the INSP sample is not fully randomised group. Therefore, it is necessary to control for differences between groups using a multivariate model.

Multivariate analysis

Tables 6.9 to 6.15 present the results obtained from the different models specified for assessing Progresa's effect on diarrhoea and ARI. These tables include odd ratios, robust standard errors and the level of significance of each parameter. For ease of interpretation, we present odds ratios (the exponentiated parameters) instead of the coefficients obtained using the logit scale. In this study, the odds ratios represent the change in odds of being ill in relation to those of children in the reference category.

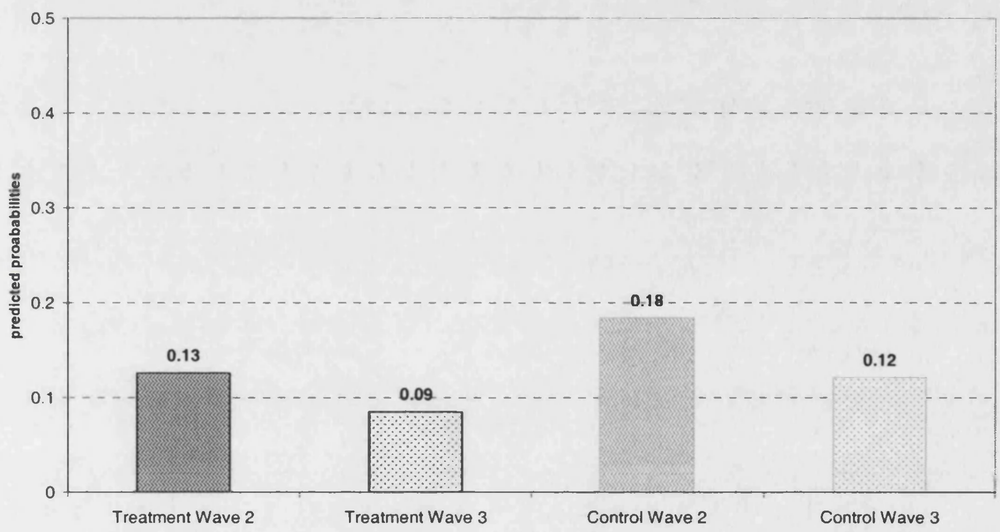
In model (1), the Programme's impact ($\beta_1 P_{it}$) is estimated from the comparison with the group not receiving benefits at wave two and indicates the extent to which morbidity levels are better than they might be in the absence of Progresa. The reference group represents the situation of the control group at wave two, which would be the one prevailing without intervention. Model (2) includes interaction terms to assess the impact of supplement "intake" on this health outcome. In this model the interpretation of parameters is more elaborate: the parameter for Progresa ($\beta_1 P_{it}$) shows the influence of living in a treatment locality at wave two; the parameter for supplement ($\beta_3 S_{it}$) describes the impact of receiving this in-kind benefit at wave two (recall some non-beneficiary children received the supplement); and the interaction term ($\beta_5 P_{it}.S_{it}$) indicates the additional effect of receiving supplements and living in a treatment locality at wave two.

Diarrhoea

In Table 6.9, the parameter estimates for model (1) suggest that at wave two the odds of being ill with diarrhoea among beneficiary children are 0.68 times (95% C.I. = 0.48, 1.00) or 32 percent lower those of children in the control group (with a significance level of 0.04). Regarding changes over time, the parameter estimates for wave three indicate that the odds of being ill among children in control localities are 0.64 times (95% C.I. = 0.44, 0.92) or 36 percent lower at wave three compared with their experiences at wave two (with a p-value of 0.02). This result suggests that, once children living in control communities were incorporated into the Programme, their morbidity risks decreased at a somewhat similar rate than those of the treatment group during the first year of intervention. Moreover, the interaction term of Progresa and wave three, which can be interpreted as the difference between treatment and control groups at wave three, shows no significant differences between groups. Hence, control children seem to catch-up once they start receiving benefits. On the other hand, the value of Progresa at wave three is estimated by combining the main effect of living in a Progresa locality (P_{it}) and wave of data collection (W_{it}) with the effect of their conjoint term ($P_{it}.W_{it}$). This estimate suggests that at wave three children in the treatment group had lower morbidity levels (odds 0.45:1) than those experienced at wave two (odds 0.68:1), and lower levels than the control group at wave three (odds 0.64:1). Furthermore, the joint significance of these parameters suggests that the treatment effect at wave three is significantly different (at the 3 percent level) from that already observed at wave two.

Figure 6.4 presents the predicted probabilities of model (1). It should be noted that these figures correspond to the probabilities for diarrhoea of an 'average' child given that the value of other covariates corresponds to that of the reference category. Since we have set the most advantaged group as the reference category, these conditional predicted probabilities refer to the 'average' child in the most favourable group (of each treatment category by wave of data collection). At wave two, the probability of being ill with diarrhoea among beneficiary children is of 13 percent and that of non-beneficiary children is of 18 percent. The difference between groups suggests a positive Programme effect. One year later, we observe that the probabilities decrease for both treatment groups, but they do so at a steeper rate among children in the control group. At wave three, the probability of being ill with diarrhoea is 9 percent among beneficiary children and 12 percent among non-beneficiaries.

Figure 6.4 Predicted Probabilities for Diarrhoea, Longitudinal sample with two observations. Children 0-59 months



Note: The predicted probabilities correspond to the probabilities for diarrhoea of an 'average' child given that the value of other covariates correspond to that of the reference category.

Table 6.9
Estimates of Progresa's Effect on Diarrhoea
Longitudinal Sample with Observations in Waves 2 and 3

	Children 0-47 months										*Children 0-23 months*					*Children 24-47 months*				
	Model 1					**Model 2**					**Model 1**					**Model 1**				
	Odd Ratios	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**	
Progresa's benefits																				
Progresa	0.68	-2.1	**	0.48	1.00	0.55	-2.4	**	0.35	0.93	0.88	-0.5		0.51	1.69	0.53	-2.5	**	0.32	0.90
	(0.13)					(0.14)					(0.26)					(0.14)				
Supplement						0.77	-0.7		0.40	1.61										
						(0.27)														
Progresa* Supplements						1.70	1.4		0.74	3.44										
						(0.67)														
Wave																				
Wave 3	0.64	-2.4	**	0.44	0.92	0.61	-1.9	*	0.36	1.00	0.76	-0.9		0.41	1.44	0.52	-2.5	**	0.31	0.87
	(0.12)					(0.16)					(0.24)					(0.14)				
Progresa*Wave																				
Progresa*Wave 3	1.02	0.1		0.61	1.71	0.81	-0.6		0.41	1.69	0.66	-0.1		0.30	1.42	1.52	1.1		0.72	3.08
	(0.27)					(0.29)					(0.26)					(0.57)				
Supplement*Wave																				
Supplement*Wave 3						1.35	0.8		0.61	2.82										
						(0.53)														
Controls:																				
Individual Characteristics	√					√					√					√				
Household Characteristics	√					√					√					√				
Community Characteristics	√					√					√					√				
Number of observations:	1,988					1,988					843					1,145				
Wald chi2:	81.9					89.3					47.7					75.4				
Pseudo R-sq:	0.08					0.08					0.11					0.10				
Log pseudo-likelihood:	-681.6					-702.5					-326.3					-357.4				

Notes: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Results by age group show that the Programme effect is mainly due to a decrease in the morbidity risks of children in the older age category. Table 6.9 shows that the odds ratios corresponding to children under the age of two, though less than 1, are not statistically significant. Yet, the estimate for the treatment group at wave three (obtained from the combined effect of the different interaction terms) yields an odd ratio of 0.44:1, which is significantly different from the reference group (p value of 0.01[136]). Progresa's benefits –nutritional supplements and the monetary grant for food– are likely to have a larger impact on morbidity after the weaning period. Before this stage, breastfeeding protects children from exposure to infections from food products and other environmental factors. At wave three, these children are aged between 12 and 35 months; hence, most of them have already been weaned. These results suggest that the impact of Progresa on this outcome takes place once children have passed this crucial stage.

Regarding children aged between 24 and 47 months old, the exponentiated coefficients and corresponding p-values provide evidence of an important Programme effect. At wave two, children living in Progresa localities have odds of being ill with diarrhoea of 0.53:1 (95% C.I.= 0.32:1 – 0.90:1). At wave three, once control children receive benefits, their odds are of 0.52:1 (95% C.I.= 0.31:1 – 0.87:1). Additionally, at wave three, the treatment group presents smaller odds than those of the reference group (odds of 0.41:1), but this parameter is not significantly different from the odds at wave two or of the odds of the control group at wave three.

Results from model (2) indicate that there is no evidence of a supplement effect on the probability of being ill with diarrhoea. Neither the p-values for the main effect of supplement nor its interaction with living in a Progresa locality suggest that children receiving this in-kind benefit were better-off than those who did not receive it. In addition, the interaction between wave three and supplement ($\beta_6 S_{it}.W_{it}$) shows there is no additional effect of supplement intake at wave three. Hence, our results do not provide evidence of a positive impact on diarrhoea attributable to supplement intake. We estimated model (2) for both age groups under study and the parameter estimates were not significant either. Thus, we only present the findings for this model without disaggregating by age.

---

[136] The p-value for this odd ratio was obtained from replicating this model, but using dummy variables for all interaction terms.

Table 6.10 displays the findings obtained for the longitudinal sample with complete information (observations in waves one, two and three). Estimates from children in this sample also indicate a positive Programme effect; yet, the magnitude of the odds ratios and the statistical significance of these parameters suggest larger and stronger differences between groups. Results from model (1) indicate that, after one year of Programme implementation, the odds of being ill among children in the treatment group were 0.43 times (or 57 percent lower; with a 95% C.I.= 0.24:1 – 0.76:1).) those of children in the control group. Additionally, we observe a significant reduction on morbidity levels for the control group at wave three (odds of 0.38:1; 95% C.I.= 0.22:1 – 0.67:1). It can be seen that while at wave two there is a large difference in the odds of being ill between treatment and control groups; at wave three the odds are almost identical. The larger effect among children in this sample might be explained by the fact that our assessment takes place when the great majority had passed the weaning period, i.e. the peak stage of diarrhoea (recall they were aged between 12 and 47 months at wave two). Furthermore, some children in this sample were exposed to the intervention during infancy, which perhaps enhanced a protective effect.

To control for possible pre-programme differences between groups we estimate model (3) including a baseline health measure (height for age) as an additional covariate. The results from this model are quite similar to those obtained without including height for age as an explanatory variable. The odds ratios are slightly larger, suggesting smaller Programme effects once we control for this lagged health outcome. The latter suggests that our estimates could slightly overestimate the Programme's effect as a result of not having a baseline measure[137].

Models (2) and (4), which include controls for supplement intake, show a pattern similar to that of the sample with two observations over time. That is, the parameter estimates for supplement intake, and the conjoint effect of Progresa and supplement are not statistically significant, suggesting no evidence of a supplement effect.

[137] The magnitude of the odds ratio for height-for-age does not show a significant reduction of illness with increased values of this anthropometric indicator (odds of 0.84:1, significant at the 16 percent level).

Table 6.10
Estimates of Progresa's Effect on Diarrhoea
Longitudinal Sample with Observations in Waves 1, 2 and 3

	Children 12-47 months																			
	Model 1					Model 2					Model 3					Model 4				
	Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]	
Progresa's benefits																				
Progresa	0.43	-2.9	***	0.24	0.76	0.32	-2.9	***	0.14	0.67	0.48	-2.5	**	0.27	0.86	0.36	-2.5	**	0.17	0.80
	(0.13)					(0.12)					(0.14)					(0.15)				
Supplement						0.91	-0.2		0.33	2.38						1.12	0.2		0.44	2.88
						(0.42)										(0.54)				
Progresa* Supplements						1.63	0.9		0.56	5.55						1.36	0.6		0.45	4.13
						(0.91)										(0.77)				
Wave																				
Wave 3	0.38	-3.4	***	0.22	0.67	0.40	-2.7	***	0.22	0.84	0.46	-2.7	***	0.26	0.81	0.50	-1.9	*	0.24	1.02
	(0.11)					(0.12)					(0.13)					(0.18)				
Progresa*Wave																				
Progresa*Wave 3	2.22	2.0	**	1.02	4.78	2.05	1.5		0.77	5.43	1.69	1.3		0.77	3.74	1.82	1.2		0.70	4.75
	(0.89)					(1.00)					(0.68)					(0.89)				
Supplement*Wave																				
Supplement*Wave 3						0.99	0.0		0.30	2.88						0.78	-0.4		0.26	2.39
						(0.55)										(0.44)				
Controls:																				
Individual Characteristics	√					√					√					√				
Household Characteristics	√					√					√					√				
Community Characteristics	√					√					√					√				
HAZ_{t-1}	-					-					√					√				
Number of observations:	967					967					893					893				
Wald chi2:	69.5					70.7					57.4					71.2				
Pseudo R-sq:	0.11					0.12					0.13					0.12				
Log pseudo-likelihood:	-301.2					-300.6					-229.8					-282.9				

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Respiratory infections

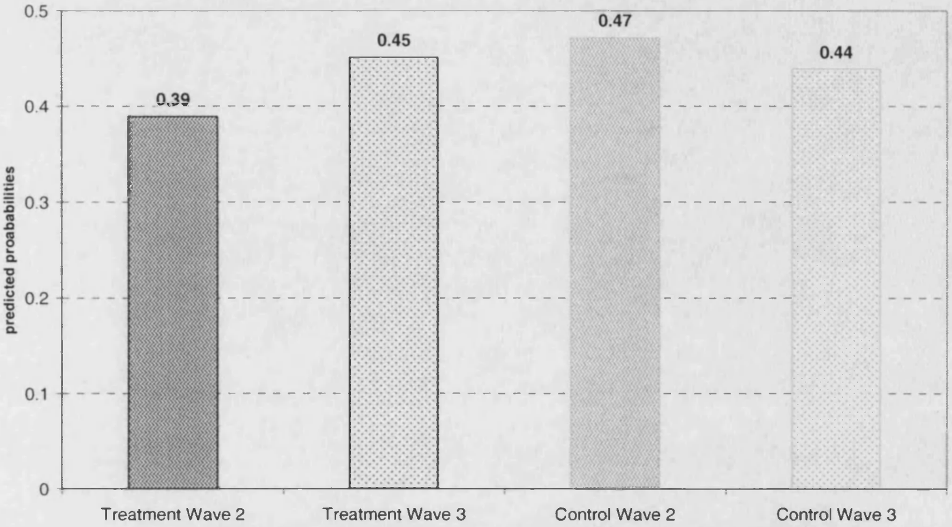
With respect to respiratory infections, we obtain two consistent results (see Tables 6.11 and 6.12). First, it is clear that, at wave two, children living in Progresa localities have reduced odds of illness compared with those in the control group (with odds ratios ranging between 0.83:1 and 0.50:1). Second, at wave three, beneficiary children have odds of being ill with ARI that are between 1.2 and 2.3 times higher than those observed at wave two, suggesting an increase in illness for children in the treatment group.

Estimates from model (1) show that the odds of being ill with a respiratory infection at wave two among beneficiary children are 0.7 times (or 30 percent lower; with a 95% C.I.= 0.54:1 – 0.93:1) those of their control counterparts, and this effect is significant at the 1 percent level. On the other hand, unlike diarrhoea, control children do not show significant reductions on ARI over time (as indicated by the parameter estimate of wave three). Moreover, as mentioned above, the interaction term of Progresa suggests an increase in morbidity risks at wave three for children in the treatment group. These trends are illustrated in Figure 6.5. After two years of intervention, the probability of being ill with respiratory infections among children in the treatment group was very similar to that observed in the absence of Progresa (as indicated by the probability among control children at wave two). These figures correspond to the conditional predicted probabilities for respiratory infections of an 'average' child given that the value of other covariates is that of the reference category.

Comparing by age groups, we notice that Progresa's effect on ARI morbidity is significant only among children in the older age category. At wave two, the estimates for beneficiary children aged between 24 and 47 months show that the odds of being ill with ARI are 38 percent lower (odds of 0.62:1; 95% C.I.= 0.46:1 – 0.89:1) than those of children in the control group (with a significance at the 0.01 level). In contrast, the odds for children in the younger age group, despite being less than one (odds of 0.83:1; 95% C.I.= 0.55:1 – 1.30:1), are not significantly different from those of the reference group. Hence, for this age group there is no evidence of a Programme effect.

Figure 6.5 Predicted Probabilities for Respiratory Infections

Longitudinal sample with two observations. Children 0-59 months



Note: The predicted probabilities correspond to the probabilities for respiratory infections of an 'average' child given that the value of other covariates correspond to that of the reference category.

The parameter estimates for the sample with complete information show results that are consistent with those of the sample with two observations in time. At wave two there are substantial and statistically significant differences in the odds of illness between beneficiary and non-beneficiary children (odds 0.55:1; 95% C.I.= 0.37:1 – 0.83:1); the control group has no significant changes over time; and beneficiary children have higher odds of illness at wave three than those observed at wave two. In addition, results from models (1) and (2) remain fairly constant after controlling for height for age.

Table 6.11
Estimates of Progresa's Effect on Respiratory Infections
Longitudinal Sample with Observations in Waves 2 and 3

	Children 0-47 months										*Children 0-23 months*					*Children 24-47 months*				
	Model 1					**Model 2**					**Model 1**					**Model 1**				
	Odd Ratios	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**	
Progresa's benefits																				
Progresa	0.70	-2.7	***	0.54	0.93	0.62	-2.8	***	0.46	0.89	0.83	-0.9		0.55	1.30	0.62	-2.7	***	0.43	0.88
	(0.09)					(0.10)					(0.17)					(0.11)				
Supplement						0.68	-1.6		1.05	2.63										
						(0.17)														
Progresa* Supplements						1.66	2.2	**	0.75	1.57										
						(0.39)														
Wave																				
Wave 3	0.89	-0.8		0.66	1.16	1.10	0.5		0.71	1.88	1.08	0.4		0.65	1.63	0.77	-1.4		0.53	1.11
	(0.13)					(0.21)					(0.25)					(0.14)				
Progresa*Wave																				
Progresa*Wave 3	1.46	2.1	**	1.02	2.11	1.17	0.6		0.40	1.08	1.18	0.6		0.65	2.06	1.74	2.3	**	1.07	2.80
	(0.27)					(0.29)					(0.34)					(0.43)				
Supplement*Wave																				
Supplement*Wave 3						1.00	0.0		0.62	1.62										
						(0.24)														
Controls:																				
Individual Characteristics	√					√					√					√				
Household Characteristics	√					√					√					√				
Community Characteristics	√					√					√					√				
Number of observations:	2,006					2,006					852					1,154				
Wald chi2:	90.6					97.9					45.0					77.0				
Pseudo R-sq:	0.03					0.04					0.03					0.05				
Log pseudo-likelihood:	-1324.5					-1324.4					-565.5					-748.5				

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Table 6.12
Estimates of Progresa's Effect on Respiratory Infections
Longitudinal Sample with Observations in Waves 1, 2 and 3

	Children 12-47 months																			
	Model 1					**Model 2**					**Model 3**					**Model 4**				
	Odd Ratios	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**		**Odd Ratios**	**z**	**P>|z|**	**[95% C.I.]**	
Progresa's benefits																				
Progresa	0.55	-3.0	***	0.37	0.83	0.57	-2.1	**	0.33	0.95	0.50	-3.3	***	0.34	0.78	0.56	-2.1	**	0.32	0.97
	(0.11)					(0.15)					(0.11)					(0.16)				
Supplement						0.45	-2.2	**	0.21	0.92						0.45	-2.0	**	0.21	0.96
						(0.17)										(0.18)				
Progresa* Supplements						1.89	1.9	*	1.01	3.84						1.71	1.5		0.88	3.60
						(0.64)										(0.61)				
Wave																				
Wave 3	0.72	-1.7	*	0.46	1.03	0.77	-1.0		0.46	1.26	0.71	-1.6		0.44	1.02	0.73	-1.2		0.41	1.20
	(0.14)					(0.20)					(0.15)					(0.20)				
Progresa*Wave																				
Progresa*Wave 3	2.10	2.8	***	1.29	3.66	1.29	0.7		0.66	2.69	2.29	3.0	***	1.38	4.12	1.45	1.0		0.72	3.02
	(0.55)					(0.46)					(0.63)					(0.53)				
Supplement*Wave																				
Supplement*Wave 3						1.75	1.6		0.85	3.40						1.81	1.7	*	0.89	3.64
						(0.62)										(0.65)				
Controls:																				
Individual Characteristics	√					√					√					√				
Household Characteristics	√					√					√					√				
Community Characteristics	√					√					√					√				
HAZ_{t-1}	-					-					√					√				
Number of observations:	974					974					900					664				
Wald chi2:	50.3					55.6					49.4					66.9				
Pseudo R-sq:	0.06					0.06					0.06					0.06				
Log pseudo-likelihood:	-643.3					-640.5					-593.2					-461.5				

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Regarding the impact of supplement "intake" on ARI, models (2) and (4) provide some evidence of a positive effect. The odds ratio for the main effect of supplement is less than one in all models; but, its p-value is significant only among the sample with complete information. Among the latter, those living in a control locality but receiving supplements[138] had odds of illness of 0.45:1 to those of the reference group. The p-value for the interaction effect of Progresa and supplement suggests that this joint effect is significant, suggesting an additional effect of receiving supplements and living in a Progresa locality. The combined effect of the interaction terms indicates that children living in a Progresa locality and receiving supplement had odds of being ill that were 0.48 those of children not receiving supplements and living in a control area. It is not clear why the supplement shows a positive effect on ARI but does not show any effect on diarrhoea. Research from animal and human studies has demonstrated that the prevalence and severity of infections worsens with nutritional deficiencies (Scrimshaw 2003). If the supplement improves children's nutritional status (which in the following chapter we will observe was limited), then it should have a positive effect on both kinds of diseases.

It is worth mentioning that these models included two covariates to control for the risk associated with indoor air pollution: dwellings without a gas stove and dwellings with one room only. However, in all the fitted models for ARI, the odds ratios for these covariates were close to one and were not statistically significant. Thus, they do not contribute to explaining the probability of illness in our study.

Interactions with household characteristics

In order to analyse whether Progresa contributes to reducing morbidity gaps between groups, we estimated a model with interactions between living in a Progresa locality and a set of background characteristics. We explored the inclusion of interactions with different household and community characteristics, but included only a few of them to avoid multicollinearity problems. The explanatory variables specified in our final model include mother's language, father's education, distance to the health centre and region of residence.

We do not find evidence of significant interactions between household or community characteristics and Progresa, except for distance to the health centre

[138] Recall that for ethical reasons, health centres provided supplements to malnourished children irrespective to whether they belonged to a control or a treatment community.

and region of residence (see Table 6.13). It seems that beneficiary children living nearer to the health centre (1 to 4 km.) have reduced chances of being ill with diarrhoea than their control peers living at the same distance from the health unit. The latter suggests that children who live within a walking distance from the health centre are more likely to benefit from this intervention than children living further away. It is possible that children living nearer to the health centre are more likely to receive treatment when ill. It is also possible that distance to the health centre is a proxy for the degree of isolation of this locality. More isolated communities tend to have restricted access to basic services and food products, which increases the likelihood and perhaps the severity of these diseases. On the other hand, the corresponding odds of the interaction between distance to the health centre and Progresa on ARI are less than one, but not statistically significant.

Regarding region of residence, our estimates suggest that beneficiary children living in the Altiplano and Huasteca region have reduced chances of being ill with respiratory infections than their control counterparts. We observe a similar trend for diarrhoea but in this case the impact is not statistically significant. The Altiplano and Huasteca regions are situated at a lower altitude than the other regions under study (*Sierra Gorda* (reference group) and the *Montaña-Sierra Negra-Sierra Norte* group). Hence, it might be more difficult to reduce the prevalence of ARI in regions where the climatic conditions (humidity and low temperature) may trigger the risk factors (crowding and exposure to indoor pollutants) associated with this illness.

Table 6.13
Estimates of Progresa's Effect on Morbidity with Interactions
Longitudinal Sample with Observations in Waves 2 and 3
Children 0-47 months

	Diarrhoea						Respiratory Infections					
	Odd Ratios	Robust Std. Err.	P>|z|		[95% C.I.]		Odd Ratios	Robust Std. Err.	P>|z|		[95% C.I.]	
Benefits												
Progresa	0.74	0.42	0.6		0.25	2.23	0.89	0.36	0.8		0.40	1.97
Wave 3	0.62	0.08	0.0	***	0.44	0.77	0.97	0.10	0.8		0.92	1.34
Mother's language * Progresa												
Indigenous language	1.11	0.27	0.7		0.07	3.82	0.64	0.10	0.0	***	0.47	0.88
M.language (1)*Progresa	1.55	0.51	0.2		0.81	2.95	1.27	0.27	0.3		0.84	1.92
Household head's education * Progresa												
No education	0.64	0.20	0.2		0.35	1.17	0.69	0.14	0.1	*	0.47	1.03
Incomplete primary	0.61	0.15	0.0	**	0.37	0.99	0.90	0.15	0.5		0.65	1.24
Hhh ed (1)*Progresa	2.55	1.08	0.0	**	1.11	5.85	1.38	0.38	0.2		0.81	2.35
Hhh ed (2)*Progresa	1.57	0.56	0.2		0.79	3.14	0.99	0.21	1.0		0.64	1.51
Distance to health centre * Progresa												
1-4 km.	1.73	0.65	0.1		0.83	3.62	1.91	0.57	0.0	**	1.07	3.43
>= 5 km.	1.13	0.42	0.7		0.55	2.36	1.87	0.57	0.0	**	1.03	3.40
Distance (1)*Progresa	0.29	0.14	0.0	**	0.11	0.77	0.68	0.26	0.3		0.32	1.45
Distance (2)*Progresa	0.97	0.51	1.0		0.35	2.71	1.35	0.56	0.5		0.60	3.03
Region * Progresa												
Montaña -Sierra Negra -Sierra Norte	1.21	0.31	0.5		0.73	1.99	1.42	0.22	0.0	**	1.04	1.93
Altiplano y Huasteca (SLP)	3.11	1.34	0.0	***	1.33	7.24	1.33	0.51	0.5		0.63	2.82
Montaña -S.Negra -S.Norte *Progresa	1.35	0.45	0.4		0.70	2.61	1.14	0.23	0.5		0.76	1.70
Altiplano y Huasteca (SLP) *Progresa	0.57	0.36	0.4		0.17	1.96	0.26	0.14	0.0	**	0.09	0.76
Number of observations:	1,988						2,006					
Wald chi2:	69.6						78.4					
Pseudo R-sq:	0.05						0.03					
Log pseudo-likelihood:	-710.5						-1335.3					

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Reference categories: maternal language: Spanish; parental education: complete primary +; dist. health centre: 0 km.; region: Sierra Gorda.

To examine further a possible difference in Progresa's effect according to background characteristics, we estimated model (1) by households' severity of poverty (measured using Progresa's poverty index). We fitted these models for the sample with complete information and for the sample with only two observations over time and obtained consistent results. Tables 6.14 and 6.15 present our estimates for diarrhoea and respiratory infections, respectively. The first thing to note is that our findings differ depending on the outcome analysed. Whereas for diarrhoeal diseases the Programme has a significant positive effect among children in the most deprived households (first tercile); for respiratory infections the impact of the Programme is significant among children in the mid poverty category (second tercile). The odd results for ARI could reflect once again the fact that these data are more heavily influenced by mothers' perception of illness. On the other hand, results in Table 6.16 differ from the stratified analysis. It seems that, once we fit a model with an interaction term between poverty and Progresa's intervention, the differences by poverty level are minor. The only coefficient that remains somewhat significant (p value<0.10) is that for the first tercile of poverty for the probability of catching diarrhoea. In the case of this disease, the fact that children in the most deprived household are experiencing a greater impact is a positive result since these children are more likely to experience severe episodes. It is possible that the Programme has a greater impact among children in the poorest families because, as other interventions have shown, the benefits provided are serving as a substitute for the lack of resources of these families. For example, the information provided at the educational sessions might have greater improvements on the health care behaviours of mothers without formal education than on those of mothers who have more years of schooling. This translates into a larger influence on the outcomes of the most disadvantaged children.

Table 6.14
Estimates of Progresa's Effect on Diarrhoea by Terciles of Poverty

Longitudinal Sample with Observations in Waves 2 and 3

	First tercile				Second tercile				Third tercile			
	Odd Ratios	z	P>|z|	[95% C.I.]	Odd Ratios	z	P>|z|	[95% C.I.]	Odd Ratios	z	P>|z|	[95% C.I.]
Progresa's benefits												
Progresa	0.36	-2.5	**	0.17 0.83	0.84	-0.5		0.40 1.73	0.91	-0.3		0.47 1.85
	(0.15)				(0.31)				(0.13)			
Wave												
Wave 3	0.60	-1.5		0.31 1.26	1.02	0.1		0.49 2.18	0.56	-1.7	*	0.28 1.11
	(0.21)				(0.39)				(0.19)			
Progresa*Wave												
Progresa*Wave 3	1.61	0.9		0.53 4.55	0.55	-1.1		0.19 1.56	1.17	0.4		0.49 2.75
	(0.88)				(0.30)				(0.51)			
Controls:												
Individual Characteristics	√				√				√			
Household Characteristics	√				√				√			
Community Characteristics	√				√				√			
Number of observations:	567				571				690			
Wald chi2:	55.1				32.3				58.9			
Pseudo R-sq:	0.14				0.08				0.11			
Log pseudo-likelihood:	-179.8				-191.5				-240.6			

Longitudinal Sample with Observations in Waves 1, 2 and 3

	First tercile				Second tercile				Third tercile			
	Odd Ratios	z	P>|z|	[95% C.I.]	Odd Ratios	z	P>|z|	[95% C.I.]	Odd Ratios	z	P>|z|	[95% C.I.]
Progresa's benefits												
Progresa	0.23	-2.5	**	0.05 0.96	0.47	-1.1		0.13 1.73	0.51	-1.3		0.19 1.41
	(0.15)				(0.31)				(0.27)			
Wave												
Wave 3	0.29	-1.7	*	0.07 1.18	0.55	-1.1		0.19 1.59	0.51	-1.4		0.19 1.35
	(0.21)				(0.30)				(0.25)			
Progresa*Wave												
Progresa*Wave 3	5.40	1.5		0.63 46.2	1.57	0.6		0.32 7.70	1.41	0.5		0.41 4.19
	(5.92)				(1.27)				(0.90)			
Controls:												
Individual Characteristics	√				√				√			
Household Characteristics	√				√				√			
Community Characteristics	√				√				√			
Number of observations:	290				259				348			
Wald chi2:	85.3				.				64.0			
Pseudo R-sq:	0.37				0.18				0.20			
Log pseudo-likelihood:	-59.5				-71.4				-108.5			

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Table 6.15
Estimates of Progresa's Effect on Respiratory Infections by Terciles of Poverty

Longitudinal Sample with Observations in Waves 2 and 3

	First tercile					Second tercile					Third tercile				
	Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]	
Progresa's benefits															
Progresa	0.82	-0.7		0.48	1.44	0.44	-3.1	***	0.24	0.71	0.92	-0.4		0.54	1.38
	(0.23)					(0.12)					(0.22)				
Wave															
Wave 3	1.78	2.0	**	0.95	3.02	0.64	-1.7	*	0.38	1.07	0.78	-1.0		0.46	1.25
	(0.51)					(0.17)					(0.20)				
Progresa*Wave															
Progresa*Wave 3	0.72	-0.9		0.35	1.51	2.77	3.0	***	1.45	5.80	1.44	1.1		0.77	2.88
	(0.27)					(0.93)					(0.47)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
Number of observations:	567					600					700				
Wald chi2:	64.0					69.2					0.0				
Pseudo R-sq:	0.08					0.08					0.05				
Log pseudo-likelihood:	-355.9					-374.2					-455.9				

Longitudinal Sample with Observations in Waves 1, 2 and 3

	First tercile					Second tercile					Third tercile				
	Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]		Odd Ratios	z	P>|z|	[95% C.I.]	
Progresa's benefits															
Progresa	0.63	-1.2		0.29	1.36	0.44	-2.2	**	0.21	0.93	0.63	-1.4		0.32	1.23
	(0.25)					(0.17)					(0.22)				
Wave															
Wave 3	1.24	0.5		0.54	2.85	0.49	-1.8	*	0.22	1.08	0.70	-1.0		0.36	1.38
	(0.53)					(0.20)					(0.24)				
Progresa*Wave															
Progresa*Wave 3	1.11	0.2		0.39	3.18	3.59	2.4	**	1.29	9.98	2.17	1.6		0.86	5.47
	(0.60)					(1.87)					(1.02)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
Number of observations:	289					290					354				
Wald chi2:	47.9					39.9					.				
Pseudo R-sq:	0.14					0.09					0.08				
Log pseudo-likelihood:	-169.9					-179.5					-226.1				

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Robust standard errors in parenthesis.
All models include controls for individual, household and community characteristics.

Table 6.16
Estimates of Progresa's Effect on Child Morbidity using Interactions between Progresa and Terciles of Poverty
Longitudinal Sample with Observations in Waves 2 and 3

	Model 3 for Diarrhoea						Model 3 for Respiratory Infections					
	Coef.	Std. Err.	z	P>|z|	[95% C.I.]		Coef.	Std. Err.	z	P>|z|	[95% C.I.]	
Progresa * Poverty terciles												
Progresa* First tercile	0.48	0.19	-1.8	*	0.21	1.06	0.82	0.21	-0.8		0.50	1.34
Progresa* Second tercile	0.65	0.25	-1.1		0.31	1.38	0.77	0.19	-1.0		0.47	1.26
Progresa* Third tercile	0.92	0.25	-0.3		0.54	1.56	0.99	0.16	-0.1		0.72	1.36
Control* First tercile	1.39	0.41	1.1		0.78	2.46	1.27	0.25	1.2		0.86	1.86
Control* Second tercile	1.17	0.33	0.6		0.68	2.03	1.05	0.20	0.3		0.73	1.53
Control* Third tercile	(Reference)	-	-	-	-	-	(Reference)	-	-	-	-	-
<u>**Controls:**</u>												
Wave												
Household's characteristics												
Dwelling characteristics												
Community characteristics												
Number of observations:	1,829						1,829					
Wald chi2:	70.8						70.8					
Pseudo R-sq:	0.06						0.06					
Log pseudo-likelihood:	-644.0						-644.0					

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

6.6.2. Duration of illness

Table 6.17 presents estimates of duration of illness for both diarrhoea and ARI over time. We carry out this analysis for the cross-sectional sample. Although looking at the longitudinal sample would allow us to control for a possible bias from respondent's perception on duration of illness, the number of children ill for this sample is quite small (e.g. around 50 cases for diarrhoea) because this question was only asked when the child was reported as ill.

It is important to point out that these means are not adjusted for right censoring (cases still ill at the moment of interview). However, the latter should not introduce an important bias in our results because the proportion of children ill at interview from all children ill in the past two weeks remained fairly constant over time. For diarrhoea, the latter proportion changed from 25 to 24 percent, and for ARI it changed from 52 to 49 percent. The fact that these proportions do not present important variations suggests that any downward estimation on duration from not adjusting for censoring is taking place in both waves of data collection; hence, it should not alter our estimates of changes over time.

Figures in Table 6.17 show that at wave two the duration of illness among children under the age of five is very similar for beneficiary and non-beneficiary children, suggesting no impact of Progresa on this outcome variable. The duration of a diarrhoeal episode is on average 4 days and that of a respiratory infection is approximately 5 days. If the number of episodes per child per year is similar to that estimated by PAHO (around 3 episodes of diarrhoea per year and between 5 and 8 of ARI), our estimates of duration suggest that throughout the year these children are ill a considerable number of days (around 45 days[139]).

At wave three, we observe that the duration of both illnesses remains unchanged (as shown by the p-values for the difference in means between waves two and three) and once again, at this round, the duration of illness among beneficiary and non-beneficiary children is fairly similar. Thus, our results do not show that Progresa is associated with a reduction in the number of days ill.

[139] The number of days was calculated as follows: (3*4=12 days with diarrhoea) + (((5+8)/2)*5=32.5 days with ARI) =45.

Table 6.17
Duration of Illness
Eligible Children in Treatment and Control Groups
INSP Cross-sectional sample

	Mean number of days ill[1]			Diff. in means ($P>\|t\|^3$)
	Wave 1	**Wave 2**	**Wave 3**	**(w2 vs w3)**
Diarrhoea				
Control	-	4.6	4.1	0.46
Treatment	-	4.1	3.8	0.38
$P>\|t\|^2$		0.36	0.49	
Number of observations		346	373	
Respiratory infections				
Control	-	5.7	5.3	0.31
Treatment	-	5.5	5.3	0.42
$P>\|t\|^2$		0.71	0.95	
Number of observations		1,121	1,287	

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
1. Estimates of mean number of days are based on children who were reported as ill.
2. Test equality on proportions (Control vs Treatment)
3. Test equality on proportions (Wave 2 vs Wave 3)

6.6.3. Treatment behaviour

This subsection presents the results relating to changes in treatment behaviour when the child is ill. For this analysis, we use data from the ENCEL survey as this information was not collected by the INSP's questionnaire. Table 6.18 shows that at baseline a high proportion of mothers were already giving some kind of medicine or treatment provided at the health centre to the child when ill, approximately 70 percent. However, at wave six, two years after Progresa started operating, the proportion of children receiving medicine when ill increased to around 80 percent. In contrast, the use of home remedies to treat child illness decreased over time. The pattern is similar among treatment and control groups.

At baseline around 65 percent of ill children received a treatment recommended by professional health personnel (doctor or nurse). Among the beneficiary group, we notice that at wave two there was an increase in the proportion of children whose treatment was recommended by a doctor (from 64.7 percent at baseline to 72.4 percent). This is perhaps due to the Programme's guidelines on frequent visits to the health centres. Similarly, at wave six, once families in the control group receive Progresa's benefits and have to follow its "coresponsibility" scheme, a higher proportion of mothers seek advice from a health provider when their child is ill (71.2 percent). To counter this, advice sought from friends, relatives and traditional advisers diminishes. It is important to make clear that this indicator refers only to the main person giving advice to the child's mother. However, seeking advice when the child is ill is a more complex behaviour than the one represented by these figures. Mothers tend to seek advice from more than one source when their child is ill, more so when the condition is severe (Heuveline and Goldman 2000). Nevertheless, information on the main advisor provides useful insight into health-related behaviours.

The reasons for not seeking professional advice at baseline were, as expected, associated with accessibility to health services: either there were no services available, or the quality of services was considered to be poor, or families had economic constraints. Over time, we observe an increase in the proportion of mothers not considering it necessary to seek advice when the child is ill. Numerous studies have found that one of the main determinants of treatment choice is the perception of illness severity (Goldman et al. 2002). It is possible that beneficiary mothers perceive their child's illness as of milder degree; hence, they believe there is no need to seek for professional advice. Additionally, we notice that as of wave two the treatment group shows important reductions in responses related to economic constraints. In contrast, among the control group reductions in this response are not evident until wave six. These responses might be associated with Progresa's monetary grants, which might facilitate families to have a greater access to health services (either allowing families to pay for transport or other expenses incurred in this kind of visits, or to pay for medicines recommended at the health centre). Nevertheless, we should recall that the cash transfers are conditional on attendance to the health centre. Hence, the increased use of health services is likely to be associated with the conditionality of the grants.

Other studies evaluating Progresa's performance on health care utilization have found that as a result of this intervention there has been an increase in nutrition monitoring visits (Handa et al. 2000), immunisation rates, and prenatal care (Gertler 2000). It is believed that continuous and opportune attention to health diminishes the risk, incidence and severity of illness. Although we observe a change in treatment behaviour when the child is ill, we only observe reductions in the incidence of diarrhoea and no impact on the duration of illnesses.

Table 6.18
Summary measures of treatment behaviour
Eligible Children in Treatment and Control Groups
ENCEL Cross-sectional sample

	Wave 1 (%)	Wave 2 (%)	Wave 3 (%)	Wave 4 (%)	Wave 5 (%)	Wave 6 (%)
Treatment given [1]						
Treatment						
Home remedy	17.1	13.9	-	-	-	9.5
Medicine or treatment	74.7	79.0	-	-	-	83.0
Both	3.4	1.6	-	-	-	1.4
None	4.3	5.0	-	-	-	2.2
Don't know	0.5	0.5				3.9
Control						
Home remedy	21.2	16.1	-	-	-	9.8
Medicine or treatment	70.9	76.6	-	-	-	80.1
Both	4.3	0.9	-	-	-	0.7
None	3.2	5.1	-	-	-	3.3
Don't know	0.5	1.3				6.2
Advice sought from [1]						
Treatment						
Relative or friend	11.0	8.6	-	-	-	4.0
Traditional provider	5.1	2.2	-	-	-	0.9
Doctor	64.7	72.4	-	-	-	76.0
Other	1.3	0.7	-	-	-	3.9
Nobody	17.9	16.1	-	-	-	15.2
Control						
Relative or friend	8.3	9.6	-	-	-	3.5
Traditional provider	6.4	4.4	-	-	-	2.8
Doctor	64.6	64.7	-	-	-	71.2
Other	2.7	0.9	-	-	-	4.1
Nobody	18.0	20.5	-	-	-	18.4
Main reason for not seeking professional advice [2]						
Treatment						
Not necessary	40.8	56.3	-	-	-	55.6
No available services	17.4	15.6	-	-	-	11.7
Too expensive	19.7	10.4	-	-	-	2.0
Bad quality of service	9.2	8.6	-	-	-	6.3
Other	5.9	4.7	-	-	-	5.9
Don't know	7.1	4.5	-	-	-	18.5
Control						
Not necessary	47.8	58.5	-	-	-	51.9
No available services	9.6	12.6	-	-	-	8.3
Too expensive	16.3	15.6	-	-	-	3.0
Bad quality of service	6.5	6.2	-	-	-	7.5
Other	4.5	2.5	-	-	-	8.3
Don't know	15.5	4.7	-	-	-	21.1

Notes:

1. These percentages are based on children who were ill.
2. These percentages are based on children who were ill and whose mother did not seek professional advise.

6.7. Conclusions

At baseline, child morbidity was very high in the rural localities under study. Almost half (47.7 percent) of eligible children were reported as sick with some kind of illness during the two weeks prior to the survey. The proportion of children reported as ill according to type of disease was 13.2 percent for diarrhoea and 43.5 percent for respiratory infections. Moreover, our estimates of duration of illness suggest that throughout the year these children are ill for a considerable number of days (roughly 45 days). These figures illustrate the poor health status of eligible children. This is of particular concern because it is widely accepted that children with ill health are more likely to experience adverse outcomes later in life

There is some evidence that Progresa contributes to reducing morbidity rates. After one year of Programme implementation, there is a significant difference between the outcomes of treatment and control groups, with this difference representing a positive effect. In addition, two years after Programme implementation, once children living in control areas are incorporated into the Programme, differences between the two groups are no longer evident. We find that for both diseases under study, the Programme effect is mainly due to a decrease in the morbidity risks of children aged between 24 and 47 months. But the evidence of a Programme effect is stronger for diarrhoea than for ARI.

Regarding the incidence of diarrhoea, estimates from our multivariate models suggest that after one year of Progresa's operation, the odds of being ill with diarrhoea among beneficiary under fives are 32 percent lower than those of their control peers (with odds ranging in a 95% C.I. = 0.48:1 – 1:1). Two years after Programme implementation we observe the control group catching up to a degree, but observe reduced improvements among the treatment group. According to age, at wave two, the odds of illness among beneficiary children are statistically significant among those aged between 24 and 47 months (odds of 0.53:1; 95% C.I.= 0.32:1 – 0.90:1); and among those with complete information aged between 12 and 47 months (odds of 0.48:1; 95% C.I.= 0.27:1 – 0.86:1).

With respect to ARI, our results suggest a positive Programme effect at wave two among children aged between 24 and 47 months old (odds of 0.62:1) and among children with complete information (odds of 0.50:1). Nonetheless, our estimates show important increases on the prevalence of ARI between waves two and three among children living in treatment localities. The quality of these reports suggests this outcome should be treated with caution. It is not clear whether these results reflect an increase in the actual levels of morbidity or correspond to an increased awareness of the symptoms associated with respiratory infections.

The impact of supplement "intake" shows different results according to illness. Whereas there is no evidence of a positive effect associated with supplements for diarrhoea, the sample with complete observations shows an important influence on respiratory infections attributable to the supplement. However, due to the data constraints associated with ARI, the supplement effect for this illness should be read with caution.

We find no evidence of significant interactions between household or community characteristics and Progresa, except for distance to the health centre and region of residence. It seems that beneficiary children living nearer to the health centre and those living in the Altiplano and Huasteca region have lower chances of being ill than their control counterparts. With reference to household's severity of poverty, the Programme has its greatest impact on reducing the chances of being ill with diarrhoea among children in the most deprived households. This finding suggests that Progresa's benefits are serving as a substitute for household's lack of resources.

Regarding duration of illness, our descriptive analysis shows no variations over time. The mean number of days sick (around 4 for diarrhoea and 5 for ARI) is similar for both treatment and control groups, with no significant differences between waves. Thus, these results suggest that the Programme is more successful in reducing the risk of illnesses rather than healing and reducing their severity.

In the previous chapter we observed a modest impact of the Programme on extending the duration of breastfeeding. The latter could have a positive effect on reducing children's susceptibility to infectious diseases, particularly diarrhoea. However, the duration of exclusive breastfeeding, which is likely to have a greater influence on child morbidity, remained unchanged. Thus, possible variations in morbidity rates could perhaps be further reduced with improvements in child feeding practices.

Appendix 6. Additional Tables – Chapter 6

Table A.6.1 Questions on Child Health used in Different Surveys

DHS questionnaires:

- Has (NAME) had diarrhoea in the last **2 weeks**?
- Has (NAME) been ill with a fever at any time in the last **2 weeks**?
- Has (NAME) had an illness with a cough at any time in the last **2 weeks**?

ENN and INSP questionnaires:

- Has (NAME) had diarrhoea in the last **2 weeks**?
- Has (NAME) been ill with cold, cough or angina at any time in the last **2 weeks**?
- Has (NAME) had bronchitis or pneumonia at any time in the last **2 weeks**?

ENCEL questionnaire:

- Has (NAME) been sick in the last **4 weeks**?

If **yes**, then:

- From what kind of illness was (NAME) sick of?
    - diarrhoea
    - cough or flu
    - other
    - fever or temperature (only from wave three onwards)
    - respiratory illness (only from wave three onwards)

Notes: The Spanish terms for these symptoms are: *diarrea; catarro; gripa; anginas; bronquitis; and neumonia.*

Chapter 7. Children's nutritional status

7.1. Introduction

It is well known that malnutrition during early childhood can place children at a great risk of child mortality and, if they survive this crucial period, a poor nutritional status can impair a variety of developmental outcomes. Several studies have shown that poverty is one of the main determinants of child malnutrition. Lack of resources and capabilities prevent children from growing to their genetic potential. One of the central goals of Progresa is to reduce and prevent child malnutrition[140] since positive effects on this health outcome are likely to translate into improved life chances.

In this chapter, we examine whether Progresa reduced child malnutrition. In the next section, we set the importance of addressing children's nutritional needs by providing a brief review of the literature on child malnutrition, a description of the international goals in this area, and the progress achieved during the 1990s, particularly in Mexico. In Section 7.3, we describe the data sources used, and present the outcome and explanatory variables included in our analyses. Section 7.4 explains the statistical methods used in this chapter. Section 7.5 presents the results obtained. Finally, the last section summarizes and discusses the findings.

7.2. Child malnutrition: an overview

7.2.1. The consequences of early child malnutrition

The influence of environmental mechanisms on children's growth begins even before the child is born. During pregnancy, mother's nutrient intake has a crucial role for the development of the child in *utero.* Mothers who are not well fed have increased probabilities of delivering newborns with dysfunctional developments, including brain damage[141] and low weight at birth (weight under 2,500 grams) (Galloway and Anderson 1994; Norton 1994). There is wide evidence showing that infants with low weight at birth because of intrauterine growth retardation have

[140] Although strictly speaking, the term 'malnutrition' refers to both undernutrition and overnutrition, in this research we use it to describe the former condition.
[141] Research in neuroscience has shown that the sensitive period for brain development starts at mid-pregnancy and extends up to the third and fourth year of life (Young 1996; Waldfogel 1999; Nelson 2000; Shonkoff and Marshall 2000; Singer and Ryff 2001).

higher chances of neonatal mortality. Moreover, if these infants survive, they are more susceptible to infectious diseases, which in turn have negative consequences on their nutritional status (Galloway and Anderson 1994; Norton 1994; ACC/SCN 2000; ACC/SCN and IFPRI 2000; Rivera et al. 2002).

During the first years of life, individuals grow physically and intellectually at the fastest rate over the life span. Thus, adverse influences during this stage can have long-lasting effects because deficiencies suffered during this period are more difficult, although not impossible, to catch up later in life. Children who grow up in poor families are likely to suffer from inadequate nutrition, frequent and severe diseases, poor health care practices, and unhygienic living conditions. The interplay of these risk factors makes young children very susceptible to poor health and growth faltering. Although it is difficult to disentangle the causal sequence of infections and nutrition (Brown 2003), research has shown that infectious diseases, particularly diarrhoea, have a negative effect on children's nutritional status (Poskitt et al. 1999; Berkman et al. 2002; Brown 2003). At the same time, malnourished children are more likely to be ill with infectious diseases (Sepúlveda et al. 1988; Brown 2003). As consequence, by the second or third year of life, many children are underweight or stunted (Martorell 1999a).

Furthermore, there is wide evidence that, poor nutritional status during early childhood is associated with a wide set of detrimental outcomes (Allen 1995; Martorell 1999a; Martorell 1999b; Alderman et al. 2001; Glewwe et al. 2001; Alderman et al. 2003). Martorell (1999a) reviews broad evidence[142] of the negative effects of undernutrition on physical and cognitive development in middle childhood, adolescence and adulthood. His review highlights results from the *INCAP* study in Guatemala. Findings from this study show that children who experienced growth failure by the age of three were more likely to delay entrance to school, to have fewer years of schooling, to perform poorly in cognitive tests, and to have reduced body size and strength as adolescents and adults (Martorell 1999a). Additionally, the *Cebu* longitudinal study in the Philippines, the Nutrition Collaborative Research Support Program in Mexico, Kenya and Egypt, and data from rural Zimbabwe confirm these results: early childhood undernutrition limits children's cognitive performance later in life (Allen 1995; Glewwe et al. 2001; Alderman et al. 2003) and their height in young adulthood (Alderman et al. 2003).

[142] This review is based on data from experimental studies (in Guatemala, Jamaica and Colombia) and adoption studies (in Korea, Chile and Romania).

Additionally, recent findings from the *INCAP* follow-up study suggest a significant and positive correlation between the height of children and that of their mothers at the same ages (Stein et al. 2004). Mother's short stature may reflect the unfavourable environmental conditions she was exposed to during childhood that affected her own growth and development. Therefore, although this correlation is in part explained by genetic factors, it also suggests that child malnutrition is one of the channels through which disadvantage is transmitted across generations.

7.2.2. Malnutrition: a serious health problem

Child malnutrition is one of the most serious health problems prevailing in less developed countries because it is strongly associated with child mortality[143], and because it can severely compromise the growth and development of those who survive. Estimates of the United Nations' Sub-Committee on Nutrition indicate that in 2000 over one in four (26.7 percent) children in the developing world was underweight[144]. During the last three decades, some progress was achieved, but it was less than international goals had aimed for. In 1990, the World Summit for Children set, among its child survival and development goals, one to halve child malnutrition[145] by the year 2000. However, estimates show that during this period the proportion of undernourished children decreased by only 16.8 percent (from 32.1 to 26.7 percent) (ACC/SCN and IFPRI 2000). As consequence, the number of underweight children remained considerably high, at around 150 million. Furthermore, achievements between 1990 and 2000 varied widely between regions. In Africa, there were no improvements at all (there was even a slight increase from 27.3 percent to 28.5 percent and the number of underweight children increased from 30 to 38 million). In Asia, there was a slight reduction (from 36.5 percent to 29.0 percent) but, the number of undernourished children remained critical (107 million). In Latin America and the Caribbean progress was more satisfactory (from 10.2 to 6.3 percent and from 5.6 million to 3.4 million)[146]. In 2000, the Millennium

[143] Pelletier et al. estimate that in developing countries (based on data from 53 countries in Asia, Africa and Latin America) half of the deaths of children under five are associated with malnutrition (Pelletier et al. 1995).

[144] Protein-energy malnutrition can be measured using three anthropometric indices: underweight (weight-for-age), stunting (height-for-age) and wasting (weight-for-height). A child is classified as having one of these conditions if its anthropometric index falls below -2 standard deviations from the reference median value.

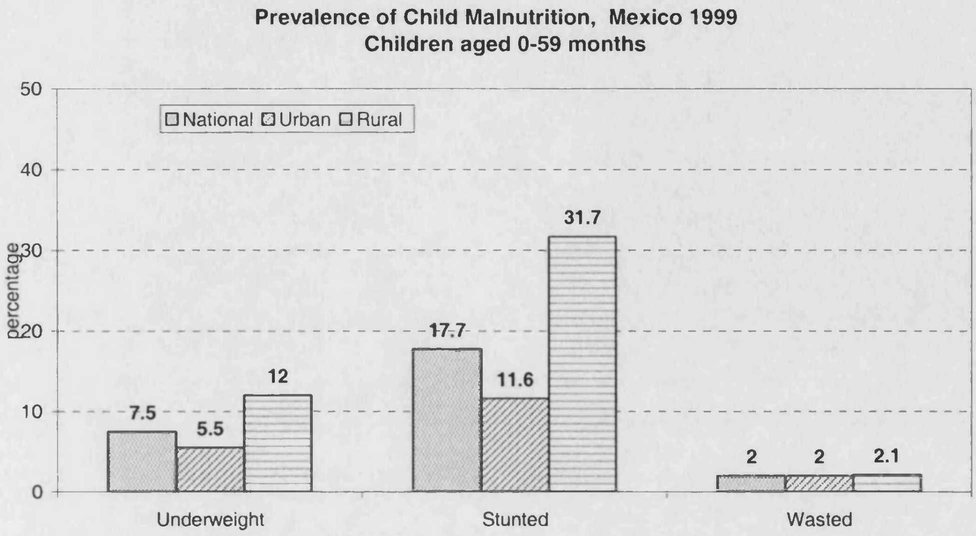
[145] The World Summit for Children set their goal using weight-for-age as the anthropometric indicator for malnutrition.

[146] Within Latin America and the Caribbean, there were also huge differences and the progress made was due mainly to the decline observed in South America. The latter was the only sub-region of the developing world that managed to halve child malnutrition (ACC/SCN 2000).

Development Goals included among their priority targets a reduction in child malnutrition. The goal was the same as that set in 1990, i.e. to halve, between 1990 and 2015, the prevalence of underweight children under five years of age.

Mexico has managed to achieve some progress in reducing the prevalence of malnutrition among children under five. In relation to underweight, it almost achieved the 1990's international goal. Between 1988 and 1999, the prevalence of children with low weight for their age decreased by 47.2 percent (from 14.2 to 7.5 percent) (Sepúlveda and Rivera 2000). Yet, regarding stunting, an indicator much more associated with the cumulative effects of poverty, progress was minor. According to this anthropometric indicator, the proportion of malnourished children diminished by only 22.4 percent, from 22.8 to 17.7 percent. In addition, improvements showed considerable differences within the country. While in urban areas the prevalence of underweight decreased by 55.2 percent (from 12.3 to 5.5 percent), in rural areas it declined by 36.8 percent (from 19.0 to 12.0 percent). This difference in progress illustrates that achievements at the national level do not necessarily reflect those of the whole population. Thus, despite national improvements, there is still a significant number of Mexican children who suffer from this malady. As in many other countries with high inequalities, malnourished children are mainly concentrated in less developed regions (in the case of Mexico, the southern part of the country) and among the most impoverished groups (e.g. indigenous population). Figure 7.1 shows the malnutrition gaps between urban and rural areas. The largest difference is observed in relation to stunting; the proportion of children with low height for their age in rural communities is almost three times that of urban localities (11.6 and 31.7 percent, respectively).

Figure 7.1



Source: INSP, Encuesta Nacional de Nutrición, 1999.

Interventions in developing countries have shown that the problem of malnutrition can be ameliorated with proper interventions targeting an early stage of development. In Chapter 1 we presented a review of longitudinal studies from developing countries, examining child health and nutritional outcomes (see Table 1.1). For policy purposes, the most valuable lessons from these studies are that nutrition interventions have stronger and more enduring effects when:

- they are targeted in early childhood and towards the most deprived groups within the population;
- their aim is to prevent malnutrition and its negative consequences rather than treating and reversing its deleterious effects;
- they include multiple actions to tackle child malnutrition (e.g. improving infectious diseases, nutrition, and health education on feeding and child care practices).

7.3. Progresa's benefits on child nutrition

One of Progresa's main goals is to improve the nutritional status of the population, especially that of mothers and children. In order to do so the Programme includes the following actions: provision of nutritional supplements, income support for the purchase of food products, a basic package of health services, and educational sessions on health care practices.

Progresa provides nutritional supplements to the members of the family at higher risk of being malnourished, that is pregnant and breastfeeding women and children under five. These supplements are given to women when they are pregnant as a way to prevent malnutrition before the child is born, to breastfeeding women in order to fortify both mother's and child's health status, and to children between the ages of four months and two years to complement their diet. They are also given to children between the ages of two and five showing any sign of malnutrition; once these children reach their optimal weight, they continue to receive the supplement for six additional months. For ethical reasons, this benefit was also made available to children under five living in control communities. Health centres provided the nutrition supplements to malnourished children, irrespective of whether they belonged to a control or a treatment community.

Mothers need to attend the health centre once a month in order to collect Progresa's supplements. At each visit, they are given six packets of supplements per eligible child. Each packet contains 5 doses; thus, the amount given is enough for one dose per day. If the supplement is consumed according to Progresa's guidelines (one daily dose of 250 grams), it should have a positive impact on children's growth because its formulation is designed to meet the nutritional and physiochemical needs of the target population (Rosado et al. 2000).

It is worth highlighting that before Progresa began, a community trial was conducted in order to evaluate its acceptance, consumption and impact on energy intake. This assessment showed that during the two week trial the consumption of supplements improved children's energy intake by 168 kcal/day and were widely acceptable among the children under study (Rosado et al. 2000). A review of small-scale interventions[147] in developing countries found that improving dietary intakes of infants (6 – 12 months of age) has positive effects on reducing early child malnutrition (Caulfield et al. 1999). Despite variability in the characteristics of these interventions[148], these studies show substantial improvements in the growth of infants, ranging from 0.25 to 0.46 standard deviation units for weight for age and from 0.04 to 0.35 standard deviation units for height for age. Therefore, if supplements are adequately consumed, they should have a positive effect on children's growth.

[147] The interventions reviewed in this paper were conducted in Guatemala (INCAP), Colombia, Jamaica, Indonesia and Bangladesh.
[148] These interventions showed differences in the net increase of kcal per day from the nutritional supplement provided (between 65 and 317 kcal/day) and in the duration of the trial (5 to 9 months).

Additionally, beneficiary families receive a monetary benefit to improve the quantity and quality of the food products they consume (for details on the cash transfers see Chapter 2). This monetary support is conditional upon the fulfilment of a series of health related activities, including attendance at a monthly educational health session.

Through the health sector, Progresa provides a package of basic health services with an emphasis on preventive health care. These services include actions focused on tackling child malnutrition. Children must attend the health centre on a regular basis for nutrition surveillance. At the same time, the health personnel provide monthly educational sessions that include themes on education and promotion of health issues (Table 7.1) In these sessions mothers learn the importance of preparing and consuming the supplements according to the guidelines of the Programme; they are encouraged to use the cash transfers for buying food products for children, and they are guided in how to make a better use of the food products available in the region.

Table 7.1 Educational sessions related with child nutrition outcomes

1. Progresa's nutrition supplement;
2. Nutrition and Health (on preparation of food indicating which items are good for the family);
3. Breastfeeding practices.

In sum, the mechanisms through which Progresa may have a positive impact on children's nutritional status are by: improving nutrient intake at critical periods of growth and development (food supplements during the prenatal period and the first two years of life); identifying and treating opportunely those cases that present any signs of malnutrition (growth monitoring and food supplements to malnourished children between two and five years of age); reducing the severity and frequency of infections through health preventive activities; and by improving maternal care practices through educational sessions.

Evaluations on the nutrition component of Progresa

The evaluations carried out in order to assess Progresa's impact on nutrition have shown that the Programme has had a positive effect. An evaluation of the impact of Progresa on pre-school children's height showed that receiving food supplements had a positive effect on children between 12 and 36 months of age (Behrman and

Hoddinott 2000). Their estimates suggest an increase of about 16 percent in mean growth per year, corresponding to approximately one centimetre per year. This evaluation assessed the impact of the programme during its first year of intervention and concentrated on children who actually received the nutrition supplement. However, it is crucial to examine the progress of children who did not receive supplements since the aim of this study is to evaluate the overall performance of Progresa and not only the impact of supplement "intake"[149]. Furthermore, it is important to assess whether this effect was observed during the second year of intervention because changes in anthropometric outcomes may increase with longer duration of programme exposure. In addition, it is important to study whether this positive effect is observed for outcomes of protein-energy malnutrition since height (the outcome used in Behrman and Hoddinot's analysis) is considered a measure of growth attainment rather than of nutritional status per se (WHO 1986).

A second study carried out using anthropometric information from health registers indicated variations in growth rates among children with different levels of Programme exposure. In particular, children incorporated in the Programme for 15 to 17 months seemed to have significantly higher growth outcomes than children incorporated for a shorter period (Handa et al. 2000). This result suggests that duration of the intervention has an important influence on the outcomes observed. One of the drawbacks of this study is that the health registers included only the data needed for estimating anthropometric outcomes: age, sex, weight and height (or length); and the date the child's family was incorporated into the Programme. They could not be linked with household data because they did not have a Progresa family identifier.

A third study assessing the performance of the Programme on improving attendance at the health centre for growth monitoring, indicated that, after the Programme was introduced, attendance rates among treatment children were significantly higher than those of the control group (Handa et al. 2000). The estimated difference-in-difference was around 8 percentage points during the first year of intervention, but dropped to 5 percentage points after 18 months. This reduction in the impact of the Programme was due to increased clinic attendance of children in the control group and not to decreased attendance of the treatment

[149] This does not mean actual intake, but rather children whose family reported having received the supplement during the month prior to the interview.

group. An important finding of this study was that, after the Programme started, the relationship between family characteristics (parental schooling and ethnic group) and access to basic services with child growth monitoring attenuated. This suggests an important achievement of the Programme; encourages those with fewer capabilities to access this basic health service (Handa et al. 2000).

A more recent study looking at Progresa's impact on child health found that the Programme was successful in reducing morbidity rates among newborns (22.6 percent less likely to be ill than newborns of control areas), in improving physical growth among children between 12 and 36 months (treatment children grew on average 0.96 cm more than their control peers), and in reducing anaemia among children aged between 12 and 48 months (treatment children 22.5 percent less likely to be anaemic than control children) (Gertler et al. mimeo). However, this assessment is limited to the performance of Progresa during its first two years of implementation (morbidity is analysed using ENCEL data of waves 1 to 4, and height and anaemia are examined using INSP data for waves one and two only); it only looks at the outcomes of children less than three years old at baseline and among those children who were born after Progresa was operating; it does not provide information on whether the effect was larger among certain groups; and it erroneously assumes that treatment and control groups are balanced which, as discussed in Chapter 3, may have biased the results.

In contrast to the positive results observed from the previous evaluations, an assessment of the operations of Progresa pointed out that, during the first two years of programme implementation, the distribution of supplements was one of the most serious operational problems of the Programme's health component (Adato et al. 2000). This evaluation was done using both qualitative and quantitative instruments applied to beneficiaries, "*promotoras*"[150] and health personnel. Estimates from this study indicate that children were consuming only part of the nutrients that the supplement, in theory, should have provided. This was due both to management problems (mothers not receiving the supplement allocation they should have) and to the fact that the supplement was shared with other family members (Adato et al. 2000).

[150] Promotoras are beneficiaries who have been selected by the community to serve as a link with Progresa's personnel. They are a key figure of the Programme because they provide beneficiaries information on how the program works and, at the same time, help the Programme's staff identify operational problems.

The objective of this analysis is to answer whether Progresa has had a positive effect in reducing malnutrition among extremely poor children living in rural Mexico. There have already been studies suggesting a positive impact of the Programme in this area over the first year of its implementation (Behrman and Hoddinott 2000; Gertler et al. Forthcoming 2004). However, these studies have not fully accounted for the characteristics of the data and have concentrated on children who actually receive the nutrition supplement. The aim of our study is to assess the performance of Progresa as a whole and not only the performance of the Programme on children from beneficiary families receiving supplements. It could be possible that those actually receiving the nutritional supplements are children from families with more endowments or more awareness on health issues than those not receiving them, thus we would be leaving out of the analysis a more vulnerable group of children. In addition, we want to evaluate Progresa's effectiveness in improving children's nutritional status during its first three years of intervention. Finally, we want to answer whether certain groups of the population are more/less likely to experience positive changes; that is, whether Progresa's intervention reduced the gaps between groups.

7.4. Data

The data for this project are drawn from two different sources of information: the household evaluation survey (ENCEL); and the nutrition survey carried out by the National Institute of Public Health (INSP survey). This analysis uses the latter survey as the main source of information because it contains the outcome variable of interest: anthropometric measurements. On the other hand, the ENCEL survey gathers a wide set of socio-economic and demographic characteristics at the individual, household and community level that are included in order to conduct a more thorough analysis. The INSP conducted three rounds of surveys approximately every 12 months: the first round was carried out between August and September 1998; the second collected data between October and December 1999; and the last wave took place between November and December 2000. These surveys collected both cross-sectional and longitudinal information about children under the age of five. After a thorough data screening[151], the final sample contained around 2,000 cases per wave of data collection (2,340 at wave one, 1,946 at wave

[151] For a detailed description of the data cleaning process, see Chapter 3. Nevertheless, it is worth mentioning that the sample sizes in this chapter differ from those of the previous one because here we do not include the cases with outlier values in anthropometric indicators.

two, and 2,379 at wave three). Of these children, 3,529 were interviewed just once, 1,051 children were surveyed at two waves, and only 356 were measured in all waves.

Before analysing the data, it was necessary to examine certain characteristics of the sample obtained such as its representativeness with respect to the ENCEL survey, the randomisation of the treatment and control groups, and the differences between the longitudinal and the cross-sectional sample. Results from these analyses indicate that the households included in the INSP sample were less disadvantaged than those included in the ENCEL data; for some household and community characteristics there were statistically significant differences between treatment and control groups; and the main difference between the longitudinal and the cross-sectional sample was the age of the child, with the former being a younger sample than the latter (details of these analyses are presented in Chapter g3). Hence, the characteristics of the sample indicate that it is important to control for observed and unobserved differences, since some background characteristics are likely to be associated with the outcome under study, which may produce a confounding effect in the estimations (Anderson 1980).

Additionally, in order to assess the performance of Progresa in the nutrition strand it is necessary to control for the "intake" of nutritional supplements. Table 7.2 presents the supplement coverage by group in waves two and three. The first INSP survey took place before the Programme started operating, thus children were not receiving supplements yet. At wave two, ten percent of control children had received the supplement, and at wave three almost two thirds had been exposed to this benefit. On the other hand, around 30 percent of those between five months and two years of age did not obtain this benefit either at wave two or at wave three. Moreover, a non-trivial percentage of underweight treatment children did not receive this in-kind benefit (around 14 percent). The main reason respondents gave for eligible children not consuming supplements was that they were unavailable at the health centre (around 70 percent of those who did not consume the supplement reported this as the main reason for not consuming). These figures corroborate Adato and colleagues' findings regarding the performance of Progresa on distributing supplements (2000). Therefore, the data suggests serious problems with the provision of supplements.

The previous findings led us to look for possible differences between those who receive supplements and those who do not. It is possible that children who actually receive the nutritional supplements are children from families with more endowments or more awareness on health issues than those not receiving them. In order to test for a possible selection bias effect, using a logit model, we estimated the probability of receiving supplements according to different child and household characteristics. Findings from this model indicate some differences according to household characteristics that support the previous hypothesis. At wave two, the only difference in likelihood was found with respect to region of residence. Children living in the Montaña region were less likely to receive supplements than those living in the Sierra Gorda region. However at wave 3, several characteristics show different odds ratios between categories. Children whose mother had some education, whose mother spoke only Spanish, and who lived in a community with a lower degree of marginality had a higher likelihood of receiving supplements than those whose mother had no education, spoke an indigenous language or who lived in a community with very high degree of marginality. Finally, it is worth mentioning, that we also found differences according to age (younger children with higher probabilities). Yet, this final finding is in accordance with the guidelines of the Programme. In addition, results from this analysis suggest that children receiving supplements had a poorer nutritional status than those who did not receive them. This result was not unexpected because, as was mentioned above, health centres have to provide supplements to malnourished children. All these aspects confirmed the need to control for supplement "intake" and characteristics of selectivity of intake in our models.

Table 7.2
Supplement coverage
Eligible children in Treatment and Control Groups
Cross-sectional sample

	Children receiving supplements			
	Wave 2		Wave 3	
	Control (%)	Treatment (%)	Control (%)	Treatment (%)
All children				
0-4 months	2.2	9.6	10.5	13.8
5-23 months	10.5	73.6	69.3	69.6
24-59 months	11.8	73.2	68.3	75.9
Total	*10.9*	*70.9*	*65.8*	*71.6*
Underweight children				
24-59 months	12.6	86.3	81.5	85.6

Outcome variables

Anthropometry is the tool most widely used in estimating protein energy malnutrition among children. One of the main advantages of this method is that only four variables are needed for its assessment: sex, age, weight and height. The information on these variables is used to construct three indices of nutritional status: weight for height, height for age and weight for age[152]. Each anthropometric index describes a different aspect of the nutritional status of a child. Children whose Z-score values fall below the cut-off point of -2 SD (standard deviations) are classified as wasted (weight for height), stunted (height for age) or underweight (weight for age). *Wasting* describes failure to gain weight or an acute nutritional deficit. This index is important for describing the current nutritional status of the individual. *Stunting* indicates that the child's stature is low in relation to his or her age. It is an indicator of cumulative deficient growth or a marker of past growth failure. It has been suggested as a measure of social deprivation because it is generally associated with poor economic conditions. *Underweight* is a composite of both height for age and weight for height and a low score may result if a child is either too short or too thin. It is generally used as an indicator of the overall prevalence of malnutrition, particularly short-term health and nutritional status (WHO 1986; ACC/SCN 2000).

[152] The anthropometric indices of this study were constructed using the Anthro program. This software converts the values of height and weight into Z-score values according to age and gender. This standardisation is done with respect to the values of the NCHS (National Centre of Health Statistics) reference population recommended by WHO (World Health Organisation) (CDC 1999).

In this study we use height for age and weight for age as outcome variables because these indices have been recognised as good measures of children's well-being (Gross 1997). Furthermore, in Mexico (see Figure 7.1), as in other Latin American countries, the prevalence of these nutritional deficiencies is much higher and more worrying than that of wasting[153]. Most studies looking at determinants of nutritional status focus on one anthropometric index, generally height for age. However, we also look at weight for age because when assessing nutrition interventions, it is recommended to use more than one indicator as different indicators may change at different rates over time (Cogill 2003). The data available for the assessment of Progresa covers a short time period (only two years after programme implementation); therefore, it is important to look at both indicators.

In the descriptive analysis, for ease of interpretation, we examine the proportion of children classified as undernourished; but for all other analyses, we assess children's nutritional status using Z-score values. We do this because undernourishment can reflect either a small decline in Z-score values (e.g. from -1.9 to -2.1) or a rather steep one (e.g. from -1.5 to -2.5). Likewise, recovering from malnutrition may reflect either a small or a large improvement. Therefore, in order to use as much information as possible, outcomes are treated as continuous variables.

Explanatory variables

The main covariate of interest is receiving Progresa's benefits. We examine the Programme's impact by using dummy variables for living in a locality incorporated into the Programme and for receiving nutritional supplements. Moreover, to control for a possible bias resulting from supplement "intake", we include an interaction term for residing in a treatment community and receiving supplements. This strategy allows us to assess the performance of Progresa on the whole and not only the performance of the Programme on children from beneficiary families receiving supplements. We also include dummy variables for wave of data collection to assess whether there are differences in Progresa's effect over time.

Additionally, our models include a set of background characteristics to control for possible differences between treatment and control groups. After previous

[153] In Latin America, the proportion of children under five years old suffering from stunting is 16 percent. In contrast, the proportion afflicted by underweight or wasting is 8 and 2 percent respectively (UNICEF, 2001).

assessments (see Chapter 3), the control variables included in the models were the following: child characteristics (age and sex); mother's characteristics (education, ethnicity); household characteristics (household head's education and number of children of different age groups: under five, between 6 and 12, and between 13 and 18 years old); community infrastructure (distance to nearest health centre, degree of marginality); prices of basic food products at the locality level; average wage of agricultural workers; incidence of natural disasters; and region of residence. All our explanatory variables are treated as categorical, with the most advantaged category set as the reference group.

All the analyses were carried out for two different age groups: children between 0 and 23 months old; and children between 24 and 47 months of age. The reason for this is that several studies have shown that factors associated with child health outcomes vary according to age (Hobcraft et al. 1984; Bicego and Boerma 1991; Boerma and Bicego 1992; Adair and Guilkey 1997; Sahn and Alderman 1997). Children's needs and susceptibility to disease change with age; hence, the influence of correlates is likely to change with children's age as well. Moreover, we disaggregate results in these two age categories because evaluations of nutrition interventions have reported that there are different treatment effects according to age; children under two years of age are more likely to be responsive to interventions than older children (Martorell 1995a; Martorell 1995b; Adair and Guilkey 1997; Sahn and Alderman 1997; Schroeder et al. 2002). Finally, nutrition interventions and outcomes are likely to accumulate with age, making the older group of children likely to show clearer effects.

7.5. Methodology

We examine Progresa's effect on children's nutritional status in two stages. First, we carry out a descriptive analysis in order to identify the prevalence of child malnutrition before the Programme started operating, and to have a preliminary insight into changes over time. Second, to answer whether Progresa has had a positive effect in reducing malnutrition, we estimate a set of multivariate models that control for the different sources of bias our data is subject to. In doing so, we examine both the magnitude of changes over time, and the extent to which the Programme was associated with these changes. This part of the analysis examines the interaction between residing in a community receiving Progresa benefits and receiving supplements. Finally, we identify whether Progresa has a differential effect according to household's level of poverty.

7.5.1. Descriptive Analysis

We carry out an exploratory analysis of the situation at baseline in order to assess the nutritional status of the children before they received any benefits from Progresa. In this section, we measure children's nutritional status using mean Z-score values and the proportion of children classified as undernourished (those whose Z-score values were below the cut-off point of -2 standard deviations).

Second, using cross-sectional data, we estimate a mean comparison test between treatment and control[154] groups before and after Progresa was implemented, and estimate the Programme's effect by computing a difference-in-difference estimator. Through the double difference method, the treatment effect is obtained from the difference between the change observed within the control group and that observed within the treatment group (Anderson 1980). The change experienced by the control group is deducted from that of treatment because it is assumed that this change would have occurred even in the absence of the programme and thus cannot be attributed to its intervention. The difference-in-difference estimator can be expressed as:

$$\text{Double-difference} = (\overline{X}_{T_{i+1}} - \overline{X}_{T_i}) - (\overline{X}_{C_{i+1}} - \overline{X}_{C_i})$$

where $\overline{X}$ = mean value of outcome *X*, *T*= treatment, *C*= control, and *i* = wave of data collection.

However, as shown previously, differences at baseline between treatment and control groups in the outcome variables indicate that this is not a randomised sample. Hence, assessing Progresa's impact with findings from the previous approach could over or underestimate the treatment effect. Therefore, to avoid introducing bias in the estimations, we use methods that account for the differences (observed and unobserved) in explanatory variables between groups.

---

[154] Recall that in our study the treatment group refers to those eligible children living in communities that were incorporated into the Programme at an early stage. The control group refers to children living in localities that were incorporated until the last stages of incorporation (they did not receive any benefits for 2 years).

7.5.2. Multivariate Models

The multivariate models fitted in this analysis are estimated using information on children with at least two repeated observations over time (either at waves one and two; waves two and three; waves one and three; or waves one, two and three), as well as for the sample of children with complete observations (with information in the three survey rounds). For the sample with at least two observations, the models are run separately for each of the age groups under consideration: 1) children whose age was under 24 months old the first time they were observed; and 2) children between 24 and 47 months old the first time they were observed. Table 7.4 presents the age of children over time for both samples under consideration. It is important to note that children in the older group were aged between 24 and 47 months the first time they were observed. Thus, in the next sections we use the previous age range to refer to the older category.

Table 7.3
Age Across Time
INSP Longitudinal Sample with Information in at least 2 Waves of Data Collection

	Sample w/ Obs. In at least Two Waves						Sample w/ Complete Obs.		
	Children 0-23 months			Children 24-59 months			Children 0-35 months		
Age first time observed (months)	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3
0-11	310	129	-	-	-	-	167	-	-
12-23	298	254	123	-	-	-	116	122	-
24-35	-	211	270	282	313	-	77	138	114
36-47	-	29	261	160	272	233	-	100	141
48-59	-	-	47	-	207	292	-	-	105
Total	*608*	*623*	*701*	*442*	*792*	*525*	*360*	*360*	*360*

Notes: Children's age is defined as the age s/he had the first time s/he was measured.
This sample includes only those cases without flags for anthropometric indicators.

Estimation methods

We use a fixed effects model that accounts for observed and unobserved differences between treatment and control groups. This approach examines how the variation in each individual response is related to the variation in the predictors (Hsiao 2003). A limitation of this method is that for any explanatory variable that is constant over time it makes no contribution to the analysis. Hence, we cannot estimate the effect over time of most of the underlying and basic causes of malnutrition. In order to retain the coefficient for participating in Progresa, we transformed it into a time varying variable by assigning a value of zero at baseline to all observations, since the Programme was yet not operating; and a value of zero or one at consecutive waves depending upon whether the child was living in a control or treatment community. On the other hand, regarding omitted variables (e.g. genetic factors, preferences), if one assumes that they remain constant over time, they are eliminated as well from the model, hence removing the possible bias of unobserved heterogeneity.

The aim of this chapter is to estimate Progresa's effect on improving children's nutritional status. We want to asses whether the Programme had a positive effect on reducing the severe levels of stunting and/or underweight, whether this effect was greater among children receiving nutritional supplements, whether the intervention had a different impact over time, and whether the Programme had differential effects among certain groups of the population.

For the first objectives, we specify two models. The first one estimates Progresa's effect on (N_{it}) children's nutritional status (Z-score values of height for age and weight for age) using a dummy variable for living in a treatment locality (P_{it}), a dummy for supplement intake (S_{it}), and a dummy for wave of data collection (W_{it}). It also includes a set of variables X_{it} at the individual, household and community level to control for differences in the outcomes that are not associated with Progresa's intervention. This basic model provides estimates of the overall effect of the dummy variables associated with Progresa's intervention. It can be expressed as follows:

$$N_{it} - \overline{N}_i = \beta_1(P_{it} - \overline{P}_i) + \beta_2(S_{it} - \overline{S}_i) + \beta_3(W_{it} - \overline{W}_i) + \sum_j \delta_j (X_{j,it} - \overline{X}_{j,it}) + (v_{it} - \overline{v}_i) + (\alpha_i - \overline{\alpha}_i) \qquad (1)$$

where i=1,2,...n (individuals), t=1,2,3 (waves of data collection), v_{it} is the stochastic error term. Since the unobservable child-specific effects are time invariant, they drop out of the model $(\alpha_i - \overline{\alpha}_i) = 0$

In a second model, we estimate the Programme's effect on child anthropometrics by using three interaction terms. The aim of including these interaction terms is to examine whether the impact of residing in a treatment community varies depending on whether the child received supplements or not, whether the impact of residing in a Progresa locality changes over time, and whether the effect of supplement "intake" differs depending on wave of data collection. This model can be represented by the following equation:

$$N_{it} - \bar{N}_i = \beta_1(P_{it} - \bar{P}_i) + \beta_2(S_{it} - \bar{S}_i) + \beta_3(W_{it} - \bar{W}_i) + \beta_4(P_{it}.S_{it} - \overline{P_i.S_i}) + \beta_5(P_{it}.W_{it} - \overline{P_i.W_i}) + \beta_6(S_{it}.W_{it} - \overline{S_i.W_i}) +$$

$$\sum_j N_{it} - \bar{N}_i = \beta_1(P_{it} - \bar{P}_i) + \beta_2(S_{it} - \bar{S}_i) + \beta_3(W_{it} - \bar{W}_i) + \beta_4(P_{it}.S_{it} - \overline{P_i.S_i}) + \beta_5(P_{it}.W_{it} - \overline{P_i.W_i}) + \beta_6(S_{it}.W_{it} - \overline{S_i.W_i}) + \quad (2)$$

where i=1,2,...n (individuals), t=1,2,3 (waves of data collection), v_{it} is the stochastic error term.

The first interaction provides estimates for the conjoint effect of residing in a treatment community and receiving supplements ($P_{it}.S_{it}$). These terms allow exploring possible differences resulting from supplement intake. The second interaction estimates the conjoint effect of residing in a treatment community and wave of data collection ($P_{it}.W_{it}$). We examine the interaction of these two variables because it is possible that the impact of the Programme changes over time. The fact that some control communities were receiving benefits at round three could mask the Programme's effect at this round. However, this interaction term allows better identification of this confounding effect. The third interaction provides estimates of the effect of receiving supplements over time ($S_{it}.W_{it}$). This term shows whether or not there are cumulative effects from receiving supplements. Like model (1), model (2) also includes a set of explanatory variables at the individual, household and community level.

The coefficients in models that include interaction terms have to be interpreted carefully because they change in the presence of these interaction terms. Additionally, it is necessary to test for the significance of the overall effect of the interaction because it can be significant even when the coefficients of the main effect terms are not (Retherford and Choe 1993). For ease of interpretation and to obtain tests of significance for all terms, we modelled the interaction terms using dummy variables. We obtained eight different dummy variables for the interaction terms of interest:

1. Progresa and Supplement and Wave 2;
2. Progresa and Supplement and Wave 3;
3. Progresa and No Supplement and Wave 2;
4. Progresa and No Supplement and Wave 3;

5. Control and Supplement and Wave 2;
6. Control and Supplement and Wave 3;
7. Control and No Supplement and Wave 2;
8. Control and No Supplement and Wave 3;

It should be noted that the four dummy variables representing wave one are excluded from the model. The reason this is that, for estimation purposes, we specified the value of Progresa's benefits to be zero at baseline (wave one) since no one received benefits at this stage. Therefore, the reference category in model (2) is the situation at baseline, which would have happened in the absence of the Programme.

Initially, to identify whether Progresa had a differential impact according to household and community characteristics, we wanted to estimate a model with interactions of residing in a treatment locality and a series of community and household characteristics linked with lack of resources and factors linked with this policy intervention (parental education, mother's language, number of children, locality's degree of marginality, distance to the health centre and region). For instance, in Chapter Two, we argued that mother's education has a substitute effect with the services in the locality. Hence, it is possible that Progresa could have a larger impact among those children whose mother has less education. However, an important limitation that we face is that with a fixed-effects model we cannot estimate the main effect of time invariant covariates because they are differenced out from the model. Despite this drawback, we fitted a model with the interactions of household characteristics and Progresa. However, estimates from this model indicated few significant interactions between Progresa and the characteristics analysed. This result could suggest that the Programme is not having a differential effect according to household characteristics. On the other hand, it is possible that the model included too many parameters.

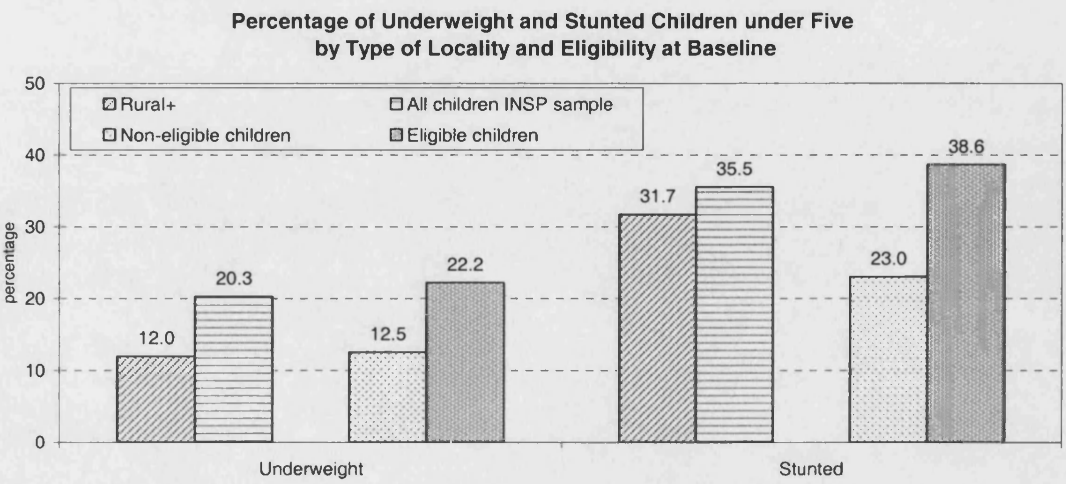
This limitation led us to investigate whether Progresa has a differential effect on child nutrition according to our measure of household's severity of poverty. Therefore, we estimate model (1) separately for three different categories of poverty (terciles of Progresa's poverty index); and fit model (1) with an interaction term between the dummy indicating whether the child lived in a Progresa locality and the dummies for the three different categories of poverty. This final approach does not provide information on the characteristics of the household that are more likely to have a positive/negative interaction with Progresa's intervention. However, our poverty index is a composite measure of multiple disadvantages within the household. Therefore, it allows us to examine whether Progresa has a greater influence among children from the most disadvantaged groups.

7.6. Results

7.6.1. Descriptive Results

Figure 7.2 shows the prevalence rates of stunting and underweight at baseline in rural localities. Among this type of localities, the levels of malnutrition at baseline were somewhat larger in marginal localities selected to receive the benefits of Progresa[155](e.g. 35.5 versus 31.7 percent of stunted children at the national level). Additionally, within marginal localities, children living in households eligible to receive benefits had the highest malnutrition rates of all (e.g. 38.6 percent of stunted children). These figures illustrate the severity of undernutrition among poor children living in rural marginal localities in the country. Furthermore, if we disaggregate the prevalence rate of eligible children by degree of malnutrition, around one-third were classified as mildly undernourished[156] (see Figure 7.3). These children also represent a vulnerable group because they are likely to fall into the moderate category of malnutrition and have increased mortality risks (UNICEF 1998). This underlines the importance of monitoring child growth and of providing preventive health services to children within this population.

Figure 7.2



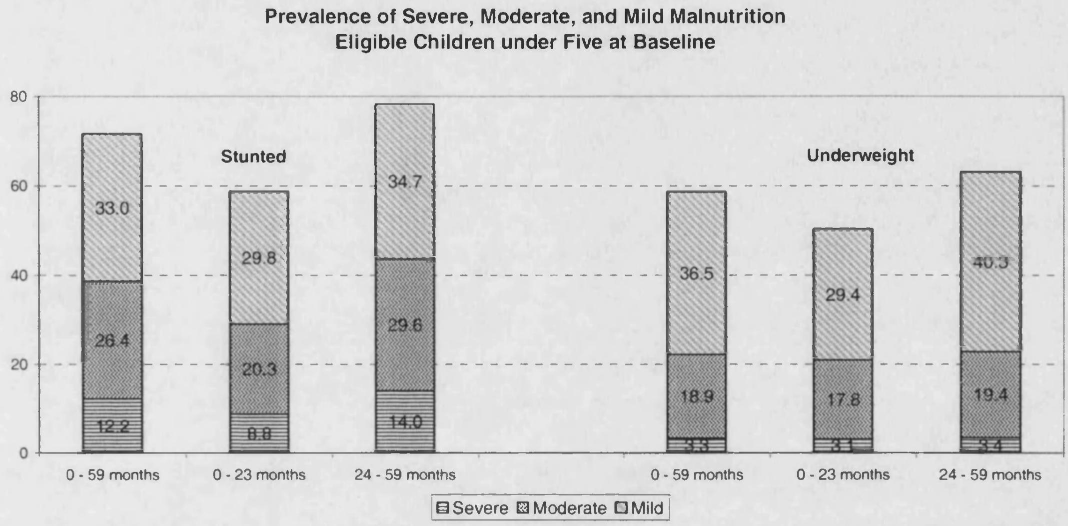
Note: Source: INSP, Encuesta Nacional de Nutrición, 1999.

---

155 This group includes the sample of localities surveyed in the INSP sample.

156 Mild malnutrition corresponds to those cases with a Z-score value <-1 but >= -2.

Figure 7.3



On the other hand, Figure 7.2 in conjunction with Table 7.4 indicates that Progresa's system for selecting the groups most vulnerable to malnutrition was successful. Table 7.4 demonstrates that the differences between eligible and ineligible groups are statistically significant. This is true for all anthropometric indicators under study. Other studies have also pointed out the effectiveness of Progresa in targeting its benefits at the most disadvantaged population in the country (Skoufias et al. 1999b; Morris and Mesoamerica Nutrition Program Targeting Study Group 2002). Although in this investigation information on ineligible children was not examined because of data limitations, it is important to highlight that at baseline 23 percent of ineligible children were stunted. This prevalence indicates that the ineligible group is also vulnerable to malnutrition and should not be excluded from the health and nutrition benefits of Progresa.

Because in theory this was a randomised sample, we would expect to find the same levels of malnutrition in treatment and control communities at baseline. However, unlike the evidence found in the ENCEL sample (Skoufias et al. 1999b), we do observe differences in stunting. Specifically, the proportion of children with low height for age was significantly greater in treatment communities than in control localities, 41.5 versus 35.2 percent respectively[157] (see Table 7.4).

---

[157] The difference in means for the Z-score value of height for age was statistically significant between groups (-1.72 among children in treatment areas versus -1.59 among children in control localities).

Table 7.4
Child Malnutrition by Eligibility and Treatment at Baseline
Eligible Children 0 - 59 months old, INSP sample

	Percentage of malnourished children				Mean value of Z-scores			
By eligibility								
	All children	**Eligible**	**Non-eligible**	**Diff**	**All children**	**Eligible**	**Non-eligible**	**Diff**
Underweight	20.3	22.2	12.5	***	-1.10	-1.18	-0.79	***
Stunted	35.5	38.6	23.0	***	-1.54	-1.66	-1.07	***
Wasted	2.9	3.0	2.7		-0.17	-0.19	-0.11	**
By treatment only eligible children								
	All children	**Treatment**	**Control**	**Diff**	**All children**	**Treatment**	**Control**	**Diff**
Underweight	22.2	22.0	22.4		-1.18	-1.21	-1.15	
Stunted	38.6	41.5	35.2	***	-1.66	-1.72	-1.59	***
Wasted	3.0	2.8	3.2		-0.19	-0.21	-0.18	

Note: Statistical significance: ***:p<.01, **:p<.05, *:p<.1

Changes over time

In order to have a first look at the variations in nutritional status before and after programme implementation, we examined the changes over time using the cross-sectional sample. It is worth pointing out that the values in this section do not show a real growth history, as they are constructed using cross-sectional data. However, they provide a preliminary estimate of changes over time. The simplest way to find out whether there is a positive impact of Progresa on the nutritional status of children is to estimate a mean comparison test between treatment and control groups before and after children started receiving benefits. Hence, we examine the mean Z-score values for height for age and weight for age over time for eligible children in the cross-sectional sample who were receiving and not receiving Programme benefits, with a test of equality of means between treatment groups and within groups over time.

The first sections of Table 7.5 and 7.6 present the mean Z-score value of the anthropometric outcomes under study by wave of data collection and by treatment group. The second sections show the p-values obtained from the difference in means test between the different waves of data collection. The third sections display our estimates of Progresa's effect using the difference-in-difference estimator (between wave one and three only).

Table 7.5 shows that, at baseline, children in the control group have a higher Z-score value for height for age than children in the treatment group (-1.72 and -1.59, respectively). Moreover, this 0.13 point difference is statistically significant. This indicates that for the outcome under study, the sample is not randomised. Therefore, regardless of other observed differences, it is not possible to assess the Programme's effect fully by simply comparing the outcome differences between groups. Additionally, one should recall that comparisons at wave three between treatment groups are weaker because at this time period some children living in control communities were already receiving benefits.

Nonetheless, Tables 7.5 and 7.6 provide a useful preliminary insight into changes over time. For instance, at wave two, just more than a year after Programme implementation, there were no significant changes in the mean value of height for age. Although the difference in means between treatment and control groups slightly increased, this variation was not significant. However, between waves two and three, both groups showed a significant improvement in the value of stunting, with beneficiary children showing a much higher growth than the non-beneficiary group (0.22 versus 0.12 SD, correspondingly). Hence, at the third round of data collection, the advantage of control children, though still significant, was much smaller than that observed at baseline. On the other hand, the equality means test between waves one and three suggests a statistically significant improvement in the values of height for age of both groups, but the difference in means over time was again much larger among the treatment group. Although the level of stunting of both groups improved over time (0.16 and 0.11 SD for treatment and control groups between waves one and three), the difference-in-difference estimator suggests that there was a slightly larger improvement (0.05 SD) among beneficiary children that would not have occurred in the absence of Progresa. In relative terms, this implies an improvement of 3 percent (from a baseline level of -1.72) in the mean value of height for age. The fact that at wave three some control communities were already incorporated into the Programme might cause a downward bias in our estimations of Progresa's effect.

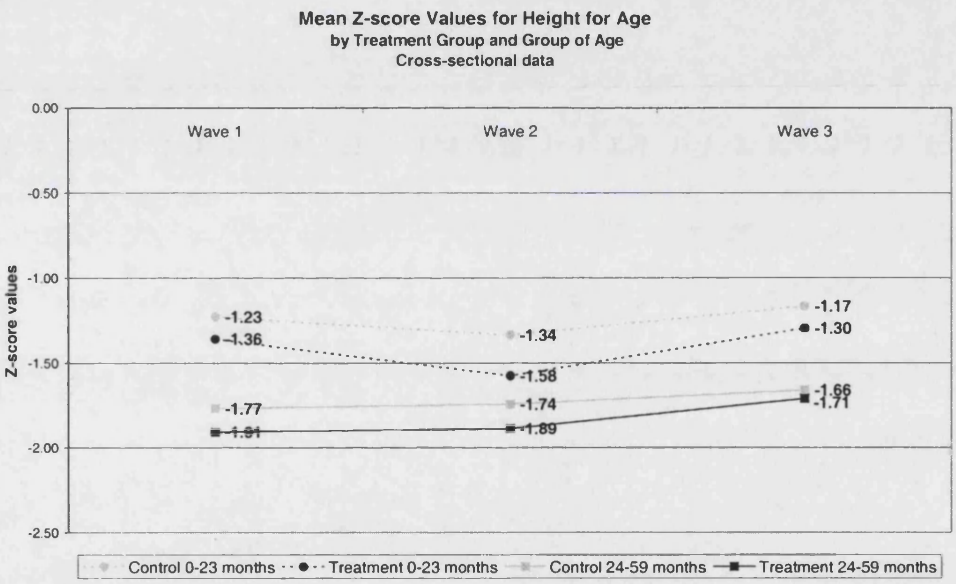
Table 7.5
Mean Z-score values for Height for Age
Eligible children in Treatment and Control Groups
Cross-sectional sample

	Mean Z-score values			T-test difference in means (p>t)			Diff (w_3 - w_1)	Diff-in-Diff (w_3 - w_1)
	Wave 1	Wave 2	Wave 3	(w1 vs w2)	(w2 vs w3)	(w1 vs w3)		
All children								
Control	-1.59	-1.60	-1.48	0.60	0.02 **	0.02 **	0.11	*0.05*
Treatment	-1.72	-1.79	-1.56	0.08 *	0.00 ***	0.00 ***	0.16	
T-test difference in means (Control vs Treatment) P>t	0.01 ***	0.00 ***	0.05 **					
Children 0-23 months								
Control	-1.23	-1.34	-1.17	0.16	0.05 **	0.26	0.06	*0.00*
Treatment	-1.36	-1.58	-1.30	0.01 ***	0.00 ***	0.23	0.06	
T-test difference in means (Control vs Treatment) P>t	0.08 *	0.01 ***	0.07 *					
Children 24-59 months								
Control	-1.77	-1.74	-1.66	0.36	0.11	0.04 **	0.11	*0.09*
Treatment	-1.91	-1.89	-1.71	0.36	0.00 ***	0.00 ***	0.20	
T-test difference in means (Control vs Treatment) P>t	0.01 **	0.01 **	0.19					

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

Results by age group show important differences between younger and older children (see Figure 7.4). Among the former, the value for this anthropometric outcome shows no significant changes between waves one and three. Moreover, the difference-in-difference estimator suggests no Programme effect for this age category since changes over time between treatment and control groups are the same (0.06 SD). Among children aged between 24 and 47 months, there is a statistically significant difference in the level of stunting between treatment and control groups at baseline (difference of -0.14 Z-score points), indicating the sample is not random at these ages. With respect to changes over time, between waves one and two, there are no significant variations either for beneficiary or non-beneficiary children. Thus, the gap between groups continued to be significant and to favour the control group. In contrast, between waves two and three, both groups show a reduction in stunting, and beneficiary children have higher growth than non-beneficiary children (a change of 0.18 and 0.08 SD for treatment and control groups, respectively). Hence, at wave three, the difference in means between groups is no longer significantly different from zero; and, thus the advantage of control children is no longer evident. Additionally, while among the treatment group, the difference in means between waves two and three is statistically significant; among the control group, it is not, even though some families in the control group were already incorporated. Finally, the difference-in-difference estimator between waves one and three suggests a larger reduction (of 0.09 Z-score values) in the prevalence of stunting among children receiving Progresa's benefit. In relative terms, this estimate is equivalent to an improvement of the mean Z-score values of 5 percent (from a baseline level of -1.91 SD). If improvements in nutrition depend on the initial nutritional status, then the fact that the treatment group did not start at the same level and showed a greater improvement suggests that estimates based on group comparisons could be underestimating the effect of the Programme on stunting levels.

Figure 7.4

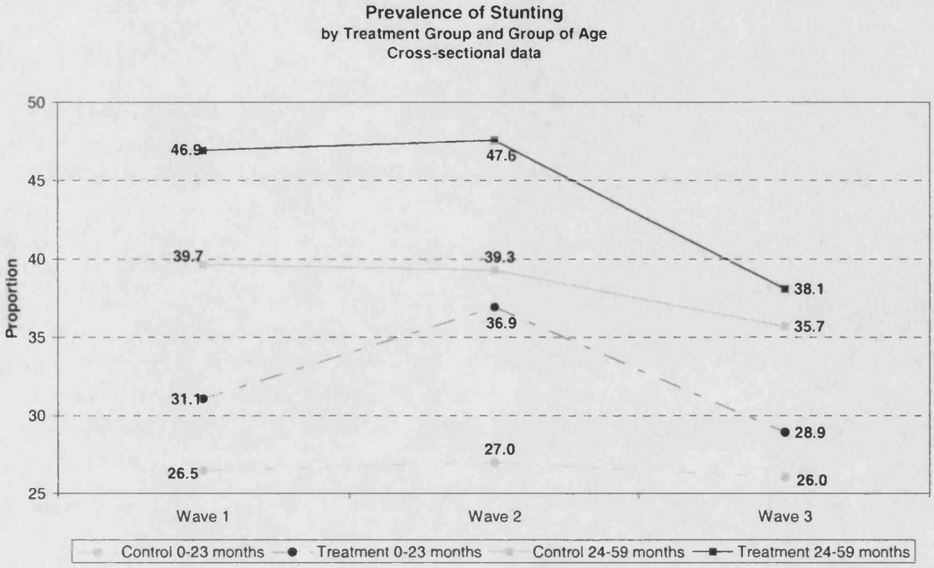


We also explored the changes over time regarding the prevalence of stunting (see Figure 7.5[158]). This dichotomous indicator had a similar trend to that of the continuous measure. A double difference estimator of this indicator suggests that, among children 24 -59 months old, between baseline and wave three, the Programme is associated with a reduction in stunting of 5 percentage points, which in relative terms corresponds to a reduction of 10 percent. In contrast, among children in the younger age group, the prevalence of stunting remained practically unchanged between waves one and three for both treatment and control groups.

---

[158] The table with the corresponding t-tests for this dichotomous indicator is presented in Appendix 7.

Figure 7.5



Results for weight for age are somewhat different to those obtained for height for age. Data on Table 7.6 shows that for this anthropometric index there are no differences between treatment and control groups at baseline for either age group. Thus, in the absence of other differences, it could be possible to estimate the Programme's effect by comparing only the outcome variable over time. In terms of changes over time, these figures show that both beneficiary and non-beneficiary children in the cross-sectional sample experienced important improvements in their nutritional status, especially during the first year of Programme operation (see Figures 7.6 and 7.7). The fact that there are no differences at baseline between groups and that both groups showed improvements during the second wave of data collection suggests that this positive effect may be due to factors other than Progresa. Thus, it is important to control for the variables that could introduce a confounding effect in these findings such as parental education, distance to health centres, region of residence and other unobserved characteristics that could be associated with the outcome of interest.

Table 7.6
Mean Z-score values for Weight for Age
Eligible children in Treatment and Control Groups
Cross-sectional sample

	Mean Z-score values			T-test difference in means (p>t)			Diff $(w_3 - w_1)$	Diff-in-Diff $(w_3 - w_1)$
	Wave 1	Wave 2	Wave 3	(w1 vs w2)	(w2 vs w3)	(w1 vs w3)		
All children								
Control	-1.15	-0.96	-0.86	0.00 ***	0.03 **	0.00 ***	0.29	*-0.02*
Treatment	-1.21	-1.03	-0.94	0.00 ***	0.02 **	0.00 ***	0.26	
T-test difference in means (Control vs Treatment)								
P>t	0.11	0.06 *	0.03 **					
Children 0-23 months								
Control	-0.94	-0.76	-0.70	0.03 **	0.24	0.00 ***	0.25	*-0.08*
Treatment	-0.99	-0.90	-0.82	0.15	0.13	0.02 **	0.17	
T-test difference in means (Control vs Treatment)								
P>t	0.30	0.06 *	0.07 *					
Children 24-59 months								
Control	-1.26	-1.06	-0.96	0.00 ***	0.03 **	0.00 ***	0.30	*0.01*
Treatment	-1.32	-1.08	-1.02	0.00 ***	0.07 *	0.00 ***	0.31	
T-test difference in means (Control vs Treatment)								
P>t	0.10	0.31	0.11					

Note: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$

Results disaggregated by age group indicate a similar trend to that of the whole sample. That is, a continuous improvement in the levels of underweight among children in both treatment and control groups, with the greatest improvement occurring between waves one and two. Moreover, among children in the younger age group, it seems that the control group made greater progress than that of treatment children; hence, a negative sign in the double difference estimator (-0.08 SD). This is a puzzling result. If the positive change experienced by the control group was due to Progresa's benefits, we would expect to observe this impact at wave three, when two thirds of control children were receiving supplements and control families were receiving other Programme benefits. However, the greatest improvement in weight for age for the control group occurred between waves one and two. During this period, the proportion of control children receiving Programme benefits was minor (only 11 percent received supplements). Hence, this positive change is likely to be due to other factors.

Figure 7.7 presents the changes over time with respect to the prevalence of underweight. Once again, these values corroborate those obtained with the continuous indicator. However, in this figure the reduction of underweight between waves one and two is striking; around 8 percentage points in just one year. As previously mentioned, the fact that this massive reduction occurred among children of both control and treatment communities during the first year of Programme implementation suggests that it cannot be completely attributed to Progresa's intervention. At wave two some undernourished children in control communities were receiving supplements, thus part of the improvement of this group could be attributed to the intervention but not all. Moreover, the magnitude of change is beyond the scope of what has been observed elsewhere (on average, other programmes have decreased underweight rate by around 1.9 percentage points per year) (Carr 2004).

In order to find a possible explanation for the remarkable reduction in underweight rates, we looked at data at the community level and found that at wave one the proportion of localities that suffered from some kind of natural disaster was much higher than that observed at consecutive waves (82 percent in comparison with 66 and 40 percent at waves 2 and 3, respectively). These kinds of events can have a transitory shock on children's nutritional status with negative consequences, affecting in the short term their weight and in the long run their growth. Findings from a study of child growth in Ethiopia showed that the recurrent droughts suffered in the country have a substantial negative effect on children's growth even after controlling for a set of background characteristics (Christiaensen et al. 2003). It is possible that the level of underweight at baseline was affected by the higher incidence of disasters during this period. The prevalence rate would have been lower in the absence of these events, and thus the reduction observed at wave two would not have been that striking[159]. Finally, it is worth highlighting how these findings illustrate the importance of having a control group when evaluating programmes. Although in our case the control group is not "clean" because it received treatment during the period under study, its presence avoids under or overestimating the effect of this intervention.

[159] In order to control for the potential negative effect of natural disasters, this variable was included in subsequent multivariate analyses.

Figure 7.6

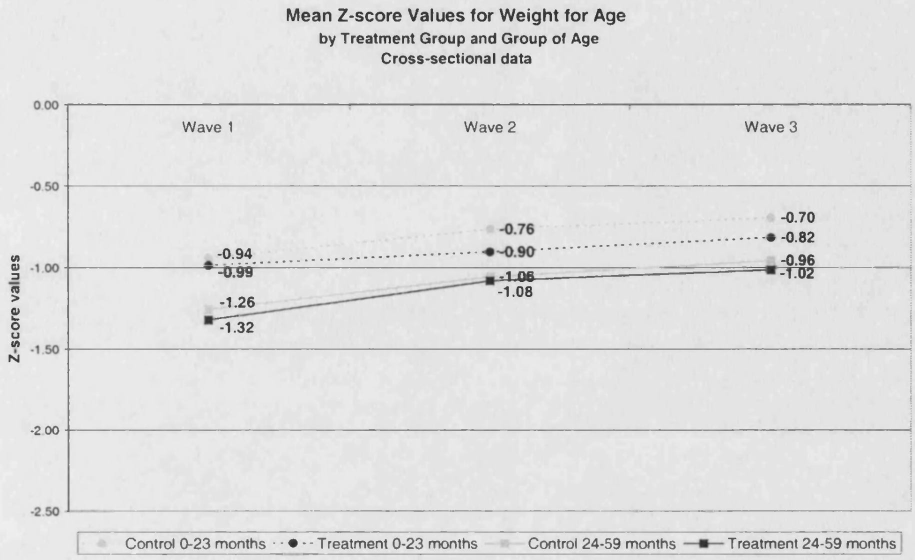
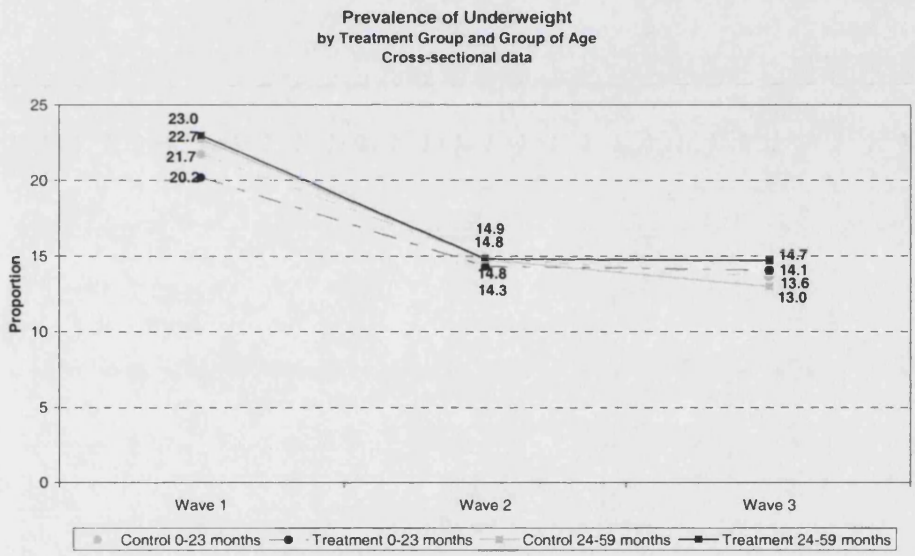


Figure 7.7



7.6.2. Multivariate Analysis

This section presents the results obtained from our multivariate analysis. We first discuss the findings for height for age obtained from running models (1) and (2); next we explain the corresponding findings for weight for age; and, lastly we present the results from our models assessing whether Progresa has a differential effect according to household's characteristics. We fitted our models for both type of longitudinal samples (with observations in at least two waves of data collection and those with all three observations). The parameter estimates for the sample with complete observations are close to those obtained for the sample of children 0-23 months with at least two observations. However, estimates for the former sample are not statistically significant. It is possible that the coefficients for this sample are not significant because the sample size is somewhat small (347 children). We focus our discussion on the longitudinal sample with two observations over time and present the results for the sample with complete observations in Tables A.7.3 and A.7.4 in Appendix 7.

Height for age

Table 7.7 shows the parameter estimates for living in a treatment locality (indicated by the row labelled as Progresa), receiving Progesa's supplements and wave of data collection. The p-values for these estimates indicate that neither living in a Progresa locality nor receiving nutritional supplements has a significant association with height for age compared to that of the corresponding reference categories (living in a control community and not receiving supplements). These results are observed for children in both age groups. Regarding variations over time, the height for age of children in the younger age group (less than two years old) shows a continuous decline (negative change). At wave two, one year after Programme implementation, the Z-score value for this anthropometric indicator is 0.37 standard deviations (SD) below that of baseline (95% C.I. = -0.66, -0.08); and, at wave three, this reduction is of 0.50 SD below their initial status (95% C.I. = -0.99, -0.01). These coefficients represent the changes over time for children in both treatment and control groups. Thus, these results reflect the negative association between nutritional status and age prevailing among children in deprived environments. In comparison, the coefficients for children in the older age category (between 24 and 47 months the first time observed) indicate no changes over time (no further deterioration). Next, to identify whether these trends are similar among different treatment groups, we examine the estimates of model (2).

Table 7.7
Estimates of Progresa's Effect on Height for Age
Fixed Effects Model 1

	Sample w/ Obs. in at least Two Waves														
	Children 0-47 months					*Children 0-23 months*					*Children 24-47 months*				
	Coef.	t	P>|t|	[95% C.I.]		Coef.	t	P>|t|	[95% C.I.]		Coef.	t	P>|t|	[95% C.I.]	
Progresa's benefits															
Progresa	-0.04 (0.06)	-0.7		-0.16	0.08	-0.04 (0.08)	-0.6		-0.20	0.11	-0.04 (0.08)	-0.5		-0.20	0.12
Supplement	-0.04 (0.05)	-0.8		-0.13	0.06	-0.07 (0.06)	-1.2		-0.20	0.05	0.04 (0.06)	0.6		-0.08	0.15
Wave															
Wave 2	-0.40 (0.10)	-4.1	***	-0.59	-0.21	-0.37 (0.15)	-2.5	**	-0.66	-0.08	-0.04 (0.14)	-0.3		-0.32	0.25
Wave 3	-0.63 (0.16)	-3.9	***	-0.95	-0.32	-0.50 (0.25)	-2.0	**	-0.99	-0.01	0.00 (0.25)	0.0		-0.50	0.49
Constant	-1.22 (0.19)	-6.5	***	-1.59	-0.85	-0.47 (0.22)	-2.2	**	-0.91	-0.04	-1.45 (0.74)	-2.0	*	-2.91	0.01
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
sigma_u	1.39					1.02					1.11				
sigma_e	0.52					0.54					0.44				
rho	0.88					0.78					0.86				
R-sq:															
within	0.24					0.36					0.18				
between	0.01					0.06					0.02				
overall	0.01					0.10					0.04				
corr(u_, Xb)	-0.28					-0.03					-0.16				
Number of observations:	2,706					1,436					1,270				
Number of groups (children):	1,353					718					635				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

For the interpretation of the following results, it is worth recalling that we modelled the interaction terms of interest using eight dummy variables. Table 7.8 presents the results of model (2) for height for age for children with at least two observations over time disaggregated by age group (children aged 0-23 months and 24-47 months).

The first thing to notice is that, for children in the younger age group, all the coefficients have a negative sign and practically all of them are highly significant (with p-values <0.05). This suggests a downward trend, which, as mentioned before, is largely explained by the fact that children in this age group are at the stage in which nutritional status deteriorates at a steeper rate (see Figure A.7.1 in Appendix 7). However, if the intervention was associated with a positive effect on children's nutritional status, we would observe a smaller decline in height for age among beneficiaries. Comparisons of the magnitude of these coefficients provide no evidence of a positive effect of supplement intake or of residing in a Progresa community. On the contrary, our estimates suggest that, at wave two, children receiving all benefits (i.e. living in a Progresa locality and receiving supplements) fare worse than children in other groups. However, these differences between groups are not significant. Likewise, at wave three, variations between the coefficients of the different treatment groups are not significant (the Z-score values range between -0.55 SD and -0.60 SD), suggesting no intervention effect. At this round, we observe a further deterioration in height for age, although not as pronounced as that observed between waves one and two.

Results for children in the older age category show a different trend over time. For this age group, the coefficients for height for age at waves two and three are not significantly different from zero. This is true for all treatment groups, indicating that among children 24-47 months this anthropometric indicator shows no variation in relation to the baseline situation. The fact that there are no fluctuations over time suggests no improvement, but also no further deterioration. This result could be associated with a positive influence of the Programme since height for age in these localities worsens until the age of five (see Figure A.7.1 in Appendix 7). However, this trend is experienced among all children; thus, we cannot attribute fully this favourable outcome to Progresa's intervention.

Table 7.8
Estimates of Progresa's Effect on Height for Age
Fixed Effects Model Two

	Sample w/ Obs. in at least Two Waves														
	Children 0-59 months					*Children 0-23 months*					*Children 24-47 months*				
	Coef.	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**	
Progresa - Supplement															
Wave 2	-0.47	-4.7	***	-0.66	-0.27	-0.51	-3.29	***	-0.81	-0.20	-0.01	-0.1		-0.31	0.28
	(0.10)					(0.15)					(0.15)				
Wave 3	-0.70	-4.3	***	-1.01	-0.38	-0.60	-2.4	**	-1.09	-0.11	0.00	0.0		-0.51	0.51
	(0.16)					(0.25)					(0.26)				
Progresa - No Supplement															
Wave 2	-0.45	-4.2	***	-0.66	-0.24	-0.45	-2.8	***	-0.77	-0.13	-0.05	-0.3		-0.36	0.26
	(0.11)					(0.16)					(0.16)				
Wave 3	-0.65	-3.8	***	-0.99	-0.32	-0.56	-2.1	**	-1.08	-0.03	0.03	0.1		-0.49	0.55
	(0.17)					(0.27)					(0.26)				
Control - Supplement															
Wave 2	-0.22	-1.0		-0.64	0.21	-0.28	-0.9		-0.88	0.31	0.39	1.3		-0.21	0.99
	(0.22)					(0.30)					(0.31)				
Wave 3	-0.68	-4.1	***	-1.01	-0.36	-0.60	-2.3	**	-1.10	-0.10	0.07	0.3		-0.45	0.58
	(0.17)					(0.26)					(0.26)				
Control -No Supplement															
Wave 2	-0.40	-4.1	***	-0.60	-0.21	-0.34	-2.2	**	-0.64	-0.04	-0.04	-0.3		-0.33	0.24
	(0.10)					(0.15)					(0.15)				
Wave 3	-0.61	-3.5	***	-0.95	-0.26	-0.55	-2.1	**	-1.07	-0.03	0.08	0.3		-0.44	0.61
	(0.18)					(0.26)					(0.27)				
Constant	-1.21	-6.4	***	-1.59	-0.84	-0.47	-2.1	**	-0.91	-0.04	-1.55	-2.1	**	-3.02	-0.08
	(0.19)					(0.22)					(0.75)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
sigma_u	1.14					1.02					1.11				
sigma_e	0.52					0.54					0.44				
rho	0.83					0.78					0.86				
R-sq:															
within	0.24					0.36					0.18				
between	0.00					0.06					0.02				
overall	0.01					0.10					0.04				
corr(u_, Xb)	-0.27					-0.03					-0.15				
Number of observations:	2,706					1,436					1,270				
Number of groups (children):	1,353					718					635				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Weight for age

Table 7.9 presents the estimates from model (1) for weight for age. Estimates from this model show different results by age group. Among children less than two years old the first time observed, the coefficients for the different covariates are not significantly different from zero. This suggests that for the younger group there is no effect associated with living in a Progresa locality, or with receiving supplements, or with wave of data collection. In other words, weight for age is not influenced by Progresa's benefits and it remains unchanged over time. In contrast, children in the older age category show important improvements (positive change) with respect to this anthropometric indicator. Furthermore, the coefficient for the dummy variable for supplements suggests that children receiving this in-kind benefit have an improvement of 0.12 standard deviations (95% C.I.= 0.0 – 0.23) relative to their peers not receiving this benefit. As for changes over time, children in this age group show continuous and significant improvements, with increases on weight for age of 0.30 SD (95% C.I.= 0.02 – 0.58) at wave two and of 0.48 SD (95% C.I.= 0.0 – 0.97) at wave three. This positive and increasing change indicates a better nutritional status after Programme implementation. Nevertheless, once again, this favourable outcome applies to all children, regardless of the type of benefit they receive or the type of community they live in. Thus, to identify whether the variations among the older age group are greater among Progresa's beneficiaries, we need to examine the estimates of model (2).

Table 7.10 presents the results obtained from running model (2) for weight for age. The parameter estimates for children 0-23 months indicate that, even after disaggregating the changes over time by type of intervention, there are no variations in the outcomes of the different treatment groups. The coefficients for children in this age category are all statistically insignificant, suggesting no improvements in weight for age with respect to the pre-programme situation. Therefore, for the younger age group, neither the supplements nor other Programme benefits have a positive influence on this anthropometric indicator.

In contrast, the coefficients for children 24-47 months old are all positive and statistically significant. For this age group, comparisons of the magnitude of the coefficients suggest some variations by treatment group. At wave two, children receiving supplements (either living in a treatment or control group) fare better than those not receiving this in-kind benefit. For example, among children in Progresa localities, those receiving supplements experience an increase in weight for age of 0.44 SD (95% C.I.= 0.15 – 0.72) compared with an improvement of 0.35 SD (95% C.I.= 0.05 – 0.65) among those not receiving this benefit. On the other hand, among children not receiving supplements, those residing in a Progresa locality experience better outcomes than those living in a control community (with a Z-score value of 0.35 SD and 0.26 SD, respectively). This last point suggests some positive effects not only of the supplement but also of the other activities related with Progresa. We carried out a test for difference between the coefficients to examine whether the variations previously described were significant or not. We observed that the only parameters which are significantly different ($p < 0.10$) from each other are the dummies at wave two for Progresa-Supplements (0.44 SD) and Control-No Supplement (0.26 SD). This result suggests that at wave two children receiving all Programme benefits have better outcomes than those of their peers receiving no benefits.

Table 7.9
Estimates of Progresa's Effect on Weight for Age
Fixed Effects Model One

	Sample w/ Obs. in at least Two Waves														
	Children 0-47 months					*Children 0-23 months*					*Children 24-47 months*				
	Coef.	t	P>|t|	[95% C.I.]		Coef.	t	P>|t|	[95% C.I.]		Coef.	t	P>|t|	[95% C.I.]	
Progresa's benefits															
Progresa	0.03	0.4		-0.10	0.16	0.01	0.1		-0.16	0.19	0.02	0.2		-0.14	0.18
	(0.07)					(0.09)					(0.08)				
Supplement	-0.08	-0.8		-0.30	0.13	-0.10	-0.6		-0.43	0.22	0.12	2.0	**	0.00	0.23
	(0.11)					(0.17)					(0.06)				
Wave															
Wave 2	-0.19	-1.0		-0.54	0.17	-0.13	-0.5		-0.68	0.43	0.30	2.1	**	0.02	0.58
	(0.18)					(0.28)					(0.14)				
Wave 3	0.04	0.8		-0.06	0.15	0.05	0.7		-0.09	0.19	0.48	2.0	*	0.00	0.97
	(0.05)					(0.07)					(0.25)				
Constant	-0.69	-3.3	***	-1.10	-0.27	0.20	0.8		-0.29	0.69	-2.02	-2.8	***	-3.45	-0.59
	(0.21)					(0.25)					(0.73)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
sigma_u	1.05					0.96					0.94				
sigma_e	0.58					0.61					0.43				
rho	0.76					0.71					0.83				
R-sq:															
within	0.25					0.36					0.25				
between	0.01					0.06					0.03				
overall	0.01					0.10					0.02				
corr(u_, Xb)	-0.28					-0.03					-0.14				
Number of observations:	2,706					1,436					1,270				
Number of groups (children):	1,353					718					635				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Between waves two and three, we observe further improvements among children in the older age group. However, those receiving supplements experience smaller gains than those not receiving them. This catch-up in weight for age among the latter led to a reduction in the gaps between treatment groups. Thus, at wave three, differences between groups are not as marked as those observed in the previous wave. As a consequence, the favourable intervention effect is no longer evident. The small variations between groups at wave three is perhaps explained by the fact that at this wave of data collection a non-trivial number of children living in control communities was receiving treatment. This aspect introduces some noise into our estimations, which we are not able to control for.

Table 7.10
Estimates of Progresa's Effect on Weight for Age
Fixed Effects Model Two

	Sample w/ Obs. in at least Two Waves														
	Children 0-59 months					*Children 0-23 months*					*Children 24-47 months*				
	Coef.	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**	
Progresa - Supplement															
Wave 2	-0.01	-0.1		-0.22	0.21	-0.13	-0.8		-0.46	0.20	0.44	3.0	***	0.15	0.72
	(0.11)					-(0.02)					(0.14)				
Wave 3	-0.16	-0.9		-0.52	0.19	-0.07	-0.3		-0.63	0.48	0.54	2.1	**	0.04	1.03
	(0.18)					(0.28)					(0.25)				
Progresa - No Supplement															
Wave 2	-0.01	-0.1		-0.25	0.22	-0.06	-0.4		-0.43	0.30	0.35	2.3	**	0.05	0.65
	(0.12)					(0.18)					(0.15)				
Wave 3	-0.11	-0.6		-0.49	0.26	-0.09	-0.3		-0.69	0.50	0.58	2.3	**	0.07	1.08
	(0.19)					(0.30)					(0.26)				
Control - Supplement															
Wave 2	0.06	0.2		-0.42	0.53	0.03	0.1		-0.64	0.70	0.62	2.1	**	0.04	1.21
	(0.24)					(0.34)					(0.30)				
Wave 3	-0.12	-0.6		-0.48	0.25	-0.07	-0.3		-0.64	0.49	0.67	2.7	***	0.17	1.18
	(0.19)					(0.29)					(0.25)				
Control -No Supplement															
Wave 2	-0.13	-1.1		-0.34	0.09	-0.14	-0.8		-0.47	0.20	0.26	1.8	*	-0.02	0.54
	(0.11)					(0.17)					(0.14)				
Wave 3	-0.16	-0.8		-0.54	0.23	-0.07	-0.2		-0.65	0.52	0.53	2.0	**	0.02	1.05
	(0.20)					(0.30)					(0.26)				
Constant	-0.69	-3.3	***	-1.11	-0.27	0.21	0.8		-0.28	0.71	-1.50	-6.2	***	-1.98	-1.02
	(0.21)					(0.25)					(0.24)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
sigma_u	1.14					0.96					0.94				
sigma_e	0.52					0.61					0.43				
rho	0.83					0.71					0.83				
R-sq:															
within	0.24					0.36					0.25				
between	0.00					0.06					0.02				
overall	0.01					0.10					0.04				
corr(u_, Xb)	-0.27					-0.03					-0.12				
Number of observations:	2,706					1,436					1,270				
Number of groups (children):	1,353					718					635				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Finally, we briefly explain the values at the bottom of the tables, which provide some measures of goodness of fit of these models. The first rows describe the error terms, with sigma_u corresponding to the subject specific error term and sigma_e to the occasion specific error term. Rho is the fraction of variance due to the subject specific error, also called the intra–class correlation. The higher its value the more the process is dominated by the persistence of unexplained subject differences (Pickles 2003). The fact that variables such as genetic factors, incidence of diseases, feeding practices, among others are not included in these models might explain the high percentage of unexplained variance (Rho is above 0.70). On the other hand, the values for the R-squared have values ranging between 0.18 and 0.36. The last row shows the correlation[160] between measures for the same individual over time. We observe that all models show a negative value for this measure. This is explained by the downward trend in nutritional status as children age.

Progresa's effect by household's severity of poverty

In Tables 7.11 and 7.12 we present the results obtained from running model (1) by household's severity of poverty. We estimated these models for children in all age groups, but we only present findings for those in the older category (children aged between 24 and 47 months old the first time observed). Only children in this age group showed differences in treatment effect by degree of poverty. In addition, we corroborated these findings by estimating a model that includes an interaction term between Progresa and poverty level. Results for height for age (shown in Table 7.11 and 7.13) indicate that residing in a Progresa locality or receiving supplements has no association with this outcome variable. Furthermore, this finding is observed among the three levels of poverty under examination. Hence, for this anthropometric outcome there is no difference in the treatment effect by severity of poverty. In contrast, results in Table 7.12 indicate that for weight for age residing in a Progresa locality and receiving supplements have a positive and significant effect for children in the most deprived category (with Z-score values of 0.30 SD each). However, once we estimate a model with interaction terms this difference is not statistically significant. Nonetheless, we observe a trend suggesting that the greatest effect occurred at the bottom of the distribution. It is possible that the mechanisms through which Progresa has a positive effect on children's nutritional status are having a greater impact among those with fewer resources and capabilities. The food supplements may have a greater benefit among families with less nutritious diets; or that compulsory attendance to the health centres allows treating opportunely those cases who only attend the health centre when ill; or that the information provided at the educational sessions has a

[160] The fixed effects assume that the correlation between measures of the same subject arise out of the effects of variables that were omitted from the model and that these effects were constant over time. There are other ways in which correlation over time could come about, but we are not able to estimate it with a fixed effects model. Nonetheless, this constraint should not affect much these findings, since the dataset includes only information on a three year period and thus variations should not be that great.

greater impact on improving maternal care practices of mothers with few years of schooling.

Table 7.11
Estimates of Progresa's Effect on Height for Age by Terciles of Poverty
Children 24 - 47 months old. Sample with Observations in Two Waves
Fixed Effects Model One

	First Tercile				*Second Tercile*				*Third Tercile*			
	Coef.	**t**	**P>|t|**	**[95% C.I.]**	**Coef.**	**t**	**P>|t|**	**[95% C.I.]**	**Coef.**	**t**	**P>|t|**	**[95% C.I.]**
Progresa's benefits												
Progresa	0.04	0.2		-0.28 0.36	0.02	0.1		-0.33 0.37	-0.07	-0.5		-0.34 0.19
	(0.16)				(0.18)				(0.13)			
Supplement	-0.11	-0.9		-0.35 0.13	0.12	1.0		-0.12 0.37	0.13	1.2		-0.08 0.34
	(0.12)				(0.12)				(0.11)			
Wave												
Wave 2	0.09	0.3		-0.46 0.63	-0.12	-0.3		-0.80 0.57	0.13	0.6		-0.33 0.58
	(0.28)				(0.34)				(0.23)			
Wave 3	0.15	0.3		-0.84 1.14	-0.08	-0.1		-1.22 1.06	0.25	0.6		-0.54 1.04
	(0.50)				(0.58)				(0.40)			
Constant	-1.83	-3.4	***	-2.90	-1.94	-1.6		-4.32 0.45	-1.28	-2.9	***	-2.17 -0.39
	(0.54)				(1.21)				(0.45)			
Controls:												
Individual Characteristics	√				√				√			
Household Characteristics	√				√				√			
Community Characteristics	√				√				√			
sigma_u	1.17				1.04				1.10			
sigma_e	0.40				0.49				0.45			
rho	0.90				0.82				0.86			
F test that all u_i=0:	9.4				5.6				8.23			
R-sq:												
within	0.21				0.11				0.23			
between	0.01				0.02				0.01			
overall	0.01				0.01				0.04			
corr(u_, Xb)	-0.18				-0.28				-0.15			
Number of observations:	382				412				452			
Number of groups (children):	191				206				226			

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Table 7.12
Estimates of Progresa's Effect on Weight for Age by Terciles of Poverty
Children 24 - 47 months old. Sample with Observations in Two Waves
Fixed Effects Model One

	First Tercile					*Second Tercile*					*Third Tercile*				
	Coef.	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**	
Progresa's benefits															
Progresa	0.30	1.7	*	-0.05	0.65	-0.05	-0.3		-0.34	0.25	-0.17	-1.3		-0.43	0.09
	(0.18)					(0.15)					(0.13)				
Supplement	0.31	3.0	***	0.10	0.52	-0.07	-0.5		-0.33	0.19	0.12	1.1		-0.09	0.32
	(0.10)					(0.13)					(0.10)				
Wave															
Wave 2	0.16	0.5		-0.43	0.76	0.48	1.6		-0.10	1.06	0.52	2.3	**	0.08	0.96
	(0.30)					(0.29)					(0.22)				
Wave 3	0.20	0.4		-0.87	1.26	0.87	1.8	*	-0.10	1.84	0.60	1.6		-0.17	1.37
	(0.54)					(0.49)					(0.39)				
Constant	-1.89	-3.2	***	-3.05	-0.74	-2.02	-2.9	***	-3.42	-0.61	-1.39	-3.2	***	-2.25	-0.52
	(0.58)					(0.71)					(0.44)				
Controls:															
Individual Characteristics	√					√					√				
Household Characteristics	√					√					√				
Community Characteristics	√					√					√				
sigma_u	0.99					0.96					0.95				
sigma_e	0.43					0.42					0.43				
rho	0.84					0.84					0.83				
F test that all u_i=0:	0.2					0.8					0.5				
R-sq:															
within	0.30					0.40					0.37				
between	0.01					0.02					0.01				
overall	0.01					0.01					0.04				
corr(u_, Xb)	-0.27					-0.36					-0.17				
Number of observations:	382					411					452				
Number of groups (children):	191					206					226				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Table 7.13
Estimates of Progresa's Effect on Height for Age and Weight for Age using Interactions between Progresa and Terciles of Poverty
Children 24 - 47 months old. Sample with Observations in Two Waves
Fixed Effects Model One

	Height for Age						Weight for Age					
	Coef.	Std. Err.	z	P>|z|	[95% C.I.]		Coef.	Std. Err.	z	P>|z|	[95% C.I.]	
Progresa * Poverty terciles												
Progresa* First tercile	0.15	0.12	1.2		-0.09	0.40	0.10	0.12	0.8		-0.14	0.33
Progresa* Second tercile	0.02	0.12	0.1		-0.22	0.25	0.09	0.12	0.8		-0.14	0.32
Progresa* Third tercile	-0.08	0.10	-0.8		-0.29	0.12	-0.03	0.10	-0.3		-0.23	0.17
Control* First tercile	(dropped)	-	-		-	-	(dropped)	-	-		-	-
Control* Second tercile	(dropped)	-	-		-	-	(dropped)	-	-		-	-
Control* Third tercile	(Reference)	-	-		-	-	(Reference)	-	-		-	-
Controls:												
Wave												
Household's characteristics												
Dwelling characteristics												
Community characteristics												
sigma_u	1.12						0.95					
sigma_e	0.44						0.43					
rho	0.86						0.82					
F test that all u_i=0:	0.0						0.0					
R-sq:												
within	0.08						0.25					
between	0.01						0.01					
overall	0.04						0.01					
corr(u_, Xb)	-0.21						-0.17					
Number of observations:	1,246						1,246					
Number of groups (children):	623						623					

Notes: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

7.7. Conclusions

Before the outset of Progresa, the prevalence of undernutrition among eligible children was critical: two out of five children suffered from stunting (38.6 percent) and one out of five from underweight (22.2 percent). In addition, around one-third were classified as mildly malnourished; hence, susceptible to falling into the moderate category of malnutrition. Therefore, although at the national level the prevalence rates are relatively low, malnutrition remains a serious health problem among poor children living in rural marginal localities in Mexico.

Our estimates show little evidence of an improvement in children's nutritional status due to Progresa's intervention. Results using the cross-sectional sample indicate some positive changes over time. However, these improvements take place among both treatment and control children. It is difficult to disentangle Progresa's impact whit this data because there was a partial intervention for undernourished control children and because children in the control group were receiving benefits before wave three. Nevertheless, a difference-in-difference estimator suggests that, between baseline and wave three, there is a somewhat larger improvement in height for age among beneficiary children over two years old. For this age group, the Programme is associated with an increase in the Z-score values for height for age of 0.09 SD (which in relative terms it is equivalent to an improvement of 5 percent) and a reduction in the prevalence of stunting of 5 percentage points (in relative terms is equivalent to a reduction of 10 percent). However, these results should be read with caution since they do not account for observed and unobserved differences between treatment and control groups.

Estimates from our fixed-effects models provide little evidence of any positive effect associated with Progresa's intervention. Only results for weight for age indicate a favourable influence of Progresa's supplements, and then only among children 24 - 47 months old (an increase of 0.12 SD; 95% C.I.= 0.0 – 0.23). At wave two, children in this age group, living in a Progresa locality and receiving supplements fare better than those not receiving benefits. A difference-in-difference estimator suggests an overall Programme impact on weight for age of 0.18 SD, i.e. a 12 percent improvement from the baseline value. At wave three, we also notice positive changes in the weight-for- age for the older age group. However, these improvements take place among children of all treatment groups. Hence, there is no evidence that the variations between waves two and three are attributable to Progresa's activities.

The fact that our results show that children in the older age group experienced larger gains suggests that Progresa is more efficient in avoiding further deterioration from malnutrition than in preventing it. In the previous chapter, we observed important reductions in the prevalence of diarrhoea that is likely to be linked with the improvements in weight for age. Children in the younger age group are at the stage when they are more likely to be affected by diarrhoea and other infectious diseases. Thus, it is more difficult for the supplement to improve children's weight. On the other hand, children in the older age group have already been incorporated into their families' diets and have passed the peak of infectious diseases; hence the supplement, a more varied diet, and an increased use of health services may contribute to improve their nutritional status as indicated by weight for age.

It seems somewhat surprising that, with longer duration of programme exposure, children receiving supplements do not show further improvements at wave three. A possible explanation for the supplement not having a significant effect at wave three could be that children are not consuming the supplement as they should. If it was consumed according to Progresa's guidelines (one daily dose of 250 grams), it should have a positive impact on children's growth because its formulation was designed to meet their nutritional needs. However, estimates from a qualitative study evaluating Progresa's operations indicate that, at the beginning of the Programme, there were serious problems with the provision of supplements (Adato et al. 2000). Mothers did not receive the supplement allocation they should and the supplement was shared with other family members. The variable used in our analyses indicates whether the child received supplements or not, but it does not account information on actual intake nor on the period of consumption. Thus, it is possible that it suffers from some measurement error.

Regarding the effect of Progresa by household's severity of poverty, our models show some evidence that the poorest children benefit more from this intervention. We observe a differential effect of the Programme for weight for age among children aged between 24 and 47 months old. Among this age group and for this anthropometric outcome, receiving supplements is associated with a positive effect of 0.30 SD (95% C.I.= 0.10 – 0.52) on the weight for age of children in the poorest category. This result suggests that children with fewer resources have experienced greater gains from Progresa's intervention than those from less deprived households. However, this conclusion should be treated with caution because this differential effect is not observed for children in the younger age category or for height for age.

It is important to continue monitoring the progress of these children in order to assess the Programme's effect in the medium and long term. It is likely that positive results do not appear in the short term because nutrition interacts with poverty, education and health, creating a cumulative effect (Martorell 1999b). The design of Progresa's actions should improve the condition in these sectors; hence, if the Programme is well implemented and managed it should have important contributions in reducing child malnutrition and its deleterious effects.

We believe that the reasons for not observing important differences between control and treatment groups include: 1) the supplement not being consumed according to the guidelines of the Programme; 2) the control group received supplements as from wave two and started receiving other Programme benefits during the last year of observation, hence introducing noise into our estimations; 3) inadequate feeding practices have not changed.

Our assessment shows an insufficient effect of Progresa on reducing the high levels of malnutrition in these localities. It is important to increase efforts on preventing malnutrition at an early age. Other studies have shown that catch-up growth after the age of two is possible, but these studies have also found that this effect tends to fade away as interventions cease to operate. Thus, in order to observe enduring effects with a positive impact in children's future life chances, it is crucial to augment efforts in the activities targeted during pregnancy and at early infancy. Additionally, the educational sessions should reinforce the importance of adequate feeding practices. Furthermore, supplements should be given to all children under the age of five, irrespective of their nutritional status, to avoid that younger children share this benefit with other children in the household.

Appendix 7. Additional Tables – Chapter 7

Table A.7.1
Prevalence of Stunting
Eligible children in Treatment and Control Groups
Cross-sectional sample

	Proportion Stunted			Test equality on proportions (p>z)			Diff (w_3 - w_1)	Diff-in-Diff (w_3 - w_1)
	Wave 1	**Wave 2**	**Wave 3**	**(w1 vs w2)**	**(w2 vs w3)**	**(w1 vs w3)**		
All children								
Control								
Proportion	35.2	35.1	32.2	0.44	0.09	0.06	-2.9	
SDE	1.5	1.6	1.4		*	*		-3.8
Treatment								
Proportion	41.5	44.1	34.8	0.86	0.00	0.00	-6.7	
SDE	1.4	1.4	1.3		***	***		
Test equality on proportions (Control vs Treatment)								
P>z	0.00	0.00	0.08					
	***	***	*					
Children 0-23 months								
Control								
Proportion	26.5	27.0	26.0	0.56	0.39	0.45	-0.4	
SDE	2.3	2.2	2.2					-1.7
Treatment								
Proportion	31.1	36.9	28.9	0.04	0.01	0.24	-2.2	
SDE	2.2	2.4	2.0	**	***			
Test equality on proportions (Control vs Treatment)								
P>z	0.08	0.00	0.17					
	*	***						
Children 24-59 months								
Control								
Proportion	39.7	39.3	35.7	0.45	0.10	0.06	-3.9	
SDE	1.9	2.1	1.8		*	*		-4.9
Treatment								
Proportion	46.9	47.6	38.1	0.61	0.00	0.00	-8.8	
SDE	1.7	1.7	1.6		***	***		
Test equality on proportions (Control vs Treatment)								
P>zt	0.00	0.00	0.16					
	***	***						

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

Table A.7.2
Prevalence of Underweight
Eligible children in Treatment and Control Groups
Cross-sectional sample

	Proportion Underweight			Test equality on proportions (p>z)			Diff ($w_2 - w_1$)	Diff-in-Diff ($w_3 - w_1$)
	Wave 1	Wave 2	Wave 3	(w1 vs w2)	(w2 vs w3)	(w1 vs w3)		
All children								
Control								
Mean	22.4	14.8	13.3	0.00	0.17	0.00	-7.6	
SDE	1.3	1.2	1.0	***		***		0.2
Treatment								
Mean	22.0	14.7	14.5	0.00	0.43	0.00	-7.4	
SDE	1.2	1.0	0.9	***		***		
Test equality on proportions (Control vs Treatment)								
P>z	0.43	0.46	0.81					
Children 0-23 months								
Control								
Mean	21.7	14.9	13.6	0.01	0.32	0.00	-6.8	
SDE	2.2	2.1	1.7	**		***		1.0
Treatment								
Mean	20.2	14.3	14.1	0.01	0.46	0.01	-5.9	
SDE	1.9	1.8	1.5	**		***		
Test equality on proportions (Control vs Treatment)								
P>z	0.30	0.42	0.58					
Children 24-59 months								
Control								
Mean	22.7	14.8	13.0	0.00	0.18	0.00	-7.9	
SDE	1.6	1.5	1.3	***		***		-0.2
Treatment								
Mean	23.0	14.8	14.7	0.00	0.47	0.00	-8.1	
SDE	1.5	1.2	1.2	***		***		
Test equality on proportions (Control vs Treatment)								
P>z	0.55	0.51	0.84					

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

Figure A.7.1

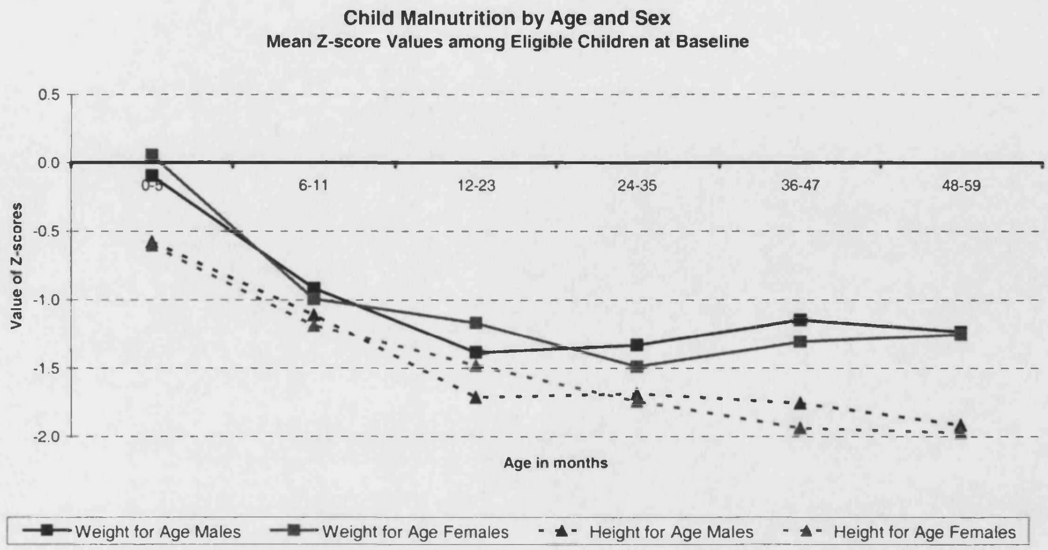


Table A.7.3
Estimates of Progresa's Effect on Height for Age and Weight for Age
Sample with Complete Observations. Fixed Effects Model One.

	Height for Age *Children 0-35 months*					Weight for Age *Children 0-35 months*				
	Coef.	**t**	**P>|t|**	**[95% C.I.]**		**Coef.**	**t**	**P>|t|**	**[95% C.I.]**	
Progresa's benefits										
Progresa	-0.02 (0.10)	-0.2		-0.20	0.17	-0.07 (0.11)	-0.6		-0.28	0.15
Supplement	-0.12 (0.08)	-1.5		-0.27	0.03	0.02 (0.09)	0.3		-0.15	0.20
Wave										
Wave 2	-0.20 (0.17)	-1.2		-0.53	0.13	0.19 (0.19)	1.0		-0.19	0.57
Wave 3	-0.21 (0.28)	-0.8		-0.77	0.34	0.27 (0.33)	0.8		-0.38	0.92
Constant	-0.64 (0.29)	-2.2	**	-1.21	-0.07	0.29 (0.34)	0.9		-0.38	0.96
Controls:										
Individual Characteristics	√					√				
Household Characteristics	√					√				
Community Characteristics	√					√				
sigma_u	1.02					0.93				
sigma_e	0.53					0.61				
rho	0.79					0.69				
F test that all u_i=0:	6.6					0.52				
R-sq:										
within	0.29					0.33				
between	0.02					0.02				
overall	0.06					0.06				
corr(u_, Xb)	-0.05					-0.06				
Number of observations:	1,041					1,041				
Number of groups (children):	347					347				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Table A.7.4
Estimates of Progresa's Effect on Height for Age and Weight for Age
Sample with Complete Observations. Fixed Effects Model Two

	Height for Age *Children 0-35 months*					Weight for Age *Children 0-35 months*				
	Coef.	t	P>|t|	[95% C.I.]		Coef.	t	P>|t|	[95% C.I.]	
Progresa - Supplement										
Wave 2	-0.27	-1.6		-0.61	0.07	0.11	0.6		-0.29	0.51
	(0.17)					(0.20)				
Wave 3	-0.30	-1.1		-0.86	0.26	0.13	0.4		-0.52	0.78
	(0.28)					(0.33)				
Progresa - No Supplement										
Wave 2	-0.26	-1.4		-0.62	0.10	0.18	0.9		-0.24	0.60
	(0.18)					(0.21)				
Wave 3	-0.20	-0.7		-0.79	0.39	0.28	0.8		-0.41	0.97
	(0.30)					(0.35)				
Control - Supplement										
Wave 2	-0.38	-1.6		-1.56	0.09	0.36	1.6		-0.20	1.72
	(0.42)					(0.49)				
Wave 3	-0.32	-1.1		-0.89	0.25	0.31	0.9		-0.35	0.98
	(0.29)					(0.34)				
Control -No Supplement										
Wave 2	-0.17	-1.0		-0.51	0.17	0.13	0.6		-0.27	0.52
	(0.17)					(0.20)				
Wave 3	-0.09	-0.3		-0.70	0.52	0.16	0.5		-0.54	0.87
	(0.31)					(0.36)				
Constant	-0.61	-2.1	**	-1.19	-0.04	0.24	0.7		-0.43	0.91
	(0.29)					(0.34)				
Controls:										
Individual Characteristics	√					√				
Household Characteristics	√					√				
Community Characteristics	√					√				
sigma_u	1.02					0.93				
sigma_e	0.53					0.61				
rho	0.79					0.69				
F test that all u_i=0:	6.6					0.5				
R-sq:										
within	0.29					0.33				
between	0.02					0.02				
overall	0.06					0.06				
corr(u_, Xb)	-0.05					-0.06				
Number of observations:	806					1,041				
Number of groups (children):	347					347				

Note: Statistical significance: * p<0.10; ** p<0.05; *** p<0.01
Standard errors in paranthesis

Chapter 8. Conclusions

8.1. Introduction

The aim of this research was to assess whether Progresa, Mexico's main anti-poverty programme, improved children's life chances during its first three years of intervention. The investigation was made through an analysis of the effects that this intervention had on improving children's health and nutritional status during this time. The analysis focused on children under the age of five because, as Chapter 1 shows, experiences during the first years of life are crucial for shifting the odds towards more favourable outcomes. It was important to look at the impact on children's health and nutritional status because these outcomes influence the accumulation of human capital in the subsequent stages of life. Thus, to assess whether Progresa improved the life chances of its beneficiaries, we examined whether it strengthened young children's basis for future attainments. Our different analyses indicated that during the period under study Progresa's intervention was associated with some positive outcomes on household's food security, and on children's diarrhoea morbidity and weight for age. However, our estimates did not show that the Programme was associated with improvements in the duration of exclusive breastfeeding or on children's height for age. Our results suggested that, among the outcomes on which the Programme had a favourable influence, its beneficial effect was greatest among the poorest groups. Even though these results are undoubtedly commendable, the modest improvements in crucial areas suggest that Progresa's effect on improving the life chances of young children is limited.

This conclusive chapter is organised as follows. In Section 8.2, we summarise and discuss the main findings obtained in the analytical chapters. In Section 8.3, we provide some policy recommendations and in section 8.4 we conclude this chapter by outlining some areas of potential future research.

8.2. Summary and Discussion of Results

In this section we present a summary of the conclusions obtained from the analytical chapters of the thesis. We start by examining the situation of eligible children before Progresa was implemented with respect to the outcomes under study. Next, we discuss the Programme's effect on each outcome showing its overall impact, its effect by wave of data collection, its impact by children's age group, and its effect by households' severity of poverty.

Baseline situation

In the previous chapters we examined the situation at baseline to have a better understanding of the living conditions of eligible children before Progresa was implemented. As expected, results from these initial analyses showed that the children selected by the Programme grow up in families who have scarce resources for accessing the most basic needs. As previously mentioned, such children have to cope with multiple disadvantages that place them at a high risk of ill health and poor nutritional status.

At the outset of the Programme, eligible households with young children were highly vulnerable to food insecurity. Their total consumption per adult equivalent per day was around PPP US$ 1.5, close to the international poverty line for extreme poverty. Moreover, these households allocated most of their expenditure to food (73 percent), leaving them with a reduced margin for other expenses. We also noticed that their diet was poor both in quantity and quality. Hence, children in eligible households had limited access to food items needed to have healthy growth and development (e.g. vegetables, fruits, milk).

Regarding feeding practices, although overall breastfeeding was nearly universal (97 percent of eligible children being breastfed) and its duration relatively long (on average around 15 months), exclusive breastfeeding was a rare practice and its duration was much shorter (only around 3.5 months) than international recommendations (6 months). The short duration of exclusive breastfeeding suggests that eligible children were not benefiting fully from the protective effect of breastfeeding (e.g. against infectious diseases).

In addition, the incidence and duration of illnesses among eligible children was noticeably high. Almost half (47.7 percent) of eligible children were reported to be afflicted with some kind of disease: 13.2 percent with diarrhoea and 43.5 percent with some kind of respiratory infection. Our estimates of duration of illness suggest that throughout the year these children were ill on a considerable number of days (around 45 days). These figures highlight the vulnerability of these children not only to infectious diseases but also to undernutrition.

Furthermore, child malnutrition was a serious health problem in rural localities selected for incorporation. The proportion of eligible children suffering from stunting (38.6 percent), underweight (22.2 percent) and wasting (3.0 percent) was high. Additionally, a considerable further proportion (around 30 percent) of children were classified as mildly malnourished (stunted or underweight), and were therefore at risk of falling into the moderate category of malnutrition. Numerous studies have found that ill health during early childhood translates into poor future outcomes (e.g. schooling performance, health at subsequent stages, labour productivity), which can carry over to the next generation. Hence, these findings illustrate the need for an intervention supporting poor Mexican families in improving their children's life chances.

Progresa's overall effect

Regarding caloric availability, our estimates suggest an overall Programme effect of 7.0 percent (with a 95% confidence interval (C.I.)= 5.8 – 8.3). However, it is important to highlight that our results showed that Progresa had a positive, albeit if only protective effect on access to calories. This is because caloric availability reduced substantially over time (waves four and six) in both treatment and control localities. This finding is of utmost relevance because negative changes in this outcome variable imply increased vulnerability of covering minimum caloric requirements and higher risks of undernutrition.

As for dietary diversity, our estimates show an overall positive Programme effect of 7.3 percent (95% C.I.= 6.5 – 8.6). In contrast to caloric availability, dietary diversity shows an increasing trend in both treatment and control localities. Therefore, the positive effect associated with Progresa indicates that beneficiary households incorporated more diverse products into their diet than their control peers. Results by food category showed a greater impact on improving the variety of products of animal source (10.1 percent increase, with a 95% C.I.= 8.0 – 11.4) followed by that of vegetables and fruits (8.8 percent; 95% C.I.= 7.5 – 10.0). This shift towards food products not common to beneficiaries' diets represents a positive impact especially in the light of the monotonous diets these families traditionally consume. However, we do not know if the magnitude of this effect is enough to approach desirable levels for a nutritious diet.

Regarding child feeding practices our estimates suggest that the Programme had a positive effect on extending the duration of overall breastfeeding but no impact on extending that of exclusive breastfeeding. On the one hand, the fact that we did not observe major changes in these feeding modes suggests that Progresa's supplements did not have a crowding-out effect on breastfeeding. On the other hand, these results indicate that there is an urgent need to promote these feeding practices, especially that of exclusive breastfeeding. Extending the duration of these practices is an efficient approach to reducing morbidity and undernutrition rates.

In relation to child morbidity, our results provided some evidence of the Programme's favourable influence. After one year of Progresa's operation, the odds of being ill with diarrhoea among beneficiary children under five were 32 percent lower (odds 0.68:1; 95% C.I.= 0.48:1 – 1:1) than those of non-beneficiaries. Moreover, a year later, the odds of being ill with this infectious disease was reduced by 36 percent among children in the control group (odds 0.64:1; 95% C.I.= 0.44:1 – 0.92:1)) and among those in treatment localities it showed, albeit minor, further reductions. The fact that children in the control group received benefits before the third round of data-collection made our assessment of Progresa's intervention difficult. However, the odds of the control group at wave three suggest that control children catch up once they received benefits.

As for respiratory infections, we observed some puzzling results. At wave two, beneficiary children under five had lower odds of illness than eligible children in control localities (odds 0.70:1; 95% C.I.= 0.54:1 – 0.93:1). Unfortunately, this positive influence was not observed at wave three. What is more, it seems that there was an increase in the likelihood of catching this disease among beneficiary children. However, these findings should be interpreted with caution. Our data quality assessment suggests that reports on respiratory infections might suffer from reporting bias. It is possible that Progresa's intervention (e.g educational sessions on health related issues or the compulsory visits to the health centre) increased mothers' awareness of the symptoms associated with this illness and made it easier for them to recognise, and therefore, report the illness.

Finally, our estimates of Progresa's impact on children's nutritional status show little evidence of an improvement due to this intervention. Only results for weight for age showed some positive Programme effect and this favourable influence was only evident among children who were aged between 24 and 47 months the first time they were observed. It is likely that we observed a greater effect on weight for age because this nutritional indicator is more susceptible to changes in the short term than height for age. The fact that the improvements have remained relatively small is of concern; this is particularly so because in these localities the prevalence of child malnutrition is high.

Progresa's effect by wave of data collection

We estimated the impact of Progresa during its first three years of operation, examining whether there was a differential treatment effect over time. While interpreting these results, we had a problem because children living in control communities started receiving benefits in December 1999. This made our comparisons between treatment groups difficult. In most of our analyses we observed a catch up of the control group in the last waves of data collection, which is likely to be associated with the incorporation of this group.

Regarding caloric availability, our calculations showed that Progresa's impact on this outcome variable increased over time, reaching its highest value at wave four (from 5.6 percent at wave two to 13.5 percent at wave four). In contrast, at wave six, we observed an effect of only 2.6 percent. As mentioned before, for this food security outcome, households had less access to calories over time. Thus, the reduced impact of Progresa at wave six indicates a smaller protective effect against the drop in calories.

Results for dietary diversity also showed an increasing treatment effect over time, reaching a maximum value of 10.6 percent at wave four (from 6.1 percent at wave two). Similarly, after this round, the difference between treatment and control groups was smaller, resulting in an impact of 1.9 percent only. However, for this food security outcome, at wave six, all households attained more variety in their diets.

With regard to child morbidity, the fact that we had a limited number of waves of data collection inhibited a proper assessment of changes over time. Nevertheless, we observed a consistent pattern in this analysis. After one year of intervention, there was a significant difference in the outcomes of treatment and control groups, with this difference representing a positive Programme effect. However, two years after the Programme's implementation, once children living in control areas were incorporated into the Programme, differences between treatment groups were no longer evident.

As for anthropometric outcomes, the treatment effect on weight for age was evident at wave two. At wave three, we observed further improvements among children in this age category irrespective of the kind of treatment received. This positive outcome may suggest a catch-up of the group not receiving benefits. However, it is not clear whether the changes observed at wave three are fully attributable to Progresa's benefits.

Progresa's effect by age group

As for differences in the treatment effect according to age, our results suggest that for both morbidity and undernutrition, the Programme had a greater influence on improving the outcomes of children who were over two years old when they were first observed.

We observed that for both diseases under study, Progresa's impact was mainly due to a decrease in the morbidity risks of children who were aged between 24 and 47 months the first time they were observed. After one year of intervention, beneficiary children in this age group had around 50 percent less odds of being ill (with a 95% C.I.= 0.32:1 – 0.90:1). In contrast, we did not observe any positive effect among children in the younger age group. The greater effect found among children over two might be related to the fact that they had passed the weaning period, so they were at a stage when they were less susceptible to diarrhoea.

Likewise, our results suggest a larger treatment effect on improving the weight for age of children in the older age category. At wave two, children receiving supplements had an improvement of 0.12 SD (95% C.I.= 0.0 – 0.23) in their weight for age relative to their peers who were not receiving this in kind-benefit, representing a 6 percent improvement from the baseline value. Moreover, among this group of children, those receiving nutritional supplements and living in Progresa localities fared better than those not receiving benefits at all. A difference-in-difference estimator suggested an overall impact on weight for age for this group of children of 0.18 SD, i.e. a 12 percent increase in weight for age.

On the other hand, height for age shows no variations for children in this age group, probably because by the age of two many children were already stunted and reversing this trend, although not impossible, was more difficult. It is worth noting that, among children over two, height for age showed no further deterioration. This could be a favourable outcome because in these localities height for age can deteriorate until the age of five.

In the short term, reductions in morbidity have a greater impact on weight for age than on height for age. Thus, over a period of two years, it is likely that we would observe a greater treatment effect on the former. Moreover, the reductions in diarrhoea among children in this age group are likely to be associated with the improvements in their weight for age because of the strong interconnection between these outcomes.

Progresa's effect by severity of poverty

Throughout our analyses we found consistent results regarding the Programme's effect by household's severity of poverty. Our estimates showed that children with fewer resources had greater gains from Progresa's intervention than those from less deprived households. This differential effect is observed among those outcomes for which the Programme had a favourable effect (caloric availability, dietary diversity, diarrhoeal morbidity and weight for age). The fact that the most deprived families were able to benefit more from this intervention suggests that Progresa's benefits have partially substituted the lack of resources of these households. The cash transfers may have had a greater impact on the poorest households because in relative terms these grants had a greater contribution to household's expenditures. Additionally, the educational sessions may have benefited more those families with lower capabilities because the information provided was more helpful to mothers with low levels of schooling. The nutritional supplements may have been an important complement to children's diet in households where there are numerous children and thus a greater competition for scarce resources. However, it is not possible to identify which of the Programme's schemes has provided greatest support to the poorest families.

In some chapters we examined the interaction between living in a Progresa locality and a set of covariates which are linked with lack of resources – this was in order to assess on which specific groups the intervention had a greater effect. However, only a few explanatory variables showed a significant change with Progresa's intervention and we did not identify a consistent pattern that could give us a reliable insight into this matter.

Finally, it is worth noting that this differential effect according to the degree of poverty has also been observed in other interventions (those reviewed in Chapter 1), which showed that the largest treatment effects took place among children from the most disadvantaged groups (Myers 1992; Martorell 1995a).

Supplement's effect

As argued, our estimates on the supplement's effect on child health outcomes showed that they did not produce the expected improvements. We did find evidence that in-kind benefit was associated with the improvement on weight for age (increase of 0.12 SD) among children aged over two. However, we did not observe that the reduction in diarrhoea was associated with supplement "intake".

It is possible that the information used for estimating the impact of the supplement had some limitations. For instance, this information only tells us if a child received the supplement during the last month. However it does not provide information about the time of exposure to the supplement, an aspect which could potentially better inform us of a possible cumulative effect. Alternatively, mothers might report that the child received the supplement during the last month because attendance to the health centre is compulsory in order to receive the monthly cash transfer although this might, in effect, not have been the case.

Nevertheless, despite these data limitations, in Chapter 7, we observed that the delivery of the supplement had more serious problems, particularly during the first year of intervention. Moreover, other qualitative assessments of Progresa's performance pointed out that the nutritional supplements were likely to be shared with other family members. Therefore, although the supplement should, in theory, improve children's nutritional status, this effect was not observed because of operation problems and because the behaviour and decisions of care-givers cannot easily be changed.

In Figure 8.1 we present a diagram showing a summary of our results. On the left hand side of the diagram, we present the estimates of Progresa's effect on the underlying causes of child health that were examined in this thesis (food security and child feeding practices). On the right hand side, we display the estimates of the Programme's impact on child outcomes (health and nutrition). The information in the boxes include estimates on the overall impact of Progresa, the wave at which the largest effect was observed, the poverty group that experienced greater movements, and estimates on the influence of supplement intake (only for child outcomes). The arrows represent the hypothesised links between the different dimensions analysed.

As for food security, Progresa's intervention worked as a safety net, protecting poor households from macro shocks (in this case, lack of production of the main crops) that could have had a larger negative effect in the absence of the Programme. We also found that, although the diet of these families was somewhat more diverse than at baseline. Thus, it seems that, through this dimension, the Programme contributed, in a minor way, to improved child health and nutritional outcomes. Nonetheless, this positive result was not enough to compensate for the drop in caloric availability.

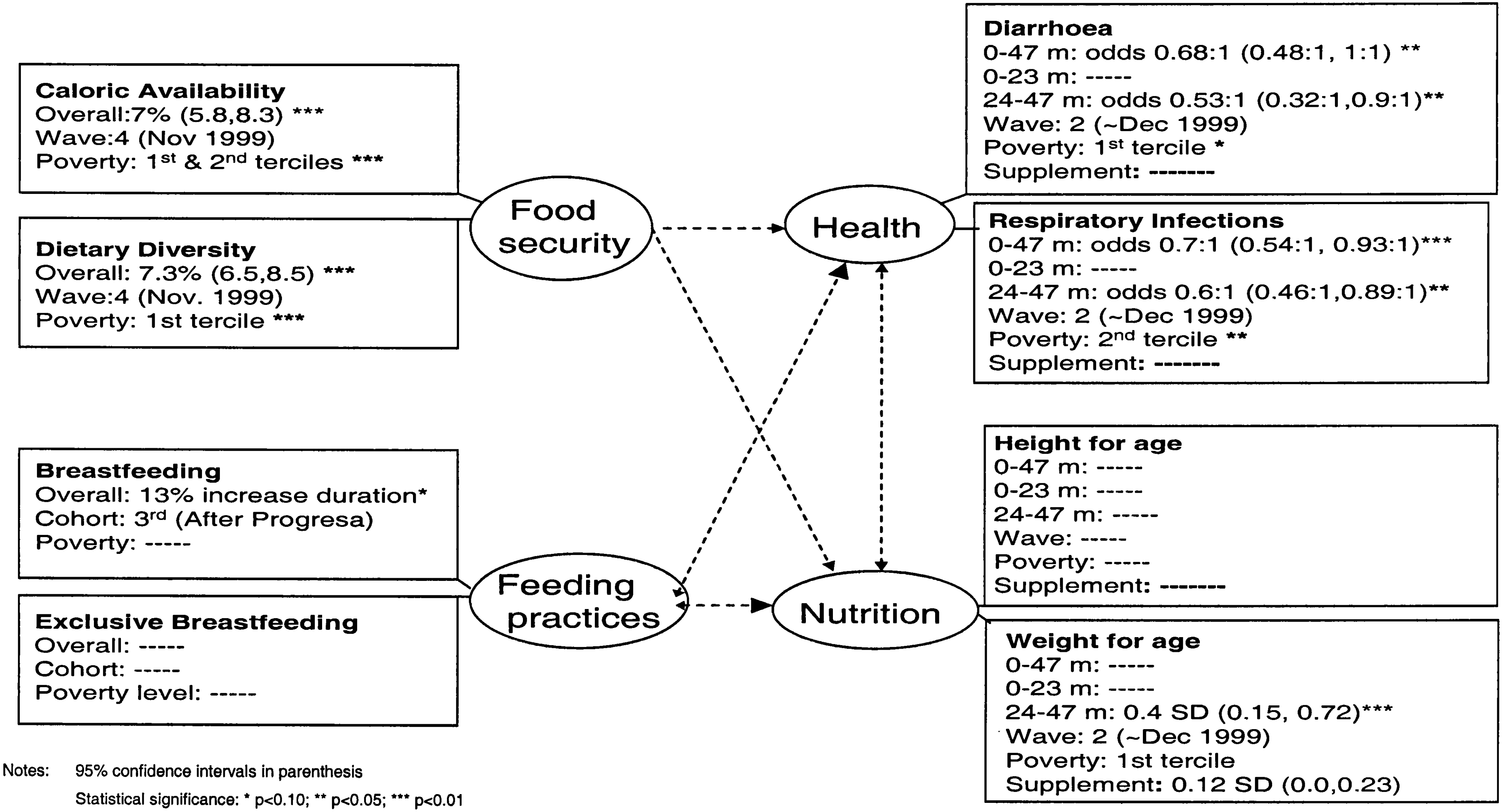
Additionally, Progresa was associated with minor changes in child feeding practices. The duration of breastfeeding was somewhat longer for the cohort born after the Programme was implemented; but the duration of exclusive breastfeeding remained unchanged. Adequate feeding practices are important for protecting young children against the incidence and severity of infectious diseases. However, as explained below, the increased duration of breastfeeding does not explain the reductions observed in morbidity rates among beneficiary children. Hence, the Programme's impact on health outcomes did not take place through this pathway.

With respect to child health outcomes, our estimates show that Progresa's benefits were associated with a drop in morbidity rates, but only among children in the older age group (aged 24 to 47 months at the start of observation). Among the underlying causes studied, only dietary diversity seems to have contributed to this positive result. Increased duration of breastfeeding is unlikely to have affected this outcome because children in the older age group were already weaned when they started to receive benefits. Additionally, our estimates suggest that the supplement intake was not linked with improvements in this outcome. Hence, it is possible that this positive result is due to other factors not examined here, such as increased use of preventive health services.

On the other hand, the lower incidence of diarrhoea is likely to be associated with improvements in weight for age since this anthropometric indicator is strongly correlated with infectious diseases. As with morbidity outcomes, the impact on weight for age was evident only among children aged 24 to 47 months at the start of observation. It seems that the factors influencing the positive effect on underweight include: a lower incidence of diarrhoeal diseases, a more varied diet and supplement intake. In contrast, we did not observe any Programme effect on height for age. The changes attributable to Progresa's intervention in other dimensions have not been enough to influence improvements in this nutritional outcome. In sum, we observed some positive, but modest, programme effects on the underlying causes of child well-being, which in turn were associated with moderate improvements in child health and nutrition.

We should recall some methodological issues that have to be taken into account in the interpretation of our estimates. These aspects include the attrition of the sample and the incorporation of the control group during the last year of data collection. Although our attrition analyses indicated that the bias observed should not represent major implications in our estimations, it should be kept in mind that the sample with repeated observations is a less disadvantaged group than the rest of the eligible population. This could have a downward effect in our estimations since there seems to be a greater effect among the most deprived groups of the population. In addition, the fact that the quasi-experimental design of Progresa's evaluation lasted only two years made our comparisons between treatment and control groups weaker. Not controlling for the delayed incorporation of the control group could represent an underestimation of Progresa's effect.

Figure 8.1 Summary of Results



Notes: 95% confidence intervals in parenthesis

Statistical significance: * p<0.10; ** p<0.05; *** p<0.01

8.3. Policy recommendations

The findings drawn from this thesis suggested a set of policy recommendations that we believe would enable Progresa's strategy to have a better performance in improving the living conditions of these children.

- Child feeding practices need to be improved by promoting exclusive breastfeeding for at least 6 months. This strategy has to be promoted both at the health centres during the visits for prenatal care and postnatal care as well as at the educational sessions.
- The nutritional supplements need to be timely distributed at the health centres; the age at which they are first given should increase from 4 to 6 months in order to respect the recommended period of exclusive breastfeeding; the importance of their adequate preparation and use as well as of their nutritious contribution to children's diet should be pointed out at the health centre and emphasised at the educational sessions; they should be given to all children under five living in the household to avoid sharing.
- The value of monetary grants should be examined to assess whether differential grants for the food component should be given according to the number of children in the household or according to the household's severity of poverty.
- It is imperative to improve the quality of health services. It is crucial to ensure that isolated locations have regular access to health services in order to opportunely detect and treat cases with malnutrition or other severe diseases.
- Progresa's strategies to alleviate poverty should be complemented with other initiatives aimed at improving other aspects Progresa does not cover but which are also related to the poverty of these households (e.g. employment opportunities, improving housing conditions, health services for non-preventive issues). The *Contigo* framework, recently implemented in the country, includes several policies that could reinforce Progresa's activities.

8.4. Future Research issues:

Finally, our research points to opportunities for further analysis. This thesis did not estimate the associations between the different outcomes analysed (shown as arrows in Figure 8.1). This is an area that future research can take forward to better understand how an intervention like Progresa can influence improvements in the life chances of its beneficiary population.

The study could focus on answering how strong the interrelationships are between a set of explanatory variables and child outcomes over time. One of the main variables to include in this complex pattern of interrelationships is Progresa's intervention. This would provide estimates of the strength of the association of the intervention with the outcomes analysed and would answer how these relationships change throughout time (strengthen, remain constant, weaken).

In addition, it is important to continue monitoring the progress of these children in order to assess the Programme's effect in the medium and long term. A follow-up survey of the rural sample was carried out in 2004. This last wave of data collection included information on anthropometric outcomes and on test scores to assess children's cognitive performance. It is necessary to examine this data to identify whether children in the younger age group showed developmental improvements at a later stage, which we were unable to identify with the information analysed. It is likely that positive results do not appear in the short term because nutrition interacts with poverty, education, and health creating a cumulative effect (Martorell 1999b). This analysis would have to be done taking into account many of the methodological aspects we came across during this work, such as not having a "perfect" randomised experiment because of attrition and because of the incorporation of the control group.

8.5. Conclusions:

Overall, our results indicate a modest Programme effect on improving young children's outcomes. The paths through which this intervention could affect children's health and nutrition changed moderately over time. Food security and maternal health care behaviours, considered to be underlying causes of child health, were barely affected by Progresa's intervention. Moreover, during the period under study, children's families had less access to calories due to factors exogenous to the Programme. It is possible that the monetary grants are not enough for supporting household's expenditures when they are affected by macro shocks. Furthermore, child-feeding practices, which are important elements of maternal health care behaviour, remained unchanged. In deprived settings like these appropriate feeding modes can have substantial effects on child health outcomes. The educational sessions are not sufficiently promoting the benefits that are associated with better feeding practices. In addition, our estimates suggested that Progresa's performance in improving the immediate causes of child malnutrition were limited. We observed that the Programme contributed to reducing the incidence of diarrhoea, but only for a selected group of the population. This reduction in child morbidity contributed to an improvement in children's weight for age. However, the limited effects on these mechanisms did not enhance further improvements. The fact that there were practically no positive changes linked with the Programme among children under two years old, and the fact that for children aged over two these improvements were modest, both suggest that Progresa's effect on improving the life chances of these children is limited.

These results are of utmost relevance because policies like Progresa have been replicated in other countries. Other evaluations have highlighted that these policies are being effective in improving children's human capital. Most of these findings are based on evidence of an increased attendance at health centres and schools, which are compulsory activities in order to receive Programme benefits. However, there is less evidence regarding their good performance on children's health outcomes. The importance of the early years on influencing future achievements indicates that these policies should reinforce their efforts to improve the conditions of very young children. Progresa's integral approach could translate into greater benefits for these children if the Programme were to be better implemented and managed. If these improvements were made to the way in which the Programme is designed, Progresa should have important contributions in reducing child malnutrition and its deleterious effects.

REFERENCES

ACC/SCN (2000). Fourth Report on the World Nutrition Situation. Geneva, ACC/SCN in collaboration with IFPRI.

ACC/SCN, U. N. and IFPRI (2000). Fourth Report on the World Nutrition Situation. Geneva, Switzerland: 121.

Adair, L. S. (1999). "Filipino Children Exhibit Catch-Up Growth from Age 2 to 12 Years." Journal of Nutrition 129(6): 1140-1148.

Adair, L. S. and D. K. Guilkey (1997). "Age-specific determinants of stunting in Filipino children." Journal of Nutrition 127(2): 314-20.

Adato, M., D. Coady and M. Ruel (2000). Final Report: An Operations Evaluation of Progresa from the Perspective of Beneficiaries, Promotoras, School Directors, and Health Staff. PROGRESA Report. Washington, D.C., International Food Policy Research Institute.

Adato, M., B. de la Brière, D. Mindek and A. Quisumbing (2000). Final Report: The Impact of PROGRESA on Women's Status and Intrahousehold Relations. Washington, D.C., International Food Policy Research Institute.

Ahmed, A. U. and C. d. Ninho (2002). Food for Education Program in Bangladesh: An Evaluation of its Impact on Educational Attainment and Food Security. Food Consumption and Nutrition Division Discussion Paper. Washington, D.C., International Food Policy Research Institute. 138.

Alderman, H., J. R. Behrman, H.-P. Kohler, J. A. Maluccio and S. C. Watkins (2001a). "Attrition in Longitudinal Household Surveys." Demographic Research Volume 5, Article 4.

Alderman, H., J. R. Behrman, V. Lavy and R. Menon (2001b). "Child Health and School Enrollment: A Longitudinal Analysis." Journal of Human Resources 36(1): 185-205.

Alderman, H., J. Hoddinott and B. Kinsey (2003). Long-term Consequences of Early Childhood Malnutrition. Food Consumption and Nutrition Division Discussion Paper. Washington, D.C., International Food Policy Research Institute. 168.

Allen, L. H. (1991). "An analytical approach for exploring the importance of dietary quality versus quantity to the growth of Mexican children." Food and Nutrition Bulletin 13: 95-104.

Allen, L. H. (1995). "Malnutrition and Human Function: A Comparison of Conclusions from the INCAP and the Nutrition CRSP Studies." Journal of Nutrition 4 Suppl(125): 1119S-1126S.

Anderson, S. (1980). Statistical methods for comparative studies: techniques for bias reduction. New York, Wiley.

Argáiz, A., R. Fuentes and A. Montes (2003). Metas de Desarrollo del Milenio: el caso de México. Cuadernos de Desarrollo Humano 8. SEDESOL. México, D.F., SEDESOL.

Attanasio, O., E. Battistin, E. Fitzsimons, A. Mesnard and M. Vera-Hernandez (2005). How effective are conditional cash transfers? Evidence from Colombia. IFS Briefing Notes, BN54. London, UK, Institute for Fiscal Studies.

Baker, D., H. Taylor and J. Henderson (1998). "Inequality in infant morbidity: causes and consequences in England in the 1990s. ALSPAC Study Team. Avon Longitudinal Study of Pregnancy and Childhood." Journal of Epidemiologic Community Health 52.(7): 451-8.

Balachander, J. (1993). Tamil Nadu's Successful Nutrition Effort. Reaching Health for All. J. Rohde, M. Chat-terjee and D. Morley. Delhi, India, Oxford University Press: 158-184.
Barrientos, A. and J. De Jong (2004). Child Poverty and Cash Transfers. CHIP Report no. 4. London, Childhood Poverty Research and Policy Centre.
Becker, G. S. and W. S. Woytinsky (1967). Human Capital and Personal Distribution of Income: An analytical approach. Ann Arbor, Michigan, Becker, Gary S. (1975), \Human Capital and the Personal Distribution of Income: AnAnalytical Approach" (W.S. Woytinsky Lecture), in: Gary S. Becker, Human Capital,2nd edition. New York: Columbia University Press.
Behrman, J. and J. Hoddinott (2000). An Evaluation of the Impact of Progresa on Pre-School Child-Height. Washington, D.C, International Food Policy Research Institute.
Behrman, J. and P. E. Todd (1999a). Randomness in the Experimental Samples of PROGRESA (Education, Health, and Nutrition Program). Washington, D.C., International Food Policy Research Institute.
Behrman, J. R., A. Gaviria and M. Szekely (2001). Intergenerational Mobility in Latin America. Washington, D.C., Inter-American Development Bank.
Behrman, J. R. and E. Skoufias (2004). "Correlates and determinants of child anthropometrics in Latin America: background and overview of the symposium." Economics & Human Biology 2(3, Special Issue on Child Health in Latin America): 335-351.
Benguigui, Y., F. J. L. Antuñano, G. Schmunis and J. Yunes (1999). Respiratory Infections in Children. Washington, D.C., Pan American Health Organization.
Berggren, G., W. Berggren, H. Menager and E. Genece (1997). Longitudinal Community Health Research for Equity and Accountability in Primary Health Care in Haiti. Prospective community studies in developing countries. M. Das Gupta. Oxford; New York, Oxford University Press: 157-185.
Berkman, D., A. Lescano, R. Gilman, S. Lopez and M. Black (2002). "Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow-up study." Lancet 359(9306): 564-71.
Bicego, G. T. and J. T. Boerma (1991). Maternal education and child survival: a comparative analysis of DHS data. Demographic and Health Survey World Conference Proceedings, Vol. 1, pp. 177-204, IRD/Macro, Columbia MD.
Bijleveld, C., L. Kamp and A. Mooijaart (1998). Longitudinal data analysis: designs, models and methods. London, Sage.
Black, R. E. (1984). "Diarrheal Diseases and Child Morbidity and Mortality." Population and Development Review 10(Supplement Child Survival: Strategies for Research): 141-161.
Blanden, J. and P. Gregg (2004). Income and Educational Attainment: A Review of Approaches and Evidence for Britain. CMPO Working Paper Series No. 04/101, Department of Economics, University of Bristol.
Boerma, J., A. Sommerfelt and G. Bicego (1992). "Child anthropometry in cross-sectional surveys in developing countries: an assessment of the survivor bias." American Journal of Epidemiology 135(4): 438-49.
Boerma, J., A. Sommerfelt, J. Van Ginneken, G. Bicego, M. Stewart and S. Rutstein (1994). Assessment of the Quality of Health Data in DHS-I Surveys: An Overview. DHS Methodological Reports. Calverton, MD., Macro International.
Boerma, J. T. and G. T. Bicego (1992). "Preceding Birth Intervals and Child Survival: Searching for Pathways of Influence." Studies in Family Planning 23(4): 243-256.
Bollen, K. A. (1989). Structural equations with latent variables. New York, Wiley.

Bollen, K. A. and J. S. Long (1993). Testing Structural Equation Models. Newbury Park, California, SAGE Publications.

Bourguignon, F. (1999). Absolute poverty, relative deprivation and social exclusion. Workshop on the World Development report, Villa Borsig Workshop Series.

Bradbury, B. and M. Jäntti (2001). Child poverty across twenty five countries. The Dynamics of Child Poverty in Industrialised Countries. J. Micklewright, B. Bradbury and S. P. Jenkins. New York, Cambridge University Press: 62-91.

Brooks-Gunn, J. (1995). Strategies for altering the outcomes of poor children and their families. Escape from poverty: what makes a difference for children? P. L. Chase-Lansdale and J. Brooks-Gunn. Cambridge [England] ; New York, NY, USA, Cambridge University Press: 87-117.

Brooks-Gunn, J., G. J. Duncan and N. Maritato (1997). Poor Families, Poor Outcomes: The Well-Being of Children and Youth. Consequences of Growing up Poor. G. J. Duncan and J. Brooks-Gunn. New York, Russell Sage Foundation: 1-17.

Brown, K., R. Black, G. Lopez de Romana and H. Creed de Kanashiro (1989). "Infant-feeding practices and their relationship with diarrheal and other diseases in Huascar (Lima), Peru." Pediatrics 83(1): 31-40.

Brown, K., K. G. Dewey and L. H. Allen (1998). Complementary Feeding of Young Children in Developing Countries: a review of current scientific knowledge. Geneva, Switzerland, World Health Organization.

Brown, K. H. (2000). "WHO/UNICEF Review on Complementary Feeding and Suggestions for Future Research." Pediatrics 106(5): 1290.

Burgess, S., C. Propper and J. A. Rigg (2004). "The Impact of Low Income on Child Health: Evidence from a Birth Cohort Study." CASE Paper 85.

Bynner, J. (1999). NCDS evidence on early years. Persistent Poverty and Lifetime Inequality: The Evidence. J. Hills. London, CASE and HM Treasury.

Carnegie Corporation of New York (1994). Starting Points: meeting the needs of Our Youngest Children, the Report of the Carnegie Task Force on Meeting the Needs of Young Children. New York, NY, Carnegie Corporation.

Carr, D. (2004). "Improving the Health of the World's Poorest People." Health Bulletin 1.

Case, A., A. Deaton and World Bank. Poverty Reduction and Economic Management. Gender and Development. (2003). Consumption, health, gender, and poverty. Washington, D.C., World Bank Poverty Reduction and Economic Management Network Gender and Development.

Case, A., A. Fertig and C. Paxson (2004). The Lasting Impact of Childhood Health and Circumstance. Working Papers. Princeton NJ, Center for Health and Wellbeing, Princeton University.

Case, A., D. Lubotsky and C. Paxson (2002). "Economic Status and Health in Childhood: The Origins of the Gradient." American Economic Review 92(5): 1308-1334.

Castañeda, T. and E. Aldaz-Carroll (1999). The intergenerational transmission of poverty: some causes and policy implications. Discussion papers. Washington, DC, Inter-American Development Bank.

Caulfield, L. E., S. L. Huffman and E. G. Piwoz (1999). "Interventions to improve intake of complementary foods by infants 6 to 12 months of age in developing countries: Impact on growth and on the prevalence of malnutrition and potential contribution to child survival." Food and Nutrition Bulletin 2(2): 183-200.

CDC (1999). Anthro 1.02. Atlanta, U.S.A., Centers for Diseases Control and Prevention in collaboration with World Health Organization.

Chase-Lansdale, P. L. and J. Brooks-Gunn (1995). Escape from poverty: what makes a difference for children? Cambridge, U.K.; New York, U.S.A., Cambridge University Press.

Chávez, A., C. Martínez and B. Soberanes (1995). A 24-year Study of Well-Nourished and Malnourished Children Living in a Poor Mexican Village. Community-based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti and Mexico. N. S. Scrimshaw. Boston, MA USA, International Foundation for Developing Countries (INFDC).

Christiaensen, L. J., H. Alderman and T. Yamano (2003). Child Growth, Shocks, and Food Aid in Rural Ethiopia. Health & Population Policy Research Working Papers. Washington, D.C., The World Bank.

CONAPO and Progresa (1998). Indices de Marginación, 1995. México, D.F., CONAPO and Progresa.

Corcoran, M. and T. Adams (1997). Race, Sex, and the Intergenerational Transmission of Poverty. Consequences of Growing up Poor. G. J. Duncan and J. Brooks-Gunn. New York, Russell Sage Foundation: 461-517.

Cortés, F., D. Hernández, E. Hernández, M. Székely and H. Vera (2002). Evolución y Características de la Pobreza en México en la última Década del Siglo XX. Documentos de Investigación 2. México, D.F., Secretaría de Desarrollo Social.

Cruz, E., R. Pérez and S. de la Vega (1999). Geografía de la marginación y desarrollo de Progresa. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. México, D.F., SEDESOL: 33-56.

Dahan, M. and A. Gaviria (1999). Sibling correlations and social mobility in Latin America. Washington, D.C., Inter-American Development Bank.

Deaton, A. (1997). The analysis of household surveys: a microeconometric approach to development policy. Baltimore, MD, Published for the World Bank by Johns Hopkins University Press.

Deleeck, H., K. Van den Bosch and L. Lathouwer (1992). Poverty and the adequacy of social security in the EC: a comparative analysis. Aldershot; Brookfield, USA, Avebury.

Duflo, E. (2000). Grandmothers and Granddaughters: Old Age Pension and Intra-household Allocation in South Africa. Working Paper 8061. Cambridge, MA, National Bureau of Economic Research.

Duncan, G. J. and J. Brooks-Gunn (1997). Consequences of growing up poor. New York, Russell Sage Foundation.

Eckhardt, C. L., J. Rivera, L. S. Adair and R. Martorell (2001). "Full Breast-Feeding for at Least Four Months Has Differential Effects on Growth before and after Six Months of Age among Children in a Mexican Community." Journal of Nutrition 131: 2304-2309.

Emerson, P. M. and A. P. Souza (2003). "Is There a Child Labor Trap? Inter-Generational Persistence of Child Labor in Brazil." Economic Development and Cultural Change 51(2): 375-398.

Escobar, A. and M. González (2003). Evaluación cualitativa del Programa Oportunidades en zonas urbanas, 2003. Evaluación Externa del Programa de Desarrollo Humano Oportunidades. México, D.F., SEDESOL: 77-264.

FAO (1993). Maize in human nutrition. Rome, Food and Agriculture Organization of the United Nations.

Feinstein, L. (2000). The relative economic importance of academic, psychological and behavioural attributes developed in childhood. Discussion papers, No.443. London, Centre for Economics Performance, London School of Economics.

Feinstein, L. (2003). "Inequality in the early cognitive development of British children in the 1970 cohort." Economica 70(277): 73-97.

Fitzgerald, J., P. Gottschalk and R. Moffitt (1998). "An Analysis of Sample Attrition in Panel Data: The Michigan Panel Study of Income Dynamics."

Journal of Human Resources 33(2): Attrition in Longitudinal Surveys 251-299.
Flores, R., S. Morris, P. Olinto, J. Medina and O. Neidecker (2003). Evaluation of the Family Allowance Program (PRAF) in Honduras: Health and Nutrition Impacts. Social Policy Monitoring Network. Washington, D.C., Inter-American Development Bank. 2003.
Flores, S. and H. Martínez (2004). Prácticas de alimentación, estado de nutrición y cuidados a la salud en niños menores de 2 años en México. México, D.F., Instituto Mexicano del Seguro Social.
Foster, J., J. Greer and E. Thorbecke (1984). "A class of decomposable poverty measures." Econometrica 52: 761-765.
Fox, V. (2004). Cuarto Informe de Gobierno. Mexico, D.F., Presidencia de la Republica.
Galloway, R. and M. A. Anderson (1994). Prepregnancy Nutritional Status and its Impact on Birthweight. SCN News. 11: 6-9.
Gertler, P. J. (2000). Final Report: An Evaluation of the Impact of Progresa on Health Care Utilization and Health Status. Washington, D.C., International Food Policy Research Institute.
Gertler, P. J., J. Rivera Domarco, S. Levy and J. Sepúlveda (Forthcoming 2004). "Mexico's PROGRESA: Using a Poverty Alleviation Program Incentive for Poor Families to Invest in Child Health." Lancet.
Gertler, P. J., J. Rivera Domarco, S. Levy and J. Sepúlveda (mimeo). "Mexico's PROGRESA: Using a Poverty Alleviation Program Incentive for Poor Families to Invest in Child Health."
Glewwe, P., H. G. Jacobya and E. M. Kinga (2001). "Early childhood nutrition and academic achievement: a longitudinal analysis." Journal of Public Economics 81: 345-368.
Goldman, N., A. R. Pebley and M. Gragnolati (2002). "Choices about treatment for ARI and diarrhea in rural Guatemala." Social Science and Medicine 55: 1693-1712.
Goldstein, H. (1995). Multilevel statistical models. London, Arnold.
González-Cossio, T., H. Moreno-Macias, J. Rivera, S. Villalpando, T. Shamah-Levy, E. Monterrubio and A. Hernandez-Garduño (2003). "Breast-feeding practices in Mexico: Results from the Second National Nutrition Survey 1999." Salud Pública México 45(Suppl. 4): S477-89.
Gregg, P. and S. Machin (1998). Child Development and Success or Failure in the Youth Labour Market. Discussion Papers No. 397. London, Centre for Economic Performance, London School of Economics.
Greiner, T. (1994). Maternal Protein-energy Malnutrition and Breastfeeding. SCN News. 11: 28-30.
Gross, R. (1997). Nutrition and the Alleviation of Absolute Poverty in Communities: Concepts and Measurements. Nutrition and Poverty. U. N. ACC/SCN. Geneva, Switzerland, United Nations. ACC/SCN.
Gwatkin, D., S. Rutstein, K. Johnson, R. Pande and A. Wagstaff (2004). Socio-Economic Differences in Health, Nutrition, and Population - 45 Countries. Washington, DC, World Bank Poverty Net Library. 2004.
Gwatkin, D. R. (2002). Who Would Gain most from Efforts to Reach the Millennium Development Goals for Health? An Inquiry into the Possibility of Progress that Fails to Reach the Poor. HNP Discussion Paper. Washington, DC, World Bank.
Haddad, L., J. Hoddinott and H. Alderman (1997). Intrahousehold Resource Allocation in Developing Countries: Models, Methods, Policy. Baltimore, MD, Johns Hopkins University Press.
Handa, S., M. C. Huerta and H. Martinez (2000). Impact of Progresa on Child Malnutrition. Más oportunidades para las familias pobres: Evaluación de

Resultados del Programa de Educación, Salud y Alimentación. Mexico, D.F., SEDESOL.
Handa, S., M. C. Huerta and C. Medina (2000). Demand of Health Care Services in Rural Localities. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. SEDESOL. Mexico, D.F., SEDESOL.
Harpham, T., S. Huttly, I. Wilson and T. d. Wet (2002). Linking Public Issues with Private Troubles:Panel Studies in Developing Countries. Working Paper 5. London, UK, Young Lives. An International Study of Childhood Poverty.
Haveman, R. and B. Wolfe (1995). "The Determinants of Children's Attainments: A Review of Methods and Findings." Journal of Economic Literature 33: 1829-1878.
Hernández, B., D. Ramírez, H. Moreno and N. Laird (2003). Evaluación del impacto de Oportunidades en la mortalidad materna e infantil. Evaluación Externa del Programa de Desarrollo Humano Oportunidades. México, D.F., SEDESOL: 57-76.
Hernández, D., C. Barberena, J. Á. Camacho and H. Vera (2003). Desnutrición infantil y pobreza en México. Cuadernos de Desarrollo Humano 12. SEDESOL. México, D.F., SEDESOL.
Hernández, D. and M. C. Huerta (2000b). Algunos aspectos de salud reproductiva de la población beneficiaria de Progresa. Más Oportunidades para las Familias Pobres. Progresa. México, D.F., Secretaría de Desarrollo Social. 2.
Heuveline, P. and N. Goldman (2000). "A description of child illness and treatment behavior in Guatemala." Social Science and Medicine 50: 345-364.
Hill, Z. (2002). Reducing Attrition in Panel Studies in Developing Countries. Working Paper 5. London, UK, Young Lives. An International Study of Childhood Poverty.
Hobcraft, J. (1994). The Health Rationale for Family Planning: Timing of Births and Child Survival. New York, NY, United Nations.
Hobcraft, J. (1998). Intergenerational and Life-Course Transmission of Social Exclusion: Influences of Childhood Poverty, Family Disruption, and Contact with the Police. CASE paper 15. London, Centre for the Analysis of Social Exclusion, London School of Economics.
Hobcraft, J. (2000). The Roles of Schooling and Educational Qualifications in the Emergence of Social Exclusion. CASE paper 43. London, Centre for the Analysis of Social Exclusion, London School of Economics.
Hobcraft, J. (2002). Social exclusion and the generations. Understanding Social Exclusion. J. Hills, D. Piachaud and J. Le Grand. Oxford, Oxford University Press.: 62-81.
Hobcraft, J. (2003). Continuity and Change in Pathways to Young Adult Disadvantage: Results from a British Birth Cohort. CASE paper 66. London, Centre for the Analysis of Social Exclusion, London School of Economics: 97.
Hobcraft, J. and K. E. Kiernan (1999). Childhood Poverty, Early Motherhood and Adult Social Exclusion. London, Centre for the Analysis of Social Exclusion, London School of Economics.
Hobcraft, J., J. McDonald and S. Rutstein (1984). "Socio-Economic Factors in Infant and Child Mortality: A Cross-National Comparison." Population Studies 38(2): 193-223.
Hoddinott, J., E. Skoufias and R. Washburn (2000). Final Report: The Impact of Progresa on Consumption. Washington, D.C, International Food Policy Research Institute.
Hoddinott, J. and Y. Yohannes (2002). Dietary Diversity as a Food Security Indicator. Discussion Papers. Washington, D.C., International Food Policy Research Institute. 136.
Hsiao, C. (2003). Analysis of panel data. Cambridge, Cambridge University Press.

Huffman, S. L. and B. B. Lamphere (1984). "Breastfeeding Performance and Child Survival." Population and Development Review, 10(Supplement: Child Survival: Strategies for Research): 93-116.

Huttly, S., S. Morris and V. Pisani (1997). "Prevention of diarrhoea in young children in developing countries." Bulletin World Health Organisation 75(2): 163-74.

INN-SZ (1987). Valor nutritivo de los alimentos mexicanos, tablas de uso práctico. México, D.F., Instituto Nacional de Nutrición.

Jones, G., R. W. Steketee, R. E. Black, Z. A. Bhutta, S. S. Morris and Bellagio Child Survival Study Group (2003). "How many child deaths can we prevent this year?" Lancet 362(9377): 65-71.

Jöreskog, K. G. (1993). Latent Variable Modeling with Ordinal Variables. Statistical Modeling and Latent Variables. K. Haagen, D. J. Bartholomew and M. Deistler, Elasevier Science Publisher: 163-171.

Jöreskog, K. G. and D. Sörbom (1995). LISREL 8: structural equation modeling with the SIMPLIS command language. Chicago, Ill., Scientific Software International.

Kamerman, S. B. (2001). Social Exclusion and Children: Background and Context. Social Exclusion and Children, Columbia University, New York.

Korenman, S. and J. E.Miller (1997). Effects of Long-Term Poverty on Physical Health of Children in the National Longitudinal Survey of Youth. Consequences of Growing up Poor. G. J. Duncan and J. Brooks-Gunn. New York, Russell Sage Foundation: 70-99.

Kramer, M. (1998). "Socioeconomic determinants of intrauterine growth retardation." European Journal of Clinical Nutrition 52(Supplement 1): S29-33.

Kramer, M. (2003). "Commentary: Breastfeeding and child health, growth, and survival." International Journal of Epidemiology 32(1): 96-98.

Lillard, L. A. and C. W. A. Panis (1998). "Panel Attrition from the Panel Study of Income Dynamics: Household Income, Marital Status, and Mortality." Journal of Human Resources 33(2): 437-457.

López R., I. (2000). Familia y género en Progresa. Más oportunidades para las familias pobres. Evaluación de Resultados del Programa de Educación, Salud y Alimentación. Impacto a Nivel Comunitario. 2000. Progresa. México, D.F., Secretaría de Desarrollo Social.

Lustig, N. and M. Székely (1997). Economic Trends, Poverty and Inequality in Mexico. Washington, D.C., Inter-american Development Bank: 47.

Lutter, C., J. Mora, J. Habicht, K. Rasmussen, D. Robson and M. Herrera (1990). "Age-specific responsiveness of weight and length to nutritional supplementation." American Journal of Clinical Nutrition . 51(3): 359-64.

Machin, S. (1998). Childhood disadvantage and intergenerational transmission of economic status. Exclusion, Employment and Opportunity. A. B. Atkinson and J. Hills. London, Department of Economics, University College of London and Centre for Economic Performance, London School of Economics.

Maluccio, J. A. and R. Flores (2004). Impact Evaluation of a Conditional Cash Transfer Program: The Nicaraguan Red de Protección Social. Food Consumption and Nutrition Division Discussion Paper. Washington, D.C., International Food Policy Research Institute. 184.

Marquis, G., J. Habicht, C. Lanata, R. Black and K. Rasmussen (1997). "Association of breastfeeding and stunting in Peruvian toddlers: an example of reverse causality." International Journal of Epidemiology 26(2): 349-56.

Martin, R., A. Ness, D. Gunnell, P. Emmett, G. Davey Smith and A. S. Team. (2004). "Does breast-feeding in infancy lower blood pressure in childhood? The Avon Longitudinal Study of Parents and Children (ALSPAC)." Circulation 109(1259-1266).

Martorell, R. (1995a). "Results and Implications of the INCAP Follow-up Study." Journal of Nutrition 4 Supplement(125): 1127S-1138S.
Martorell, R. (1995b). The INCAP longitudinal study (1969-1977) and its follow-up (1988-1989): An overview of results. Community-based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti and Mexico. N. S. Scrimshaw. Boston, MA USA, International Foundation for Developing Countries (INFDC).
Martorell, R. (1999a). "Long-term consequences of undernutrition on physical and cognitive development." Annales Nestlé 57(3): 96-106.
Martorell, R. (1999b). "The nature of child malnutrition and its long-term implications." Food and Nutrition Bulletin 20(3): 288-299.
Martorell, R. and J.-P. Habicht (1986). Growth in Early Childhood in Developing Countries. Human Growth: A Comprehensive Treatise. F. Falkner and J. M. Tanner. New York, Plenum. 3: 241-262.
Martorell, R. and T. J. Ho (1984). "Malnutrition, Morbidity, and Mortality (in Intervening Variables: Nutrition)." Population and Development Review 10 Supplement(Child Survival: Strategies for Research): 49-68.
Martorell, R., L. K. Khan and D. G. Schroeder (1994). "Reversibility of stunting: Epidemiological findings in children from developing countries." European Journal of Clinical Nutrition 48(Supplement 1): S45-57.
Mata, L. (1995). The Santa María Cauqué study: Health and survival of Mayan Indians under deprivation, Guatemala. Community-based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti and Mexico. N. S. Scrimshaw. Boston, MA USA, UNU Press.
Mayer, S. E. (2002). The Influence of Parental Income on Children's Outcomes. Wellington, NZ, Ministry of Social Development.
Meneses, F., B. Hernández, M. C. Baltazar, A. Camacho, M. B. Duarte, J. E. Urquieta, M. M. Téllez and M. Hernández (2003). Evaluación del cumplimiento de metas, costos unitarios y apego del Programa Oportunidades a las Reglas de Operación. Evaluación Externa del Programa de Desarrollo Humano Oportunidades. México, D.F., SEDESOL: 77-264.
Merchant, K. M. (1994). Maternal Nutritional Depletion. SCN News. 11: 30-33.
Micklewright, J. and K. Stewart (1999). "Is the Well-Being of Children Converging in the European Union?" The Economic Journal 109: F692-F714
Morris, S., P. Olinto, R. Flores, E. Nilson and A. Figueiró (2004). "Conditional Cash Transfers Are Associated with a Small Reduction in the Rate of Weight Gain of Preschool Children in Northeast Brazil." Journal of Nutrition 134(9): 2336-2341.
Morris, S. S. and Mesoamerica Nutrition Program Targeting Study Group (2002). "Targeting performance of three large-scale, nutrition-oriented social programs in Central America and Mexico." Food and Nutrition Bulletin 23(2): 162-74.
Mosley, W. H. and L. C. Chen (1984). "Introduction and Conceptual Framework. An Analytical Framework for the Study of Child Survival in Developing Countries." Population and Development Review 10: 25-45.
Myers, R. G. (1992). Relating child development to schooling and beyond. The twelve who survive: strengthening programmes of early childhood development in the Third World. R. G. Myers and Consultative Group on Early Childhood Care and Development. London, Routledge in cooperation with UNESCO for the Consultative Group on Early Childhood Care and Development: 209-262.
Myers, R. G. (1992a). The twelve who survive: strengthening programmes of early childhood development in the Third World. London, Routledge in cooperation with UNESCO for the Consultative Group on Early Childhood Care and Development.

Nelson, C. A. (2000). The Neurobiological Bases of Early Intervention. Handbook of Early Childhood Intervention. J. P. Shonkoff and S. J. Meisels. New York, Cambridge University Press. 2.
Norton, R. (1994). Maternal nutrition during pregnancy as it affects infant growth, development and health. SCN News. 11: 10-13.
OECD (2002). PPPs for OECD Countries since 1980. March 2002. 2004: Excel Table.
Orozco, M., J. Gómez de León and D. Hernández (1999a). La identificación de los hogares beneficiarios de Progresa. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. México, D.F., SEDESOL.
Orozco, M., M. C. Huerta and D. Sotres (1999b). Resultados sobre la operación de Progresa en el componente educativo. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. México, D.F., SEDESOL: 181-210.
Orozco, M., S. Parker and D. Hernández (2000). El modelo de evaluación de Progresa. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. México, D.F., SEDESOL: 3-29.
Page, H., R. Lesthaeghe and I. Shah (1982). Breastfeeding in Pakistan: An Illustrative analysis. WFS Scientific Reports No. 37. Netherlands, International Statistical Institute.
Palloni, A. and S. Millman (1986). "Effects of Inter-Birth Intervals and Breastfeeding on Infant and Early Childhood Mortality." Population Studies 40(2): 215-236.
Palloni, A. and M. Tienda (1986). "The effects of breastfeeding and pace of childbearing on mortality at early ages." Demography. 23(1): 31-52.
Parashar, U. D., J. S. Bresse and R. I. Glass (2003). "The global burden of diarrhoeal disease in children." Bulletin of the World Health Organization. 81(4): 236.
Parker, S. (1999). Evidencia prelimiar del impacto de Progresa en la inscripción a la escuela en 1997 y 1998. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. México, D.F., SEDESOL: 155-180.
Parker, S. (2003). Evaluación del impacto de Oportunidades sobre la inscripción, reprobación y abandono escolar. Resultados de la Evaluación Externa del Programa de Desarrollo Humano Oportunidades. México, D.F., SEDESOL: 5-57.
Parker, S. and E. Skoufias (2000). The Impact of Progresa on Work, Leisure, and Time Allocation. Más oportunidades para las familias pobres: Evaluación de Resultados del Programa de Educación, Salud y Alimentación. Mexico, D.F., SEDESOL.
Pebley, A. R. and N. Goldman (1995). "Social inequality and children's growth in Guatemala." Health Transition Review 5(1): 1-20.
Pelletier, D. L., E. A. J. Frongillo, D. G. Schroeder and J. P. Habicht (1995). The effects of malnutrition on child mortality in developing countries. Bulletin World Health Organization. Ithaca, New York, USA., Division of Nutritional Sciences, Cornell University. 73: 443-8.
Pickles, A. (2003). Longitudinal Analysis. A 3-day practical course using Stata. Manchester, University of Manchester.
Poskitt, E., T. Cole and R. Whitehead (1999). "Less diarrhoea but no change in growth: 15 years' data from three Gambian villages." Archives of Disease in Childhood 80(115-119).
Potter, J. E. (1977). "Problems in using birth-history analysis to estimate trends in fertility." Population Studies 31(2): 335-364.

Progresa (1999). Lineamientos Generales para la Operación del Programa de Educación, Salud y Alimentación , Documentos de divulgación. México, D.F., SEDESOL.
Psacharopoulos, G. and World Bank. (1995). Building human capital for better lives. Washington, D.C, The World Bank.
Ravallion, M. (2001). "The Mystery of the Vanishing Benefits: An Introduction to Impact Evaluation." World Bank Economic Review 15(1): 115-140.
Rawlings, L. and G. Rubio (2003). Evaluating the Impact of Conditional Cash Transfer Programs: Lessons from Latin America. World Bank Policy Research Working Paper. Washington, D.C., World Bank.
Rawlings, L. B. (2004). A New Approach to Social Assistance: Latin America's Experience with Conditional Cash Transfer Programs. Social Protection Discussion Paper Series. Washington D.C., World Bank.
Retherford, R. D. and M. K. Choe (1993). Statistical Models for Causal Analysis. New York, John Wiley & Sons, Inc.
Rivera Domarco, J., T. Shamah and G. Rodriguez (2000). "Implementation, monitoring, and evaluation of the nutrition component of the Mexican Social Programme (Progresa)." Food and Nutrition Bulletin 21(1): 35-42.
Rivera, J., T. Shama, S. Villalpando, T. González de Cossío, B. Hernández and J. Sepúlveda (2002). Estado de nutrición de las mujeres en edad reproductiva. Resultados de la Encuesta Nacional de Nutrición 1999. Perinatología y Reproducción Humana. 16: 61-73.
Rivera, J., T. Shamah and G. Rodriguez (2000). "Implementation, monitoring, and evaluation of the nutrition component of the Mexican Social Programme (Progresa)." Food and Nutrition Bulletin 21(1): 35-42.
Rosado, J., J. Rivera and G. Lopez (2000). "Development, production, and quality control of nutritional supplements for a national supplementation programme in Mexico." Food and Nutrition Bulletin 21(1): 30-34.
Roseboom, T., J. van der Meulen, A. Ravelli, C. Osmond, D. Barker and O. Bleker (2001). "Effects of prenatal exposure to the Dutch famine on adult disease in later life: an overview." Molecular and Cellular Endocrinology 185(1): 93-98.
Rowntree, B. S. (1902). Poverty: A study of town life. London, Nelson.
Ruel, M. (2002). Is Dietary Diversity an Indicator of Food Security or Dietary Quality? A Review of Measurement Issues and Research Needs. Food Consumption and Nutrition Division Discussion Paper. Washington, D.C., International Food Policy Research Institute. 140.
Ruel, M., C. Levin, M. Armar-Klemesu, D. Maxwell and S. Morris (1999). "Good Care Practices Mitigate the Negative Effects of Poverty and Low Maternal Schooling on Children's Nutritional Status: Evidence from Accra." World Development 27(11): 1993-2009.
Ruel, M. T. and P. Menon (2002). "Child Feeding Practices Are Associated with Child Nutritional Status in Latin America: Innovative Uses of the Demographic and Health Surveys." Journal of Nutrition 132: 1180-1187.
Ruiz-Arranz, M., B. Davis, M. Stampini, P. Winters and S. Handa (2002). More calories or more diversity? An econometric evaluation of the impact of the PROGRESA and PROCAMPO transfer programs on food security in rural Mexico. ESA Working Paper No. 02-09. Rome, Italy, Agricultural and Development Economics Division. The Food and Agriculture Organization of the United Nations.
Ryland, S. and H. Raggers (1998). Child Morbidity and Treatment Patterns. Demographic and Health Surveys Comparative Studies. Claverton, Maryland USA, Macro International Inc.
Sadoulet, E., A. d. Janvry and B. Davis (2001). "Cash Transfer Programs with Income Multiplier: PROCAMPO in Mexico." World Development 29(6): 1043-1056.

SAGARPA (2000). Serie Histórica Producción Agrícola. México, D.F. 2002: PDF File http://www.siap.sagarpa.gob.mx/.
Sahn, D. E. and H. Alderman (1997). "On the Determinants of Nutrition in Mozambique: The Importance of Age-Specific Effects." World Development 25(4): 577-588.
Sastry, N. (1996). "Community characteristics, individual and household attributes, and child survival in Brazil." Demography 33(2): 211-229.
Schroeder, D. G., H. Pachon, K. A. Dearden, T. T. Ha, T. T. Lang and D. R. Marsh (2002). "An integrated child nutrition intervention improved growth of younger, more malnourished children in northern Viet Nam." Food and Nutrition Bulletin 23(4): 50-58.
Schultz, T. P. (1984). "Studying the Impact of Household Economic and Community Variables on Child Mortality." Population and Development Review 10: 215-235.
Schultz, T. P. (2000). Final Report: The Impact of Progresa on School Enrollments. Washington, D.C, International Food Policy Research Institute.
Scrimshaw, N. S. (1995). Community-based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti and Mexico. Boston, MA USA, UNU Press.
Scrimshaw, N. S. (2003). "Historical Concepts of Interactions, Synergism and Antagonism between Nutrition and Infection." Journal of Nutrition 133: 316S-321S.
Secretaría de Salud (2004). Infecciones respiratorias agudas. Panorama Epidemiológico 1990 - 2000. México, D.F., Secretaría de Salud. 2004.
SEDESOL (1999). Lineamientos Generales para la Operación del Programa de Educación, Salud y Alimentación (PROGRESA). Documento de Divulgación. Diario Oficial de la Federación.
SEDESOL (2002). Medición de la Pobreza. Variantes metodológicas y estimación preliminar. Documentos de Investigación 1. México, D.F., Comité Técnico para la Medición de la Pobreza.
Sefton, T. and J. A. Rigg (2004). Income Dynamics and the Life Cycle. CASE Paper 81. London, Centre for the Analysis of Social Exclusion, London School of Economics.
Sen, A. K. (1993). Capability and Well-Being. The quality of life. M. C. Nussbaum and A. K. Sen. Oxford; New York, Oxford University Press: 30-53.
Sen, A. K. (1999). Development as freedom. New York, Oxford University Press.
Sepúlveda, J. and J. Rivera (2000). Encuesta Nacional de Nutrición. Cuernavaca, Morelos, Instituto Nacional de Salud Pública.
Shetty, P. S. and W. P. T. James (1994). Body mass index - A measure of chronic energy deficiency in adults. Rome, Food and Agriculture Organization of the United Nations.
Shonkoff, J. P. and P. C. Marshall (2000). The Biology of Development Vulnerability. Handbook of Early Childhood Intervention. J. P. Shonkoff and S. J. Meisels. New York, Cambridge University Press. 2.
Shonkoff, J. P. and S. J. Meisels (2000). Handbook of Early Childhood Intervention. New York, Cambridge University Press.
Shonkoff, J. P. and D. A. Philipps (2000). Family resources. From Neurons to Neighborhoods: the science of early child development. Washington, D.C., National Academy Press. 267-296.
Shonkoff, J. P. and D. A. Philips (2000a). From Neurons to Neighborhoods: the science of early child development. Washington, D.C., National Academy Press.
Sigle-Rushton, W. (2004). Intergenerational and Life-Course Transmission of Social Exclusion in the 1970 British Cohort Study. CASE paper 78. London, Centre for the Analysis of Social Exclusion, London School of Economics.

Singer, B. H. and C. D. Ryff (2001). New Horizons in Health. Washington, D.C., National Academy Press.

Skoufias, E. (2000). Synthesis Evaluation Report: Impact of the Education, Health, and Nutrition Program. Washington, D.C., International Food Policy Research Institute.

Skoufias, E., B. Davis and S. de la Vega (1999b). An Addendum to the Final Report: An Evaluation of the Selection of Beneficiary Households in the Education, Health, and Nutrition Program (PROGRESA) of Mexico. Targeting the Poor in Mexico: Evaluation of the Selection of Beneficiary Households into PROGRESA. IFPRI. Washington, D.C., International Food Policy Research Institute.

Smith, K., J. Samet, I. Romieu and N. Bruce (2000). "Indoor air pollution in developing countries and acute lower respiratory infections in children." Thorax 55(6): 518-532.

Smith, L. and L. Haddad (2000). Explaining Child Malnutrition in Developing Countries. Washington D.C., U.S.A., International Food Policy Research Institute.

Smith, L. C. (2002). The use of household expenditure surveys for the assessment of food insecurity. International Scientific Symposium on Measurement and Assessment of Food Deprivation and Undernutrition, Rome, Italy, FAO.

Smith, L. C., U. Ramakrishnan, A. Ndiaye, L. Haddad and R. Martorell (2003). The Importance of Women's Status for Child Nutrition in Developing Countries. Research Report. Washington, DC, International Food Policy Research Institute and Department of International Health, Emory University.

Sommerfelt, E. and J. T. Boerma (1994). Anthropometric Status of Young Children in DHS-I Surveys: An Assessment of Data Quality. An Assessment of the Quality of Health Data in DHS-I Surveys. Macro International and DHS. Calverton, Maryland: 126-141.

Stata Corporation (2003). Stata user's guide : release 8. College Station, Tex., Stata Press.

Stein, A. D., H. X. Barnhart, M. Hickey, U. Ramakrishnan, D. G. Schroeder and R. Martorell (2003). "Prospective study of protein-energy supplementation early in life and of growth in the subsequent generation in Guatemala." American Journal of Clinical Nutrition 78(1): 162-167.

Stein, A. D., H. X. Barnhart, M. Wang, M. B. Hoshen, K. Ologoudou, U. Ramakrishnan, R. Grajeda, M. Ramirez-Zea and R. Martorell (2004). "Comparison of Linear Growth Patterns in the First Three Years of Life Across Two Generations in Guatemala." Pediatrics 113(3): e270-e275.

Székely, M. (2003). Es posible un México con menor pobreza y desigualdad. Documentos de Investigación. México, D.F., Secretaría de Desarrollo Social.

Taylor, C. E. and C. d. Sweemer (1997). Lessons from Narangwal about Primary Health Care, Family Planning, and Nutrition. Prospective community studies in developing countries. M. Das Gupta. Oxford ; New York, Oxford University Press: 101-129.

Thomas, D. (1994). "Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height." The Journal of Human Resources 29(Special Issue 4: The Family and Intergenerational Relations): 950-988.

Thomas, D., J. Strauss and M. H. Henriques (1991). "How does mother's education affect child height?" Journal of Human Resources 26(2): 183-211.

Townsend, P. (1979). Poverty in the United Kingdom: a survey of household resources and standards of living. Harmondsworth, Penguin.

UNDP (2002). Informe sobre Desarrollo Humano Mexico 2002. New York, NY, United Nations Development Programme.

UNDP (2003). Human Development Report 2003. New York, NY, United Nations Development Programme.

UNICEF (1995). The State of the World's Children. New York, NY, UNICEF.
UNICEF (1998). The State of the World's Children. New York, NY, UNICEF.
UNICEF (2001). The State of the World's Children. New York, N.Y., UNICEF.
VanLandingham, M., J. Trussell and L. Grummer-Strawn (1991). "Contraceptive and Health Benefits of Breastfeeding: A Review of the Recent Evidence." International Family Planning Perspectives 17(4): 131-136.
Vázquez, G. and M. C. Huerta (1999). Efecto de la introducción de suplementos alimenticios en las prácticas de la lactancia materna en las localidades beneficiarias de Progresa. Más Oportunidades para las Familias Pobres. S. Programa de Educación, y Alimentación. México, D.F., Secretaría de Desarrollo Social. 1: 289-300.
Victora, C. (1999). Risk Factors for Acute Lower Respiratory Infections. Respiratory Infections in Children. Y. Benguigui, F. J. L. Antuñano, G. Schmunis and J. Yunes. Washington, D.C., Pan American Health Organization.
Victora, C., B. Kirkwood, A. Ashworth, R. Black, S. Rogers, S. Sazawal, H. Campbell and S. Gove (1999). "Potential interventions for the prevention of childhood pneumonia in developing countries: improving nutrition." American Journal of Clinical Nutrition 70(3): 309-20.
Waldfogel, J. (1999). Early childhood interventions and outcomes. CASE paper 21. London, Centre for Analysis of Social Exclusion. London School of Economics and Political Science: 20p.
Walker, S., S. Grantham-McGregor, J. Himes, C. Powell and S. Chang (1996). "Early childhood supplementation does not benefit the long-term growth of stunted children in Jamaica." Journal of Nutrition 126(12): 3017-24.
WHO (1986). "Use and interpretation of anthropometric indicators of nutritional status." Bulletin of the World Health Organization. 64(924-941).
WHO (1999). "A Critical Link. Interventions for physical growth and psychological development." WHO/CHS/CAH/99.3.
WHO (2001). WHO's contribtution to the Report for the Follow-up to the World Summit for Children. In Preparation for the UN General Assembly Special Session on Children, September 2001, Department of Child and Adolescent Health and Development.
WHO (2001). WHO's contribution to the Report for the Follow-up to the World Summit for Children. In Preparation for the UN General Assembly Special Session on Children, September 2001, Department of Child and Adolescent Health and Development.
WHO (2003). World Health Report. Geneva, Switzerland, World Health Organization.
WHO/NCD (2001). The optimal duration of exclusive breastfeeding. Report of an expert consultation. Geneva, Switzerland, World Health Organization.
Wilson, A., J. Forsyth, S. Greene, L. Irvine, C. Hau and P. Howie (1998). "Relation of infant diet to childhood health: seven year follow up of cohort of children in Dundee infant feeding study." British Journal of Medicine(316): 21-25.
Wolfe, B. L. and J. R. Behrman (1982). "Determinants of Child Mortality, Health, and Nutrition in a Developing Country." Journal of Development Economics 11: 163-193.
World Bank (2000). World Development Report 2000/2001. Washington, D.C., World Bank.
World Bank (2003). Inequality in Latin America & the Caribbean: Breaking with History? Washington, DC, World Bank.
World Bank (2004a). Longitudinal Studies Evaluating the Impact of Early Childhood Programs in Developing Countries. Washington, D.C. 2004.
World Bank (2004b). Millennium Development Goals. Washington, D.C. 2004.
World Bank (2005). World Development Indicators 2005. Washington, D.C. 2005.

WorldBank (1986). Poverty and Hunger: Issues and Options for Food Security in Developing Countries. A World Bank Policy Study. Washington, DC, World Bank.
WorldBank (2001). Brazil: An Assessment of the Bolsa Escola Programs. Human Development Department, Latin America and the Caribbean Region. Washington, D.C., World Bank.
Yaqub, S. (2000). Intertemporal Welfare Dynamics: Extent and Causes. Sussex, Sussex University.
Yaqub, S. (2002). "Poor Children Grow into Poor Adults: Harmful Mechanisms or Over-deterministic Theory?" Journal of International Development 14: 1081–1093.
Young, M. E. (1996). Early childhood development: investing in the future. Washington, D.C, World Bank.
Zedillo, E. (2000). Sexto Informe de Gobierno. México, D.F., Presidencia de la República. 2004.

WEBSITES

www.progresa.gob.mx
www.contigo.gob.mx
www.ifpri.gob.mx
www.worldbank.org
www.oecd.org
www.mec.gov.br
www.chilesolidario.gov.cl
www.younglives.org.uk

(consulted and accessed between Jan 2001 and June 2005)