Residential Mobility in Greater Johannesburg: Patterns, Associations and Educational Outcomes amongst Children in the Birth to Twenty Cohort

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Declaration

I declare that the thesis entitled 'Residential Mobility in Greater Johannesburg: Patterns, Associations and Educational Outcomes amongst Children in the Birth to Twenty Cohort' submitted for the degree of Doctor of Philosophy is the result of my own work. Any assistance received or reference made to the work of others has been fully acknowledged.

This thesis is being submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg. No part of this work has been submitted for degree or examination purposes to any other university or institution.

Carren Ginsburg

Signed……

February 2011

Dedication

This thesis is dedicated to my father, Cyril Ginsburg, for his unwavering support and love.

Thesis Material

Over the course of this PhD, the research was written up and published in a series of publications. The results were also presented at various conferences, and successful grant applications attached to the study were obtained.

Peer Reviewed Publications

1. Ginsburg, C., Norris, S.A., Richter, L.M. and Coplan, D.B., 2009. Patterns of residential mobility amongst children in Greater Johannesburg-Soweto, South Africa: observations from the Birth to Twenty cohort. *Urban Forum,* 20(4), pp. 397-413.

2. Ginsburg, C., Steele, F., Richter, L.M. and Norris, S.A., 2010. Modelling residential mobility: factors associated with the movement of children in Greater Johannesburg, South Africa. *Population, Space and Place.* In Press.

3. Ginsburg, C., Richter, L.M., Fleisch, B. and Norris, S.A., 2010. An analysis of associations between residential and school mobility and educational outcomes in South African urban children: the Birth to Twenty cohort. *International Journal of Educational Development.* In Press.

Student's contribution to the publications:

The PhD student was responsible for study design, questionnaire development and piloting, study implementation and management (including supervision of data collection and training of fieldworkers), data management (including data cleaning and coding), data analysis and writing of the manuscripts. Co-authors assisted with providing guidance on the conceptualisation of the manuscripts, methodology or analysis, editing manuscripts and/or reviewing drafts.

Conference Presentations

1. International Conference on Migrant Children: Identities, Mobilities and Belonging(s). University College Cork, 9 - 11 April 2008: Oral Presentation

2. University of the Witwatersrand Faculty of Health Sciences Research Day, 20 August 2008: Poster Presentation

3. 3rd Annual Conference for the Population Association of Southern Africa. Umhlanga, Durban 29 September - 2 October 2008: Oral Presentation

4. Seminar - Department of Anthropology, University of the Witwatersrand, 30 April 2009: Oral Presentation

Grants and Awards

1. 2005: Faculty of Health Sciences Individual Research Grant (PI: Carren Ginsburg; Amount: R5000)

2. 2007: Department of Science and Technology Woman Scientist Fellowship awarded to Carren Ginsburg to fund studies in an area where participation by women is traditionally low (Amount: R100 000)

3. 2007: NRF Doctoral Bursary (PI: Professor Pettifor; Amount: R35 000)

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Abstract

The United Nations has projected that Africa's urban population will expand from fourth largest to becoming the second largest of the world's regions by the year 2050. Patterns of migration and urbanisation have therefore been highlighted as significant focus areas for research and policy. Movement has the potential to result in improved living conditions and well-being, but may also reinforce inequalities and conditions of vulnerability. These consequences may pose particular risks in the case of children, and understanding the patterns, drivers and outcomes associated with child mobility is therefore critical.

South Africa provides an important setting in which to explore child movements. The shift within the country from politically controlled migration to movement based on choice has resulted in high levels of mobility both to and within urban areas. Children have been shown to participate in such movements either independently or in conjunction with connected adults. However, there is currently little knowledge of the patterns and consequences of child residential mobility in South Africa, particularly within the urban environment. This PhD thesis attempts to address this research gap.

Data from Birth to Twenty, a cohort of South African urban children living in Greater Johannesburg, was used to investigate three central research questions concerning residential mobility of cohort children over a 14 year period. Specifically, the thesis aimed to determine the frequencies and patterns of residential mobility observed over the first 14 years of the children's lives, to examine the associations with mobility of children over a set of domains relating to the child, the child's primary caregiver, and the child's household and to assess the relationships between residential and school mobility and a set of educational outcomes.

Routine data collected over the course of the Birth to Twenty study was supplemented with data from a Residential Move Questionnaire, administered to children's primary caregivers in order to validate and provide additional information concerning the children's residential movements over the time frame. The research objectives were achieved through the use of cross-sectional and longitudinal analysis techniques applied to these data. In particular, multilevel event-history analysis was used to model the children's residential movements over time.

Of the 3273 children enrolled into the cohort in 1990, two thirds of the children (64%) had moved home at least once by the time they reached 15 years of age. Nonetheless, a third of the children had never moved, indicating stability or a lack of opportunity for movement amongst this urban child population. Mobility was found to be more likely amongst children whose primary caregivers had no formal education and who lived in households with fewer assets and less access to services, suggesting that residential movement within this group of children was more common in the context of disadvantage. Extending these findings to an exploration of children's educational outcomes revealed some unexpected results. The analyses provided evidence of a positive association between changes in residence and numeracy and literacy scores, and school mobility was found to be associated with grade repetition, however, a negligible relationship was found between residential mobility and school progression.

In conclusion, mobility is associated with opportunities for some children in the cohort and challenges or hardships for others. However, even in the instance of movement connected to disadvantage, changes of residence did not prejudice children in terms of the educational outcomes investigated. This is suggestive of children's possible resilience and adaptability in the face of change and highlights the potential for mobility to influence children's lives positively. The findings concerning the relationship between mobility and child well-being run counter to trends observed in high-income countries and on that

basis, the need for further research into dynamics associated with child mobility in other low- and middle-income country settings is highlighted. There is justification for monitoring child mobility in South Africa; mobility trends provide a valuable indicator of children's living situations as well as the spatial and social changes occurring in the country more broadly.

Keywords: residential mobility; internal migration; urban children; South Africa; event-history models; school progression; numeracy and literacy; school mobility

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This has been a most challenging and rewarding experience and I wish to extend my sincerest appreciation to my colleagues, family and friends who have supported me over the course of this journey. In particular, I am most grateful to the following people without whose assistance, guidance and encouragement this would not have been possible.

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I would like to thank most sincerely the Department of Science and Technology for the generous award which allowed me the opportunity to travel to Bristol to receive specialised training; also the Wellcome Trust, National Research Foundation and University of the Witwatersrand for your support of the Birth to Twenty project and this doctoral study.

To the staff at Birth to Twenty (past and present) thank you for all your help and dedication to this project and to the cohort. A big ‘thank you’ to the Birth to Twenty cohort

for your continued support and interest in this study - without your participation none of our work would be possible.

Finally to my family - GC, for being the best husband I could ask for, my beautiful Anna for arriving towards the end and motivating me to complete this work, Mom, Dad, Neil, Gran and, in memory, Aunty Anne for being there for me - always.

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Definition of Terms and Abbreviations

BT20: Birth to Twenty (cohort)

Child: Article 1 of the United Nations Convention on the Rights of the Child defines a 'child' as any person below the age of 18 (Hodgkin and Newell, 2007).

Cohort: Defined by the INDEPTH Network (2002) as a "group of people sharing a common temporal demographic experience who are observed through time".

DSS: Demographic surveillance system

Ethnicity: The categories Black, Coloured (mixed ancestral origin), White and Asian are carried over from South Africa's Apartheid past. While they no longer have legislative force, they have so influenced South African society, and in many ways continue to do so, that there is consensus on the importance of retaining these categories for social analyses. This thesis has employed these racial categories in analyses as opposed to ethnic categories (for example Zulu, Xhosa, Sotho, Afrikaans).

GIS: Geographic information system

HICs: High-income countries

HIV/AIDS: Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome

Household: A variety of definitions exist in the literature for the term 'household'. Broadly, a household may be defined according to de facto membership (implying physical presence in a place of residence) or de jure membership (allowing for absent members)

(see Collinson, et al., 2006a; INDEPTH Network, 2002). This distinction is not directly relevant to this thesis and 'household' refers to a group of individuals living in a particular residential unit.

Household socioeconomic status: A range of indicators of household socioeconomic status are identified in the literature, primarily: household income, household consumption expenditures and household wealth (see Rutstein and Johnson, 2004). Household wealth has advantages in terms of measurement and is usually calculated as a composite of household assets and services. This is the approach that has been followed in this thesis.

HSRC: Human Sciences Research Council

INDEPTH: The International Network for the Demographic Evaluation of Populations and their Health in Developing Countries

JHB: Johannesburg

LMICs: Low- and middle-income countries

NS: Non-significant

Primary caregiver: For the purposes of this thesis, a child's primary caregiver is the person directly responsible for caring for and seeing to his/her basic needs. This may be a parent, grandparent, sibling or alternative.

Residential mobility: In this thesis, a residential move has been defined as a move that involves a change in a child's primary place of residence within a certain interval of time. 'Primary place of residence' refers to the place where the child spends the majority of

his/her time and calls home. However, in instances where a child spends time between two places, a primary residence was determined on a case by case basis (see McHugh, et al., 1995; Statistics South Africa, 2007a).

RMQ: Residential Move Questionnaire

Rural/Urban: While this dichotomy has frequently been employed in the literature, difficulties in classifying the variety of different settlement types has motivated that areas be defined across a rural-urban continuum (Kok and Collinson, 2006). Definitions are country and sometimes study specific. In South Africa, the classification of areas has undergone changes over time with recent classifications detailed in Statistics South Africa's 2003 report. Although a range of settlement types have been defined, these may be dichotomised into urban and rural areas on the basis of criteria such as population density, type of economic activity and land use (see Statistics South Africa, 2003).

Soweto: An acronym derived from 'South-Western Townships'

Township: A 'township' refers to a residential area reserved for accommodation of non-White South Africans, designed as part of Apartheid policy of urban residential segregation to be spatially and administratively separated from 'White' cities or towns (Wilkinson, 1998).

UNICEF: United Nations Children's Fund

“There can be no keener revelation of a society’s soul than the way in which it treats its children.”

Nelson Mandela

Preface

In 2010, the world's urban population is estimated at 50.5%, with over two thirds of the globe projected to be living in urban areas by the year 2050 (United Nations, 2010). Patterns of urbanisation and the migration of people to and within urban spaces is therefore a topic of much interest the world over. Of particular significance are the determinants and consequences of such flows of mobility, be they positive or negative, as individuals seek to establish themselves in new contexts and environments. Research in this area has focused on the movement of adults, with child mobility generally conceptualised as occurring in conjunction with that of parents or families. However, this assumption may not necessarily hold, particularly in transitional societies where children of all ages have been shown to move independently. Movement and relocation carry economic, social and health related challenges, many of which are more pronounced in the urban environment, and may be particularly challenging in the case of children. Thus it is important to develop an understanding of the patterns, processes and outcomes associated with child mobility in different localities.

In South Africa, the urban population makes up the majority, however, the process of urbanisation has been significantly influenced by the country's socio-political history where controls and restrictions were imposed on population movements. In the new democratic era, population mobility remains high as people relocate to access economic opportunities, both to and within urban areas. Research in this field has focused on labour migration and more recently, cross-border migration, and movements involving South African children have been very little researched.

The opportunity arose for me to develop a research project around the mobility of urban South African children in Johannesburg-Soweto through the Birth to Twenty cohort study (BT20). I was interested in understanding the frequency and patterns of movement and

the ways in which mobility might affect, in particular children's educational attainment. With a background and strong interest in research methodology, I was also motivated by the methodological challenges inherent in analysing mobility data from a cohort study design. Thus I conceptualised a PhD which had a strong empirical component but also involved developing and applying my skills to the study's methodological aspect. I began work on the study by exploring BT20's historical records and in particular, the contacts database. Through this process, I realised it would be necessary to supplement available historical data so as to address the more specific research objectives around children's residential mobility. I therefore developed a questionnaire which was distributed in the form of a structured interview to all 'in-contact' cohort members commencing during the year in which the participants turned 15 years of age. Following the completion of this data collection, I developed a coding schedule and set up a database for capture of the questionnaires. Questionnaire data were merged with historical data and a series of datasets constructed for the purposes of statistical analyses.

Through the time spent on this project, I was fortunate to gain experience with all aspects of the research protocol, from data collection and fieldwork, staff training and management, to primary as well as secondary data analysis. This highlighted for me some of the challenges associated with working on a cohort study and gave me important insight into the South African context which I was able to bring to the interpretation of my study findings. During the course of working on the PhD I received a fellowship from the Department of Science and Technology which allowed me the opportunity to spend time at the Centre for Multilevel Modelling, Bristol University where I received training and mentorship from experts using and developing multilevel modelling techniques. The experience allowed me to apply these longitudinal data analysis techniques to the BT20 mobility data and highlighted other useful applications of these techniques, which I aim to apply to further research developing on outcomes associated with child residential and school mobility.

The thesis aims to investigate residential mobility amongst children who form part of the BT20 cohort, observed over a 14 year period commencing at birth.

The specific study objectives are as follows:

i. To identify the patterns and frequencies of child residential mobility within the cohort.
ii. To explore the reasons prompting residential mobility within the cohort.
iii. To identify the child, caregiver and household factors associated with residential mobility within the cohort, and explore that nature of associations.
iv. To investigate the relationship between residential and school mobility and cohort children's educational progression and attainment.
v. To consider methodological approaches for dealing with sample attrition in the analysis of longitudinal mobility data.

These aims have been addressed in a series of publications from which the thesis has been constructed. The three papers have all been published in accredited journals. All references have been collated and standardised using the Harvard style. The thesis comprises three parts:

- Part 1 (which includes Chapter 1) presents a literature review of the conceptual, empirical and methodological contributions pertinent to the study of child mobility.
- Part 2 (which includes Chapters 2 to 4) comprises the three publications in which the methods and results of the thesis are outlined.
- Part 3 (which includes Chapter 5) presents a synthesis of the findings from all three papers and discusses the thesis conclusions.

The studies presented in this thesis were granted ethics clearance by the University of the Witwatersrand Human Research Ethics Committee (Protocol Number: MO60611). The BT20 Research Programme, including all data collection, has received clearance by the Ethics Committee on Human Subjects at the University of the Witwatersrand (Protocol Number: M010556).

Part 1

Background and Literature

Chapter 1

Literature Review

Chapter 1: Literature Review

This chapter presents a foundation for the studies undertaken in this thesis. It aims to provide a broad sweep of the literature, introducing the relevant theory and evidence connected to the topic area. The chapter comprises a review of the relevant literature divided into six components: the first section provides a background to the study of mobility and children, the second presents an overview of internal mobility in South Africa, the third explores associations with mobility, the fourth considers the relationship between mobility and child well-being outcomes, the fifth discusses some of the methodological considerations pertaining to the analysis of child mobility data, and the final section presents highlights of the literature review as a summary.

1.1 Mobility and Children

In order to situate the current study of child residential mobility within the broader body of work in this area, it is necessary to outline the field of migration, which is vast and spans many disciplines within the social sciences. This section will present some background to the study of population mobility and migration. The first part will introduce the study of migration and discuss the importance of understanding and researching human population movements. Definitions of different forms of mobility will be outlined and selected conceptual frameworks for migration processes discussed. The section will conclude by providing a rationale for the study of children's movement and will highlight some of the research gaps in this area.

1.1.1 Introduction to the study of movement

Throughout history, population movement has occurred in response to social, political and economic change, with processes such as industrialisation, urbanisation and globalisation impacting on migration trends. In the twenty-first

century, population mobility has increased in magnitude and it is anticipated that levels of movement will continue to grow (Castles, 2000). To date, almost all countries, regions and communities across the globe have been affected by outflows and/or inflows of individuals (Crush and Frayne, 2010). Such streams of movement shape regional demographic profiles and impact on the distribution, growth and decline of populations (Rowland, 2003). Whether through the loss or gain of individuals in a population, human mobility transforms local cultures and environments, thus affecting societal change.

As global communication, trade and travel networks continue to expand, and human mobility increases, issues surrounding migration have gained a more central focus on the world's political and economic agendas (Castles, 2000). Contemporary trends in migration have revealed new and changing forms of movement, however, international migration has commonly occurred amongst the less-advantaged populations from low- and middle-income countries (LMICs) who move to high-income countries (HICs) in search of better standards of living (Castles and Miller, 2009). Nevertheless, the poorest and lower skilled individuals are often barred from entry into countries where they might access opportunities (United Nations Development Programme, 2009). These issues have sparked contemporary debates around poverty, inequality, development and human rights in relation to migration. In this regard, governments and the international community have been called upon to develop more co-operative immigration and migration policies and legislation (Castles, 2000).

While these issues are pertinent to current international policy discourse, it is nevertheless estimated that the vast majority of population movements are internal, taking place within political and administrative boundaries (United Nations Development Programme, 2009). These moves are often integral to the process of

urbanisation and, as in the case of cross-border migrations, driven by the search for opportunity and improved standards of living. Such movements require policy and planning responses from government authorities and city planners in order to ensure that infrastructure and service provision can adequately accommodate and provide for growing urban populations (Gelderblom and Kok, 1994).

Consequently, the study of population mobility whether across international boundaries, or internally based, is highly significant. The ability of governments to estimate the volumes, directions and patterns of migration is key to producing appropriate policy, planning and development strategies. Central to this is the need to understand the characteristics of movers as well as non-movers, and the causes and drivers of movement. Of paramount significance, are the consequences of movement and the ways in which human mobility impacts on regions, communities, households and individuals.

1.1.2 Definitions and measurement of population mobility

A range of terms are employed in the literature to describe the variety of human movements. These are summarised in Table 1.1. Broadly, the term 'mobility' includes all forms of human movement between territories (Zelinsky, 1971). Parnwell (1993) elaborates on this definition by describing 'mobility' as "the facility of being mobile, which enables some people to move from one area to another and … prevents others from doing so". The more restricted term, 'migration' refers to the 'crossing of a boundary' where boundary may apply to a border, a region or what Kok (1999) describes as an alternative 'migration-defining area'. Migration is generally classified as either international/external or intra-national/internal. International migration refers to movement between countries where there is a crossing of an international border, while internal migration applies to movement within a country's borders where there is a crossing of a regional, district or

municipal boundary (United Nations Development Programme, 2009). On a smaller scale, the term ‘residential mobility’ refers to moves which involve a change in residence within the same region or locality (Rossi, 1980). Commuting refers to repeated moves which are oscillatory and do not involve a change in residence (Rowland, 2003).

While there is no uniform framework or typology for the description and measurement of different types of movement, definitions generally incorporate a spatial and a temporal dimension (see Gould and Prothero, 1975; Roseman, 1971). Within the spatial dimension, moves are characterised in terms of origin and destination locations (Kosinski and Prothero, 1975). These may be described and classified in terms of geographical area delineations representing distance such as suburbs, or towns (for example, a move may be defined as a change in city within a province or district, or a change in suburb within a city). Moves may also be described in terms of directional classifications such as ‘urban’ or ‘rural’ (for example, a move may occur between urban areas, or a move may take place from a rural to an urban area). The temporal dimension of movement refers to the length of time or degree of permanence attached to the move. Thus moves may be permanent or temporary and in the case of temporary moves, they may be circulatory with people leaving and returning to their place of origin within varying intervals of time (Gould and Prothero, 1975).

In addition to these classifications, alternative descriptors may be used to define characteristics associated with migration. For example, voluntary migration may be distinguished from involuntary or forced migration (Boyle, et al., 1998). Migration may also be defined in terms of motives or purpose. For example labour migration, which refers to movement to access employment, family reunion migration, which refers to moves to join family members at their new destination, or return

migration, which refers to a migrant's return to a place of birth (Boyle, et al., 1998; Parnwell, 1993).

Table 1.1 Typology of population movements

Mobility	Spatial Dimension: Distance	Spatial Dimension: Direction	Temporal Dimension	Motive/Purpose/ Characteristics
External/ international migration	Cross-border Change in country	HIC; LMIC	Permanent ↓	Voluntary/involuntary Legal/illegal
Internal/ intra-national migration	Change in state/province	Rural-rural; Rural-urban; Urban-rural; Urban-urban	Temporary ↓	Labour migration Family reunion migration
Residential mobility	Change in town/city/suburb/ street		Circulatory ↓	Return migration
Commuting			Oscillatory	

Sources: Parnwell (1993) and Boyle et al. (1998).

Population movements are influenced by a region's historical, social, cultural, economic, political and environmental context (Parnwell, 1993). Consequently, there has been a lack of consensus amongst researchers on the ways in which movement is characterised and conceptualised across different locations (Kok, 1999). For example, spatial boundaries are often subjective and measurement may vary depending on the study objectives and level of data. Similarly difficulties may arise in distinguishing a permanent move from a temporary move and differentiating between the range of temporary and circular movements that may be encountered in certain settings. The debate concerning existing definitions is ongoing, and it has been suggested that each study derive its own appropriate and 'unambiguous' measurements of movement dimensions (Statistics South Africa, 2007a). However, this hinders comparability across studies, which may limit the applicability of findings across different contexts.

1.1.3 Conceptual frameworks explaining movement processes

Building on the definitions of mobility, a number of related theories and conceptual frameworks have evolved to explain migration behaviour and processes. The approaches are interdisciplinary, and premised on a range of paradigms depending on the research focus and the level of data (individual or aggregate), as well as the type of movement (international, internal) and context (HIC or LMIC etc.) (Castles and Miller, 2009). This full body of work is extensive and will not all be reviewed here, rather this section will elaborate on some of the more applicable theoretical developments.

The first contribution to the theory of migration was a set of hypotheses or 'Laws of Migration' proposed by Ravenstein (1885) at the end of the 19th century. These sought to explain, on an aggregate basis, the flows and drivers of movement as well as some of the characteristics of movers. This work was elaborated by Lee (1966) who suggested that movement decisions are dependent on factors at origin and destination locations, and are influenced by a set of intervening obstacles. Lee (1966) posited that the drivers of migration are selective, with positive selection occurring where movement is motivated by opportunity, and negative selection taking place where movement is prompted by necessity or disadvantage. This framework formed the foundation for 'push-pull' theories of movement, later criticised for being too simplistic (Boyle, et al., 1998). Following from Lee's work, Zelinsky's (1971) mobility transition model hypothesised that changes in mobility patterns occur in response to the 'modernisation process' (or the process of social change). Other salient works include that of Rossi (1980) who discussed how intra-urban residential mobility is motivated by changes in housing requirements, family composition and life cycles. The life cycle model was used as a basis for many studies that analysed the link between these various stages and patterns of movement (see for example Sandefur and Scott, 1981; Speare, 1970). The life

cycle perspective, criticised for being overly deterministic, later gave way to the more fluid life course approach to understanding movement that focused on the individual's life transitions (Boyle, et al., 1998).

The most prolific cluster of theories relate to the economic motives for movement. These economic models of migration are categorised under the following sub-headings: neo-classical economics, new economics of migration, dual labour market theory and world systems theory (Massey, et al., 1993). While these theories function at very different levels of analysis, the models essentially hypothesise that economic considerations, such as supply and demand for labour, and wage differentials, are the fundamental drivers of movement (Massey, et al., 1993). These aspects will motivate decisions to migrate taken at the level of the individual or the household/family, who act in the interests of maximising benefits while minimising costs (DaVanzo, 1981). Economic frameworks have been criticised for excluding pertinent non-economic causal factors which play a role in individuals' decision-making, with the result that more holistic models for mobility decisions have been proposed. A prominent of these is the value-expectancy model derived by De Jong and Fawcett (1981), who assert that at the micro level, movement is a "function of multiple motives". This model suggests a causal framework where individual and household characteristics, societal norms, personal traits and opportunity differentials influence individual's values (or goals) and expectations, which in turn impact on migration behaviour intentions (De Jong and Fawcett, 1981). This model was later refined to the version presented in Figure 1.1. The model is based on the theory of planned behaviour and proposes that, "intentions to move are the primary determinant of migration behaviour, along with direct behavioural constraint and facilitator factors" (De Jong, 2000). The model holds that a range of factors at the level of the individual, household and community exert an indirect influence on movement intentions. These explanatory

factors are mediated by a set of seven concepts (which include values and perceived family norms), identified as direct determinants of the intention to migrate (De Jong, 2000). The model takes account of a set of constraints and facilitators that act both on intentions and behaviour. This model adopts an individual approach but also overcomes some of the limitations of the life course approach which does not account for the structural context. The model was tested in a LMIC setting and conceptualised around both permanent and temporary internal mobility (De Jong, 2000). This suggests that it may be applicable to a range of settings. It is amongst the more inclusive and comprehensive of the conceptual frameworks for movement that may be applied to individual level data. Nevertheless, as in the case of definitions for migration, conceptual models for movement have been described as 'fragmented' and scholars have recommended integration of the range of approaches in order to move the field forward (Boyle, et al., 1998).

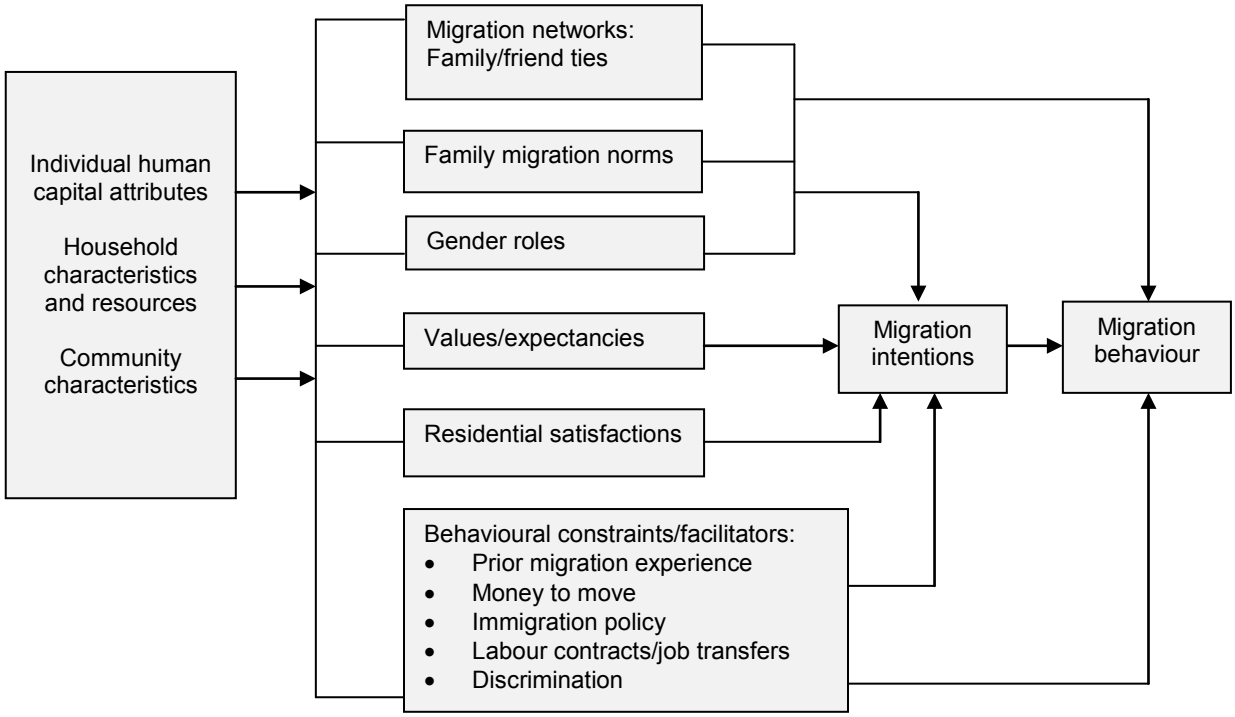

Figure 1.1 De Jong's general model of migration decision-making, which illustrates how concepts such as values and expectations are the primary predictors of movement intentions, which in turn explain migration behaviour. Reproduced from De Jong (2000).

1.1.4 Child mobility

While the theoretical models of migration described in the preceding section have evolved to allow for the inclusion of a range of movement processes and drivers, difficulty still arises in extending broad definitions and frameworks to all contexts. This is particularly true in applying migration frameworks to describe mobility amongst children. In the HIC setting, where a large proportion of the conceptualisation of migration has occurred, movement of children has been assumed to be connected to a parent or household and models describing mobility have therefore centred on adults or family groups. However, in LMICs, these assumptions of family structures and child movements may not hold. Migration in children has been very under-researched. However, there has been increasing evidence of independent child mobility and the ensuing need to consider child migration in contemporary migration-development debates (Yaqub, 2009).

Children frequently move together with caregivers or parents, or as part of family units, and they have been shown to both participate and exert an influence on family migratory decisions (Orellana, et al., 2001). Children may also participate in their own migratory decision-making and move independently of adults (Young, 2004). Children's independent migration can be involuntary occurring in the context of human trafficking, forced migration or asylum seeking, or voluntary where children may migrate as part of a family's livelihood strategy or for their own economic or educational incentives (Yaqub, 2009). Child migration has also been connected to orphan status, which may have consequences for children's care and living arrangements (Hosegood, et al., 2007). In such situations, child mobility is often prompted by conditions of poverty and disadvantage; circumstances which may be exacerbated by movement. However, a number of research gaps have been identified in understanding processes of movement involving children. Children's independent migration has been difficult to detect and quantify using the

current methodologies applied to the collection of migration data (Yaqub, 2009). In addition, analytical approaches have generally failed to recognise children's agency in frameworks explaining migration behaviour and as a result, movement of children may be overlooked or the drivers misunderstood. The UN Convention on the Rights of the Child defines the term 'childhood' as a space socially and legally distinct from adulthood, where children have the right to grow and develop in a protected environment (UNICEF, 2005). Given the paucity of research on child movement and the fact that mobility has the potential to situate children in positions of vulnerability, knowledge of patterns, drivers and consequences of movement involving children have been flagged as a significant avenue for further research (Dobson and Stillwell, 2000; Save the Children, 2007).

1.2 Population Mobility in South Africa

The focus on mobility amongst children has become particularly relevant in the sub-Saharan African region. This region is the worst affected by the HIV/AIDS pandemic, which has had a significant effect on both children's living arrangements and their movements (Ansell and Van Blerk, 2004; Hosegood, et al., 2007). South Africa provides a particularly interesting context in which to investigate child mobility as, in addition to these dynamics, population movements within the country have been influenced by a long history of political control. The subsequent shift to movement based on choice has resulted in high levels of internal mobility both amongst adults and children. This section will outline the relevant South African historical background and provide a description of current patterns of internal population mobility, with a focus on the country's most populous province, Gauteng. What is known about movement patterns involving South African children will also be reviewed.

1.2.1 South African historical context

In the South African context, movement patterns have reflected significant social changes and assumed a unique form as a result of the country's political and economic history (Kok, et al., 2003; Wentzel and Tlabela, 2006). Forced and controlled migration took root in Southern Africa with the British colonial system encouraging circular migration and discouraging permanent urban settlement amongst native populations recruited from rural surrounds as members of an urban work force (Crush, 2000; Zlotnik, 2006). With the onset of the Apartheid system in South Africa, a series of legislative initiatives were introduced, which sought to further control the movement and settlement of specifically Black South Africans (see Figure 1.2 for an outline of some of the relevant events that shaped South African history). In 1923, the Natives Urban Areas Act saw the introduction of pass laws which over time evolved into a rigid system of movement (influx) control (Giliomee and Schlemmer, 1985). The 1950's Group Areas Act delineated areas in accordance with racial classifications making it compulsory for people to reside in their designated areas, while the formal establishment of ethnic rural homelands and the implementation of the Bantu Homelands Citizenship Act of 1970 denied Black people citizenship rights in South Africa. These segregationist policies were concerned with restricting Black urbanisation and regulating the accommodation of Black workers in urban areas, while simultaneously ensuring that labour demands in urban areas could be met (Giliomee and Schlemmer, 1985; Posel, 1991). Further, within urban centres, policies of forced removals resulted in members of the Black workforce being shifted to rural homelands or informal settlements situated on the city's peripheries where they were provided with rental housing (Gelderblom and Kok, 1994). The most well known of these was the 1955 forced removal of Black residents from Sophiatown, to the Meadowlands suburb of the newly established Soweto, Johannesburg (Bonner and Segal, 1998).

1886	Discovery of gold on the Witwatersrand and establishment of Johannesburg
1910	Formation of the Union of South Africa
1923	Natives Urban Areas Act passed
1931	Orlando, the first township of Soweto, Johannesburg constructed
1937	Native Laws Amendment Act passed prohibiting Black people from acquiring land in urban areas
1948	National Party elected and the policy of Apartheid adopted
1950	Group Areas Act passed
1953	Bantu Education Act passed, segregating Black education
1961	South Africa declared a Republic
1964	ANC leader Nelson Mandela sentenced to life imprisonment
1970	Bantu Homelands Citizenship Act passed
1986	Influx Control Act and pass laws abolished, South African Citizenship Act restored
1990	Mandela released after spending 27 years in prison
1991	Group Areas Act repealed
1994	ANC wins first non-racial elections, Mandela inaugurated as president

Figure 1.2 Timeline of key South African events[1]
Sources: Bonner and Segal (1998) and Worden (2007).

A prominent characteristic of this simultaneous labour market and residential control was oscillatory labour migration, primarily of men, between urban locations of employment and rural homelands where women and children remained (Wilson, 1972). These patterns of circular labour migration had a series of implications. Economically, labour migration yielded remittance income which was used towards the upkeep of land, homes and families at migrants' rural homesteads. These remittances maintained migrants' connections to their places of origin, which assisted in securing for them a place to return to on retirement (Wilson, 1972). However the absence of household members for extended periods of time resulted in unstable residential arrangements, characterised by fluid household structures of varying sizes and compositions (Murray, 1981). In this context, child care arrangements were flexible with children often shifted between homes in order to maximise access to care and resources, or to provide support to extended kin

[1] Note that in relation to the thesis study sample, the BT20 cohort was recruited in Greater Johannesburg-Soweto in 1990, and the cohort reached 20 years of age in 2010.

through the mechanism of child fosterage (Jones, 1993; Van der Waal, 1996). These events and patterns had a significant and lasting impact on subsequent patterns of urbanisation and residence amongst Black South Africans.

1.2.2 Contemporary patterns of movement within South Africa

By the end of the Apartheid era, government's attempts to curb permanent urbanisation of the Black population were evident in South Africa's settlement profile (Kok, et al., 2003). At this time, an estimated 42% of Black South Africans were classified as residing in urban areas, as compared with 89.3% of non-Black South Africans (Anderson, 2006). The years following 1994 and South Africa's transition to democracy have seen a marked relative rise in rates of urbanisation amongst Black people, with an estimated urbanisation level of 47.5% in 2001 (Kok and Collinson, 2006). Nevertheless, there is evidence to suggest that oscillatory labour migration trends have not significantly altered, nor been replaced by increases in permanent urban settlement that might have been anticipated with the abandonment of restrictive policies (Posel, 2006). Further, rises in female labour migration have been observed as increasing numbers of women enter the labour market in an environment of changing work conditions and social roles (Collinson, et al., 2006a; Posel and Casale, 2003). Within South Africa's urban centres, increased population mobility has also been reported (South African Cities Network, 2004). Contemporary patterns of internal migration are therefore complex, in part reflecting the continuation of Apartheid trends, and in other respects reflecting new population dynamics (De Jong and Steinmetz, 2006; Kok, et al., 2003). Currently no overarching theory that singularly encapsulates the diversity of movements in the South African setting has been suggested. Nevertheless, a range or combination of theories of movement may provide some insight into these dynamics.

The conceptualisation and analysis of migration and mobility within South Africa have been hampered by a lack of cross-sectional and longitudinal data. However, research efforts have more recently been directed towards questions concerning both the levels and drivers of internal population movements (Kok, et al., 2003). Patterns of internal migration involving either permanent or more temporary relocation of households or individuals have been described in terms of direction as well as distance, with reasons for movement found to vary in relation to these spatial dimensions.

Analyses of census data have revealed that population movement streams most commonly occur in the direction of metropolitan areas, with few migratory moves taking place from metropolitan areas to other 'less urbanised' regions (Kok, et al., 2003). Multi-directional movements within former homeland and agricultural areas have been observed at higher than expected levels, while movements from these rural settlement categories towards smaller urban municipalities make up a relatively large migration stream (Collinson, et al., 2006a). The rural-to-rural migration stream was prominent in the findings of the 2001–02 HSRC Migration Survey[2], as was movement from rural areas to towns and smaller centres (Cross, 2006). This survey, which targeted a sample of migrants across the country, revealed that overall, employment was the most frequently cited reason for movement (see Figure 1.3 for a list of respondents' main reasons for their last move). Employment and economic issues were the most dominant drivers of rural-to-urban movement streams, while mobility occurring within urban centres was more commonly motivated by personal issues and housing (Cross, 2006).

[2] This survey was designed to explore amongst other aspects, the drivers of migration both into and within South Africa and yielded a stratified random cluster sample of 4266 households. The details of the survey methodology and sampling can be found in Kok et al. (2006).

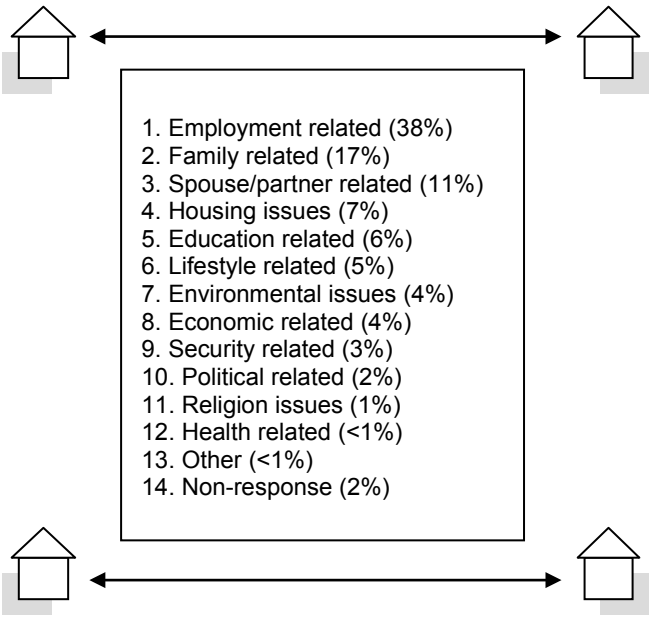

Figure 1.3 Main reasons for moving reported by respondents of the 2001–02 HSRC Migration Survey. Source: Wentzel et al. (2006).

The distance dimension of movement has commonly been calculated in relation to provincial boundaries as South African provinces form their own governing and administrative units and population characteristics and movement dynamics are distinct to each. Estimated population volumes, urban and rural population composition and net migration streams are presented by province in Table 1.2. Of the nine South African provinces, Gauteng is the most densely populated urban centre, and home to approximately 10.5 million residents (Statistics South Africa, 2009). This province is regarded as the economic hub of the country, and is the largest receiver of migrants from other provinces - across all population groups (Kok, et al., 2003; Statistics South Africa, 2006). As the thesis study sample was recruited from the Johannesburg–Soweto area of the Gauteng Province, the focus is on this region (see Figure 1.4).

Table 1.2 Population estimates and net migration by province

	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape
Population estimate 2009	6 648 600	2 902 400	10 531 300	10 449 300	5 227 200	3 606 800	1 147 600	3 450 400	5 356 900
% of total population by province	13.5%	5.9%	21.4%	21.2%	10.6%	7.3%	2.3%	7.0%	10.9%
Proportion urban 2001	38.1%	74.5%	96.3%	45.2%	10.4%	39.1%	80.7%	40.8%	89.8%
Proportion rural 2001	61.9%	25.5%	3.7%	54.8%	89.6%	60.9%	19.3%	59.2%	10.2%
Net migration 2006-2011	-273 600	-31 800	446 900	12 100	-189 200	-43 800	-25 500	-32 100	137 000

Sources: Statistics South Africa (2001; 2009).

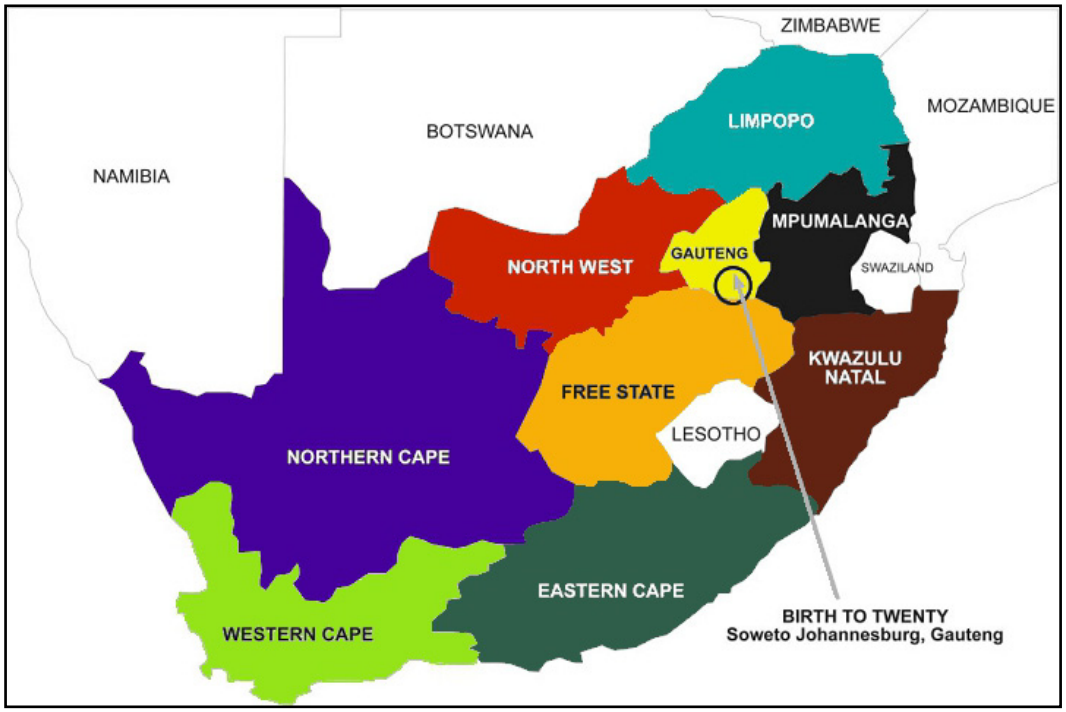

Figure 1.4 Map of South Africa indicating the thesis study site, Johannesburg-Soweto, in the Gauteng Province

1.2.3 Gauteng: Johannesburg-Soweto

The Gauteng Province comprises three metropolitan municipalities, namely Ekurhuleni, Johannesburg and Tshwane. The Johannesburg metropolis, which includes Soweto, is the most populous of the three and consists of an inner city, surrounded by suburban areas comprising formal housing and informal settlements on the city's periphery. Apartheid policies had a profound effect on Johannesburg's settlement structures, housing and city growth rates. Post-Apartheid, Black migrants entering the area have primarily chosen to settle in townships such as Soweto, with far lower levels of occupation occurring in the inner city (Gilbert and Crankshaw, 1999). The type of accommodation obtained by migrants has also varied depending on the period during which they arrived in the metropolis (Beall, et al., 2002). Prior to 1960, formal council housing was available to Black migrants, while hostels became a common accommodation option thereafter. More recently, the most common forms of first accommodation obtained

by migrants are rented backyard rooms or shacks (Beall, et al., 2002; Gilbert and Crankshaw, 1999).

The attractiveness of Gauteng as a migration destination may be attributed to the greater employment prospects, higher standard of living and better access to health, education and social services perceived to be offered in this province as compared with others (Oosthuizen and Naidoo, 2004) However, concentrations of poverty or 'poverty pockets' have been identified on the outer boundaries of the Johannesburg metropolis, with an overlap between these areas and areas of high in-migration (Cross, et al., 2005). Efforts have been made to redress the social inequalities resulting from Apartheid to allow for more equitable access to services and benefits for households across all areas (South African Cities Network, 2004). Nevertheless, disparities persist in housing availability, infrastructure development and service provision in many parts of the province. For internal migrants residing in township areas in particular, living conditions have been described as severe, and associated with material deprivation, unemployment, crime, exposure to pollutants, inadequate water and sanitation and a lack of access to electricity and social services (Barbarin and Richter, 2001; Oosthuizen and Naidoo, 2004; Richter, et al., 2006).

Within Gauteng, and the Johannesburg conurbation in particular, high levels of residential movement and circular migration have been observed; often in response to opportunities for employment, education, transportation and housing (Oosthuizen and Naidoo, 2004; Rule, 2000). Much of this intra-urban mobility has been reported to be undertaken by young, unmarried adults, splitting from larger households to live alone or in smaller household units (Cross, et al., 2005; Todes, et al., 2010).

1.2.4 Child mobility in South Africa

In the context of a highly mobile adult population, corresponding patterns of movement amongst South African children have been investigated only minimally. However, studies of children's living arrangements have provided some insight into these dynamics. Research has indicated that children may be considered members of multiple households at a single point in time, or may change households over time (Hosegood and Ford, 2003). A proportion of children have also been shown to live independently of parents, with extended family members or grandparents, for periods of varying duration (Hosegood, et al., 2007). Thus for some children in South Africa, family life may be fluid and characterised by frequent changes in living and care arrangements, which are often associated with mobility (Henderson, 1998; Jones, 1992; Murray, 1981; Spiegel, et al., 1996a). However, these circumstances do not exhaustively capture all forms of child mobility.

Current South African research has shown that patterns of movement involving children can take place within urban or rural environments, or between rural and urban areas, and moves may be either permanent or temporary (Collinson, et al., 2006a; Kok and Collinson, 2006). Table 1.3 presents rates of child mobility observed in two rural-based studies. Comparative rates of mobility involving movement of children within urban areas have not been ascertained up until now.

Table 1.3 Prevalence of child mobility in rural South Africa[a]

Study	Period of Observation	Sample	Age	Rates of Mobility	Location	Reference
Agincourt Health and Demographic Surveillance System	2000-2004	± 70 000 individuals	<5 years	6.5% within the study area, 3% out of the study area, 7% circular migration, 20% of children per year were involved in either permanent or circular migration.	Bushbuckridge, Rural Limpopo, South Africa	Collinson et al. (2006c)
Africa Centre Demographic Surveillance Area	2000-2002	39 163 children	0-17 years	8.8% within the study area, 12.44% out of the study area, 21.2% total.	Umkhanyakude, Rural KwaZulu-Natal, South Africa	Ford and Hosegood (2005)

[a] Comparative rates amongst children in urban areas are not available (aside from the findings of this thesis)

Children have been reported to move either together with a primary caregiver or independent of one where a move involves a change in primary caregiver (Jones, 1993; Van der Waal, 1996). The factors prompting movement may be linked to circumstances surrounding the child's primary caregiver or family, or to circumstances attached to the child directly. For example, children may move independently in response to crisis such as the death of a caregiver, or for opportunity incentives such as accessing education by taking up residence with extended family (Bekker, 2002; Collinson, et al., 2006a; Ford and Hosegood, 2005; Hosegood and Ford, 2003; Kok and Collinson, 2006; Van der Waal, 1996). Children may also be fostered, often by extended family members, who assist with child-rearing in situations where parents are unable to provide adequate care (Madhavan, 2004; McDaniel and Zulu, 1996; Van der Waal, 1996). Alternatively, children may accompany a caregiver in a move prompted by changes in a parental relationship, or employment status (Collinson, et al., 2006c; Kok and Collinson, 2006; Van der Waal, 1996).

1.3 Associations with Mobility

Researchers have emphasised the need to verify and support the development and extension of theoretical representations of mobility through the application of empirical analyses in varying contexts (Massey, et al., 1993). Therefore, a vast number of studies have examined and identified factors such as age, education and occupation associated with both movement and non-movement (De Jong and Fawcett, 1981). The decision to move has commonly been viewed as a sequential process where the inclination to move develops into a movement intention which is followed by behaviour (Rossi, 1980). Thus certain studies have concentrated on movement intentions, while others have considered movement behaviour using data sources describing mobility histories (see for example Lee, et al., 1994; Speare, et al., 1982). Although there are conceptual distinctions between these different focus areas and corresponding

analytical approaches, they are collectively important in investigating the process of human mobility and profiles of movers and non-movers. Using an extension of the groups of factors outlined in the first component of De Jong's model (see Figure 1.1), this section will investigate the child individual, adult, household and community characteristics found in the literature to be associated with migration and residential mobility, with a focus on South African studies (these are summarised in Table 1.4). De Jong's multilevel framework provides a useful way of clustering determinants of mobility, and is appropriate in examining the South African setting where children's connections to adults or households may be fluid.

1.3.1 Child individual factors

Very little research has profiled child mobility as children have not generally been treated as an analytically distinct population, however, the following set of child level attributes have been found to be associated with movement and these are therefore considered.

1.3.1.1 Age

Findings from studies of residential mobility in HICs have generally found high levels of movement among one to four year olds, with rates declining between the ages of ten and 14 (Long, 1972; Long, 1992a; Long, 1992b). These patterns have been connected to corresponding life cycle stages of parents who may be moving in relation to changes in employment or shifting residence in order to accommodate a child (Long, 1992a). South African studies of child mobility have similarly indicated that movement occurs most often amongst pre-school aged children (Collinson, et al., 2006c; Ford and Hosegood, 2005). In studies conducted in rural South Africa, permanent migration out of the study area and local mobility within the study area were highest for both males and females aged less than five years (Collinson, et al., 2006c). Mobility levels

appear to decline and then increase in the late teenage years where the search for employment or marriage may prompt a move (Collinson, et al., 2006a).

1.3.1.2 Gender

Gender differences in studies of residential mobility in HICs have not been reported as significant in children under the age of 15 years (Long, 1992b). In South African studies, gender differences in patterns of child mobility have not been emphasised, however, a study of rural-based temporary migrants revealed a marginally higher level of mobility in girls as compared with boys (Collinson, et al., 2006a). This is potentially explained by McDaniel and Zulu (1996) who found that girls in sub-Saharan Africa are more likely to be fostered than boys.

1.3.1.3 Ethnicity

HIC studies have investigated ethnic differences in mobility patterns (see for example McAllister, et al., 1971), however, these findings are not applicable to the South African setting. While migration patterns within selected child populations (for example, rural-based, Black children) have been considered, no study has been identified that explores specific ethnic differences in a representative sample of South African children. Variations in child mobility across ethnic groups may be connected to cultural differences in living arrangements as well as divergent family survival strategies which have arisen in the context of South Africa's racial inequalities (see Amoateng, et al., 2007).

1.3.1.4 Care and residency

HIC studies tend to assume that movement of children is reflective of parental mobility. However, in the South African case, children may not necessarily

reside continuously with the same parent or primary caregiver, and in the same household. For instance, South African census data indicate that only 36.4% of Black children aged between five and 13 years live in a household together with both parents, in contrast with 58.7%, 80.0% and 83.8% of Coloured, White and Asian children respectively (Statistics South Africa, 2001). Care structures and corresponding patterns of residence have been associated with child mobility. In a rural-based study, mobility was found to be higher amongst children whose mothers were not resident in the same household (Ford and Hosegood, 2005).

1.3.2 Adult factors

In the context of child mobility, associations with mobility of connected adults would be relevant and the key determinants of mobility in adults are therefore outlined.

1.3.2.1 Age

Researchers in HICs have identified an inverse relationship between age and residential mobility in adults, with rates of movement tending to decline around the age of 45 years (Long, 1972; Speare, 1970). Studies of internal migration in a number of sub-Saharan African countries found that 20 to 24 year olds most frequently engaged in migration (Oucho and Gould, 1993). South African census data reveal similar associations, with levels of internal migration peaking in young adults aged 25 to 29 years, and declining after the age of 44 (Kok, et al., 2003).

1.3.2.2 Gender

In HICs, gendered patterns of movement have been identified as a result of the younger relative ages that women marry and women's greater longevity (Long,

1992b). This pattern, termed the ‘double gender crossover’ describes two peaks in movement amongst women - one occurring at younger ages relating to marriage and another occurring in older ages signifying widowhood (Rogers, 1988). Gender differences have also been observed in the profiles of migrants in various South African regional studies. However, census data suggest that overall, levels of male and female internal migration do not differ significantly from each other. The exception is the case of labour migration, which tends more often to be undertaken by males, although increasing numbers of females have been observed to engage in this form of movement (Kok, et al., 2003; Posel and Casale, 2003).

1.3.2.3 Ethnicity

South African census data have demonstrated ethnic differences in the profile of inter-provincial migrants, with higher levels of movement amongst White and Black South Africans and lower levels of movement amongst the Coloured and Asian populations (Kok, et al., 2003).

1.3.2.4 Marital status

The association between marital status and residential mobility has been demonstrated in the literature and found to vary in different HIC settings (Long, 1992b). Research has nevertheless shown that partnership formation and breakdown are likely to result in residential mobility (Speare, 1970; Speare and Goldscheider, 1987). While South African census data do not identify a significant relationship between marital status and internal migration, the HSRC Migration Survey indicated that movement was more frequently undertaken by unmarried individuals, with married individuals reporting a lower desire to relocate (Cross, 2006; Wentzel, et al., 2006).

1.3.2.5 Numbers of children

Research conducted in the United States has identified a relationship between numbers of children and levels of mobility in adults. Numbers of children were found to be inversely related to movement, and relatively high levels of mobility in married couples with no children have been observed (Long, 1972; Sandefur and Scott, 1981). While some South African studies have controlled for household size in analyses of mobility, studies have not been identified that consider numbers of children. This is likely because the units of analysis used in studies of movement in South Africa tend to be at the level of the household or individual rather than the family group, which does not presuppose co-residency.

1.3.2.6 Educational attainment

The correlation between educational attainment and mobility has been established in HICs with the better educated generally being more mobile and having the greater desire and opportunity for movement (Long, 1973; Speare, et al., 1982). This relationship was also observed in relation to internal migration patterns in sub-Saharan African countries (Oucho and Gould, 1993). South African studies of inter-provincial migration have found a correlation between labour migration and lower levels of education, while higher levels of education have been associated with movement intentions and relocation linked to economic opportunity (Kok, et al., 2003; Wentzel, et al., 2006).

1.3.2.7 Employment status

Economic theories have dominated much of the literature explaining movement, and employment has been identified as a significant driver of mobility. Thus events such as the search for work, entry into the labour market and job changes may all prompt relocation over varying distances, with higher

skilled professionals being relatively more mobile as compared with other occupational categories (Long, 1973). Employment has been highlighted as the primary driver of internal mobility in South Africa, whether in the context of labour migration or migration amongst those with higher occupational status (Cross, 2006; Wentzel, et al., 2006). This is further demonstrated in analyses of census data, where economically inactive individuals had the lowest probability of ever having migrated (Kok, et al., 2003).

1.3.3 Household factors

In addition to characteristics of connected adults, the following household attributes have been associated with relocation.

1.3.3.1 Household socioeconomic status

Research conducted in HICs has linked low family income to greater levels of mobility (Long, 1992a). However, changes of residence may also reflect upward social mobility where families becoming more prosperous may move to settle in improved housing or neighbourhoods (Rossi, 1980). South African studies have investigated the relationship between household socioeconomic status (usually calculated with reference to household assets or income) and different forms of mobility. A divergent picture emerges where higher-income households appear more likely to engage in internal migration, with members of lower-income households more likely to participate in labour migration (Cross, 2006; Kok, et al., 2003). In the case of children, however, higher levels of household assets are associated with lower levels of mobility (Ford and Hosegood, 2005).

1.3.3.2 Dwelling type and ownership

A negative association between home ownership and residential mobility has been observed in HIC literature, with renters displaying a greater inclination to move (Lee, et al., 1994; Speare, 1974). South African data would suggest that residing in a more permanent type of dwelling (i.e. a formal house as compared with a shack), and owning a home are both associated with lower relative probabilities of movement (Kok, et al., 2003).

1.3.3.3 Household size and space

In Rossi's (1980) study, the quality of dwelling and availability of space were important factors contributing to mobility. Similarly in another United States based study, Speare (1974) observed a negative relationship between room crowding and residential satisfaction, which impacted on subsequent mobility. In South Africa, some smaller-scale studies found no association between household size and the propensity to move, however, analyses of census data have revealed an inverse relationship between the two (Ford and Hosegood, 2005; Kok, et al., 2003; Wentzel, et al., 2006).

1.3.4 Community factors

The following attributes at the level of the community or neighbourhood have been linked to adult mobility and are also potentially related to movement amongst children.

1.3.4.1 Duration of residence

A negative relationship between residential mobility and duration of residence in a particular area has been observed in studies conducted in the United States (Lee, et al., 1994; Speare, 1974; Speare, et al., 1982). Although length of residence has been considered in terms of migrants' destination locations

and labour migrants patterns of return, the duration of residence preceding a move does not appear to have been considered beyond a five-year interval of time in the most recent South African population census (Statistics South Africa, 2007a).

1.3.4.2 Neighbourhood quality

In an American study of residential mobility, Lee et al. (1994) highlight the importance of the little researched dimension of neighbourhood context on mobility. This study found weak evidence that subjective measures (such as perceived neighbourhood turnover or physical and social change) were associated with mobility thoughts and decisions, while no direct relationship was observed in the case of objective measures (such as neighbourhood income level or density) (Lee, et al., 1994). No South African study has been identified that investigates this aspect in relation to residential relocation.

1.3.4.3 Community ties

Migrant networks have frequently been identified as important in driving and facilitating movement, and allowing newcomers to adapt to new environments (Collinson, et al., 2006a; Gelderblom and Adams, 2006; Graves and Graves, 1980). Research conducted in HICs has found a negative association between the strength of social ties in an area (such as family and friends or community involvement) and the desire to relocate (Speare, et al., 1982). An empirical study of internal migrants in South Africa highlighted the importance of social connections in selecting destination locations (Gelderblom and Adams, 2006).

Table 1.4 Key South African studies of mobility profiles

Study	Year[a]	Sample[a]	Key Findings[b]			Location	Reference
			Child	Adult	Household		
Africa Centre Demographic Surveillance Area	2000-2002	39 163 children	The youngest children (0-2 years) were the most mobile with girls more likely to move than boys. Parent mortality increased the probability of movement in children.	N/A	Higher quantities of household assets were associated with lower levels of child mobility. Household size did not have an effect on child movement.	Umkhanyakude, Rural KwaZulu-Natal, South Africa	Ford and Hosegood (2005)
Agincourt Health and Demographic Surveillance System	1992-2003	11 305 households, 68 599 individuals (including children)	The proportion of child migrants appeared to be increasing. Temporary migrants were more likely to be girls than boys.	Females aged 15-25 were the most mobile of the permanent migrants (which was linked to marriage). High levels of temporary migration were observed amongst males aged between 35-54 years.	N/A	Bushbuckridge, Rural Limpopo, South Africa	Collinson et al. (2006a)

Table 1.4 continued

Study	Year	Sample	Key Findings			Location	Reference
			Child	Adult	Household		
Agincourt Health and Demographic Surveillance System	2000-2004 *1999-2003	±70 000 individuals (including children)	Male and female children under five years old were relatively more mobile, compared with children of older ages.	*Households with temporary, circular migrant members had household heads with higher levels of education.	*Households with temporary, circular migrant members had larger quantities of modern household assets.	Bushbuckridge, Rural Limpopo, South Africa	Collinson et al.(2006c)
Census data	1992-1996	38 015 802 population, 4 288 447 migrants *Sub-sample 2 640 854 migrants	Low levels of migration were found in children aged 5-9 years.	Levels of migration peaked between ages 25-29 years. Migration was found to be associated with both males and females, who were marginally more likely to be Black or White, with higher levels of income and education. Labour migration was associated with primarily Black, male South Africans, with lower levels of education and income. *Controlling for other factors, marital status was found to have no effect on migration.	*Higher household income was associated with a greater probability of migration, and household size was negatively associated with the potential to migrate. Home ownership was negatively associated with migration, while the more informal housing types were related to higher relative levels of movement.	National, South Africa	Kok et al. (2003)

Table 1.4 continued

Study	Year	Sample	Key Findings			Location	Reference
			Child	Adult	Household		
Census data and Labour Force Survey	1996-2001 and 2002	19 800 in-migrants	Smaller numbers of child in-migrants were observed as compared with the local child population, suggesting that children may not be accompanying adults in a move.	Permanent in-migration to the province was highest amongst Black South Africans. Migrants were more likely to be male, of working age, with lower levels of income and education as compared with the Gauteng-born population.	The status of 'migrant' was associated with lower levels of household assets and access to services as compared with Gauteng-born residents.	Gauteng, South Africa	Oosthuizen and Naidoo (2004)
2001-02 HSRC Migration Survey	2001-2002	2142 internal migrants	N/A	In an analysis of lifetime migration streams, migrants from rural to metropolitan areas were primarily male, under 34 years old with low levels of education. Movement within metropolitan areas occurred more often amongst females, and was associated with younger, unmarried adults with higher levels of basic education.	Rural to metropolitan migrants had household income that was either at the lowest end or the highest end of the continuum.	National, South Africa	Cross (2006)

Table 1.4 continued

Study	Year	Sample	Key Findings			Location	Reference
			Child	Adult	Household		
2001-02 HSRC Migration Survey	2001-2002	2142 internal migrants *Sub-sample based on 29% of the original sample	N/A	Gender differences were found to be insignificant. Internal migrant respondents were relatively more likely to be employed, with higher income levels as compared with non-migrants. *Migration intentions were related to younger, unmarried adults with higher levels of education.	N/A	National, South Africa	Wentzel et al. (2006)

[a] Results preceded with an asterisk relate to alternative years or samples indicated in the corresponding row

[b] No studies included in this Table investigated community-related factors associated with mobility or migration

1.4 Mobility and Child Outcomes

Mobility amongst children precipitates change and requires adjustment to a new environment. It therefore has the potential to improve or impair children's living circumstances and conditions. Following from the review of possible characteristics associated with movement in children, the question of how mobility may impact on child well-being is of significance. This section briefly outlines the relationship between mobility and child outcomes and reviews studies concerned with the impact of mobility on child well-being. The section will conclude with some discussion of children's experiences of movement.

1.4.1 Overview of the relationship between mobility and child health

Many studies have emphasised the detrimental effects of child migration or mobility on health and development outcomes, however, movement may also have beneficial consequences. This basic relationship is presented in Figure 1.5, which illustrates that migration may have positive or negative effects on health, while health may act as a driver of movement (Garenne, 2006).

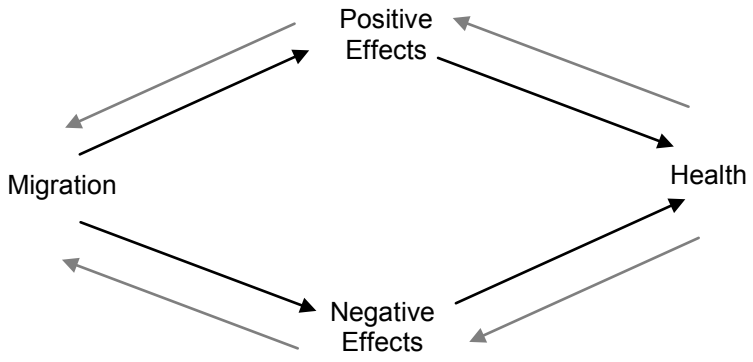

Figure 1.5 Basic relationships between migration and health
Reproduced from Garenne (2006).

The relationship between mobility and health is nonetheless complex and may be influenced by the form the movement takes (for instance international, internal or circular migration), the circumstances driving the movement (voluntary or forced, prompted by personal or economic circumstances etc.), as well as a range of confounders (such as residential arrangements, family and household structures, socioeconomic status and environmental factors) (Collinson, et al., 2006b; Garenne, 2006). An appropriate conceptual framework illustrating the relationship between child health outcomes and migration was one proposed by Brockerhoff (1990) in a study of child mortality and rural-to-urban migration (see Figure 1.6). Using the concepts of migration selection, disruption and adaptation, this framework hypothesises that environmental and socioeconomic conditions at locations of origin (the rural area) influence the status of the child health outcome pre-migration, as well as the decision to migrate. In turn, the act of migration together with environmental and socioeconomic conditions at destination locations (the urban area) impact on child health outcomes following movement. This framework posits that origin 'place' characteristics are mediating factors in relation to child health outcomes post-mobility, while pre-move individual socioeconomic characteristics are distal determinants as they operate through individual socioeconomic factors post-migration, which are directly linked to the outcome. Socioeconomic and environmental exposures at the movement destination may be defined as proximal determinants as they impact directly on the outcome (see Victora, et al., 1997). This conceptual framework can be applied to different forms of movement such as intra-urban mobility as, although the scale of movement is smaller and the extent of disruption and adaptation likely to be less, the relationships and direction of associations should still apply. Some of these relationships will be explored further in terms of previous study findings.

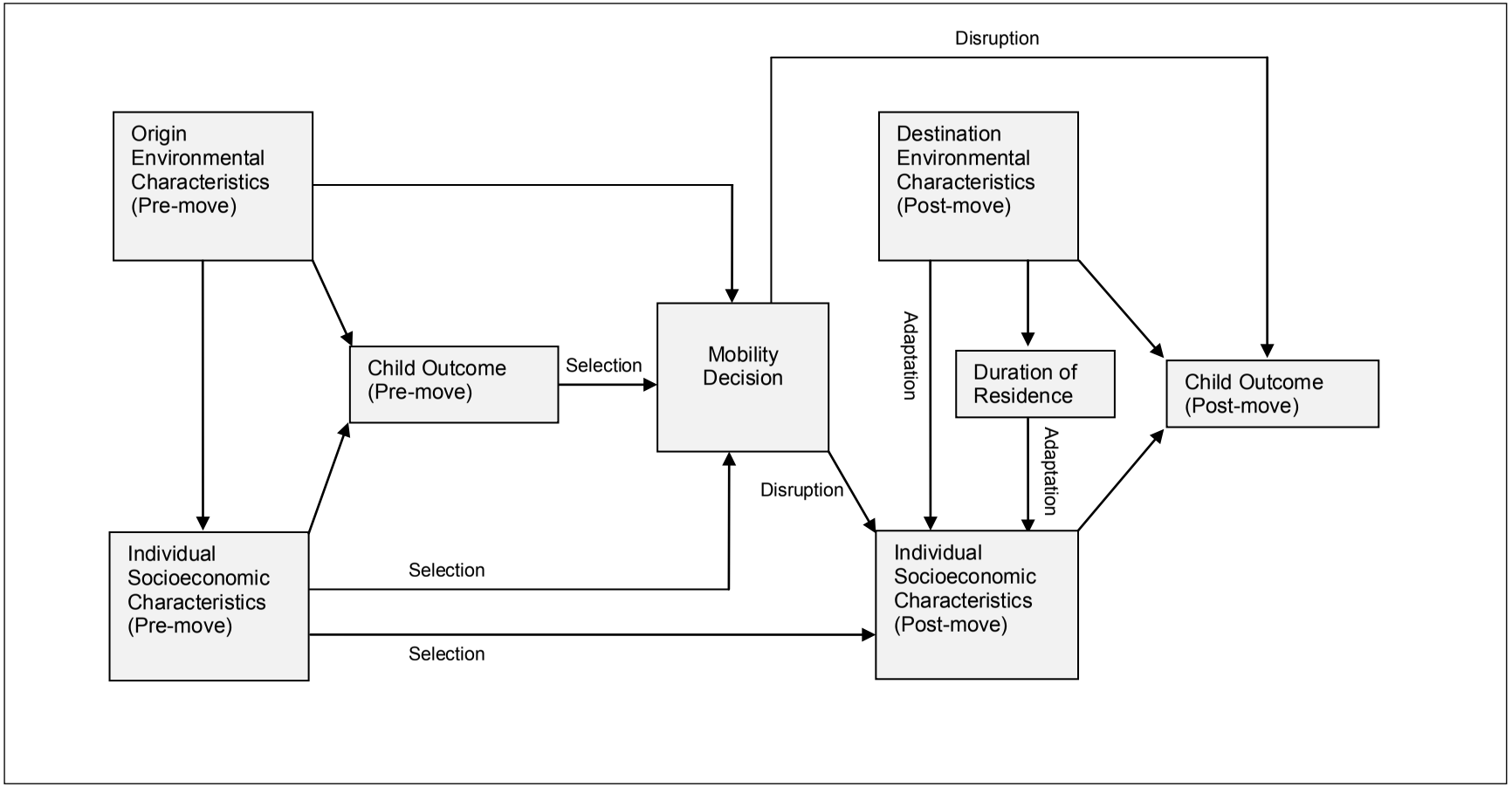

Figure 1.6 Brockerhoff's conceptual framework for the relationship between mobility and child well-being, which illustrates the causal pathways connecting rural-urban migration to a child health outcome (mortality). 'Selection' refers to the characteristics of migrants, 'adaptation' concerns change resulting from contact with the urban environment and 'disruption' relates to interference with existing practices. Adapted from Brockerhoff (1990).

1.4.2 Associations between mobility and child well-being

A range of health and educational outcomes have been explored in relation to child mobility.

1.4.2.1 Health outcomes

HIC studies of residential mobility have predominantly concluded that relocation is detrimental to children's well-being (see Jelleyman and Spencer, 2008). Frequent movement has been connected to emotional and behavioural problems (Simpson and Fowler, 1994; Wood, et al., 1993), adjustment issues (Adam, 2004), depression (Gilman, et al., 2003) and stress (Lewis, et al., 1984). Significant positive associations between frequent geographic mobility in childhood and the onset of drug use have been observed (Dewit, 1998), while relocation has also been linked to premarital sex (Stack, 1994). Further, families that have moved more often have been observed to access health care services less regularly (Fowler, et al., 1993). Many of the studies of mobility and health have conceptualised movement and relocation as a stressful life event, weakening social ties (Dewit, 1998; Pribesh and Downey, 1999). However, various studies have found a negligible direct relationship between mobility and well-being, once other mediating factors (such as family structure or adverse experiences) are considered (Dong, et al., 2005; Juon, et al., 2003). It has also been suggested that moving home has the potential to be a positive and beneficial experience for some children (Verropoulou, et al., 2002).

Research conducted in South Africa and other LMICs has similarly linked mobility or migration status amongst children to a range of negative health and social consequences such as increased child mortality (Brockerhoff, 1995; Collinson, et al., 2006b; Hosegood and Ford, 2003), susceptibility to disease

(Garenne, 2006), deprivation (Barbarin and Richter, 2001), exposure to violence (Barbarin and Richter, 2001) and stress (Magwaza, 1994). Studies contrasting native-born residents with internal migrants have indicated a health advantage amongst lifelong residents although the risk factors may be ameliorated by longer duration of residence, and are mediated by socioeconomic differentials (Brockerhoff, 1990; Thomas, 2007). Migration may also promote child well-being by effecting better standards of living, improved nutrition and access to health care facilities and social services (Collinson, et al., 2006b; Garenne, 2006). Further empirical research that will disentangle the risk factors and potential positive impacts of internal migration on health in South Africa is required, particularly in relation to children where the consequences of movement are likely to differ from that of adults (Hosegood and Ford, 2003).

1.4.2.2 Educational outcomes

Perhaps the most researched consequence of child mobility has concerned the effect of movement on education. As with other well-being indicators, changes of residence during children's school careers have been shown to have a predominantly adverse effect on various educational outcome measures. Studies have demonstrated a negative relationship between residential mobility and academic achievement (Ingersoll, et al., 1989), progression through school (Simpson and Fowler, 1994; Wood, et al., 1993) and completion of basic education (Haveman, et al., 1991). Furthermore, frequent relocation has been connected to school behavioural problems resulting in suspension or expulsion (Simpson and Fowler, 1994). Residential change is often accompanied by a change in school and some studies of residential mobility have also considered the effects of corresponding school mobility on children's academic performance and progression (see for example Pribesh and Downey, 1999;

South, et al., 2007; Swanson and Schneider, 1999). While some studies of school mobility have found evidence of independent negative impacts (Alexander, et al., 1996; Astone and McLanahan, 1994; Heinlein and Shinn, 2000; Nelson, et al., 1996), numerous studies have shown that the strength and pattern of associations between educational outcomes and child residential and school mobility are likely to be influenced by a series of individual, family, household and school factors (Pribesh and Downey, 1999; South, et al., 2007; Tucker, et al., 1998). For instance, the negative impact of movement was found to be mitigated in instances where children had parental support (Hagan, et al., 1996), were living with both parents (Tucker, et al., 1998) or amongst the more advantaged (higher-income) children (Straits, 1987). Further, the impact of mobility on school progression has been observed to be detrimental for children whose parents had lower levels of education, but the opposite (or no) effect has been found for children whose parents had achieved higher levels of education (Long, 1975; Straits, 1987).

Little is known about the effects of mobility on children's educational progression and achievement in LMICs, however, education has been identified as a driver of child migration in these settings. In South Africa, education has been shown to effect child relocations, and children may take up residence with extended family in order to access schooling (Bekker, 2002; Kok and Collinson, 2006; Paterson and Kruss, 1998; Zimmerman, 2003). Knowledge of the educational outcomes associated with such movements is nevertheless very sparse. The relationship between education and movement has been elaborated in the case of orphaned children, with subsequent relocation linked to school drop-out (Ansell and Van Blerk, 2004). Mobility has also been observed to have an impact on children's school attendance and the age of school commencement (Jones, 1993; Richter, et al., 2006).

1.4.3 Children's experiences of mobility

It has been established that mobility may impact significantly on child well-being. However, without attempting to understand the ways in which movement is experienced and perceived by children, this picture is incomplete. Conceptual frameworks, associations or measured outcomes cannot holistically explain the ways in which relocation affects children. Therefore, the importance of giving voice to mobile children and allowing them to describe their experiences of movement has been highlighted.

In Ansell and Van Blerk's (2004) study of child mobility in Southern Africa, children's experiences of relocating to new households following HIV/AIDS related death are described. Some children reported feeling discriminated against in their new households, some were ill treated or expected to take on different forms of household work, and others experienced emotional distress and isolation in having had to separate from siblings and friends while coping with the loss of a parent (Ansell and Van Blerk, 2004). Related research has corroborated that movement resulting in changes in children's caregiver and kinship relations are a cause of insecurity, disturbance and psychological distress (Henderson, 1998; Jones, 1992; Magwaza, 1994). In a qualitative study of mobile children in South Africa's Western Cape, one child's experience encapsulates some of the feelings of confusion and anguish that may ensue from movement, "My mother did not tell me she was leaving me there. She took me to her grandparents and then one day when I got out of the bed she was not there. She did not tell me she was going away. I did not know where she went, and I was worried that she was dead," (Jones, 1993). Other qualitative research speaks of children's resilience in relation to mobility experiences and describes strategies that they may employ to adapt to or change their residential circumstances (see Van der Waal, 1996).

1.5 Methodological Approaches to Analysing Mobility of Children

As inferred in the preceding sections, quantitative, qualitative and mixed method research designs have all been utilised in studies of child movement. The choice of research design and methodology is guided by the research focus and objectives. Thus qualitative studies have been used to investigate children's experiences of moving, while patterns and characteristics of child movement have been derived from survey-based studies. Nevertheless, a number of challenges are present in the analysis of children's movements. Building on from some of the definitional and measurement issues presented in Section 1.1, this section considers certain operational aspects involved in the use and analysis of mobility data. The section will begin with a review of the range of data sources that may be utilised in studies of mobility, with a focus on internal movements. It will follow with a brief outline of some of the approaches used in quantitative analyses of mobility. Finally, the section will highlight some of the methodological considerations and challenges concerning analysis of data on child mobility. This section aims to set the scene for the empirical work undertaken in the following section of this thesis.

1.5.1 Data sources

The range of data sources that have been employed in studies of internal mobility and migration, as well as their uses and limitations are summarised in Table 1.5. The principal source of migration data is the census, defined by the United Nations (2008) as a total population and household enumeration within a precisely defined territory (such as a country) at a specified point in time. Censuses provide valuable baseline data and allow for the measurement and characterisation of internal migration flows and analysis of migration trends (Kok, et al., 2003). The strength of the census as a tool for analysing migration lies in the adequacy and quality of data collected and appropriateness of definitions attached to the measurements obtained (see Statistics South Africa, 2007a). On a smaller scale to the census,

demographic surveillance systems (DSS) have been used as a source of internal migration data in LMICs. These systems accumulate longitudinal health and demographic data for the total population of a defined geographical area, which are used to monitor population dynamics, analyse trends, and investigate outcomes (INDEPTH Network, 2002). While the DSS has the advantage of generating longitudinal data, it has limitations in terms of generalisability beyond the study location. A further potential source of longitudinal migration data is the cohort or panel study whereby a group of the same individuals are followed at various intervals over time. These studies have been used to establish trends, track change over time (such as the development of disease) and investigate outcomes (Hennekens and Buring, 1987; Moser and Kalton, 1971). Limitations of the cohort or panel study relate to the representativeness of the initial sample, subsequent sample attrition and 'conditioning' resulting from continued participation in the study (Moser and Kalton, 1971). Drop-out is of particular concern in studies of movement because attrition is closely related to the outcome of interest - mobility - leading to bias if individuals with missing data are excluded.

The cross-sectional sample survey is most appropriate for investigating focused aspects of movement, such as reasons for moves or movement intentions. This method is useful in deriving data from a representative subset of a population or a particular group of interest, but may suffer from different forms of bias associated with questionnaire design, non-response or recall (Fowler, 2002). Further, in the case of sampling migrants, an appropriate survey sampling frame may not be available (Kalton and Anderson, 1986). Lastly, qualitative interviewing techniques are useful in extracting diversity and depth of information, and may be applied to the investigation of individual's movement histories, reasons for movement and experiences of mobility. Limitations with qualitative methods include challenges in

gaining access to appropriate informants and difficulties in defining the extent to which findings typify broader settings (Flick, 1998).

1.5.2 Quantitative techniques for analysing mobility data

Mobility or migration can be defined as a single event, whose occurrence may be understood as marking a change from one 'state' to another (Singer and Willett, 2003). Certain events can take place only once (for example, the onset of a disease), while others (such as movement) may take place repeatedly within a period of time. Episodes or spells describe the duration between the time following the occurrence of the event and its re-occurrence (Willett and Singer, 1995). Censoring refers to the non-occurrence of the event within the observation time (Box-Steffensmeier and Jones, 2004). Conventional statistical analysis methods have been limited in exploring duration data primarily because of difficulties in handling censored observations. These problems may be overcome using longitudinal event-history techniques where the analytical approach will differ depending on whether time is measured on a continuous scale or as a set of discrete intervals (see Singer and Willett, 2003; Yamaguchi, 1991 for a more detailed account of these issues). Nevertheless the majority of studies on migration and mobility have used cross-sectional analysis methods, and longitudinal datasets describing movement histories are less widely available.

Cross-sectional analysis methods that have been applied to studies of movement generally focus on whether an event occurred within a set interval of time. Cross-sectional datasets may be used to calculate migration or mobility rates, often reported as a percentage of the population 'at risk' of moving, and to determine patterns and frequencies of movement (Statistics South Africa, 2007a). Probability models have been used to analyse relationships between movement and one or more covariates representing various characteristics or attributes. Analytical

techniques will vary according to the way movement is measured. For example, movement may be represented by a binary indicator, a count or a multiple category variable and analysed using logistic, Poisson or multinomial models respectively (see for example Agresti, 2007). Mobility variables may also be included in models where a relationship between movement and a particular outcome is hypothesised.

Longitudinal methods of analysing movement are based on event-histories, and take into account both 'if' and 'when' the event (the move) occurred (Box-Steffensmeier and Jones, 2004). These analytical approaches may be referred to collectively as survival methods. In the simplest case, they are used to model the time to a single event (such as the time to a first move). In the case of repeated events, where a dataset consists of a number of residency episodes, duration data may be modelled using a multilevel framework where movement histories are viewed as a two-level structure with episodes or periods between moves at level one nested within individuals at level two (Goldstein, 2003). These models would include a time indicator variable (such as age) as well as a set of independent variables which may take on different values at different measurement occasions (time-varying covariates). As in the case of cross-sectional analyses, multilevel analysis techniques may also be used to model a longitudinal outcome variable (such as test scores at different measurement occasions) with a measure of mobility included as a covariate.

Table 1.5 Sources of mobility data

Data Sources	Description	South African Sources: Examples	Uses	Limitations	Methodological Reference
Population census	▪ Full enumeration of population ▪ Cross-sectional	South African Population Census (Statistics South Africa, 2001)	▪ Baseline data ▪ Calculation of rates, trends and projections	▪ Data comparability issues ▪ Infrequent	United Nations (2008)
Demographic surveillance systems	▪ Full enumeration of defined population ▪ Prospective ▪ Longitudinal	Agincourt DSS (Collinson, et al., 2006a) Africa Centre DSS (Hosegood, et al., 2005)	▪ Calculation of trends and outcomes ▪ Comparable data over time	▪ Generalisability to other areas	INDEPTH Network (2002)
Cohort/panel study	▪ Observational study ▪ Defined selection criteria ▪ Prospective ▪ Longitudinal	BT20 cohort (Richter, et al., 2007) Cape Area Panel Study (Lam, et al., 2008a)	▪ Calculation of trends, change over time, life cycle transitions and outcomes	▪ Sample attrition ▪ Cohort/panel selectivity ▪ Representativity	Hennekens and Buring (1987)
Sample survey	▪ Probability sample design ▪ Retrospective ▪ Cross-sectional	HSRC Migration Study (Wentzel, et al., 2006)	▪ Determination of processes, causes and intentions	▪ Recall ▪ Non-response	Moser and Kalton (1971)
Qualitative interviews	▪ Non-random sampling method (e.g. purposive or convenience sampling) ▪ Emic perspective	Study of children's experiences of migrancy (Jones, 1993)	▪ Exploration of experiences and histories	▪ Small sample sizes ▪ Issues of access ▪ Representativity	Flick (1998)

1.5.3 Methodological considerations for analysing mobility data in children

Having considered the potential sources of movement data and some methods that may be employed to analyse such data, the question of how this may be applied to analyses of child movements may be posed. Indeed a particular challenge in the study of child mobility relates to the appropriateness of different data sources and the handling of definitions and measurements that may be particularly complex in the case of children. These will be considered below.

1.5.3.1 Appropriate data

One of the biggest limitations in the study of child mobility is the lack of appropriate data describing children's movement patterns. Official statistics generally fail to recognise children as independent of adults or households, and few data collection efforts have focused exclusively on mobile children (Yaqub, 2009). However, analytical approaches that centre on the household or parent as the unit of analysis may be limited in capturing accurate information on mobile children whose movements may not correspond to a particular caregiver or household. For example, DSS studies provide a rich source of mobility data, however, their focus on a particular region and household implies that children who leave the area in excess of a certain length of time may be lost to follow-up (INDEPTH Network, 2002). These issues mean that children are often left out of routine data collection activities. In view of this, researchers have suggested a child-focused approach to mobility studies of children (Ansell and Van Blerk, 2004; Save the Children, 2007; Young, 2004).

1.5.3.2 Definition of movement

It has been observed that movements involving children, particularly those in urban areas, frequently take place over shorter distances (Ansell and Van

Blerk, 2004; Dobson and Stillwell, 2000). These types of moves may not be captured in instruments designed to look at inter-provincial movements or movements over longer distances (Hosegood and Ford, 2003). Further, children may move from a main place of residence to reside with family or alternative caregivers temporarily and in some cases children might have multiple addresses where their time is split between residences (see McHugh, et al., 1995). Therefore the decision of what constitutes a move (in terms of place, distance and duration) is important in ensuring that the range of movements involving children may be detected.

1.5.3.3 Movement histories

Obtaining data on children's movement histories may present a challenge. In a retrospective cross-sectional study design, the risk of recall bias would be significant and the choice of respondent may not always be clear. A child respondent may not have memory of early movements, while a current caregiver respondent may not have knowledge of a child's movement history in cases where a change in caregiver had occurred. The acquisition of life history data would therefore best be obtained from prospective longitudinal study designs, such as the cohort or panel study, or DSS.

1.5.3.4 Access to children

A particular challenge in studies of children's movement is the difficulty associated with gaining access to mobile children for the purpose of data collection. Mobile children form what Kalton and Anderson (1986) describe as a 'rare population' and the investigation of this group would require application of special methods of sampling such as screening and/or costly methods of tracing. Therefore, cohort study designs that are at risk of losing mobile

children to follow-up would need to allocate resources and develop strategies around tracing mobile children.

1.5.3.5 Ethics

Over and above the principles of general research ethics, there are specific ethical considerations that apply to research with children. In particular the issue of child protection is significant, where research should be conducted in children's best interests and should not cause them harm (Save the Children, 2000).

1.6 Summary of the Literature Review

This literature review has outlined the area in which the thesis is situated and attempted to contextualise the thesis both in terms of a conceptual and methodological orientation, as well as within the particular physical setting in which it is being conducted.

In summary, the literature review revealed a number of research gaps in this area:

- It is clear that although a range of definitions and conceptual frameworks have evolved around mobility and mobility processes, there is a lack of uniformity and consensus in the application of these aspects to different research problems. This necessitates further developing the area to gain clarity on measurement and conceptual issues, which would aid comparability across studies and contribute to developing cross-disciplinary theoretical representations of human mobility.
- Notwithstanding the above, the drivers, processes and outcomes linked to movement are very context specific. For example, even within the South African setting, a dichotomy is apparent between characteristics associated with labour migration and those associated with other forms of permanent migration. Therefore the importance of conducting empirical investigations in a range of

settings to build knowledge within these specific localities, as well as to expand on the body of work in the field, must be emphasised.

- On the basis of available evidence, mobility in children is a significant factor in studies of child well-being. Dedicated research investigating causal pathways linking movement of children to a range of well-being outcomes would be a research priority, particularly for children in LMICs where the effects of mobility might be profound. Interventions concerning mobility and associated child outcomes cannot be adequately formulated without a suitable understanding of these processes.
- Investigating human mobility presents numerous methodological challenges affecting study design, data collection and data analysis. These are particularly complex in relation to child mobility. While no approach is without limitations, mixed method approaches may offer broader insights into this phenomenon, while the application of new methodologies may strengthen the quality of child-centred analyses.

This literature review presents the foundation for the studies undertaken in this thesis. The thesis will endeavour to address some of the research gaps identified, with particular emphasis on those relating to child mobility. The overall aim of the thesis is to investigate residential mobility amongst children who form part of the BT20 cohort, observed over a 14 year period commencing at birth. The more specific research objectives are outlined and addressed in Chapter 2, 3 and 4.

Part 2

Empirical Papers

Chapter 2

Patterns of Residential Mobility amongst Children in Greater Johannesburg–Soweto, South Africa: Observations from the Birth to Twenty Cohort

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Chapter 2: Patterns of Residential Mobility amongst Children in Greater Johannesburg–Soweto, South Africa: Observations from the Birth to Twenty Cohort

2.1 Introduction

Movement patterns in South Africa have assumed a unique form as a result of the country's political and social history (Wentzel and Tlabela, 2006). Forced and controlled migration took root in Southern Africa with the British colonial system encouraging circular migration and discouraging permanent urban settlement amongst native populations recruited from rural surrounds as members of an urban work force (Crush, 2000; Hargrove, 2007). With the onset of the Apartheid system in South Africa, a series of legislative initiatives were introduced, which sought to further control the movement and settlement of specifically Black South Africans. The system of movement (influx) control and the introduction of the Group Areas Act, were amongst the segregationist policies concerned with restricting Black urbanisation and regulating the accommodation of Black workers in urban areas, while simultaneously ensuring that labour demands in urban areas could be met (Giliomee and Schlemmer, 1985; Posel, 1991). A prominent characteristic of this simultaneous labour market and residential control was oscillatory migration, primarily of men, between urban locations of employment and rural homesteads where women and children remained (Wilson, 1972). As a result, residential arrangements fluctuated with fluid household structures of varying sizes and compositions (Murray, 1981).

The end of Apartheid and the years following South Africa's transition to democracy have seen a marked relative rise in rates of urbanisation amongst Black people (Kok and Collinson, 2006; Statistics South Africa, 2007b). Despite the absence of legal barriers to movement, there is evidence that the oscillatory labour migration trends have not significantly altered, nor have they been replaced by increases in permanent

urban settlement that might have been anticipated (Posel, 2006). Further, rises in female labour migration have been observed as increasing numbers of women enter the labour market in an environment of changing work conditions and social roles (Collinson, et al., 2006a; Posel and Casale, 2003).

In the context of a highly mobile adult population, corresponding patterns of movement amongst children have been investigated only minimally. Current South African research has shown that patterns of movement involving children can take place within urban or rural environments, or between rural and urban areas, and moves can be either permanent or temporary (Collinson, et al., 2006a). Children have been reported to move either together with one or more primary caregivers or independent of them (Van der Waal, 1996). Movement may be prompted primarily by the connected adult/s (who may move to access an employment opportunity, or in response to relationship formation/dissolution). Movement may also be motivated by children's specific needs or circumstances such as movement to gain access to education, or movement in response to the death of a caregiver (Collinson, et al., 2006a; Ford and Hosegood, 2005; Van der Waal, 1996). In addition, children may be shifted between homes in order to maximise access to care and resources, or to provide support to extended kin through the mechanism of child fosterage (Jones, 1993; Van der Waal, 1996). Motives for moves are, however, unlikely to be clear cut, and may result from decision-making with consideration of both adult and child factors. Nevertheless, there is a dearth of research on children's movement patterns in South Africa and in other LMICs.

The lack of information about child migration stems from the fact that most data concerning population movements in South Africa have been collected as part of cross-sectional national population censuses, which are primarily concerned with investigating economically active adults and inter-provincial movements (Hosegood

and Ford, 2003). These surveys pose problems in the investigation of child movements for the following reasons: they are centred on the household rather than the individual as the unit of analysis, there are complexities associated with measuring and defining mobility of children in terms of their connection to related adults or households, and there are difficulties associated with gaining access to mobile children for the purpose of data collection. Studies using demographic surveillance systems such as those based at Agincourt and Mtubatuba have investigated the movements of children as members of households in rural South Africa. However, there is no published research directly exploring residential mobility amongst children born and residing in urban areas of South Africa.

The urban environment is often thought to promise higher standards of living through easier access to health care, social services, employment and educational facilities. However, urban systems frequently reinforce patterns of inequality and poverty, thus increasing the vulnerability of the poor (South African Cities Network, 2006). Recent migrants to urban areas have been found to be particularly disadvantaged by negative aspects of urban living such as overcrowding, inadequate housing and amenities, material deprivation and crime (Brockerhoff, 1995; Richter, et al., 2006). In such circumstances, children are particularly vulnerable to a range of negative health and social consequences (Barbarin and Richter, 2001). Research conducted in LMICs has linked high levels of mobility amongst children to consequences such as increased child mortality, susceptibility to disease, exposure to violence and increased psychological distress (Barbarin and Richter, 2001; Brockerhoff, 1995; Garenne, 2006; Magwaza, 1994). However, mobility may also be associated with improved standards of living and health (Collinson, et al., 2006b). The relationship between urbanisation and mobility and their associations with child health and well-being is complex and has been shown to be influenced by the form the migration takes, as well as a range of confounders including residential arrangements, family and household structures and

socioeconomic status (Collinson, et al., 2006b; Garenne, 2006; Tucker, et al., 1998). There has been limited research in the LMIC context to understand the associations between mobility, household structures and child well-being.

South Africa's largest urban population is based within the Greater Johannesburg-Soweto area (in the Gauteng Province), which is also the largest receiver of net in-migrants from other provinces in the country - across all ethnic groups (Kok, et al., 2003; Statistics South Africa, 2006). The attractiveness of Gauteng as a migration destination can be attributed to the fact that the province is the economic hub of South Africa with the highest reported employment growth rates (South African Cities Network, 2006). Within the Gauteng Province, relatively high levels of adult residential movement and circular migration have been observed, often in response to opportunities for employment, education, transportation and housing (Richter, et al., 2004; Rule, 2000). The Greater Johannesburg-Soweto area provides an appropriate context in which to explore patterns of residential mobility amongst a group of urban South African children who form part of the BT20 cohort.

This chapter presents results from a 14 year longitudinal study of child residential movement in the Greater Johannesburg area, using data collected through the BT20 Research Programme. BT20 is a longitudinal birth cohort study, and as such, is in a unique position to address research questions concerning changing social dynamics over time. The chapter describes the movement patterns and frequencies of child residential mobility as well as elicited reasons prompting residential change. Key demographic factors associated with differing levels of residential movement are also considered.

2.2 Methods

2.2.1 Study sample and protocol

The BT20 cohort was defined to include all children born within a seven-week period between April and June 1990 at public delivery centres in the Greater Johannesburg metropolitan area, including Soweto and Diepmeadow. The cohort was further refined to include only those women and children who were identified as having a residential address in Johannesburg-Soweto both at the time of delivery, and in the six months following the birth of the child, to exclude non-residential women who came into Johannesburg-Soweto only to deliver their baby. Upon inception of the study, the longitudinal sample comprised a residential cohort of 3273 children. The research aims and goals of the BT20 project, and characteristics of the sample, are described elsewhere (see Richter, et al., 2004; Richter, et al., 2007).

At recruitment, the BT20 cohort was demographically representative of the area. The majority of children in the cohort were Black (78.5%), born at a public hospital (86.5%) and resident in the Soweto/Diepmeadow area at birth (74.2%). White, Coloured and Asian children made up 6.3%, 11.7% and 3.5% of the cohort respectively. Biological mothers were primarily aged between 19 and 34 years (79.3%) at the time of the birth of their BT20 child, at which time 56.5% were single and 50.8% had commenced primary but not completed secondary school.

The study of residential movement described in this chapter comprised four phases. In the first phase, historical address data were collated and summarised to generate a profile of address information for each participant. In the second phase the historical address data were used as a base for designing and developing a survey instrument to probe children's residential movements. In the

third phase, the questionnaire was administered to as many of the contactable cohort members as possible, yielding a sample of 2158 complete questionnaires (66% of the original cohort of 3273). The final phase of the study involved preparing and analysing all available address data relating to both the movement survey respondents and the identified non-contactable cohort members, or attrition cases (amounting to 1115 members of the original residential cohort). This was an attempt to deal with the methodological limitation of excluding untraceable participants when analysing mobility.

2.2.2 Construction of historical address profiles for years 1989–2004

Over the 15 years of the BT20 study, address data were collected and maintained in a database for the purpose of corresponding with and locating participants, and managing and monitoring study attrition (Anderson and Richter, 1994; Norris, et al., 2007). At the onset of the BT20 study, data collection was conducted in health centres and by field staff who visited participants' homes and documented addresses. In the later years of the study, addresses were updated when participants visited one of the BT20 data collection sites at the Johannesburg General or Chris Hani Baragwanath Hospitals, or when follow-up and data collection was conducted during a home visit. For the current analysis, address data were available at each of the ten data collection time points that spanned the years 1989 to 2004, commencing immediately preceding the birth of the BT20 child (the baseline address), and continuing when the child was aged 1, 2, 3-4, 5-6, 7-8, 9-10, 11-12, 13 and 14 years. These historical address records were consolidated to obtain a longitudinal database describing the movement history for each participant.

2.2.3 Construction of the survey instrument

The longitudinal database had several limitations in utilising the data to specifically describe children's movements. For example, contact details on record often reflected the place of residence of the BT20 child's biological mother or primary caregiver, which was found not always to correspond to the BT20 child's place of residence. Therefore, a Residential Move Questionnaire (RMQ) was developed with the aim of addressing these limitations and obtaining further information about children's movements (see Appendix 1 for an example of the questionnaire and more detailed methods concerning its development and implementation). The questionnaire was designed to incorporate all longitudinal data which could be verified by respondents as reflecting the place of residence of the BT20 child. The questionnaire also allowed for the completion of any missing address components or undocumented moves involving the BT20 child. Finally, the questionnaire explored the central reasons prompting movement which were recorded verbatim through an open-ended question to which respondents were free to explain in their own words why the move had taken place. The questionnaire was structured around the set of ten discrete time points that corresponded to BT20's historical data collection waves between 1989 and 2004.

2.2.4 Implementation of the study protocol

Data collection on the RMQ took place at participant's homes and at the BT20 offices during BT20's Year 15 and Year 16 data collection waves. Questionnaires were administered in the form of a structured interview. Preference was given to conducting the interviews with children's primary caregivers as they were deemed to have the most knowledge of a child's residential movements over time. Questionnaires were administered by members of a team of trained field staff and an ongoing system of training and quality checking of questionnaires was implemented. The majority of questionnaire respondents were biological mothers

or primary caregivers (82%), with the balance of questionnaires completed by a family or household member who verified that they had knowledge of the BT20 child's residential movements.

2.2.5 Data analysis

Due to the strong association between sample attrition and child and family movement, the known residential movements relating to the 1115 cases of documented cumulative attrition were compiled and included in the current study. Survey data was therefore merged with the historical residential movement data available from the attrition sample in order to describe the overall movement patterns of children in the cohort. The analytical dataset was then reduced to the sample of 2158 participants who had completed the RMQ, where more detail about the classification of moves, reasons for movement and characteristics associated with differing movement profiles could be analysed. A socioeconomic index was derived for each participant on the basis of access to a set of ten services and household assets (home ownership, house type, water indoors, flush toilet, electricity, television, motor vehicle, refrigerator, washing machine and telephone), which were summed and participants grouped into quartiles. Data analysis was conducted using SPSS (2007); descriptive statistics were utilised to identify patterns and frequencies of mobility within the cohort, and chi-square tests were employed to establish significance of associations.

2.3 Results

2.3.1 Overall movement within the cohort

Based on the pooled sample of 3273 participants, an analysis of the frequency of children's summed residential movements over the period commencing at birth until the age of 15 years revealed a total of 1169 (35.7%) children who had never

experienced a residential move, with two thirds of children (64.3%) having moved home one or more times. Of the 2104 children who had experienced a residential move, 60.1% had changed residence only once, 28.9% had moved twice and 10.9% had moved three or more times. The chart presented in Figure 2.1 contrasts the frequency of moves for the children who comprised the cumulative attrition group – that is, who were lost to follow-up - and the children who remained in the study and completed the RMQ. The difference between the movement profiles of the two groups was significant ($\chi_{(4)}^2 = 230.149$, $p < 0.001$, $n = 3273$) with children who were lost to follow-up having experienced a higher recorded frequency of residential movement (81.3% having moved one or more times, and an average of 13.3% of the group moving home at any one time point) as compared with the children who had remained in contact with the BT20 study (55.5% having moved one or more times, with an average of 9.9% of the group changing residence at any one time point).

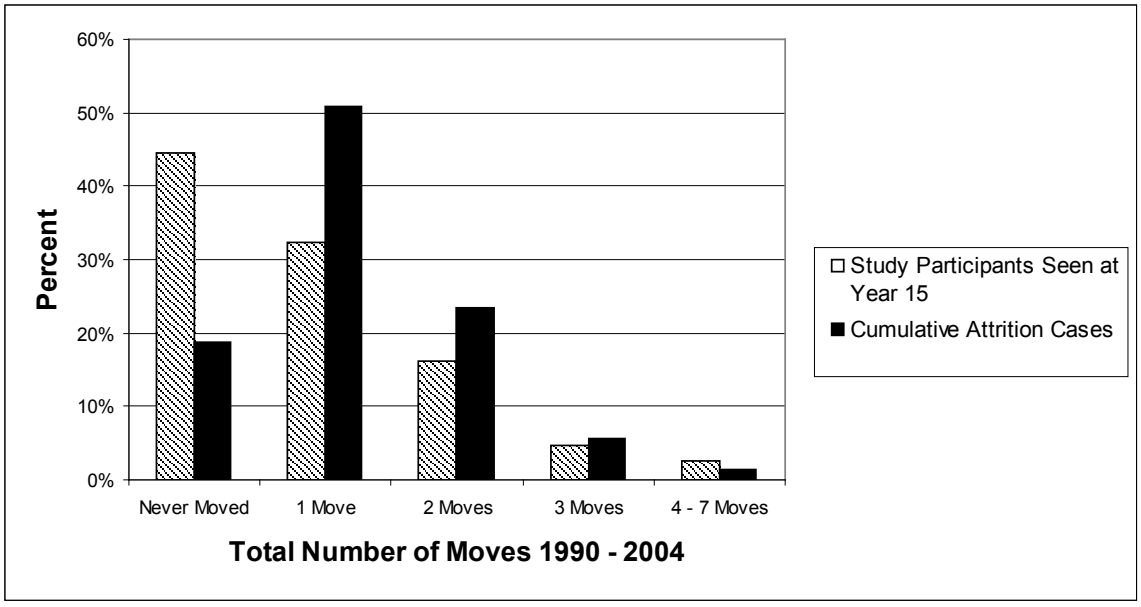

Figure 2.1 Longitudinal summary of the frequency of residential movement from 1990–2004

Comparative analyses performed between the cumulative attrition sample and the sample of participants who completed the RMQ revealed that, in contrast with the

study participants seen at Years 15-16, the cumulative attrition group comprised higher levels of White participants (12.6% as compared with 3.1% for Year 15; $\chi_{(3)}^2$ = 121.597, p < 0.001, n = 3273), children born in private hospitals (16.2% as compared with 12.1%; $\chi_{(1)}^2$ = 11.010, p < 0.01, n = 3272) and children resident in the inner city or suburbs at birth (5.1% as compared with 0.6%, and 20.3% as compared with 5.4% respectively; $\chi_{(3)}^2$ = 258.953, p < 0.001, n = 3273). Biological mothers whose children were lost to follow-up were more likely to have been married (52.1% as compared with 39.1%; $\chi_{(1)}^2$ = 50.573, p < 0.001, n = 3251), with either no formal education or post-school training (3.1% as compared with 0.9%, and 14.0% as compared with 9.8% respectively; $\chi_{(3)}^2$ = 36.991, p < 0.001, n = 2932). In addition, the cumulative attrition group comprised relatively higher proportions from the lowest resourced households (with access to three or fewer assets and services) and the highest resourced households (with access to between eight and ten assets and services) (38.0% as compared with 24.9%, and 24.1% as compared with 17.9% respectively; $\chi_{(3)}^2$ = 65.709, p < 0.001, n = 2054).

The movement profile and sample characteristics of the two groups over time are displayed in Table 2.1. The number of attrition cases increased at each data collection wave, with 66 children lost to follow-up at the start of Year 1 (2.0% of the cohort) and a total of 1115 children lost to follow-up by the start of Year 15 data collection (34.1% of the cohort). Movement levels in the cohort were highest when children were aged between three and four years (19.3% of children changed residence at this time), followed by relatively high levels of movement when children were aged between 11 and 12 years (14.9%). Furthermore, the cumulative attrition group accounted for the majority of total residential movement between the ages two to four years (56.6% and 64.9% of total moves over the two data collection waves were attributed to this group).

Table 2.1 Sample characteristics and movement profile by data collection wave

	Data Collection Wave								
	Year 1	**Year 2**	**Year 3-4**	**Year 5-6**	**Year 7-8**	**Year 9-10**	**Year 11-12**	**Year 13**	**Year 14**
Total Cohort	3273	3273	3273	3273	3273	3273	3273	3273	3273
Sample of participants who completed the RMQ	2158	2158	2158	2158	2158	2158	2158	2158	2158
Sample of cumulative attrition cases lost to follow-up (% of cohort)	66 (2.0)	144 (4.4)	293 (8.9)	499 (15.3)	559 (17.1)	670 (20.5)	732 (22.4)	1013 (30.9)	1037 (31.7)
Total movement of full cohort (% of cohort)	329 (10.1)	410 (12.5)	630 (19.3)	341 (10.4)	397 (12.1)	289 (8.8)	487 (14.9)	185 (5.7)	199 (6.1)
Movement linked to cumulative attrition sample (% of total movement)	125 (38.0)	232 (56.6)	409 (64.9)	108 (31. 7)	136 (34.3)	44 (15.2)	212 (43.5)	15 (8.1)	56 (28.1)

2.3.2 Number of residential moves at each time point by move category

The distribution of residential moves by category of move is presented in Figure 2.2. The chart depicts, at each of the nine data collection time points, the proportion of total moves that occurred either within the Greater Johannesburg area or outside of it. Moves were accounted for in full. Therefore where a move occurred but knowledge of the destination of the move was uncertain, it was included into the analysis (as a move to an unknown location). At each of the nine time points, the largest proportion of moves involved intra-urban mobility - movement that took place within the Greater Johannesburg area. Moves outside of Greater Johannesburg occurred more frequently in early childhood (below the age of five years), or when children were in their 14th year (28.3% and 33.2% respectively). Amongst the cumulative attrition group, 36.6% of total moves took place within Greater Johannesburg, 37.4% of moves were to destinations outside of Greater Johannesburg and 26.0% of moves were to an unknown destination. In contrast, 94.2% of movements within the group of current participants took place within the Greater Johannesburg area, with only 5.9% of movement within this group involving relocation outside of the study area.

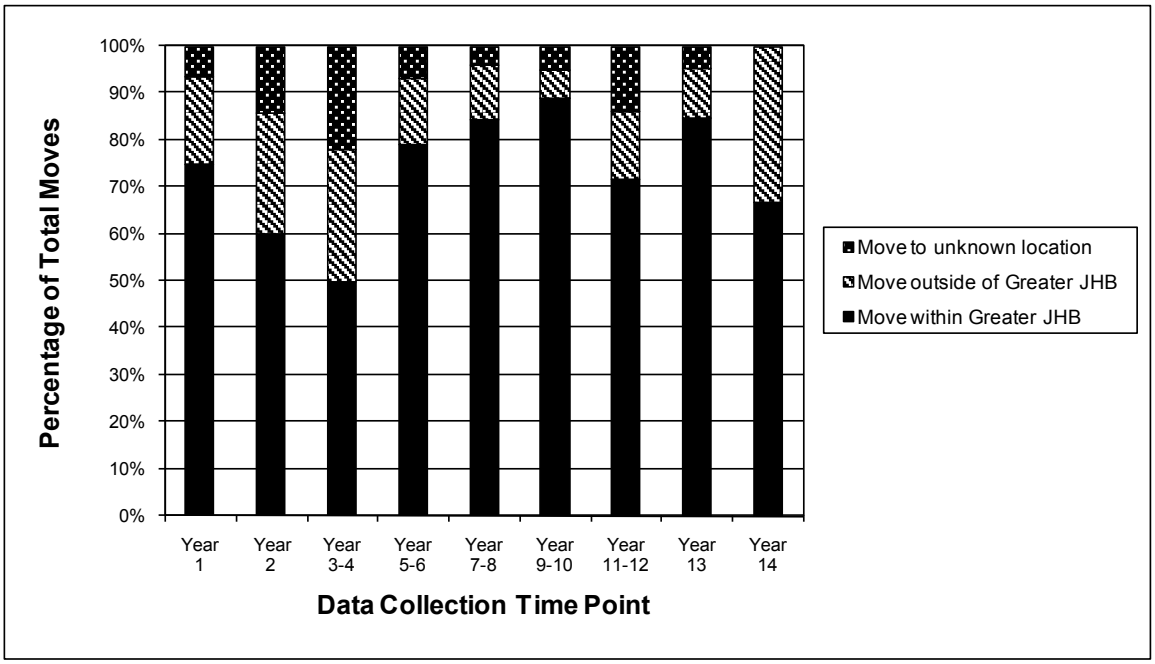

Figure 2.2 Cross-sectional number of residential moves at each time point by move category

2.3.3 Distribution of moves within Gauteng

The RMQ allowed for a more detailed classification of the spatial dimension of children's residential movements within the Gauteng Province. Moves were grouped according to whether they involved a change in dwelling within the same street, a change in street within the same suburb, a change of suburb within the same town or city, or a change in town or city within the province (codes were assigned by consulting maps and sources detailing towns, cities and regions of each of the six metropolitan/district municipalities within Gauteng). As illustrated in Figure 2.3, the largest proportion of cumulative moves between 1990 and 2004 within the Gauteng Province occurred between suburbs within the same town or city (47.8%), with the lowest number of moves occurring over the shortest distances such as moves within the same street (1.1%).

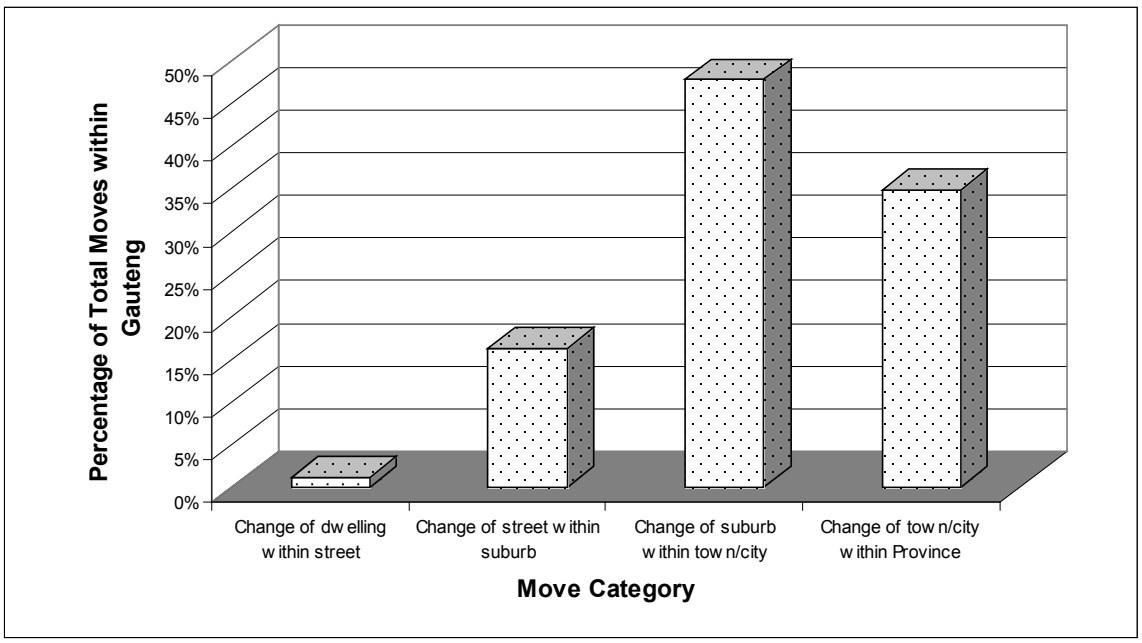

Figure 2.3 Cumulative residential move categories for participants seen at Year 15

2.3.4 Differences in characteristics of movers and non-movers

In order to generate a profile of children who had experienced a move as compared with children who had not moved home by age 15, a set of demographic variables were tested for significance across the two groups, and the results are displayed in Table 2.2. Significant differences were found across all the demographic variables analysed, with the exception of gender. In contrast with children who had not experienced a residential move, children more likely to have changed residence at least once over the period were either White or Asian (3.7% as compared with 2.3%, and 3.8% as compared with 2.4% respectively), born at private hospitals (13.5% as compared with 10.2%) or residing in the inner city or suburbs at birth (1.0% as compared with 0.0%, and 6.5% as compared with 4.1% respectively). A relatively larger proportion of children who experienced a residential move had biological mother's who were married or living with their partner (43.1% as compared with 34.0%), had completed either Grade 11–12 schooling (secondary school) or had post-school training (34.0% as compared with

29.8%, and 11.2% as compared with 8.1% respectively). As was the case with the attrition group reported on previously, movement was more frequently associated with participants who were lowest resourced and highest resourced in terms of their socioeconomic categorisations (27.6% as compared with 21.5%, and 19.0% as compared with 16.6% respectively).

Table 2.2 Characteristics of movers and non-movers

Characteristics by Movement Profile		**Never Moved** Total (%) n = 960	**Moved** Total (%) n = 1198
Child Gender	Male	484 (50.4)	569 (47.5)
$\chi_{(1)}^2 = 1.820$, NS, n = 2158	Female	476 (49.6)	629 (52.5)
Child Ethnicity	White	22 (2.3)	44 (3.7)
	Black	776 (80.8)	970 (81.0)
	Coloured	139 (14.5)	139 (11.6)
$\chi_{(3)}^2 = 9.878$, $p < 0.05$, n = 2158	Asian	23 (2.4)	45 (3.8)
Hospital of Birth	Public	862 (89.8)	1035 (86.5)
$\chi_{(1)}^2 = 5.558$, $p < 0.05$, n = 2157	Private	98 (10.2)	162 (13.5)
Residential Area at Birth	Soweto/Diepmeadow	774 (80.6)	944 (78.8)
	Former Coloured/Asian	147 (15.3)	164 (13.7)
	Inner City	0 (0.0)	12 (1.0)
$\chi_{(3)}^2 = 16.706$, $p < 0.01$, n = 2158	Suburban	39 (4.1)	78 (6.5)
Maternal Age at Delivery	≤ 18	131 (13.7)	123 (10.3)
	19-34	698 (72.8)	976 (81.5)
$\chi_{(2)}^2 = 24.942$, $p < 0.001$, n = 2156	35+	130 (13.6)	98 (8.2)
Maternal Education	No Formal Schooling	9 (1.0)	8 (0.7)
	Grade 10 or less	530 (61.1)	597 (54.1)
	Grade 11–12	259 (29.8)	375 (34.0)
$\chi_{(3)}^2 = 11.972$, $p < 0.01$, n = 1971	Post-School Training	70 (8.1)	123 (11.2)
Maternal Marital Status	Married/Living with Partner	324 (34.0)	513 (43.1)
	Single/Widowed/Divorced/	628 (66.0)	677 (56.9)
$\chi_{(1)}^2 = 18.299$, $p < 0.001$, n = 2142	Separated		
Household Socioeconomic Index	≤ 3 assets	136 (21.5)	225 (27.6)
	4–5 assets	225 (35.5)	253 (31.0)
	6–7 assets	168 (26.5)	182 (22.3)
$\chi_{(3)}^2 = 11.325$, $p < 0.05$, n = 1449	8–10 assets	105 (16.6)	155 (19.0)

The analysis was extended to contrast children who moved once with children who experienced multiple moves (two or more). Significant differences were found between these two levels of movement and the variables 'maternal education' and 'maternal age at delivery'. A larger proportion of repeated movement amongst children occurred in cases where biological mothers were aged between 19 and 34 years at the birth of their child (84.8% of repeated movers fell within this category as compared with 79.2% of single movers). Repeated moves were more frequently associated with children whose biological mothers had Grade 11-12 schooling or post-school training (50.8% of repeated movers had mothers with these characteristics, as compared with 41.0% of single movers), while very low levels of repeated moves occurred amongst children whose mothers had no formal education (one out of the eight children in this category had moved more than once).

2.3.5 Exploration of reasons for moves

On the basis of the qualitative responses to the open-ended question concerning predominant reasons for movement, a set of five broad categories were identified that captured the range of responses into which reasons could be coded (see Kok and Collinson, 2006; Wentzel, et al., 2006). The following categories were identified: reasons concerning employment or finance, those relating to housing requirements, reasons concerning household or partnership formation or dissolution, community-related reasons and reasons around child care. Reasons provided were not mutually exclusive and multiple codes were assigned to a given reason in cases where the reason spanned more than one of the above categories. Of the 1930 residential moves undertaken by BT20 children over 14 years, a total of 2900 reason codes were generated from the qualitative data. The most common set of reasons for movement, as reported by respondents, were those associated with relationship and family circumstances. These reasons,

which accounted for 38.6% of the total reasons, included (family) household or partnership formation/dissolution, or death of a family member. For example, one caregiver indicated, “I had to move to my husband’s family house because I got married.” Another caregiver explained that when her husband’s grandmother died, she and her child went home to stay with her own mother. Reasons associated with accommodation or housing were also frequently cited (36.1% of all reasons). These reasons included moves associated with rental accommodation or housing ownership, or moves relating to specific accommodation requirements or inadequacies. For example, one caregiver explained, “We moved to a better place where it was a bigger room than the one in Senaoane”. Moves associated with child care arrangements comprised 14.9% of all reasons. These included movement associated with the death of the BT20 child’s primary caregiver, or moves relating to schooling. A grandmother explained that when the BT20 child’s mother passed away, the child moved house to live under her care. Another caregiver indicated that the family had moved because of, “…travelling and school for the children. We found a house in Lenasia and sold the Zakariya Park house. Children could get to school easily”. Reasons associated with work or finance such as leaving or entering employment made up 6.3% of all reasons cited for a child moving. One caregiver indicated that they moved because they could no longer afford the rent in Randburg. Another explained that she found a job as a domestic worker and was offered an outside room with enough space to accommodate her and the BT20 child. Finally, community-related reasons such as movement because of security concerns in an area, or because of the desire to live in a particular neighbourhood comprised 4.1% of all reasons for residential change. One caregiver explained, “We were too restricted in that neighbourhood because of no safety, so we moved to a safer environment”. Another moved because of violence in the hostel in which they were living.

Although the current study does not specifically investigate the movement of children in relation to a biological parent or primary caregiver, the exploration of reasons for movement suggest that the movement of children and primary caregivers do not always correspond to one another. A comparison of the historical address records reflecting primary caregivers' contact details with children's residential addresses recorded in the RMQ revealed that an average of 7.5% of caregivers' contact addresses at each time point differed from the residential locations of the BT20 cohort members. The rate of correspondence between primary caregiver's and children's addresses tended to decrease as the children became older, with a 6.2% discrepancy in addresses at Year 1 and an 11.8% discrepancy at Year 14.

2.4 Discussion

This is the first study that we could identify that investigates child residential mobility in the Greater Johannesburg-Soweto area over time. The study describes the frequency of residential movement amongst children born in an urban South African context. The majority of children moved at least once over the period, but a third of children never changed residence during their first 14 years. The study also contrasted the movement patterns of cohort members lost to follow-up with cohort members who continued their participation in BT20. Overall, the largest proportion of moves occurring at each time point took place within the Greater Johannesburg area, however, a large proportion of movement that occurred inter-provincially was associated with study attrition. Residential mobility was found to be associated with high and low household socioeconomic status. That is, better and worse off children were the most mobile.

2.4.1 Patterns and frequencies

By the age of 15, the majority of children in the BT20 cohort had either never moved residence or had moved home only once (74.4%). On average, 11.1% of children in the cohort changed residence at any single time point (which spanned either one or two years). By comparison, in a study of rural South African children, 21.2% of the sample were found to have moved within a two year period from 2000 to 2002 (Ford and Hosegood, 2005). The lower rate of movement amongst the group of children born in Greater Johannesburg suggests stable patterns of residence, with people potentially becoming more permanently anchored to the urban environment. This is further emphasised by the fact that where movement did occur in the current study, the moves primarily took place across suburbs within Greater Johannesburg. This is again in contrast to the rural study where a larger proportion of moves were to destinations outside as opposed to within the study area (Ford and Hosegood, 2005).

The study afforded a unique opportunity to investigate the movement patterns of the group of BT20 participants who have remained in the cohort and the group of BT20 participants who were lost to follow-up. This is of particular relevance given the strong correlation between residential movement and study attrition. A set of differing movement trajectories were evident for these two groups of children. For the cumulative attrition cases, the largest proportion of residential movements occurred when the children were aged four years or younger, with a substantial proportion of movements to locations outside of the study area. This finding mirrors results from the study conducted by Ford and Hosegood (2005), which showed that the youngest children had the highest probability of moving. This suggests that the commencement of schooling may be a stabilising force in children's lives. The relatively high levels of movement observed in the current

study at 3-4 years and at 11-12 years seem to coincide with the commencement of school and the juncture of transfers from primary to secondary school.

In contrast to the group of children lost to follow-up, a large proportion of the children who remained in the BT20 study had never experienced a residential move by age 15. The average residential moves per time point amongst this group of study participants (9.9%) was consistent with the results of the HSRC's national survey of public opinion, in which it was found that 10% of Gauteng-based adult respondents had changed residence within a 12-month period (Rule, 2000). Thus the study using data from BT20 suggests that urban families and children may be more stable than would be anticipated, however, the length of time since families had settled in the region is likely to be an important factor. A survey of Soweto households conducted in 1997 revealed that many families of migrant origin were currently more permanently established in Soweto, with 41% of household heads born in the metropolitan area. Of the Soweto Survey respondents, few reported to have moved home frequently (Gilbert and Crankshaw, 1999). Future research into the length of time that BT20 families have resided in the area is currently underway.

Within the group of retained cohort members, the propensity to move was found to be highest amongst Whites and lowest amongst Coloureds. Further, mobility within the retained cohort group was associated with the highest and lowest socioeconomic indicators, reflecting movement for both economically advantageous and disadvantageous reasons. These findings coincide with the results of analyses conducted by Kok et al. (2003) using South African census data, in which they found that migration involving a move of a household was associated with higher education levels and income, while migration involving a move of an individual for reasons of employment (specifically labour migration)

was correlated with lower levels of education and income. A study of rural South African children found that the likelihood of moving was higher amongst children living in households with fewer assets (Ford and Hosegood, 2005). The low level of movement observed in this study may be associated with a potential poverty of opportunity, with people lacking incentive or resources to facilitate or motivate residential change. As revealed in Gilbert and Crankshaw's Soweto survey (1999), a large proportion of respondents had not improved their housing conditions since their arrival in the area.

2.4.2 Reasons

The study offered insight into some of the reasons for movement, as well as the potential role of children in decisions around movement. Primary reasons for movement as cited by respondents most frequently centred on changing family and relationship circumstances, or housing requirements. Some parallels may be drawn between these findings and the results of the 2001-02 HSRC Migration Survey. Although the HSRC survey found that 38% of total reasons provided for internal migration were employment related, a significant number of female respondents reported that they had moved because of relationship formation or dissolution (Wentzel, et al., 2006). Furthermore, the HSRC survey found that migration occurring within the urban sector was more commonly driven by personal issues and housing, as opposed to the economic issues that more frequently motivated rural-to-urban movement streams (Cross, 2006).

The results of the current study allude to the fact that children may move independently of primary caregivers for reasons linked to accessing care or schooling. These observations concur with findings from the Agincourt 1999-2003 study, which revealed that rural-based children moved most frequently in conjunction with the move of a parent, but moves to live with another family

member or to access schooling were also common (Kok and Collinson, 2006). Similarly, the Western Cape Migration Study found that children entering the province may take up residence with extended kin, often to access education (Bekker, 2002). The discrepancy between primary caregiver's and children's addresses observed in the current study may also be explained by the movement of a primary caregiver from a household where a child remains, such as may occur when caregivers find work in other areas. Thus the relative stability observed within the urban area may suggest that urban children have access to broader care networks, potentially in the form of an extended family, where a movement of a parent from a house shared with extended family members does not necessarily imply a move for a child.

2.4.3 Limitations

While the study illuminated some of the dynamics around mobility of the group of participants who were lost to follow-up, the extent of their movements are most likely to be under-reported. Further exploration of the patterns of movement amongst this group was not possible once contact with the families was lost. Furthermore, the exploration of the relationship between child and caregiver movement patterns warrants more detailed investigation. While it is apparent that movements of urban children in the current sample may occur independently of an existing household or caregiver, an understanding of these movement patterns in relation to families and care networks is important. More in-depth research into reasons for movement will form part of a subsequent study within BT20, with the aim of exploring the differential consequences of movement for children in relation to the factors motivating residential change.

2.4.4 Conclusion

In conclusion, the results presented in this chapter suggest that the frequency of residential movement amongst urban children in Gauteng is not high, particularly during the primary school years. The findings of the study further indicate that mobile children are either socially advantaged or potentially vulnerable. Future research focusing on outcome-oriented data (such as education and health) would assist in informing this picture, both in relation to mobile children, and in the case of those children whose levels of mobility are low. Indeed, research to investigate the impact of mobility on child outcomes is currently underway within the BT20 cohort. Understanding the mobility of children has important policy implications in the areas of education, health and social security provision. Knowledge of the patterns and reasons for residential mobility can support urban planning initiatives and policy concerning service delivery.

Chapter 3

Modelling Residential Mobility: Factors Associated with the Movement of Children in Greater Johannesburg, South Africa

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Chapter 3: Modelling Residential Mobility: Factors Associated with the Movement of Children in Greater Johannesburg, South Africa

3.1 Introduction

The study of residential mobility among children has been recognised as important and has been researched in resource-rich countries, revealing dissimilar levels of mobility in different regions and environments (Long, 1992a). These empirical studies have been underpinned by a range of theoretical models for migration behaviour and processes. Early migration theorists such as Lee (1966) posited that the drivers of migration are selective, with positive selection occurring where movement is motivated by opportunity, and negative selection taking place where movement is prompted by necessity or disadvantage. Elaborating on this, more detailed frameworks for movement such as that developed by De Jong (2000) propose a range of factors at the level of the individual, household and community that impact on intentions to migrate which, in turn, influence migration decision-making. In the HIC context, where much of the conceptualisation of migration has occurred, movement of children has been assumed to be connected to a parent and models describing mobility have therefore centred on adults. In LMICs, residential mobility in children has been very under-researched, however, studies of children's living arrangements have indicated that a proportion of children live independently of parents, with extended family members, for periods of varying duration (Hosegood, et al., 2007). In this setting, frameworks describing mobility among children would need to be expanded to consider individual child characteristics as well as the characteristics of parents, alternative caregivers or family members who may be involved in movement decisions concerning children. Knowledge of these dynamics and attributes, and how they might be associated with children's movement behaviour, would yield significant insights into

patterns of movement amongst children and, more importantly, lay the foundation for investigations into the impact of mobility on child health and development outcomes.

South Africa provides an interesting context in which to study internal population movements because of the shift within the country from politically controlled migration to movement based on choice, very often economically motivated. Further, the focus on children has become particularly relevant in the sub-Saharan region as a whole, in light of HIV prevalence and the potential effects of this on children's living arrangements and movements (Hosegood, et al., 2007). This chapter presents the first longitudinal study of child residential mobility within urban South Africa and, in so doing, lays out methodological challenges to analysing children's movements.

South Africa's Apartheid legacy significantly influenced internal population movement patterns through the implementation of policies such as influx control and the Group Areas Act, which restricted permanent settlement of Black people within urban areas (Giliomee and Schlemmer, 1985). These regulations gave rise to a system of oscillatory labour migration between rural homes and urban places of employment where workers were accommodated temporarily (Wilson, 1972). High rates of urbanisation of Black South Africans have been observed, immediately preceding and following South Africa's democratic transition in 1994. However patterns of rural-urban circulation remain prominent with evidence of increasing mobility within urban areas (Posel, 2006; South African Cities Network, 2004).

Movement to and within urban environments has the potential to render improved circumstances and conditions through better access to education, employment, health care and social services. However, several studies have cautioned about the potential negative effects of urban living in large cities in LMICs (Brockerhoff, 1995; UNICEF Innocenti Research Centre, 2002). In South Africa, for example, urban environments

of large cities are associated with overcrowding, crime, unemployment, poverty and susceptibility to disease (including increased mortality resulting from the AIDS pandemic).

Within these settings, children may be particularly at risk (UNICEF Innocenti Research Centre, 2002). These adverse circumstances may be exacerbated by unstable living arrangements and high residential mobility. For some children in South Africa, family life is characterised by residential insecurity, with frequent changes in household membership and child care arrangements (Murray, 1981; Spiegel, et al., 1996a). South African children have been reported to move residence independently and/or in conjunction with a connected adult (Jones, 1992; Van der Waal, 1996). The factors prompting movement may be linked to circumstances surrounding the child's primary caregiver or family, or to circumstances attached to the child directly. For example, children may move independently in response to the death of a caregiver, or to access education by taking up residence with extended family (Ford and Hosegood, 2005; Kok and Collinson, 2006). Children may also accompany a caregiver in a move prompted by changes in a parental relationship, or employment status (Kok and Collinson, 2006; Wentzel, et al., 2006).

In this new phase of South Africa's socio-political development, patterns of urban mobility are of particular interest, however, little research has focused specifically on the analysis of internal migration and movement trends (Collinson, et al., 2006a; Kok, et al., 2003). South African researchers have highlighted the need for focused, localised survey research that addresses questions concerning residential mobility, life course migration, the profile of mobile groups and reasons for movement (Kok and Collinson, 2006; Kok, et al., 2003). The reason for the dearth of research in this area is primarily because of a lack of available cross-sectional and longitudinal data concerning internal population movements. While national household and labour

surveys, and more recent population censuses, have incorporated questions investigating internal migration, limitations have been identified with the applicability of these data in analyses of movement patterns (Kok and Collinson, 2006; Kok, et al., 2003; Posel, 2002). Furthermore, very few studies have investigated the movement patterns of children, particularly amongst those born and living in urban environments (Ford and Hosegood, 2005). A significant reason for this research gap is the difficulty in measuring child mobility over time and the need for analytical techniques that take account of the complexity of the data. Datasets pose difficulties because of missing data due to permanent or temporary attrition. Drop-out is of particular concern in studies of migration because attrition is closely related to the outcome of interest - mobility - leading to bias if children with missing data are excluded.

In response to the research needs highlighted, an analysis of residential mobility amongst urban children was undertaken using data collected from the BT20 study located in Johannesburg-Soweto, in the Gauteng Province. Gauteng is South Africa's most densely populated urban centre, containing approximately 8.8 million residents (Statistics South Africa, 2006). The province is regarded as the economic hub of the country, and is the largest receiver of migrants from other provinces (Kok, et al., 2003; Statistics South Africa, 2006). The Johannesburg-Soweto metropolis consists of an inner city, surrounded by informal settlements and suburban areas comprising formal housing. During the Apartheid era, segregation legislation separated regions on the basis of race resulting in socioeconomic inequalities between areas. These restrictions were lifted following democratisation; nevertheless disparities persist in infrastructure development and service provision in many areas. In 1990, on the eve of South Africa's transition to democracy, a group of Johannesburg-Soweto born children were recruited into a longitudinal birth cohort, BT20. The aim of the study was to track children's physical and social development in a context of rapid urbanisation and social change (Richter, et al., 2007). Regular data collection conducted among the

cohort has generated longitudinal data for a range of child health and development areas, including children's places of residence.

A preliminary analysis of the frequency of residential mobility within the BT20 cohort revealed that the majority of children (64%) had moved home at least once during their first 14 years, with the largest proportion of moves occurring within the Greater Johannesburg urban area (Ginsburg, et al., 2009). The principal aim of this study is to model the occurrence of initial and repeated residential mobility of children in the cohort so as to identify factors associated with movement, relating to the child, the child's primary caregiver and the child's household. Multilevel event-history analysis is used to allow for repeated moves and to explore the effects of time-varying characteristics such as household socioeconomic status and attributes relating to children's current primary caregivers. The chapter further proposes a novel approach to deal with permanent and temporary attrition which avoids the exclusion of drop-outs, thereby maximising the analysis sample and reducing the potential for selection bias.

3.2 Data

3.2.1 The BT20 study sample and data collection

The BT20 study was conceptualised and initiated by researchers from the University of the Witwatersrand and the South African Medical Research Council. The study sample was designed to include all singleton children born within a seven-week period between April and June 1990 at mainly public clinics and hospitals in the Greater Johannesburg metropolitan area situated in the Gauteng Province. Of the total births that took place over the defined period, a sample of 3273 children identified as permanently resident in the area were recruited into the longitudinal birth cohort (Richter, et al., 2004). At enrolment, the cohort was

demographically representative of the study area and comprised roughly equal numbers of male (48.6%) and female (51.4%) participants. The majority of participants were Black (78.5%); with White, Coloured, and Asian children comprising 6.3%, 11.7% and 3.5% of the cohort respectively. At the birth of their child, the majority of biological mothers were aged between 19 and 34 years (79.3%). Mothers were primarily single (56.5%), and most had not completed secondary school (58.4%).

Data collection activities among the cohort have taken place over a series of waves beginning with questionnaires administered antenatally to pregnant women, and continuing at intervals of either one or two years. The study has focused on a set of core themes which include children's household environments, health and nutrition, growth and development and risk behaviours (Richter, et al., 2007). Data collection has taken the form of physical and biological measures and questionnaires, administered to cohort children and their primary caregivers at health care centres and through home visits. Over the course of the study, contact has been maintained with approximately 70% of the original cohort, with an average of 14% of the sample lost to follow-up in any data collection wave (Norris, et al., 2007). During the study's 15th wave of data collection, a survey of children's residential movements was conducted. The questionnaire included a section in which all historical address records were verified as correctly reflecting the children's primary places of residence at the time. Missing or incomplete address data and additional data concerning reasons for movement were also collected. The RMQ was completed by 2158 members of the original residential cohort (66%), with the balance of 1115 cohort members identified as cases of study attrition. A more detailed account of the BT20 data collection processes and the development and implementation of the specific study of residential movement within the cohort can be found in Richter et al. (2007) and Ginsburg et al. (2009).

3.2.2 Construction of residential histories

The analyses conducted in this chapter are based on a longitudinal dataset of children's residential addresses. These address data were used to construct a residential history for each child from which movements could be identified. Baseline address data reflecting the biological mother's place of residence immediately preceding the birth of the child were collected. Thereafter, residential address data were available for a series of nine intervals when children were aged between 0-1 year, 1-2 years, 2-4 years, 4-6 years, 6-8 years, 8-10 years, 10-12 years, 12-13 years and 13-14 years. These intervals correspond to the BT20 study's data collection waves, where each cohort member was seen either annually or within a two year period. The addresses reflect the BT20 child's primary place of residence during the interval. Residential addresses were updated in a database on each occasion that a cohort member was seen or contact attempted. The address data were later verified through the RMQ during the study's 15th year. Based on the address information, it was possible to derive a binary indicator of whether there had been a change in the child's main place of residence between age intervals *t* and *t – 1*. This variable is taken as the outcome in the analysis of residential mobility. Movement was defined in terms of the child and therefore refers to both independent moves, or moves in combination with a primary caregiver or household.

Full movement histories (for each of the nine age intervals) were available for 99% of children whose residential details were confirmed in the RMQ. However, address data corresponding to a particular age interval or set of intervals may have been missing for children who were out of contact with the study at age 15 when the RMQ was administered. At each wave of data collection, a proportion of the cohort was identified as lost to follow-up for reasons such as caregiver or child mortality, study fatigue or movement (see Norris, et al., 2007). In some instances,

these losses to follow-up were classified as permanent (such as migrating out of the study area, emigrating to Europe or child death), which meant that the child did not rejoin the study at a later stage. In other cases, non-participation was periodic with children rejoining the study after a period of absence – for example, after spending some time living with a relative in a rural area. In instances where a child did not return to the study, the child's movement history was treated as censored from the interval corresponding to the first missing address and after which there was no further knowledge of the child's residential locations. In cases where a child left and then returned to the study, missing address data for a particular age interval may have been followed by one or more age intervals for which the residential address was recorded. A move was inferred in these cases through a comparison with the last recorded address, with the assumption that only one move had occurred if the address had changed. This approach allowed for the inclusion of all age intervals in which residential address information was available, with movement histories treated as censored at the last point at which information about children's residences was known. However, cases where address information was missing for seven or more consecutive years were excluded from the analyses on the basis that information was too sparse, and children may have experienced multiple moves within this time[3].

The completeness of the residential histories of children included in the sample is presented in Table 3.1.

[3] The analysis was repeated with a different exclusion rule for children with gaps in their residential histories. The results were found to be robust to whether the cut-off was more than four, five or six consecutive years.

Table 3.1 Completeness of residential histories in analysis sample

Completeness of Residential Information	No. of Children	Percent
Complete History[a]	2155	65.84
Drop-out After Baseline	66	2.02
Permanent Attrition[b]	306	9.35
Temporary Drop-out[c]	746	22.79
Total	3273	100
Max Consecutive Years Missing for Temporary Drop-outs		
1	-	-
2	85	11.39
3	87	11.66
4	268	35.92
5	7	0.94
6	69	9.25
> 6	230	30.83
Total	746	100

[a] Children present at all nine waves with any gaps filled in from the RMQ at age 15
[b] Children with some mobility information who were permanently lost at any age
[c] Children who were absent at one or more waves not compensated for by information collected in the RMQ

From the original cohort of 3273 children, 66 permanent drop-outs were excluded from the analysis sample as these children were not present at any follow-up after the baseline and therefore no information was available on their residential moves. A further 230 children with address information missing for more than six years were excluded, resulting in a sample of 2977 children observed for 21830 age intervals.

3.2.3 Explanatory variables

The selection of explanatory variables considered in the event-history analysis was governed by theory and prior empirical findings. Potential predictors were conceptualised across three domains: attributes of the child, characteristics of the child's biological mother or current primary caregiver, and variables representing features of the child's current household (see Table 3.2).

The explanatory variables are a mixture of time-invariant and time-varying characteristics. While residential addresses and corresponding movement status

was known at each data collection wave, other information was collected periodically. It is therefore necessary to assume that the time-varying covariates remained constant between those waves at which information was updated. Starting values of the time-varying variables were derived from questionnaire data collected antenatally or when children were aged one year. These values were held constant over the age intervals [0,1], (1,2], and (2,4] years. Questionnaire data collected in the children's seventh year were then used to update the values of these variables over the three age ranges (4,6], (6,8], and (8,10] years. Values for the remaining intervals (10, 12], (12,13], and (13,14] years were based on information collected when the children were 12 or 13 years of age.

A socioeconomic index was constructed from a set of ten time-varying binary variables measuring access to a range of services and household assets: home ownership, house type, indoor water supply, indoor flush toilet, electricity supply and household ownership of a television, motor vehicle, refrigerator, washing machine and telephone. A probit factor model (see, for example, Bartholomew, et al., 2008: chap. 8) was fitted using Markov chain Monte Carlo methods to incorporate children with missing data under a missing at random assumption (Browne, 2009); estimated factor loadings for each item were then used to compute a 'wealth index'. The socioeconomic factor values ranged from -2.22 to 1.71, with a mean of 0.03 and a standard deviation of 0.82. A higher positive score on this index indicates greater relative wealth or household assets.

The multilevel analyses of repeated moves included a binary dummy variable indicating, for each age interval, whether a move had occurred in any previous age interval. Also included in the model was an interaction between the previous move indicator and the duration since the last move. This interaction variable was coded

zero up to the first move, so its coefficient is interpreted as a duration effect among movers.

Table 3.2 Explanatory variables

Variable	Description
Time-invariant	
Child Gender	Male, female
Child Ethnicity	White, Black, Coloured, Asian
Hospital of Birth	Public, private
Residential Area at Birth	Soweto/Diepmeadow, former Coloured/Asian, inner city, suburban
Maternal Age at Delivery	≤18, 19-34, 35+ years
Biological Mother Born in the Gauteng Province	Yes, no
Time-varying	
Age of Child (t)	Intervals in years: [0,1], (1,2], (2,4], (4,6], (6,8], (8,10], (10,12], (12,13], (13,14]
Child Moved Previously[a]	Coded 0 prior to the first move, and 1 after the first move
Duration Since Child's Last Move[a]	Length of time between moves in years
Caregiver Schooling	No formal schooling, primary school, secondary school
Caregiver Marital Status	Married/living with partner, single/widowed/divorced/separated
Household Socioeconomic Index	Constructed from the following binary items: home ownership at birth (owned, other), house type (house, other), water indoors, flush toilet, electricity, TV, car, fridge, washing machine, telephone

[a] Only included in the multilevel models where repeated moves are analysed

3.3 Statistical Methods

Multilevel discrete-time event-history analysis (e.g. Steele, et al., 1996) was used to model the timing of children's residential moves, allowing for the possibility that a child may be exposed to the risk of a move more than once over the observation period of

14 years. Residential histories can be viewed as a type of two-level hierarchical structure with episodes of exposure (periods between moves) at level one nested within individuals at level two.

Denote by y_{it}, a binary response coded 1 if child *i* moves during age interval *t* and 0 otherwise. We assume that y_{it} follows a binomial distribution with probability π_{it} and denominator n_{it} where, in the present application, n_{it} equals the length of interval *t* for child *i*. A multilevel logit model for the probability of a move, π_{it}, can be written:

$$\log\left(\frac{\pi_{it}}{1-\pi_{it}}\right) = \alpha_t + \boldsymbol{\beta}^T \mathbf{x}_{it} + u_i \qquad (1)$$

where α_t is the coefficient of a dummy variable for age interval *t*; $\mathbf{x}_{it}$ is a vector of time-varying and time-invariant characteristics of the child, caregiver or household with coefficients $\boldsymbol{\beta}$, and u_i is a child-specific random effect assumed to be normally distributed with a mean of zero and variance of σ_u^2. The random effect represents unmeasured time-invariant child characteristics affecting the probability of a move throughout the study period. The child's residential history up to interval *t* is captured by an indicator of a previous move and the duration since the last move, both included as time-varying covariates in $\mathbf{x}_{it}$.

Equation (1) defines a proportional odds model where the effects of the covariates $\mathbf{x}_{it}$ are assumed to be constant across age intervals. Non-proportional effects may be accommodated by adding interactions between elements of $\mathbf{x}_{it}$ and the age dummies

but, in our application, the proportionality assumption was found to be reasonable for all covariates.

When all time intervals are of equal width the denominator for the binary response, n_{it}, equals 1 for all *t* and *i*, and (1) can be estimated as a standard multilevel logit model for binary data. In the present application, however, age intervals vary in width. Children who were present at every wave contribute nine age intervals, where the width of an interval is either one or two years. As described in Section 3.2.2, children who dropped out permanently contribute one- or two-year intervals up to the point of being lost to follow-up. If a child temporarily left the study the interval(s) for the missing wave(s) are combined with the interval for the wave at which the child rejoined the study, and n_{it} is updated to equal the width of the new interval. An adjustment to the coding of the dummy variables for the age intervals being aggregated is also needed. For example, consider a child who is absent at the age two interview but present at age four. Age intervals (1,2] and (2,4] are combined to give a three-year interval, and the dummy variables for these intervals are each coded 0.5. In general, if *k* intervals are combined the dummy variables for these intervals will each be coded 1/*k*, regardless of the relative widths of the interval (see the Appendix in Section 3.6 for further details and an example of the required data structure).

The multilevel event-history model (1) is estimated using procedures for multilevel binomial response data (Steele, et al., 2004). We use Markov chain Monte Carlo (MCMC) methods as implemented in the MLwiN software (Browne, 2009; Rasbash, et al., 2009)[4].

To aid interpretation of the fitted model, predicted probabilities may be calculated for a range of values of each covariate (or each value in the case of categorical covariates), holding constant the values of all other covariates in the model. To obtain mean probabilities, it is necessary to average across child-specific unobservables by integrating out the random effect or by simulating random effect values. The simulation approach involves generating a large number of random effect values from a normal distribution with variance $\hat{\sigma}_u^2$, calculating a predicted probability based on each of these values and the estimated coefficients, and taking the mean across the simulated values. This procedure is implemented in MLwiN v2.10 and described in Rasbash et al. (2009).

3.4 Results

An event-history analysis was conducted to examine the occurrence of the children's first residential move, with cases censored after the first move or at the last time interval when information regarding their movements was available (15844 age intervals of 3146 children).

[4] MCMC methods are used to estimate statistical models in a Bayesian framework. In the Bayesian approach, each unknown parameter in the model is viewed as a random variable with an associated probability distribution that incorporates any prior beliefs about the value of that parameter. MCMC methods are simulation-based procedures in which a chain of random draws is taken from the current conditional probability distribution for each parameter. A point estimate of a parameter may be obtained by taking the mean, median or mode of the parameter values across the chains, while the standard deviation of parameter values corresponds to a frequentist standard error. See Browne (2009) for an introduction to MCMC methods for multilevel analysis. The estimates presented in this chapter are from 50000 chains using approximate quasi-likelihood estimates (Goldstein, 2003:112-113) as starting values for the sampling.

The conditional probability of the first residential move in age interval *t*, given no move occurred before *t,* is displayed in Figure 3.1. The probability of a first move is highest between ages one and two years ($\hat{\pi}$ = 0.147). By age four, the probability of a first residential move decreased, with the lowest predicted probability of a first move in age interval (13,14] ($\hat{\pi}$ = 0.046).

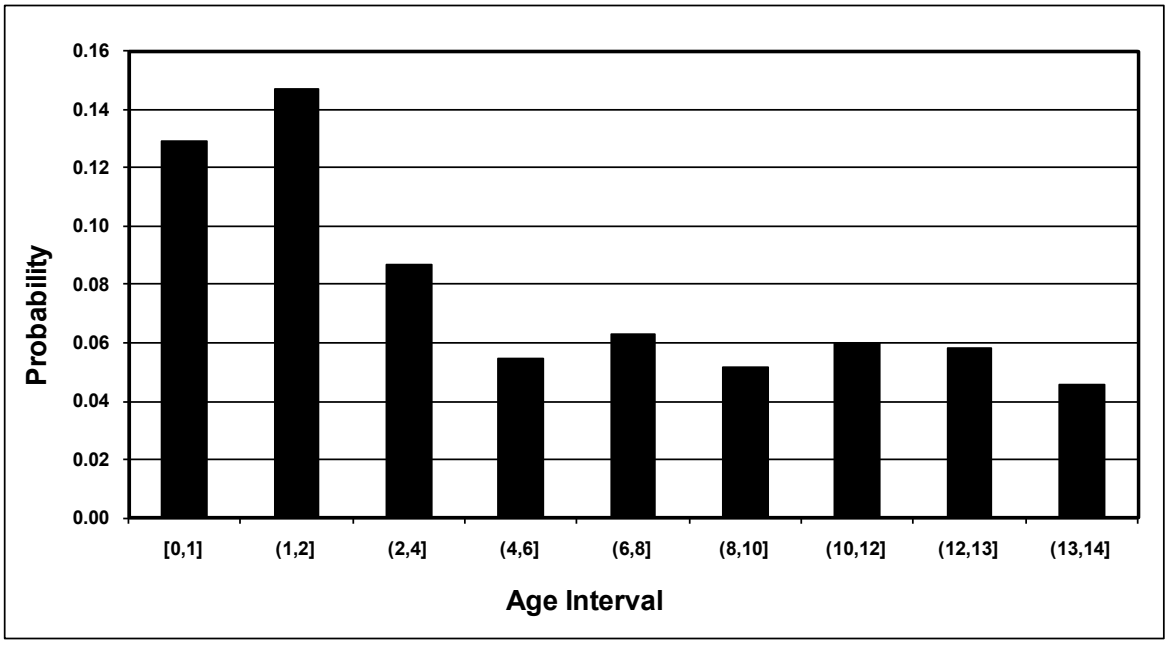

Figure 3.1 Probability of first move by age interval

While most children had experienced at most one residential move by age 15, 15% moved more than once (see Table 3.3). Multilevel event-history analysis was therefore used to consider repeated moves, and to estimate the effect of previous mobility on the probability of a subsequent move.

Table 3.3 Distribution of number of residential moves per child

No. of Moves	No. of Children	Percent
Never Moved	1287	43.2
1	1245	41.8
2	368	12.4
3	61	2.0
4	14	0.5
5	2	0.1
Total	2977	100

The first model was based on the complete dataset of 2977 children, observed for 21830 age intervals. Due to a substantial number of missing values, the covariates 'caregiver schooling' and 'caregiver marital status' were initially excluded. A model was then fitted with these covariates included, where records were dropped from the dataset after the first missing value. The reduced sample contains 2853 children who contributed 15761 age intervals. Although the exclusion of these observations leads to the omission of some repeated moves (the percentage of children with more than one move decreases to 9.6%), the effects of the caregiver variables were of substantive interest because previous research has suggested that movements amongst children have been linked to caregiver characteristics and circumstances. Furthermore, a comparison between the models fitted to the full and reduced datasets revealed little difference in the magnitude and statistical significance of the regression coefficients of other covariates. The results presented in Table 3.4 are therefore based on the reduced dataset with the inclusion of the two caregiver variables.

Other covariates were tested for significance using a combination of forward selection and backward elimination. The covariate 'hospital of birth' was excluded from the analysis because it failed to achieve significance in any preliminary analyses. The variable 'biological mother born in the Gauteng Province' was also excluded from the models because of a substantial number of missing values together with non-significance at the 5% level. This variable had a negative effect on the probability of moving, indicating that children whose biological mothers were born in the province were less inclined to experience residential mobility. The interaction between child ethnicity and household socioeconomic status was of interest because of the possible differences in the effect of socioeconomic indicators on child movement between more and less advantaged ethnic groups, however, the term was found to be non-significant when tested and was therefore excluded from the models.

Table 3.4 Parameter estimates (and standard errors) from the multilevel event-history model of residential mobility

Variable	β	Standard Error	Wald	*p*
Female Child	0.060	0.047	1.658	0.198
Child Ethnicity (ref: White)			3.051[a]	0.384
Black	-0.143	0.171	0.706	0.401
Coloured	-0.326	0.206	2.494	0.114
Asian	-0.146	0.227	0.415	0.519
Residential Area at Birth (ref: Soweto/Diepmeadow)			16.146[a]	0.001
Former Coloured/Asian	-0.039	0.178	0.049	0.825
Inner City	0.658	0.202	10.625	0.001
Suburban	0.317	0.133	5.688	0.017
Maternal Age at Delivery (ref: ≤18)			41.347[a]	<0.001
19-34	0.197	0.078	6.31	0.012
35+	-0.379	0.119	10.101	0.001
Caregiver Schooling (ref: No Formal Schooling)			8.853[a]	0.012
Primary School	-0.487	0.185	6.968	0.008
Secondary School	-0.534	0.180	8.783	0.003
Caregiver Single/Widowed/ Divorced/Separated	-0.273	0.049	31.437	<0.001
Household Socioeconomic Index	-0.162	0.031	26.738	<0.001
Child Moved Previously	0.590	0.083	50.599	<0.001
Child Moved Previously × Duration Since Child's Last Move	-0.036	0.020	3.274	0.070
Age of child in years (*t*)				
Age [0,1]	-1.375	0.281	23.961	<0.001
Age (1,2]	-1.139	0.280	16.542	<0.001
Age (2,4]	-1.781	0.280	40.457	<0.001
Age (4,6]	-2.343	0.285	67.741	<0.001
Age (6,8]	-2.257	0.284	63.179	<0.001
Age (8,10]	-2.235	0.286	61.092	<0.001
Age (10,12]	-2.246	0.293	58.842	<0.001
Age (12,13]	-2.220	0.310	51.232	<0.001
Age (13,14]	-2.311	0.312	54.813	<0.001
Child level Random Effect Variance	0.006	0.003		

[a] For categorical variables with more than two categories, the results of two types of Wald test are presented: i) a joint test of the null hypothesis that the coefficients of the dummy variables for each category are simultaneously equal to zero, and ii) individual tests comparing each category with the reference.

Table 3.5 shows predicted probabilities of a move during age interval (1,2], the period when moves were most frequent. The probabilities were calculated by varying the values of one variable at a time, holding all other covariates at their sample mean values. In the case of a categorical variable, the dummy variable associated with a

particular category takes on the value of the sample proportion in that category instead of the usual 0 or 1 value. The two variables associated with a previous move were fixed at a value of 0 so that probabilities refer to a first move (which is reasonable given the probabilities are calculated for ages one to two years). Although the probabilities will be different for other age intervals, their general pattern will be the same because the effects of covariates were found to be independent of age.

Table 3.5 Predicted probabilities of a first move between one and two years of age

Variable	Probability
Child Gender	
Male	0.137
Female	0.144
Child Ethnicity	
White	0.161
Black	0.143
Coloured	0.122
Asian	0.142
Residential Area at Birth	
Soweto/Diepmeadow	0.139
Former Coloured/Asian	0.134
Inner City	0.238
Suburban	0.181
Maternal Age at Delivery (years)	
≤18	0.127
19-34	0.151
35+	0.091
Caregiver Schooling	
No Formal Schooling	0.216
Primary School	0.145
Secondary School	0.139
Caregiver Marital Status	
Married/Living With Partner	0.161
Single/Widowed/Divorced/Separated	0.127
Household Socioeconomic Index	
1 Standard Deviation Above Mean	0.125
Mean	0.141
1 Standard Deviation Below Mean	0.158

Of the child characteristics, gender and ethnic differences in the probability of a move were found not to be statistically significant. However, controlling for ethnic group, the effect of residential area at birth was found to be significant with a higher chance of

moving among children born in the inner city and suburbs compared with those born in former Asian or Coloured areas or in Soweto/Diepmeadow. The variables ‘child ethnicity’ and ‘residential area at birth’ are highly correlated due to the racial segregation of residential areas during the Apartheid era; nevertheless, a significant effect of area that is independent of ethnic differences was found. Children who experienced a previous residential move were more likely to experience a (further) move as compared with non-movers, and there is some evidence (at the 10% level) that the probability of a move decreases with the duration since the last move.

Children born to older mothers (aged 35 or more) were less likely to move as compared with children born to younger mothers. Children whose biological mothers or primary caregivers were single, widowed, divorced or separated rather than married or living with a partner were less likely to move. Similarly, a negative effect on the rate of residential movement was found amongst children whose primary caregivers had attained either primary or secondary level schooling, as compared with caregivers with no formal education. The probability of a first residential move for children aged one and two years was highest for the group whose primary caregivers had no formal schooling.

The analysis revealed a significant negative relationship between household socioeconomic status (as measured by the socioeconomic factor values) and residential mobility. Holding household socioeconomic status at its lowest level of -2.22, the probability of a first move for a child aged one to two years was 0.19, while the probability was 0.11 when household socioeconomic status was held at its highest level of 1.71.

After controlling for child, caregiver and household characteristics, there remains a small amount of unobserved heterogeneity between children ($\hat{\sigma}_u^2$ = 0.006, *SE* = 0.003). As expected, indicators of children's prior residential history – whether they had moved previously and the duration since the last move – explained a large proportion of the between-child variance; before accounting for these variables, the random effect variance was estimated as 0.198 (*SE* = 0.054).

3.5 Discussion

This is the first South African study to explore longitudinal patterns of residential mobility amongst urban children. Using data from the BT20 cohort, children's residential movements over the first 14 years of their lives were analysed with the aim of identifying child, caregiver and household factors associated with movement. The study looked both at the timing of children's first residential moves, and at repeated residential mobility, with the conclusion that the more disadvantaged children in the cohort had a higher likelihood of experiencing residential change. Furthermore, standard event-history methods were adapted to handle permanent attrition and gaps in children's movement histories.

Knowledge of the patterns of child mobility in South Africa is scarce and consequently it is important to develop a more detailed understanding of this area. Movement and its timing can have an important influence on future events and transitions in an individual's life course (Amoateng, 2007). In the current study, children's first residential moves occurred most frequently in early childhood (at age two years or younger). This finding is consistent with results from rural South African studies, in which movement was found to be highest amongst pre-school children (Collinson, et al., 2006c; Ford and Hosegood, 2005). Similarly, findings from studies of residential mobility in HICs have found relatively high levels of movement among one to four year

olds, suggesting that the birth and early care of a child may prompt parents to move (Long, 1992a; Long, 1992b). In the South African case, we hypothesise that the higher levels of first movement in very early childhood is reflective of changes in the life cycle of mothers who may be moving to access employment, or to enter into cohabitating relationships. In addition, children may move more frequently in their pre-school years, after which families attempt to stabilise children's status in the interest of minimising interruptions of schooling. Children who experience a first move early in life are more likely to experience repeated residential relocations during childhood. In the BT20 sample, 15% of children had experienced repeated residential movement. Although we found that the statistical significance and effects of the covariates were the same regardless of whether children had experienced a single or multiple moves (results not shown), it is possible that the group of multiple movers may be more at risk of disrupted living conditions (by virtue of having shifted households more often).

The multilevel analysis of repeated moves revealed no significant gender differences and ethnicity was not significantly associated with residential mobility. Previous empirical studies investigating inter-provincial migration in South Africa have shown strong ethnic differences in the profile of migrants, with higher levels of movement amongst White and Black South Africans and lower levels of movement amongst Coloureds (Kok, et al., 2003). In the current study, a significant neighbourhood effect was present, with children born in Johannesburg's inner city or suburban regions more likely to change residence as compared with children in the areas of the city formerly designated as Black or Coloured/Asian. The finding is suggestive of a more integrated social geography in these regions following the dismantling of Apartheid policy where residential areas were strictly segregated according to ethnic group membership. The higher levels of stability amongst those in the Coloured and Black township areas is potentially explained by the tendency amongst these communities towards extended

family household structures (Amoateng, et al., 2007), suggesting that these families may be less inclined to move home.

At any particular time, children whose biological mothers or current primary caregivers were married or living with a partner, were more likely to change residence as compared with children whose caregivers were single. Research has shown that partnership formation and breakdown are likely to result in residential mobility as part of changes in family cycles (Long, 1992b; Speare and Goldscheider, 1987). In addition, children living with parents, or with a caregiver and her partner, may be more geographically mobile because employment or accommodation options are increased by the presence of two adults as compared to one. Levels of movement may be lower amongst children being cared for by single women who could have fewer residential choices available to them, and are potentially more likely to be living in extended family accommodation.

Mobility among children was found to be associated with lower levels of educational attainment of mothers or primary caregivers. South African studies of inter-provincial migration have found a correlation between labour migration (which may be prompted by instability or vagaries of circumstance) and lower levels of education, while higher levels of education have been associated with relocation linked to economic opportunity and options (Kok, et al., 2003; Wentzel, et al., 2006). The evidence of a link between intra-urban mobility and lower levels of education is suggestive of a group of children whose movements may be necessitated by limited employment or accommodation options for their mothers or caregivers. Similarly, the association between lower household socioeconomic status and higher levels of mobility for children in the cohort further connects residential mobility to economic disadvantage. The negative relationship between household socioeconomic status and movement

suggests that negative selection, described by Lee (1966), is likely to be occurring within the cohort.

A strength of the current study is the focus on the movement of children. The data suggests an expansion of De Jong's (2000) model of migration decision-making in that child individual characteristics as well as the characteristics of a current primary caregiver and household need to be taken into account in explaining movements involving children. This must allow for the fact that a child may not necessarily reside continuously with the same primary caregiver, and in the same household. South African census data indicate that only 36.4% of Black children aged between five and 13 years live in a household together with both parents, 31.5% live with a mother only and 25.7% live in households with neither parents. These rates are higher amongst Coloured, White and Asian children where 58.7%, 80.0% and 83.8% respectively live in households with both parents (Statistics South Africa, 2001). In addition to evaluating the relative importance of child, caregiver and household factors on movement decisions concerning children, the extent of children's broader care networks as well as context specific drivers and constraints would need to be incorporated into a framework explaining mobility in children.

The study contributes to the development of a broader understanding of the principle of migration selection in relation to child mobility by revealing a number of associations with child movement which could be used to define a set of *a priori* hypotheses for future investigation within different sub-populations. For example, changes in the life cycle of children's primary caregivers (such as partnership and employment status) may be associated with a higher probability of mobility for connected children. The study also lays the foundation for future research into impact studies. In order to begin to assess the consequences of relocation on child well-being, attributes of movement

destinations at the neighbourhood or community level would be significant, and may be analysed through the application of more complex multilevel modelling techniques.

Missing data and sample attrition encountered in a cohort study presents a complex challenge, but an approach to handle children who drop out of the study and return at a later wave (non-monotone attrition) is proposed. This method of analysing all available data, allows for higher levels of data retention than would have been the case if movement histories were censored at the first instance of lost contact. It thus includes into the analysis children who, often due to mobility, may not have been traceable over all data collection time points.

A limitation of the study relates to the potential underestimate in the total number of residential moves per child reported. It is likely that permanent drop-outs and children with long gaps in their residential histories are more mobile and may have experienced multiple moves during their time out of the study, which would not have been known. A further limitation relates to a lack of data concerning shifts in children's caregiving structures and its relationship to child and caregiver movements. Research is currently underway in BT20 to explore caregiving patterns longitudinally and these will then be mapped onto children's movement trajectories.

In conclusion, the results of the analysis reveal a set of characteristics associated with residential mobility amongst a group of urban South African children that is suggestive of socioeconomic disadvantage. For example, children experiencing residential mobility were more likely to have mothers or current primary caregivers with no formal education and reside in households with less access to assets and services. Moves were most likely to occur before the age of two, and approximately 15% of all children studied experienced repeated moves during childhood. This group of mobile children

may therefore have experienced economic adversities and a lack of stability in living arrangements.

The study addresses a critical gap in children's developmental research in South Africa and suggests the need for comparative research on child mobility, both in rural regions of South Africa and in other LMICs. Insight into the drivers and processes around child mobility within different contexts would contribute to current frameworks describing movement among adults and thus fill an important research gap. Given that movement may be one response to disadvantage, understanding the consequences of mobility for children is a key priority. Knowledge of the impact of movement on children's adjustment, physical health and education would significantly inform local policy initiatives centred on vulnerable children.

3.6 Appendix: Treatment of Residential Histories for Temporary Drop-outs

Table 3.6 shows the data structure for two children, where D_1, D_2, . . ., D_9 are the dummy variables for age interval *t* with coefficients given by α_t in equation (1). Complete information is available for child 1 who contributes records for the full set of nine age intervals. Child 2 is a combination of a permanent and temporary drop-out, being absent at the age two interview, then present at age four before being lost to follow-up after the age six interview. For this child, age intervals (1,2] and (2,4] are combined to give a three-year interval. The values of the dummy variables for these intervals are also changed from the usual (0,1) coding to reflect the fact that the second interval is now an aggregate of intervals *t* = 2 and *t* = 3. Specifically the dummies for intervals (1,2] and (2,4] are each coded 0.5.

Table 3.6 Example of data structure for complete and partial residential histories

Child *i*	Interval *t*	n_{it}	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9
1	[0,1]	1	1	0	0	0	0	0	0	0	0
1	(1,2]	1	0	1	0	0	0	0	0	0	0
1	(2,4]	2	0	0	1	0	0	0	0	0	0
1	(4,6]	2	0	0	0	1	0	0	0	0	0
1	(6,8]	2	0	0	0	0	1	0	0	0	0
1	(8,10]	2	0	0	0	0	0	1	0	0	0
1	(10,12]	2	0	0	0	0	0	0	1	0	0
1	(12,13]	1	0	0	0	0	0	0	0	1	0
1	(13,14]	1	0	0	0	0	0	0	0	0	1
2	[0,1]	1	1	0	0	0	0	0	0	0	0
2	(1,4][a]	3	0	0.5	0.5	0	0	0	0	0	0
2	(4,6]	2	0	0	0	1	0	0	0	0	0

[a] Combined interval

This coding of the dummies for age is based on the following approximation. Consider a simplified specification of the model in equation (1) with only age effects, and no child-specific random effects. Omitting child subscripts, the model can be written:

$$\text{logit}(\pi_t) = \alpha_t \tag{A1}$$

Combining age intervals *t* and *t* + 1, the probability of a move in the joint interval is

$$\pi = \pi_t + \pi_{t+1} \tag{A2}$$

When the probability of a move is small within each interval *t*, the logit transformation is well approximated by the log transformation, so that

$$\log(\pi_t) \approx \alpha_t \tag{A3}$$

Exponentiating (A3) and substituting in (A2) gives

$$\pi \approx \exp(\alpha_t) + \exp(\alpha_{t+1}) \tag{A4}$$

We next carry out a Taylor series expansion of exp(α_{t+1}) around α_t :

$$\exp(\alpha_{t+1}) = \exp(\alpha_t) + (\alpha_{t+1} - \alpha_t)\exp(\alpha_t) + O(\alpha^2) \quad \text{(A5)}$$

where α = $\alpha_{t+1} - \alpha_t$. Substituting (A5) in (A4) leads to

$$\begin{aligned} \pi &\approx \exp(\alpha_t) + \{\exp(\alpha_t) + (\alpha_{t+1} - \alpha_t)\exp(\alpha_t) + O(\alpha^2)\} \\ &= \exp(\alpha_t)\{2 + (\alpha_{t+1} - \alpha_t) + O(\alpha^2)\} \\ &= 2\exp(\alpha_t)\{1 + (\alpha_{t+1} - \alpha_t)/2 + O(\alpha^2)\} \end{aligned} \quad \text{(A6)}$$

Using a first-order McLaurin series expansion $\exp(z) = 1 + z + O(z^2)$, we can write

$$\exp\{(\alpha_{t+1} - \alpha_t)/2\} = 1 + (\alpha_{t+1} - \alpha_t)/2 + O(\alpha^2) \quad \text{(A7)}$$

Finally, substituting (A7) in the last line of (A6), and assuming that the difference in the log-probability between intervals *t* and *t*+1 is small (so that $O(\alpha^2) \to 0$) we have the following first-order approximation for the probability of an event in the joint interval:

$$\pi \approx 2\exp(\alpha_t)\exp\{(\alpha_{t+1} - \alpha_t)/2\} = 2\exp(0.5\alpha_t + 0.5\alpha_{t+1}) \quad \text{(A8)}$$

which can be written in log-linear form as

$$\log(\pi) \approx \log(2) + 0.5\alpha_t + 0.5\alpha_{t+1} \quad \text{(A9)}$$

The log-probability implied by (A9) is fitted by including log(2) as an offset term and coding the dummy variables for intervals *t* and *t*+1 as 0.5 and the dummies for all other intervals as 0. Reverting to the original logit scale, the width of the joint interval (n_t = 2) is included as a denominator for the binary response. Note that the approximation (A9) holds for combining any two intervals, regardless of their width.

Chapter 4

An Analysis of Associations between Residential and School Mobility and Educational Outcomes in South African Urban Children: The Birth to Twenty Cohort

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Chapter 4: An Analysis of Associations between Residential and School Mobility and Educational Outcomes in South African Urban Children: The Birth to Twenty Cohort

4.1 Introduction

4.1.1 General overview

Education has long been recognised as an important measure and indicator of children's well-being. As such, research into child welfare has included extensive explorations into the factors which impact on educational attainment. Children's living conditions, family circumstances, health status and physical and social environments have been identified as significant determinants of child well-being as well as educational achievement.

Mobility among children precipitates change and requires adjustment to a new environment, it therefore has the potential to improve or impair conditions for child well-being. Many international studies have emphasised the detrimental effects of the movement of children on health and development outcomes, including education. For instance, changes of residence during children's school careers have been shown to have a predominantly adverse effect on academic achievement, progression through school and completion of basic education (Haveman, et al., 1991; Ingersoll, et al., 1989; Simpson and Fowler, 1994; Wood, et al., 1993). Similarly, school mobility (either accompanied by or independent of a residential relocation) has been observed in many studies to impact on children's academic performance and progression (Heinlein and Shinn, 2000; Swanson and Schneider, 1999). Studies have shown that the strength and pattern of associations between educational outcomes and child residential and school mobility are likely to be influenced by a series of individual, family, household and

school factors (Astone and McLanahan, 1994; Pribesh and Downey, 1999; Tucker, et al., 1998; Wood, et al., 1993). The effect of these are not necessarily uniform, for example, the impact of mobility on school progression has been observed to be detrimental for children whose parents had lower levels of education, but the opposite (or no) effect has been found for children whose parents had achieved higher levels of education (Long, 1975; Straits, 1987). Researchers have been alerted to the complexity of assessing the independent effects of movement on child outcomes given the number of potentially confounding factors (Alexander, et al., 1996; Rumberger, 2002). In attempting to establish the sequence of causal pathways, circumstances surrounding mobility decisions are important as there may be unobserved factors which manifest in a move that ultimately impact on the child, rather than the event itself (Dong, et al., 2005).

Research in this area has been conducted primarily in HICs and little is known about the effects of residential and school mobility on children's educational progression and achievement in LMICs. Given the unique nature of population movements and education provision in these different settings, an exploration of their relationship is of interest, and relevant in light of the United Nations Millennium Development Goals targeting education provision and access (UNICEF, 2005).

4.1.2 South Africa

South Africa provides an interesting context in which to investigate relationships between child mobility and education, particularly given its unique policy and political history. In post-Apartheid South Africa, the majority of the population continues to be marked by poverty and unemployment, and education has been emphasised as a vital component in moving toward a more equitable society. However, there is current significant under-achievement in primary education,

particularly amongst disadvantaged groups (Fleisch, 2008). This has been substantiated in a number of studies identifying high levels of grade repetition and interrupted progression through school, as well as low competency in numeracy and literacy amongst South African learners (Anderson, et al., 2001; Branson and Lam, 2009; Fleisch, 2008; Lam, et al., 2008b; Liddell and Rae, 2001; Motala, 1995; Shindler, 2008).

As with education, population movements in South Africa have been significantly influenced by Apartheid policies, which restricted the free movement and settlement of Black people (Wentzel and Tlabela, 2006). Following the new political dispensation in 1994, internal population movements have increased, particularly to and within the country's urban centres (Kok and Collinson, 2006; South African Cities Network, 2004). While mobility amongst adults is frequently prompted by relationship formation/dissolution, or the search for employment or adequate housing and services, children have also been observed to move or be moved independently of adults in order to increase their access to care or educational opportunities (Collinson, et al., 2006a; Ford and Hosegood, 2005; Paterson and Kruss, 1998; Wentzel, et al., 2006).

This is suggestive of a relationship between education and mobility with education acting as a driver of movement amongst children. However, there has been little published research on patterns of residential or school mobility among South African children and, as far as we can ascertain, the association between residential and school mobility and educational outcomes has never been expressly investigated.

In order to begin to address this research gap, a study of residential mobility and schooling was undertaken amongst children enrolled in the BT20 cohort. This

urban-based birth cohort study, the recruitment and follow-up of which spans South Africa's transition to democracy, has yielded 15 years worth of longitudinal data on children's places of residence, as well as their school enrolment and progression.

Findings from preceding analyses conducted on residential mobility within the cohort have shown that by age 15, two thirds of children had moved residence at least once (Ginsburg, et al., 2009). Child movement was also found to be associated with lower resourced households suggesting that mobile children are potentially vulnerable (Ginsburg, et al., 2010). Analyses of the patterns of schooling within the cohort have revealed high rates of grade repetition, particularly amongst male participants and especially in the early years (Fleisch and Shindler, 2009). Following from these findings, the aim of the current chapter is to determine whether an association exists between residential and school mobility and a set of educational outcomes measuring progression through school and competency in numeracy and literacy. The chapter will explore the relationship between mobility and education within the context of a set of individual child, family background and household factors that have been identified as having a mediating effect in previous empirical studies. The study aims to test the hypothesis that residential and school mobility have a negative effect on educational outcomes, as has been observed in much of the international literature.

4.2 Methods

4.2.1 Study sample

The BT20 cohort study was initiated and developed by a group of researchers from the University of the Witwatersrand and the South African Medical Research Council. Commencing at the onset of South Africa's transition to democracy, the

study aimed to track children's physical and social development in a context of rapid social change (Richter, et al., 2007). The BT20 cohort comprised all singleton children born within a seven-week period between April and June 1990 at primarily public delivery centres in the Greater Johannesburg-Soweto area situated in the Gauteng Province, South Africa's most densely populated urban centre. The residential cohort of 3273 excluded those children whose mothers relocated from Johannesburg-Soweto within six months following their birth, on the basis that these families were only temporarily resident in the area. At enrolment, the cohort consisted of a majority of Black participants (78.5%) followed by 11.7%, 6.3% and 3.5% Coloured, White and Asian children respectively. Females, comprising 51.4% of the cohort, marginally outnumbered males (see Richter, et al., 2004; Richter, et al., 2007; Yach, et al., 1991 for a more detailed description of the study's research aims and methods).

The study has focused on a set of multidisciplinary themes connected to children's well-being including health and nutrition, growth and development, household environments, and educational progression (Richter, et al., 2007). Data collection has taken the form of physical and biological measures and questionnaires, administered to cohort children and their primary caregivers either annually or within a two-year interval, at health care centres and through home visits. Over the course of the study, contact has been maintained with approximately 70% of the original cohort, with one third of the cohort identified as cases of cumulative attrition (Norris, et al., 2007).

The study of mobility and education outcomes described in this chapter is presented in two parts centred on two educational outcome variables, the first measuring grade repetition or school progression and the second, competency in numeracy and literacy. The educational progression component is based on data

derived from a retrospective questionnaire administered to cohort members in their homes during the study's 15th year. The aim of this questionnaire was to capture information concerning participant's school attendance and progression through school from the commencement of primary education up until the age of 15. The retrospective schooling questionnaire yielded a response rate of 87.3% (n = 2001) of the 2291 cohort members still in contact with the study in its 15th year. The analytical dataset for this study component is based on a sample of 1989 respondents as 12 participants who reported having attended special schooling because of learning disabilities were excluded.

The second part of the chapter is based on results from a numeracy and literacy evaluation completed by cohort members at BT20's data collection site a year later, during the study's Year 16 data collection wave. The evaluation utilised a standardised instrument that was developed through expert consultation with the Joint Education Trust for the Cape Area Panel Study (Lam, et al., 2008a). Participants were given 20 minutes to complete the evaluation and it was invigilated by a research assistant. The numeracy and literacy evaluation was administered to 1761 participants, 76.9% of the cohort still in contact with the study. A total of 17 participants with learning disabilities (and attending special education schools) were once again excluded from the sample, yielding an analytical sample of 1744 participants.

4.2.2 Variables

Outcome and explanatory variables employed in the analyses are described in Table 4.1. Both sections of the chapter utilise residential mobility data derived from participant's records, collected at each contact, and later verified in a RMQ administered to primary caregivers during the study's 15th and 16th years.

Table 4.1 Outcome and explanatory variables

Variable	Description
Schooling	
Age at School Entry	Age in years participant commenced schooling
Grade Repeats	Never repeated, repeated / 1 repeat, >1 repeat
Numeracy Score	Standardised score on numeracy section of evaluation
Literacy Score	Standardised score on literacy section of evaluation
Age at Assessment	Participant's age on the date of evaluation
Mobility	
Total Residential Moves Prior to School Entry	Never moved, moved
Total Residential Moves Following School Entry	Never moved, moved
Total School Changes (Excluding Transition from Primary to Secondary School)	Never changed, 1 change, >1 change
Child, Maternal and Household Characteristics	
Child Gender	Male, female
Child Ethnicity	White, Black, Coloured, Asian
Hospital of Birth	Public, private
Residential Area at Birth	Soweto/Diepmeadow, former Coloured/Asian, inner city, suburban
Maternal Age at Delivery	≤18, 19-34, 35+ years
Maternal Education at Delivery	Grade 10 or less, grade 11-12, post-school training
Maternal Marital Status at Delivery	Married/living with partner, single/widowed/divorced/separated
Household Socioeconomic Index at Birth [a]	Constructed from the following binary items: Home ownership: owned, other House type: house, other Water indoors: yes, no Flush toilet: yes, no Electricity: yes, no TV: yes, no Car: yes, no Fridge: yes, no Washing machine: yes, no Telephone: yes, no

[a] This index was calculated using a probit factor model where estimated factor loadings for each item were used to compute a 'wealth index' (see Section 3.2.3, Chapter 3 for further details).

The residential mobility variables represent the total number of times the cohort members moved home, split between the number of moves that occurred from birth prior to the commencement of schooling, and the number of moves that occurred following the commencement of schooling until the age of 15 (i.e. calculated with reference to the age that the corresponding cohort member

commenced school). The variable representing the number of school changes excludes the school change associated with the transition to secondary school; therefore this variable represents school changes outside of the normal educational progression from primary to secondary school.

The two components of the chapter also make use of demographic data describing child, maternal and household characteristics, collected from participants' biological mothers at the onset of the study as part of BT20's routine data collection activities. The selection of the set of explanatory variables considered in the analyses is governed by theory, prior empirical findings and data availability.

4.2.3 Data analysis

A set of bivariate analyses was conducted for each of the study components presented in the chapter. In the case of categorical variables, chi-square tests were performed to establish significance of associations. For continuous variables, t-tests or one-way analysis of variance tests were used to compare means. The outcome variable representing grade repeats contrasted those participants who had never repeated a grade over the course of their schooling with those participants who had repeated a grade on one or more occasions. The categories contrasting participants who had repeated a grade on one occasion with participants who had repeated a grade more than once were also considered in analyses. Grade repetition was modelled using binary logistic regression analysis.

The numeracy and literacy scores were standardised by transforming raw scores into z-scores, for males and females. The z-scores were calculated by taking the raw numeracy and literacy score, subtracting the study population mean (by gender) and dividing the result by the study population standard deviation (by gender). The standardised scores allowed for comparison across the study

population, which is justified by the lack of population norms that would enable comparability with the BT20 cohort. Standardised z-scores were modelled using multiple linear regression analysis. Data analysis was conducted using SPSS (2007). Unless stated otherwise, statistical significance was tested at the 5% level in all analyses undertaken.

4.3 Results

4.3.1 School progression

4.3.1.1 Sample characteristics

Comparative analyses were conducted between the sample of 1989 cohort members who completed the school progression questionnaire (the analytical sample) and the 1284 remaining cohort members who were either receiving special schooling or were not in contact with BT20 and did not complete the questionnaire during the study's 15th year (see Table 4.2). The analytical sample comprised roughly equal numbers of male and female participants and there were no significant differences between the proportion of males and females in the analytical sample and those who were excluded. However, members of the analytical sample were more likely to be Black, born in the Soweto/Diepmeadow area and delivered in public health facilities. There was a higher representation in the analytical sample of biological mothers who were single at the time of delivery, while those mothers with grade ten or less education, or post-school training were slightly under-represented in the analytical sample. There were no significant differences in the household socioeconomic index between the group that was analysed and the group for whom school progression data was not available.

Table 4.2 Characteristics of members of the analytical sample and cohort members excluded from the analytical sample

		School Progression Sample Total (%)	**BT20 Participants Excluded from Analysis** Total (%)
Child Gender	Male	964 (48.5)	627 (48.8)
$\chi_{(1)}^2 = 0.042$, NS, n = 3273	Female	1025 (51.5)	657 (51.2)
Child Ethnicity	White	51 (2.6)	156 (12.1)
	Black	1662 (83.6)	906 (70.6)
	Coloured	241 (12.1)	142 (11.1)
$\chi_{(3)}^2 = 175.298$, $p < 0.001$, n = 3273	Asian	35 (1.8)	80 (6.2)
Hospital of Birth	Public	1780 (89.5)	1051 (81.9)
$\chi_{(1)}^2 = 39.496$, $p < 0.001$, n = 3272	Private	208 (10.5)	233 (18.1)
Residential Area at Birth	Soweto/Diepmeadow	1642 (82.6)	787 (61.3)
	Former Coloured/Asian	244 (12.3)	188 (14.6)
	Inner City	11 (0.6)	58 (4.5)
$\chi_{(3)}^2 = 274.832$, $p < 0.001$, n = 3273	Suburban	92 (4.6)	251 (19.5)
Maternal Age at Delivery	≤18	235 (11.8)	107 (8.3)
	19-34	1542 (77.6)	1053 (82.0)
$\chi_{(2)}^2 = 11.647$, $p < 0.001$, n = 3271	35+	210 (10.6)	124 (9.7)
Maternal Education at Delivery	Grade 10 or less	227 (12.4)	228 (20.6)
	Grade 11–12	1430 (78.3)	719 (65.0)
$\chi_{(2)}^2 = 62.504$, $p < 0.001$, n = 2932	Post-School Training	169 (9.3)	159 (14.4)
Maternal Marital Status at Delivery	Married/ Living with Partner	740 (37.4)	675 (52.9)
	Single/Widowed/Divorced/	1236 (62.6)	600 (47.1)
$\chi_{(1)}^2 = 75.664$, $p < 0.001$, n = 3251	Separated		
Household Socioeconomic Index at Birth	Minimum	-2.193	-2.216
	Maximum	1.699	1.673
$t_{(2069.219)} = -1.037$, NS, n = 3181	Mean	-0.170	-0.206

4.3.1.2 Education and mobility

The education and mobility profile of participants who completed the school progression questionnaire is presented in Table 4.3. The majority of study participants commenced their schooling in their sixth or seventh years (43.4% and 42.7% of the sample respectively), and by the age of 15, the majority of the BT20 study sample had completed primary school, and were enrolled in grade nine or higher. While most of the study participants had not repeated a grade over the course of their schooling, just over a quarter of the participants had repeated a grade on one occasion, and approximately 5% of the sample had repeated grades more than once (where the maximum number of grade repeats in the sample was four). All schooling variables differed significantly for males and females. While males and females were equally likely to have started school under the age of six, males were more likely than females to have commenced primary school at the age of eight or older (15.8% compared with 9.7%), and they were therefore less likely to have completed primary school or to be enrolled in grade ten or higher by the time they were 15 years old. In addition, levels of grade repetition differed significantly for males and females in the sample, with males having repeated grades more frequently than females.

Table 4.3 Education and mobility profile by gender

		Male (%) n = 964	**Female** (%) n = 1025	**Total** (%) n = 1989
Age at School Entry	Minimum	5 years	5 years	5 years
	Maximum	10 years	9 years	10 years
$t_{(1987)} = 5.168$, $p < 0.001$, n = 1989	Mean	6.774 years	6.601 years	6.685 years
Grade Repeats	Never Repeated	585 (60.7)	793 (77.4)	1378 (69.3)
	1 Repeat	309 (32.1)	205 (20.0)	514 (25.8)
$\chi_{(2)}^2 = 69.696$, $p < 0.001$, n = 1989	>1 Repeat	70 (7.3)	27 (2.6)	97 (4.9)
Total Residential Moves Prior to School Entry	Never Moved	663 (68.8)	700 (68.3)	1363 (68.5)
	Moved	301 (31.2)	325 (31.7)	626 (31.5)
$\chi_{(1)}^2 = 0.054$, NS, n = 1989				
Total Residential Moves Following School Entry	Never Moved	635 (65.9)	622 (60.7)	1257 (63.2)
	Moved	329 (34.1)	403 (39.3)	732 (36.8)
$\chi_{(1)}^2 = 5.750$, $p < 0.05$, n = 1989				
Total School Changes	Never Changed	390 (40.5)	419 (41.0)	809 (40.7)
	1 Change	383 (39.8)	420 (41.1)	803 (40.4)
$\chi_{(2)}^2 = 1.029$, NS, n = 1986	>1 Change	190 (19.7)	184 (18.0)	374 (18.8)

An analysis of the rates of residential mobility and school changes amongst the group of BT20 participants revealed that prior to the commencement of schooling, 31.5% of children had moved residence on one or more occasions (where the maximum number of moves was four). In the period following school entry up until cohort members reached the age of 15, 36.8% of the children had moved home on one or more occasions (up to a maximum of five times). The majority of BT20 participants (59.2%) had transferred schools at least once outside of the normal transition from primary to secondary school. By the age of 15, 40.4% of children had experienced one non-promotional related school change, and 18.8% of children had transferred schools more than once (up to a maximum of five times). While the levels of residential mobility prior to the commencement of schooling and the rates of school change did not differ significantly by gender, a significantly larger proportion of females in the sample moved residence after the commencement of school as compared with males in the group.

4.3.1.3 Associations with school progression

Residential mobility prior to the commencement of schooling was not significantly associated with grade repetition ($\chi_{(1)}^2 = 0.032$, NS, n = 1989), nor was residential mobility following school entry significantly associated with repeating a grade ($\chi_{(1)}^2 = 0.349$, NS, n = 1989). Nevertheless, the association between grade repetition and school transfers was highly significant within the analytical sample ($\chi_{(2)}^2 = 11.248$, $p < 0.01$, n = 1986).

To further explore the association between grade repetition and school and residential mobility, grade repeats were modelled using logistic regression. Because of the highly significant differences in the pattern of grade repeats for

males and females in the sample, the logistic regression models were stratified by gender. The logistic regression models presented in Table 4.4 contrast participants who had never repeated a grade over the course of their schooling with participants who had repeated a grade on one or more occasions. Due to small frequencies of multiple repeaters in the sample, the ability of the logistic regression model to predict multiple repeats within this group was limited, however, the substantive conclusions did not differ when contrasting the multiple and single repeaters. The explanatory variables 'ethnicity' and 'residential area at birth' were excluded from the final models on the basis that the frequencies of some categories of these variables were very low once the sample was split by gender (which led to validity issues when estimating the models).

Amongst the male participants, the residential mobility variables were not found to be statistically significant in predicting grade repetition, however, the odds of a grade repeat amongst males who changed schools on multiple occasions was 1.524 times the odds of a repeat amongst males who had not changed schools, and for males who had changed schools once outside of the transition to secondary school, the odds of repeating a grade was 1.707 times the odds of a grade repeat amongst males who had never changed schools. A significant negative relationship was found between household socioeconomic status and the probability of repeating a grade, while higher levels of maternal education reduced the probability of a grade repeat for males (the odds of a grade repeat for males whose mother's had post-school education was 0.395 times the odds of a repeat for males whose mothers had grade ten or less schooling). The model adjusted for the age at which participants commenced their schooling, revealing a negative association. For example, the odds of a grade repeat for a participant who commenced school at the age of seven, was

0.741 times the odds of a repeat for a male who began school at age six. The model could correctly predict 61.2% of repeaters in the sample of males.

The logistic regression model applied to female participants revealed far fewer variables that significantly accounted for grade repetition. Residential and school mobility were not found to be associated with grade repetition among females. Nor was an association present between grade repetition and household socioeconomic status or any of the variables representing maternal characteristics. There was weak evidence of an association between hospital of birth (a proxy for socioeconomic status) and the probability of grade repetition, with the odds of a grade repeat amongst females born in a private health facility 0.513 times the odds of a repeat for females born in a public hospital. As was observed in the sample of males, an increase in the age of school entry was negatively associated with grade repetition amongst females. The model could correctly predict 77.1% of repeaters in the sample of females.

Table 4.4 Logistic regression analyses: school progression

	Grade Repeats: Males			Grade Repeats: Females		
	β	Std Error	Exp(β)	β	Std Error	Exp(β)
Age at School Entry	-0.299	0.095[a]	0.741	-0.284	0.116[b]	0.752
Total Residential Moves Prior to School Entry (Moved)	-0.004	0.156	0.996	-0.004	0.173	0.996
Total Residential Moves Following School Entry (Moved)	-0.055	0.153	0.947	0.197	0.165	1.218
Total School Changes (Never Changed)						
1 Change	0.535	0.162[a]	1.707	-0.114	0.180	0.892
>1 Change	0.421	0.200[b]	1.524	0.226	0.221	1.254
Hospital of Birth (Private)	-0.286	0.297	0.751	-0.668	0.353[c]	0.513
Maternal Age at Delivery (≤18)						
19-34	0.107	0.230	1.113	-0.277	0.240	0.758
35+	0.545	0.322[c]	1.725	-0.096	0.345	0.908
Maternal Education at Delivery (Grade 10 or less)						
Grade 11-12	-0.740	0.221[a]	0.477	-0.384	0.241	0.681
Post-School Training	-0.930	0.329[a]	0.395	-0.578	0.392	0.561
Maternal Marital Status at Delivery (Single/Widowed/ Divorced/Separated)	0.077	0.162	1.080	-0.085	0.183	0.918
Household Socioeconomic Index at Birth	-0.203	0.100[b]	0.816	-0.025	0.116	0.975
Constant	1.748	0.748[b]	5.741	1.247	0.858	3.482
-2 Log Likelihood	1135.781			984.109		
	$\chi_{(12)}^2 = 50.274$, $p < 0.001$			$\chi_{(12)}^2 = 22.313$, $p < 0.05$		

[a] *p < 0.01,* [b] *p < 0.05,* [c] *p < 0.10*

4.3.2 Competency in numeracy and literacy

4.3.2.1 Sample characteristics

The sample of 1989 participants in the school progression dataset dropped to 1744 participants who completed the numeracy and literacy evaluation. A series of chi-square and mean comparison tests was conducted to determine if the drop in sample resulted in any significant changes in the profile of participants described in the school progression study component. The proportion of male and female participants did not differ significantly between the two analytical datasets; similarly the distributions of maternal characteristics and household socioeconomic status were congruent across the school progression and reduced numeracy and literacy study samples. However, significant differences were present in the ethnic group, hospital of birth and residential area profile across the two samples. In particular there was a drop in the proportion of White and suburban-born children (from 2.6% to 0.3% and 4.6% to 2.2% respectively), with the participants who completed the numeracy and literacy evaluation most likely to be Black (87.0% of the sample), born in public hospitals (91.8% of the sample) and resident in the Soweto/Diepmeadow area at birth (85.6% of the sample).

4.3.2.2 Numeracy and literacy

An exploration of the unstandardised results of the numeracy and literacy assessment revealed an average score for male participants of 7.538 (SD = 4.837) out of a possible 23 in the numeracy component of the assessment, and 15.987 (SD = 3.850) out of a possible 22 in the literacy component (n = 831). Females obtained similar average scores to males in the numeracy component with a mean score of 7.629 (SD = 4.669) out of 23 ($t_{(1742)}$ = -0.399, NS, n = 913), however, females in the sample scored significantly higher than

males in the literacy component of the assessment with an average of 17.104 (SD = 3.056) out of 22 ($t_{(1581.582)}$ = -6.669, p < 0.001, n = 913).

4.3.2.3 Associations with numeracy and literacy

A series of analyses of variance was conducted on the numeracy and literacy test scores for males and females to determine if mean scores differed according to whether or not the participants had experienced a residential movement or changed schools. There were no significant differences in mean numeracy and literacy scores amongst the group of participants who had moved residence prior to the commencement of schooling as compared with those who had not experienced a move, nor did average test scores differ significantly for participants who had changed schools once, multiple times or not at all. However, average scores on the male literacy and the male and female numeracy components of the evaluation differed significantly amongst participants who had experienced a residential move following the commencement of school as compared with those who had not (Numeracy (males) $t_{(467.972)}$ = -2.308, p < 0.05, n = 804; Numeracy (females) $t_{(871)}$ = -2.488, p < 0.05, n = 873; Literacy (males) $t_{(802)}$ = -2.325, p < 0.05, n = 804; Literacy (females) $t_{(871)}$ = -1.801, NS, n = 873). In each case, the mean score amongst the group who had changed residence after the commencement of school was higher than the mean score of those participants who had not moved home. For males, movers scored an average of 3.7% higher than non-movers on the numeracy component and 3.1% higher on the literacy component of the evaluation, while female movers obtained average scores of 3.5% higher than non-movers on the numeracy evaluation.

In order to explore the associations between the full set of explanatory variables and the numeracy and literacy scores, a series of linear regression

models was run using the standardised z-scores as outcome measures (see Table 4.5). As was the case with the school progression regression models, variables ‘ethnicity’ and ‘residential area at birth’ were excluded from the final models because of unfeasibly small sample sizes; the vast majority of the sample were Black and born in the Soweto/Diepmeadow area.

The results of the multiple regression model of standardised numeracy scores for males revealed that neither residential mobility prior to the commencement of schooling nor school mobility were significantly associated with competency. However, males who experienced residential mobility after the commencement of schooling fared moderately better (with z-scores or standard deviation units of 0.188 higher) in the numeracy evaluation as compared with those in the sample who had not moved. Of the child and maternal characteristics included in the model, a significant positive relationship was found between males born in private hospitals and numeracy scores. In addition, household socioeconomic status was found to be positively related to numeracy among males. There was also a significant negative relationship between grade repetition and numeracy with males who had repeated a grade achieving z-scores of 0.601 lower than those who had not repeated a grade (equivalent to a difference in raw test scores of 2.907 points). Increased age at school entry was negatively related to scores on the numeracy assessment, with males commencing school one year older achieving scores 0.543 standard deviation units below those who had begun school a year younger. The model’s adjusted R^2 value indicates that the set of explanatory variables included in the model explained 32.9% of the variation in numeracy scores amongst male participants. Residential mobility after the commencement of schooling described as significant in the numeracy model for males was also found to be significant in explaining literacy scores, with males who experienced a move

after commencing school attaining z-scores of 0.197 higher than those who had not moved house. Maternal education and household socioeconomic status were significant in the model of male literacy scores with increased levels of maternal education and higher household socioeconomic indices associated with higher z-scores. For instance, a male whose mother had completed post-school training achieved z-scores of 0.621 higher on the assessment compared with a male whose mother had not received post-school education (with the difference equivalent to 2.391 raw test points). As was the case in the numeracy model, commencing school at an older age and/or repeating a grade were associated with reduced literacy scores. The set of explanatory variables in this model explained 32.1% of the variation in literacy scores amongst male participants.

Table 4.5 Multiple linear regression analyses: numeracy and literacy

	Numeracy: Males		Numeracy: Females		Literacy: Males		Literacy: Females	
	β	Std Error	β	Std Error	β	Std Error	β	Std Error
Age at School Entry	-0.543	0.040[a]	-0.414	0.044[a]	-0.535	0.041[a]	-0.566	0.044[a]
Grade Repeats (Repeated)	-0.601	0.061[a]	-0.513	0.073[a]	-0.658	0.063[a]	-0.494	0.072[a]
Age at Assessment	0.071	0.107	0.017	0.116	0.099	0.110	-0.106	0.113
Total Residential Moves Prior to School Entry (Moved)	0.071	0.066	0.096	0.068	-0.038	0.067	0.060	0.067
Total Residential Moves Following School Entry (Moved)	0.188	0.065[b]	0.150	0.066[c]	0.197	0.067[b]	0.089	0.065
Total School Changes (Never Changed)								
1 Change	-0.063	0.068	-0.090	0.070	0.104	0.070	-0.038	0.069
>1 Change	0.015	0.084	-0.077	0.090	0.039	0.086	-0.037	0.088
Hospital of Birth (Private)	0.473	0.128[a]	0.392	0.128[b]	0.094	0.131	0.377	0.125[b]
Maternal Age at Delivery (≤18)								
19-34	-0.047	0.094	-0.030	0.097	-0.154	0.097	-0.046	0.095
35+	-0.087	0.132	-0.054	0.140	-0.100	0.135	-0.061	0.137
Maternal Education at Delivery (Grade 10 or less)								
Grade 11-12	-0.117	0.092	0.088	0.103	0.195	0.094[c]	0.272	0.101[b]
Post-School Training	0.272	0.143[d]	0.625	0.155[a]	0.621	0.147[a]	0.618	0.152[a]
Maternal Marital Status at Delivery (Single/Widowed/ Divorced/Separated)	0.052	0.067	-0.033	0.073	0.013	0.069	0.004	0.072
Household Socioeconomic Index at Birth	0.209	0.042[a]	0.200	0.046[a]	0.173	0.043[a]	0.092	0.045[c]
Constant	2.777	1.812	2.488	1.955	2.091	1.861	5.338	1.918[b]
Adjusted R^2	0.329		0.220		0.321		0.251	
	$F_{26.876, 14, 725}$ $p < 0.001$		$F_{17.236, 14, 790}$ $p < 0.001$		$F_{25.914, 14, 725}$ $p < 0.001$		$F_{20.228, 14, 790}$ $p < 0.001$	

[a] *p < 0.001,* [b] *p < 0.01,* [c] *p < 0.05,* [d] *p < 0.10*

The regression model of female numeracy scores revealed a similar set of significant predictors as was found in the model for males. Females in the sample who had experienced residential mobility following school entry achieved z-scores of 0.150 higher on the numeracy evaluation as compared with females who had not moved (equating to a difference in unstandardised test scores of 0.700). In addition, being born in a private health facility, to a mother with post-school education and/or in a household with higher socioeconomic status was associated with higher relative assessment scores for females. As was the case in the male numeracy model, the variables 'grade repeats' and 'age at school entry' were negatively associated with numeracy scores, while the set of explanatory variables in this model described a slightly lower proportion of the variation in numeracy scores (22.0%) as compared with the model for males. A similar set of explanatory variables found to be significant in the numeracy model for females also achieved significance in the female literacy model, with the exception that no significant linear relationship was present between female literacy scores and residential mobility following school entry. The set of explanatory variables in the model described slightly more of the variation in female literacy scores (25.1%) than was found in the female numeracy model.

4.4 Discussion

As far as we can ascertain, this is the first study to consider the association between residential and school mobility and educational outcomes in a cohort of South African learners. The analyses utilise two educational outcome measures, progression through school indicated by grade repetition, and competency in numeracy and literacy measured by scores on an assessment. The study considers the frequency of children's residential change prior to and following the commencement of schooling and also quantifies, for the first time, the degree of school movement occurring outside

of the normal educational transition. The relationships between residential and school mobility and educational outcomes were found to differ from those observed in the prevailing international literature. While these studies predominantly link movement to disrupted schooling and lower levels of achievement, the South African study demonstrates no association between residential mobility and transition through school, and a positive relationship between residential mobility and numeracy and literacy scores. School mobility was found to be associated with grade repetition for males, but no relationship was observed between school changes and competency in numeracy and literacy. The South African study provides a counter example to the trends observed in HICs, while highlighting the complexity and important influence of context on these relationships.

4.4.1 School progression

Amongst this cohort of urban children, almost a third had moved residence prior to school entry and over a third of the sample had shifted households at some stage following the commencement of their school careers up until the age of 15. However, residential mobility was not found to be associated with progression through school as indicated by grade failure. The BT20 data provides, for what we think is the first time in a South African study, a quantum of the rates of non-promotional school mobility. Rates of school mobility in the sample were very high with 59.2% of participants changing schools outside of the primary to secondary school transition. While the reasons prompting school transfer were beyond the scope of the current study, it is feasible that a proportion of school mobility can be explained as a response (or a precursor) to grade failure. However, only 33.4% of the sample who had transferred schools on one or more occasions had also repeated a grade over the course of their schooling, suggesting that school changes within the cohort are taking place for other reasons, besides those related to grade retention. We would hypothesise that the high frequency of school

change may be attributed to learners shifting schools in order to maximise or improve academic outcomes, as was suggested in Motala's (1995) study of a cohort of Soweto-based learners. In the context of Soweto, where the majority of the BT20 study sample is resident, a current over-supply of educational facilities (due to an expansion during the Apartheid era followed by an aging population) has resulted in a wide range of schooling options with schools incentivised to accept new enrolments. Thus the local environment might offer learners a broad spectrum of choice around schooling. A proportion of learners are also known to be travelling outside of their immediate area to attend schools at a greater distance from their homes, in the interests of accessing schools perceived as superior (Sekete, et al., 2001). In order to investigate this hypothesis, issues surrounding school quality and learner migration would need to be considered to determine whether learners are moving from low-achieving schools to higher-achieving schools.

The BT20 data provides further evidence of the large repeater burden in the South African schooling system, and the higher level of grade repeats amongst male learners as compared with females, a finding synonymous with research conducted by Anderson et al. (2001) and Branson and Lam (2009). The analyses revealed a larger set of predictors significantly associated with grade repetition amongst males as compared with females in the sample. For males, a significant relationship was found between grade repetition and school mobility. South African studies have not expressly investigated the relationship between school mobility and academic achievement, however, grade failure has been linked to negative in-school experiences (Department of Education, 2007). Further, international research has demonstrated negative associations between school mobility and school and academic functioning (Alexander, et al., 1996; Nelson, et al., 1996). Therefore, it seems plausible that males in the sample may shift schools as a

response to grade failure at an existing school. Alternatively, a change in school may lead to adjustment issues or disruption, which may in turn result in males being held back a grade. An inverse relationship was found between grade repetition and socioeconomic indicators such as maternal education and household assets for males, and birth at a private hospital for females. This link between socioeconomic status and academic achievement has been well demonstrated in educational attainment literature. For both male and female participants, the higher the age of school entry, the lower the probability of a grade repeat. In previous research findings, BT20 cohort members who commenced school at younger ages (at age six) were more likely to repeat grades earlier in their schooling with the pattern of grade repeats becoming more uniform for cohort members who began school slightly older (at age seven) (Fleisch and Shindler, 2009). This finding is consistent with provincial level survey data indicating that grade failure is more common in under-age children, who may be perceived by teachers as immature (Perry and Arends, 2003).

4.4.2 Competency in numeracy and literacy

One striking difference between the school progression analysis and the analysis of numeracy and literacy scores was the significant positive relationship between the later educational outcome and residential mobility following commencement of schooling. Males who had moved home after entering school achieved significantly higher average scores on both components of the assessment, while females in the sample scored significantly higher on the numeracy component if they had experienced residential change. As suggested in the international literature, an understanding of the effect of mobility on educational outcomes would be assisted by investigating the circumstances driving (and resulting from) movement (Alexander, et al., 1996; Dong, et al., 2005; Rumberger, 2002). In South Africa, residential mobility has been shown to enable children to gain access to potentially

improved care structures and educational opportunities (Paterson and Kruss, 1998; Zimmerman, 2003). Studies have also demonstrated significant associations between educational outcomes and children's living arrangements and household structures (Anderson, et al., 2001; Townsend, et al., 2002).

In the BT20 study, detailed data describing children's living circumstances were not available, however, results of a longitudinal analysis of factors associated with movement linked residential mobility to lower socioeconomic proxies - suggesting movement within the cohort is more frequently driven by necessity (Ginsburg, et al., 2010). Nevertheless we might hypothesise that even in these instances relocation may have the advantageous effect of offering stability to some children, possibly in the form of an alternative schooling or care arrangement, or an improved residential locality. A preliminary exploration of reasons for movement within the BT20 cohort revealed that moves associated with child care or schooling comprised 14.9% of all reasons cited by caregivers for participants changing residence (Ginsburg, et al., 2009). Reasons included moving to be in closer proximity to participants' schools, which would have the effect of reducing transport time and costs associated with travel. This example illustrates a positive consequence of residential movement, which may translate into improved educational outcomes for children.

Controlling for residential mobility, the analyses of BT20 participant's numeracy and literacy scores provided evidence of a positive relationship between household socioeconomic status and competency. In addition, being born in a private hospital, or to mothers with higher levels of education was linked to higher outcomes in the assessment. The analysis of numeracy and literacy scores also controlled for aspects of school education, thus connecting the two study components. The relationship between school progression and competency was

significant, with those participants who had repeated a grade scoring lower on the evaluation, and those progressing through school without a grade failure achieving higher scores. Nevertheless, while residential mobility was found to be positively associated with competency, the lack of association between school mobility and numeracy and literacy would suggest that changing schools is not translating into improved educational outcomes amongst this group of children, even if this is the intention. As with the school progression analysis, a measure of school quality is likely to have a mediating influence on these relationships and would be of interest. Older ages of school entry were associated with lower relative scores on the numeracy and literacy assessment reflecting the fewer years of schooling completed by learners who had commenced school later.

4.4.3 Limitations and future research

The current study provides insight into the relationship between residential and school mobility and two educational outcomes, thus offering a new and original contribution to understanding the potential forces impacting education in an urban South African setting. The results reveal certain limitations with the current data and highlight a number of areas warranting further investigation. While the analyses identified some important factors explaining school progression and competency in numeracy and literacy, a number of confounding factors could not be included in the investigations because of a lack of available data. These explanatory models would benefit from the inclusion of school level variables such as measures of school quality in order to ascertain the extent to which movers are shifting from poorer to better quality schools. Neighbourhood and community-related factors would also be of interest in understanding the context in which children are living and attending school. Further, knowledge of how residential moves reflect new household formation and composition, as well as the relationships between learners and household heads would add value. A more

complete understanding of these dynamics would be greatly assisted by further exploration of the circumstances and reasons prompting both residential mobility and school change.

The educational outcome variables employed in such analyses may not always provide adequate or sensitive enough measures of educational achievement and academic ability. While grade repetition may be indicative of individual academic ability, it may also be a function of social processes occurring within schools themselves. Numeracy and literacy evaluations are subject to issues of validity and reliability, however, they are considered better proxies of educational attainment and have the advantage of providing a uniform means of comparison for learners attending a range of schools with diverse standards and methods of academic assessment. Finally, the current study provides an initial investigation of the frequency of residential mobility and school changes over time. Following from this study, a longitudinal analysis incorporating the sequential placement of school and residence would be of interest. This approach would consider the patterns of interaction between residential movement and school change over time, while further incorporating the effects of the timing of a school or residential change on learners' educational outcomes, which has been found to be significant in international studies (Haveman, et al., 1991; Swanson and Schneider, 1999). This would also allow for an investigation of the relationship between school mobility and grade repetition to gain clarity on the extent to which school changes are a consequence of a grade failure, and vice versa.

4.4.4 Conclusion

The results of the analyses presented in the chapter reveal that residential mobility amongst South African urban children does not appear to have an adverse effect on educational outcomes. On the contrary, the study provides some evidence of a

positive association between changes in residence and educational outcomes, possibility as consequence of movement resulting in improved living circumstances, even amongst the more disadvantaged children. The study demonstrates a high frequency of school change occurring within this cohort of primarily Soweto-based children. While some school mobility may be a response or precursor to grade failure it is likely that a large proportion of this non-promotional school change is occurring as a result of the wide range of educational options available to these children. This environment of diverse choice would allow for children to maximise their schooling outcomes, however, the extent to which school change is linked to improved educational outcomes is not evident.

The South African study reveals a range of generative mechanisms linking residential and school mobility to educational outcomes. It also highlights the complexity of these relationships, illustrating that observed trends are likely to be highly context specific. Given the important role of education in developing human potential, alleviating poverty and unemployment, and promoting future economic growth, a broad understanding of factors that may impact on educational access and outcomes in South Africa and other transitional societies is a priority. This study provides a new contribution to furthering the understanding of these issues, and proposes a direction for future research into these phenomena.

Part 3

Discussion

Chapter 5

Discussion

Chapter 5: Discussion

This chapter presents a synthesis of the empirical studies undertaken in this thesis. The chapter commences with a consolidation of the research findings, following from which two research themes are identified and discussed. The theoretical relevance of the research is then considered and a revised conceptual framework proposed. Subsequently, the significance of the findings are discussed first in relation to the South African context, and then in relation to the LMIC setting more broadly. Finally the thesis limitations and future research directions are elaborated and a conclusion presented.

5.1 Consolidated Findings

The thesis set out to explore a set of five research questions concerning residential mobility amongst a cohort of urban-based children over a period of 14 years. The thesis objectives were achieved through a series of empirical studies presented in Chapters 2, 3 and 4. The central findings linked to each research objective are summarised in Table 5.1. These findings are re-organised diagrammatically in Figure 5.1. This figure outlines the set of factors investigated across all the empirical chapters and highlights which of these factors were significantly related to mobility, and to the educational outcomes explored.

Table 5.1 Summary of thesis findings

Objective		Chapter	Thesis Findings
i	To identify the patterns and frequencies of child residential mobility within the cohort	2 and 3	▪ The majority of children moved at least once within their first 14 years, however, a substantial number of children had not experienced a move within this time. ▪ Relatively high rates of residential mobility occurred when children were aged 4 years or younger. ▪ The largest proportion of moves were intra-urban, taking place within the Johannesburg-Soweto area.
ii	To explore the reasons prompting residential mobility within the cohort	2	▪ Changing family and relationship circumstances or housing requirements were the primary reasons reported for movement. ▪ Child-centric reasons for movement were linked to accessing care or schooling.
iii	To identify the child, caregiver and household factors associated with residential mobility within the cohort, and explore that nature of associations	2 and 3	▪ Mobility within the retained cohort group was associated with the highest and lowest socioeconomic indicators in bivariate analyses. ▪ Overall, ethnic and gender differences were not significant predictors of movement. ▪ Mobility was more likely amongst children whose primary caregivers had no formal education and who lived in households with fewer assets and less access to services. ▪ Children who experienced a first move early in life were more likely to experience repeated residential relocations.
iv	To investigate the relationship between residential and school mobility and cohort children's educational progression and attainment	4	▪ Rates of school change were high within the cohort. ▪ A positive association between changes in residence and numeracy and literacy scores was observed. ▪ School changes were found to be associated with grade repetition, while no relationship was observed between residential mobility and progression through school.
v	To consider methodological approaches for dealing with sample attrition in the analysis of longitudinal mobility data	3	▪ A methodological approach was proposed for analysing repeated moves using multilevel models, adapted to maximise information from children who dropped out of the BT20 study or who had long gaps in their residential histories.

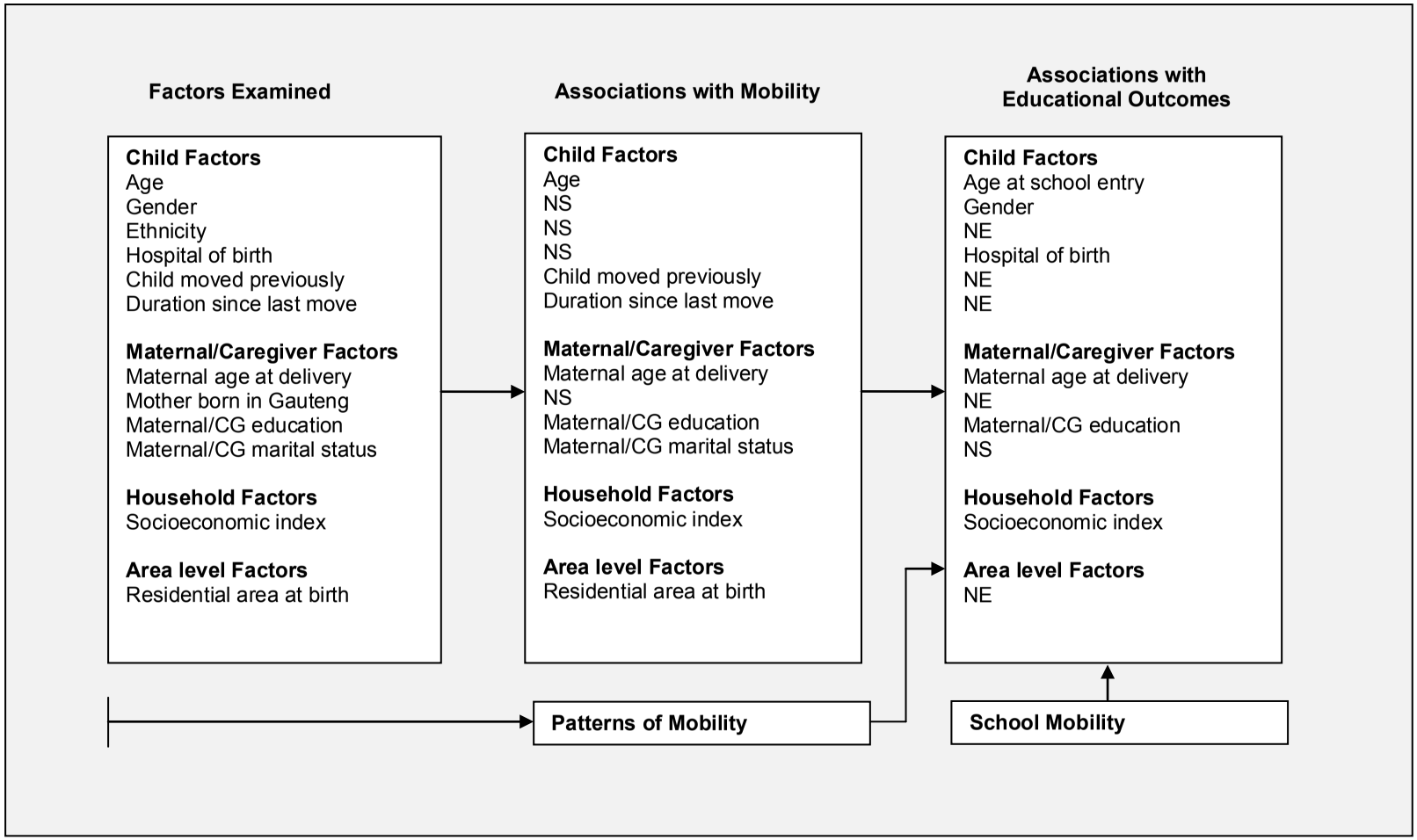

Figure 5.1 Thesis findings: associations with mobility and educational outcomes. This figure comprises a diagrammatic representation of the set of factors examined in the study in terms of their associations first to residential mobility (based on results from Chapter 3) and then to the set of educational outcomes (based on results from Chapter 4). Significant associations are recorded in the diagram, while those that were not significant are indicated as NS. Factors that were not examined (in the education outcome component) are indicated as NE. The figure indicates that in addition to these associations, patterns of residential and school mobility were also explored in the thesis.

On the basis of these findings, three groups of children may be identified: children who had experienced one or more residential moves by the age of 15, children who had not moved by age 15 and children who had dropped out of the BT20 study either temporarily or permanently by the age of 15. In order to generate a profile these three groups of children, the findings from the analyses conducted in Chapters 2, 3 and 4 discussed above were consolidated. As there was some variation in the analytical samples across the empirical analyses, an illustration of the samples employed in each chapter is outlined in Figure 5.2 for reference.

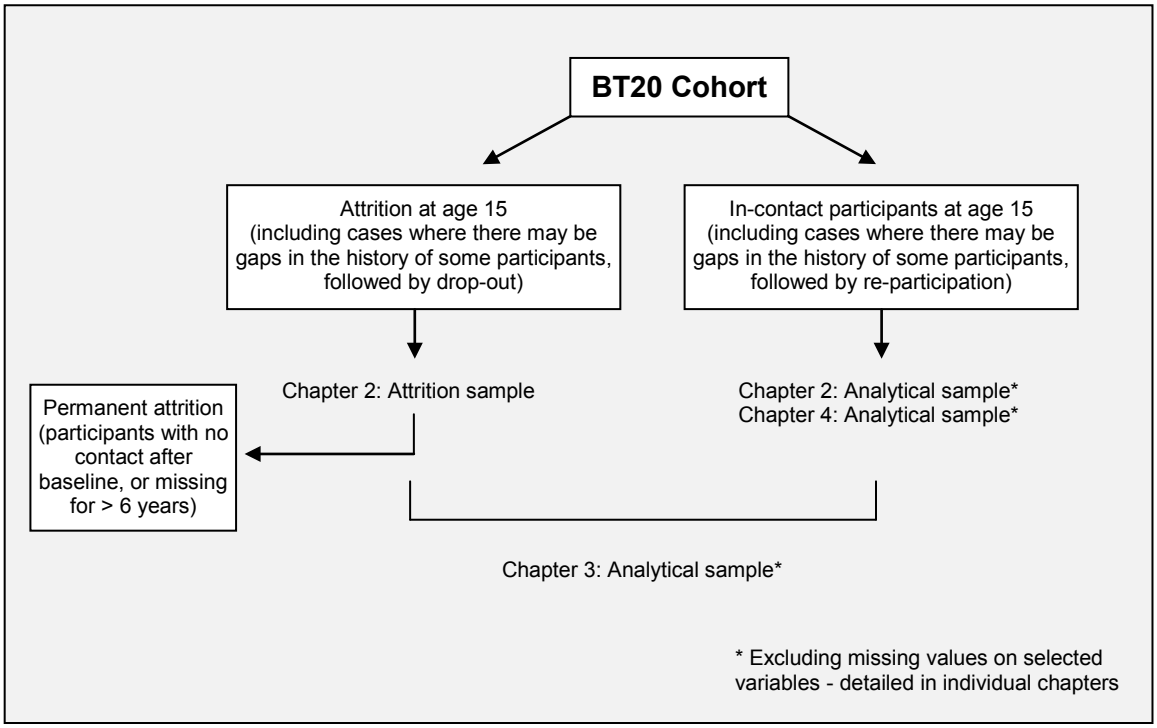

Figure 5.2 Summary of the analytical samples employed in empirical analyses

A profile of three identified groups of children will now be considered.

5.1.1 Children who had experienced one or more residential moves by age 15

In relation to the group of mobile children, there were some discrepancies between the characteristics of movers described in Chapter 2 and the associations with

mobility observed in Chapter 3. The reasons for this can be ascribed to differences in the analytical samples, the structure of the datasets (cross-sectional aggregated data compared with longitudinal data) and the statistical techniques employed in the two sets of analyses (Chapter 2 presented a set of bivariate associations, while Chapter 3 reported on a multivariate multilevel model). The findings from the longitudinal analysis have been emphasised as this approach is superior in dealing with duration data, takes account of repeated moves and their timing, and allows values of the independent variables to change over time. This analysis revealed that probabilities of movement were higher amongst children whose primary caregivers had lower levels of schooling and lower household socioeconomic status. This set of associations is suggestive of movement related to conditions of poverty or disadvantage. However, the bivariate analysis conducted in Chapter 2, revealed that amongst the group of movers, were some children who were potentially advantaged, born to mothers with higher levels of education and from higher resourced households. This would indicate that amongst the group of mobile children, 'successful' mobility was also occurring.

In order to further explain this movement behaviour, some additional analyses were conducted. Children's main reasons for relocating were analysed by the level of household resources[5], revealing significant differences. Children from lower resourced households were more likely to move because of individual or

[5] This analysis was conducted using the analytical dataset employed in Chapter 2. A household socioeconomic index was constructed for each cohort member by summing household assets and splitting them into quartiles indicating ≤ 3 assets, 4-5 assets, 6-7 assets and 8-10 assets. These were cross-tabulated with the main (or in the case of two reasons, first) reason category provided by caregivers for each child movement (reason categories included moves relating to work/finance, housing, relationship, child and community issues). The association between reason category and socioeconomic index was significant ($\chi_{(12)}^2 = 47{,}665$ $p < 0.001$, $n = 2400$). Notably, 55.10% of the community-related reasons reported were connected to movement amongst children from the highest socioeconomic quartile, while the majority of work/finance (58.5%), housing (56.0%), relationship (59.7%) and child (61.7%) related moves occurred amongst children from the lowest two socioeconomic quartiles.

household related factors (such as reasons surrounding employment, relationships and child care), while most of the community-related reasons for movement (such as moves to better areas, or moves because of security concerns) were reported by caregivers of children from the highest resourced households. These findings further support the proposition that children from better resourced households are likely to be moving to improved circumstances, while children from more impoverished households may be moving out of necessity. Information regarding the destination of movers would be important in informing this picture and a subsequent analysis of mobile children's final destinations by the age of 15 was also conducted. This analysis indicated that the vast majority children born in Soweto or former disadvantaged areas were still living in these areas with very few moves from these areas to suburban Johannesburg[6]. Suburban-born children were most likely to remain in the suburbs, with a minority relocating to the inner city.

Nevertheless, controlling for the range of individual, caregiver and household factors examined in Chapters 2 and 3, the results in Chapter 4 revealed that children who had experienced a residential move following the commencement of schooling scored relatively higher on numeracy and, in the case of males, literacy test scores in comparison with children who had not moved. This finding suggests that even where mobility occurs in the context of disadvantage, relocation can potentially yield positive benefits.

[6] This analysis was conducted using the analytical dataset employed in Chapter 2. Cohort member's residential areas at birth were cross-tabulated with their final destination locations, categorised as either township or previously disadvantaged area, inner city, suburban or other area (such as industrial or agricultural areas), revealing significant differences ($\chi_{(6)}^2 = 414.743$ $p < 0.001$, $n = 1198$). Of the children who were born in Soweto/Diepmeadow or former Coloured/Asian areas, 87.36% had moved within township or previously disadvantaged areas, while 4.96% had moved to suburban Johannesburg. The majority of suburban-born children (55.13%) moved within the suburbs with 32.05% relocating to inner city addresses.

5.1.2 Children who had not experienced a residential move by age 15

Results presented in Chapter 2 revealed a number of children in the cohort who had not moved residence within their first 14 years. The longitudinal analysis presented in Chapter 3 revealed that, in contrast to the findings concerning mobile children, children who were less likely to move were those whose primary caregivers were unattached, with primary or secondary level schooling and living in households with relatively higher levels of resources. The bivariate analyses contrasting movers and non-movers conducted in Chapter 2, found that the group of non-mobile children were neither amongst the most disadvantaged of the cohort, nor amongst the more advantaged. These children may be described as a moderately resourced group within the cohort, given that the cohort ultimately represents a lower socioeconomic sector of the South African population with living standards well below average in comparison with a HIC environment (see Richter, et al., 2007).

In relation to the educational outcomes explored in Chapter 4, children who had not experienced a residential move scored lower on numeracy and (in the case of males) literacy test scores, controlling for other factors. This finding challenges the assumption that movement is detrimental, and raises the question of whether in fact a lack of movement underlies a poverty of opportunity in the case of these children.

5.1.3 Children who had dropped out of the BT20 study, either permanently or temporarily by the age of 15

The profile of this group of children was examined in Chapter 2 revealing a contrasting set of characteristics. A significant proportion of the children comprising the attrition group by Year 15 of the study were White and born in private hospitals. The children in this group were also from the highest or lowest

resourced households, with biological mothers having either no formal or post-school education. While the movement histories of this group of children were incomplete in the analyses undertaken and their reasons for movement not ascertained, it is likely that this group displayed a different movement profile to children discussed in the previous sections. For example, the current findings reveal a significantly higher level of (known) movements amongst this group compared with the retained cohort members. The temporary drop-outs within this group are potentially engaging in circular migration which is likely to have different implications for children in comparison with more permanent forms of movement. Further, in a BT20 investigation of cohort attrition, drop-out linked to reasons such as child or caregiver mortality, or refusal to participate in the study comprised a very small proportion of losses to follow-up within the cohort, with the vast majority of attrition linked to mobility, in many instances to destinations outside of the study area (Norris, et al., 2007). It can be surmised that movement within this group of children is linked to two poles of mobility such as has been suggested in the South African literature (see Kok, et al., 2003; Oosthuizen and Naidoo, 2004). Movement associated with higher socioeconomic status and opportunity, and movement linked to a lack of opportunity or disadvantage. Amongst this group of children, educational outcomes were not investigated.

Having outlined the thesis findings and discussed them in relation to three groups of children, the following key findings emerged:

Key Findings

- The proportion of the urban child population who had not experienced a residential move over the period investigated was higher than anticipated and larger than comparative rates observed in rural-based South African studies.
- Of the mobile children, first movements were found to take place in early childhood with movement levels peaking at ages preceding the commencement of primary and high school.
- There was evidence that factors across four domains (child individual, caregiver, household and a limited area level measure) were related to mobility in children.
- There was some evidence of an association between movement and higher socioeconomic indicators in bivariate analyses, while the multivariate longitudinal analysis revealed that movement was more frequently associated with children from lower socioeconomic backgrounds.
- The findings concerning the relationship between residential mobility and a set of educational outcomes revealed a positive association in the case of numeracy and literacy test scores, and a negligible association in relation to school progression.

5.2 Emerging Research Themes

The specific patterns and associations identified in the analyses have been discussed and contrasted with results observed in other studies in the empirical chapters and will not be elaborated further. However, two key thematic areas emerge from the consolidated findings and these will be considered in more detail: the first concerns the two poles of mobility – movement driven by advantage and movement induced by poverty, the second relates to the question of stability or immobility.

5.2.1 Poles of mobility

The concepts of positive and negative selection, conceived by Lee (1966), have featured in many contributions to migration theory. Migrants can be either positively or negatively selected where positive selection relates to movement associated with opportunities at a destination (pull factors), and negative selection relates to challenges or negative factors at origins driving mobility (push factors) (Lee, 1966). Negative selection may also advance to positive selection once the household reaches a certain threshold in terms of resources. In studies of intra-urban residential mobility in HICs, positive selection has been emphasised with studies identifying drivers such as upward social mobility, residential satisfaction and lifestyle and family status changes as central to movement decisions (see De Jong and Fawcett, 1981). Mobility linked to necessity or disadvantage has been discussed more frequently in the context of internal (or international) migration in LMIC settings with financial constraints, the need to secure employment, family disruption, or issues surrounding tenure found to drive relocation (see, for example, Parnwell, 1993).

Within the BT20 study population, residential mobility is strongly linked to socioeconomic factors with socioeconomic differences in the profile of movers suggesting that negative and to a lesser extent, positive selection is occurring within the cohort. On this basis it can be inferred that within the cohort, movement is employed as a strategy to either improve children and families' living circumstances, or to survive in challenging or prohibitive conditions. This implies that in some circumstances movement is reflective of choice, while in other instances movement may be compelled or imposed. Movement is therefore a surrogate marker of a broader set of attributes and circumstances. Families appear to employ multiple strategies involving mobility to meet their needs and negotiate their positions and livelihoods within this urban landscape.

The importance of understanding selection within this study population is apparent when considering the potential impact of mobility on outcomes. The prevailing literature tends to take the view that change associated with movement of children is disruptive with very few of the explored studies suggesting that change might be beneficial. While it is likely in cases of negative selection that many of the circumstances resulting from movement would be deleterious for children (such as moves to less adequate housing), it is also possible that in these instances, change can yield positive consequences. To attempt to better understand this paradox, the principle of selection can be extended. It is likely that, within a group of low resourced households, movement occurs amongst the more resilient. This implies that those who are able to move are positively selected within the group, although negatively selected within the population. This resilience may be passed on to the mobile child, reinforcing the child's resilience in maintaining or improving well-being outcomes. In cases of positive selection, movement is likely to be associated with upward social mobility and undertaken with the view of improving living conditions. In these instances the expectation would be that movement has advantageous consequences for children. Existing approaches to measuring child outcomes often adopt a negative perspective. It is possible that through broadening the focus and the types of outcomes investigated, some of the benefits of mobility would be brought to light.

5.2.2 Stability or immobility

The question of why people do not move has been raised in United States based literature and generally explained by factors such as social ties in an area, house ownership or duration of residence (see, for example, Speare, et al., 1982). In contrast, research conducted in Latin American countries has found that residential mobility amongst the poor is limited because of economic constraints and even in the case of home owners, alternative housing opportunities may be

very restricted (Gilbert, 1999; Gilbert and Ward, 1982). In Gilbert and Crankshaw's (1999) analysis of the Soweto survey, this lack of mobility was highlighted - for the majority of the Sowetan respondents, residential choice and housing options were limited in the face of poverty.

It would therefore seem plausible that in the BT20 study population, the lack of mobility observed would be indicative of a lack of resources or alternative residential options. Immobility is therefore likely in many instances to reflect constraints that children and families face in improving their living conditions. Nevertheless, as in the case of mobility, non-mobility may also be a choice. Multigenerational or extended family households are favoured in some communities, with South African census data revealing that nuclear family structures are less common amongst Black and Coloured South Africans as compared with the White and Asian population (Amoateng, et al., 2007). Notwithstanding the variety of reasons proposed for these trends, the extended family household environment may be supportive in raising children. South African studies of child mobility have focused mainly on movers and provided minimal insight into circumstances surrounding immobility. Therefore more detailed explorations of the reasons and dynamics underlying non-movement would be important to decipher when a lack of movement represents a choice, and when it indicates a lack of choice.

5.3 Theoretical Relevance

Following from the consolidation of the thesis findings and exploration of research themes, the two conceptual frameworks that were introduced in Chapter 1 (Figures 1.1 and 1.6) will now be revisited. The ways in which the thesis contributes to the understanding and development of these models is outlined below.

5.3.1 De Jong's general model of migration decision-making

The research presented in this thesis can be applied to De Jong's model of migration decision-making in a limited way. De Jong (2000) proposes a range of individual, household and community characteristics that have an indirect effect on migration behaviour through their impact on a set of concepts which shape movement intentions. The thesis did not explore movement intentions; rather it considered the outcome of this process that is movement behaviour. Therefore, the direct relationship between the set of characteristics outlined in De Jong's model and movement behaviour was examined. The results of the research confirmed connections between these dimensions and movement behaviour, however the extent to which this relationship may be mediated through movement intentions is unknown.

One of the strength's of De Jong's model is its ability to explain non-movement, or 'stay' decisions as a form of mobility behaviour. As the current discussion highlights, understanding reasons for non-movement are just as pertinent. Nevertheless, the thesis findings suggest a few limitations of this model in terms of its applicability to compelled movements in lower-income settings such as are encountered in the BT20 cohort, and to children's mobilities more generally. As De Jong, concludes in his empirical application of this framework in rural Thailand, the connection between movement intentions and behaviour did not hold in the case of temporary moves, which were speculated to be occurring in conditions of crisis rather than social mobility (De Jong, 2000). While intentions were not tested in this thesis, it can be hypothesised that a framework which assumes choice is likely to be less applicable to movements that might be imposed as a result of disadvantageous circumstances. Gilbert and Ward (1982) made a similar observation in their study of mobility in lower-income cities by concluding that, "residential patterns … are less the outcome of migrant choice … and more the

product of constraints imposed by the land and housing markets". Although De Jong's framework does take account of structural constraints that directly impact on mobility behaviour, the range of factors are likely to be more numerous and their impact more central to issues of immobility in certain contexts. Further, in the case of children, choice is likely to be more restricted and constraints more significant. For example, where child movement is imposed as a result of a death of a caregiver, children may be left with few if any residency options (see Ansell and Van Blerk, 2004).

5.3.2 Brockerhoff's conceptual framework for the relationship between mobility and child well-being

Brockerhoff's framework provides a useful representation of the extension of mobility decisions to mobility outcomes, which takes account of changes in environmental and individual circumstances following a move. This model posits that environmental and socioeconomic characteristics at origin locations impact on a pre-movement outcome which is linked to a movement decision through the mechanism of migration selection (Brockerhoff, 1990). The act of movement, together with socioeconomic and environmental attributes at destination locations, impact on child well-being outcomes following movement (Brockerhoff, 1990). In Brockerhoff's (1990) application of the model to rural-urban migration in Senegal, migration selection appeared to be largely positive, but the model would be applicable to instances of negative selection as well. The framework highlights the importance of environmental aspects on movement related outcomes, and the processes of adaptation and disruption connected to relocation are recognised.

A strength of this model is that it allows for variation in pre- and post-move circumstances, which the current research supports in allowing explanatory variables to change over time. A further advantage of Brockerhoff's framework is

the incorporation of a pre-move outcome measure. Many of the cross-sectional studies of outcomes associated with mobility do not consider this and the study designs are therefore limited in their ability to assess the effect of the move itself. While it may be possible to extend the model to investigating outcomes associated with non-movers, the model is limited in terms of its ability to explain decisions or consequences associated with non-movement. Further, although the framework is applied to children, it makes the assumption that children move together with their mothers which may not reflect every reality. Brockerhoff's model is more suited to longitudinal study designs as opposed to cross-sectional designs because of the need to consider the migration process over time. This may restrict the empirical application of the framework, as the required level of data is often difficult to assimilate.

5.3.3 Conceptual framework of child mobility suggested from the thesis

On the basis of the thesis findings and the two models discussed above, an adapted conceptual framework has been suggested and presented in Figure 5.3. In the case of analysing children's movements, the thesis demonstrates the significance of including of a set of child level individual characteristics into a framework explaining mobility, which allows for children's movements to be differentiated from those of adults and is adaptable to children's independent participation in mobility processes and decisions. Therefore the suggested framework extends the range of individual (caregiver), household and community factors proposed in De Jong's model to include a set of child individual characteristics.

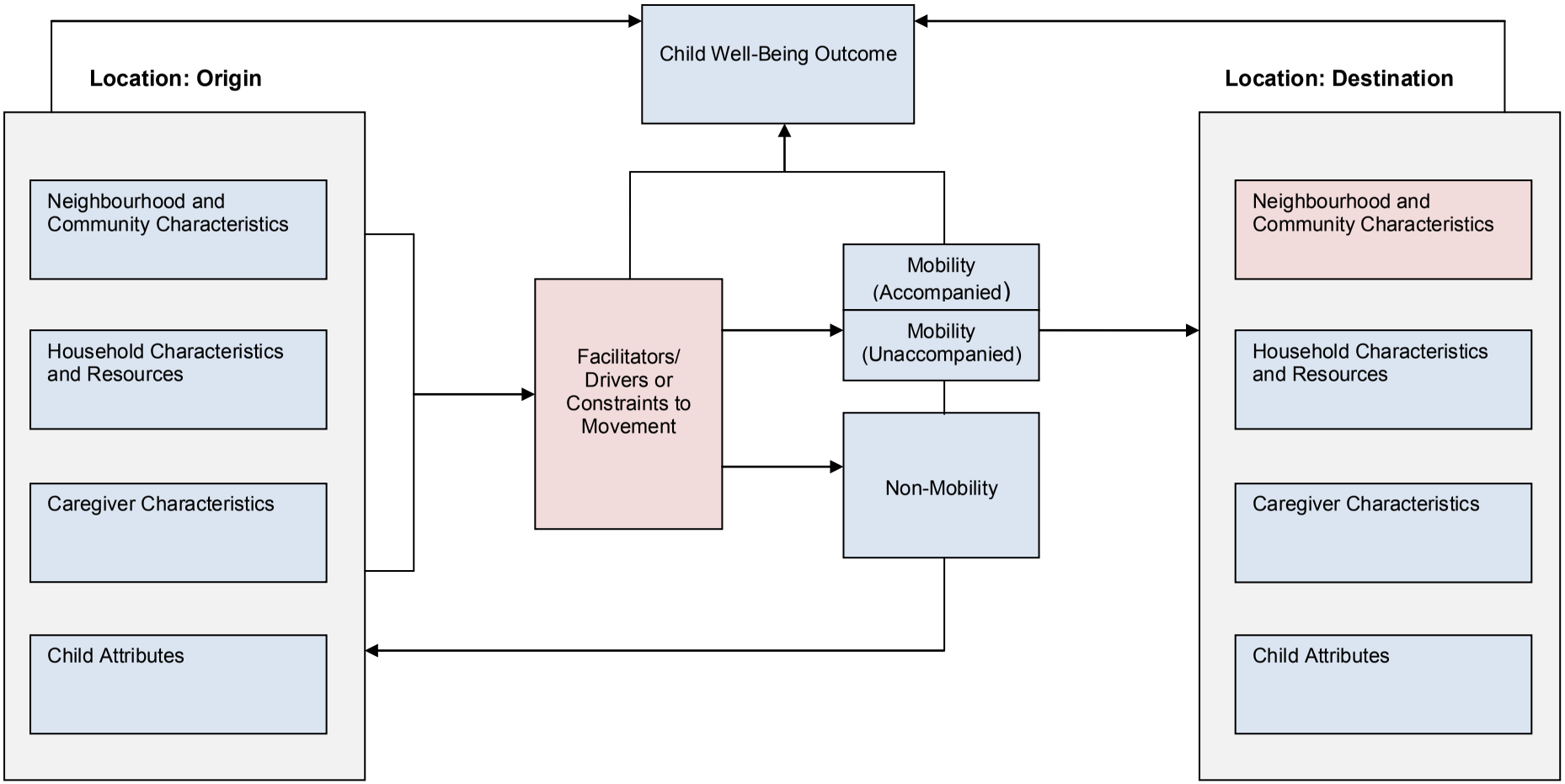

Figure 5.3 Conceptual framework of residential mobility amongst children

Dimensions or relationships not explored in this study

Dimensions or relationships explored in this study

Association

Connected to these factors are a set of facilitators/drivers or constraints to movement, which will affect a decision to move or a decision not to move. Mobility will result in changes in the set of pre-move characteristics to reflect the new set of circumstances describing the destination location. Conversely, in the case of a 'stay' decision, characteristics pertaining to the origin location would remain unchanged. Certain of the characteristics would be invariant or unrelated to the exposure, mobility, and would therefore remain the same in both instances.

The framework incorporates a child well-being outcome which would be influenced by circumstances pre- and post-movement, as well as the mobility decision itself. All factors in the framework therefore have the potential to either directly or indirectly impact on this outcome. The framework differentiates between mobility in which the child is accompanied and mobility which the child undertakes alone to account for the fact that these circumstances will likely result in very different outcomes for the child involved. Further, the framework is applicable to movements involving children over a range of distances, where changes in the characteristics of origin and destination environments are captured at the community level.

To illustrate this framework, two case studies based on BT20 cohort members will be presented[7].

Case study 1: Zandi

Zandi lives in Orlando West, Soweto in a rented backyard room with her unmarried mother who is her primary caregiver. Zandi's mother is unemployed but manages to find a job in Johannesburg's inner city, where she is able to rent a room nearby. In order to avoid transport costs, Zandi, who is attending a primary school in Soweto, moves to stay with her grandmother who owns a house in Meadowlands, Soweto. Zandi's grandmother shares the house with her brother, her daughter and her daughter's two children. One of the cousins that Zandi is now living with is two grades above her in school and is able to assist her with mathematics, a subject that she is having some difficulties with.

Case study 2: Simon

Simon lives in Zola, a suburb of Soweto, with his parents, grandparents, an aunt, a cousin and two sisters in a house owed by his paternal grandparents. Simon's father is working but his mother is unemployed. Simon's parents and siblings want to move to their own house as they would like more space and privacy and they are experiencing family conflict in their existing accommodation. They also unhappy in the area they are living in as it is far from transportation and shops. However, at this time they are unable to find an affordable accommodation alternative and are therefore unable to move.

In the first case, a particular set of characteristics describing Zandi's living conditions and circumstances in Orlando West are presented, some of which will change in her new home environment. Zandi's mother's offer of employment is a driver of a mobility decision which results in Zandi moving to Meadowlands. Zandi is now living in a household which is more crowded and she needs to adjust to a new neighbourhood and the absence of her mother. However, the effect of the move might be advantageous in relation to Zandi's education. In Simon's case the family are living in sub-optimal conditions, however, financial constraints mean that they are unable to alter their living situation. In addition to household and individual level factors identified, their mobility decision may be influenced by structural constraints such as the current housing and employment markets. Simon's living circumstances therefore remain unchanged and the disruptive home environment may adversely affect his school performance.

[7] These case studies are hypothetical but the movement histories are based on some of the more typical examples of reasons and circumstances for movement reported by primary caregiver's in the BT20 study.

5.4 Contextual Relevance

The relevance of the thesis findings will be discussed, first in relation to the South African context and then to other settings.

5.4.1 South Africa

The thesis makes an important contribution to understanding some of the dynamics and challenges facing children and families in contemporary urban South Africa. The research reveals important patterns of association with movement and suggests the ways in which mobility may present as an indicator of opportunities or challenges that children, caregivers and households may encounter. Given that movement may be employed as a strategy to either improve living circumstances, or to cope with adversities, the importance of monitoring mobility is clear.

The research reveals that even 15 years after the end of Apartheid and considerable investment into urban infrastructure and development, many communities remain in transition and face significant barriers and constraints which may relate both to mobility or immobility. The relationship between migration and poverty has been demonstrated in South Africa (see Cross, et al., 2005). So too have the growing demands on cities in response to internal mobility dynamics been emphasised (Todes, et al., 2010). Monitoring population mobility is therefore a key factor in informing initiatives around poverty alleviation and urban development. The circumstances that underpin mobility trends are particularly significant in relation to children whose socioeconomic rights include amongst others, shelter and housing, social services and education (Constitution of the Republic of South Africa, 1996).

In light of these issues, the question of what policy responses can develop from these findings may be raised. Due to the scope of the research, policy implications would be modest, however, the thesis does provide some insight into previously unexplored avenues which may warrant the attention of policy-makers.

5.4.1.1 Tracking mobile children

One issue that emerges from this research concerns the tracking of mobile children as they move between different places of residence and schools, as this mobility may impact on initiatives targeting child welfare. For instance, the child support grant, aimed at assisting vulnerable children, is intended to 'follow the child' by awarding the grant to the child's primary caregiver rather than the biological parent. However, administrative difficulties have been reported with the implementation of this system where, particularly in the case of changes in primary caregiver, the necessary documentary evidence required to show eligibility may not be readily accessible (Delany, et al., 2008). Frequent child mobility and changes in care are therefore likely to pose challenges of access for children eligible for this grant, and systems would therefore need to be aware of and provide for these different circumstances. Similarly frequent school mobility as was observed within the BT20 study population has implications concerning continuity of education provision and record keeping. Children who change schools frequently may not be monitored appropriately and their education may suffer as a result of disruption. Related to this issue are questions surrounding policy concerning school choice. The current legislation has been interpreted as 'enabling' conditions of choice, which may be exclusionary for more disadvantaged learners (Woolman and Fleisch, 2006). Policy concerning school choice would best be formulated on the basis of evidence regarding the impact of frequent school change on children's educational outcomes.

5.4.1.2 Access to housing

The thesis findings suggest the need for housing and residential options that are financially viable, appropriate and accessible to low-income families who may be living in inadequate conditions. In this regard, limitations of the current policy framework concerning housing have been identified. Project-linked subsidy housing developments have been criticised for failing to take account of the realities of household sizes, and the diversity and fluidity of household composition (Hall, et al., 2006; Spiegel, et al., 1996b). Child mobility has even been observed as a consequence of the criteria that applicants have financial dependents in order to be eligible for a housing subsidy (Hall, et al., 2006). Housing developments are frequently constructed on the periphery of urban areas which creates problems of access to places of employment, schools or facilities that are more centrally located. This is particularly challenging given the inadequacy of current systems of transportation and the costs involved in employing these services.

5.4.1.3 Urban planning

At the level of urban planning, the research provides some insight into aspects of spatial change, revealing that within this study population, change appears to be limited. Nevertheless, the extent to which areas are becoming more desegregated and communities more differentiated is one which can be answered in part through the exploration of intra-urban mobility patterns. Further research that will assist in developing appropriate evidence-based policy around urban planning issues would therefore be of value, particularly in light of the Johannesburg 2030 strategic plan to upgrade and restructure the city through directed government intervention (see City of Johannesburg, 2002).

5.4.1.4 Community interventions

Information regarding the possible impact of movement on children could significantly assist caregivers and schools to better manage or reduce disruptions or adverse effects that children may experience following school or residential mobility. Similarly, awareness of the possible positive consequences of movement may also feed into decision-making processes surrounding residential and school change. Enhancing such knowledge could be achieved through community awareness programmes or interventions targeted at parents and educators.

5.4.2 Low- and middle-income countries, and others

Although the thesis' specific empirical findings may not have relevance beyond the South African setting, the observations concerning the conceptualisation and analysis of child mobility may transcend the local South African context. Independent child movement is a phenomenon that has been observed in a number of LMICs across the globe and the need for appropriate conceptualisation, methodology and statistics in these various settings have been highlighted. This thesis makes a contribution to these areas and to the body of knowledge concerning children's mobilities more broadly. Specifically, the thesis proposes an analytical approach concerning study attrition that may be applicable to cohort or panel studies in other contexts. In addition, given the diversity of family structures and children's living circumstances that may exist within different environments, the research illustrates that there is some value in considering child level factors in movement decisions and processes.

While international migration trends and to a lesser extent, patterns of internal migration have been investigated in transitional societies, there is a paucity of research concerning urban children's movements and associated outcomes. The

findings of the research, which were in some instances unexpected, illustrate the value of exploring these trends in other areas and motivate for the inclusion of urban-based child mobility into this larger research agenda.

5.5 Limitations and Future Research

The thesis presented numerous challenges in endeavouring to tackle a set of research questions which, as demonstrated in the review of the literature, span a wide range of theoretical, methodological and analytical approaches. In attempting to answer these questions, much consideration was given to the most suitable use of available data as well as the limitations of such data and how these may impact on the research findings. In this regard, future directions following from this work were illuminated and a set of further research objectives identified. Certain of these aspects have been elaborated in the empirical chapters. This section will highlight the most significant of these in relation to the thesis as a whole.

5.5.1 Study attrition and sample

The methodological review presented in Section 1.5 expounded some of the limitations of mobility data, including those related to the cohort or panel study. The value of conducting a study using longitudinal data has been demonstrated, however, cohort studies suffer from the problem of attrition which is confounded in an investigation of movement where attrition and mobility are so closely connected. This may result in systematic bias which would affect generalisability of the research findings beyond the selected study sample. The empirical studies presented in this thesis have attempted to overcome some of these limitations by providing detailed sample comparisons and including into analyses all documented moves involving attrition cases. Further, the thesis proposes a strategy for analysing cases of non-monotone attrition as children who drop out of and then return to the cohort may be involved in circular mobility and capturing their

movements is therefore significant. However, despite these efforts, there is likely to be an under-reporting of movements in these analyses and it is probable that, by virtue of their different movement profiles, children who dropped out of the study display a different set of characteristics to those who continued participation. The BT20 study has focused considerable efforts on tracing members of the attrition group but the realities of a transitional country setting and the circumstances surrounding particularly the more vulnerable children in the cohort has meant that tracing may present a significant challenge. An investigation into the circumstances and movements amongst this group of children would be of value, and a qualitative study could potentially be conceived to explore these issues if it were possible to access a small sample of attrition cases (perhaps among participants who had dropped out and then returned to the study).

A further question may be posed concerning the extent to which the thesis findings can be extrapolated to children in other parts of South Africa. The BT20 cohort represents a group of primarily Soweto-based children born and living in South Africa's largest urban metropolis. The city of Johannesburg has its own unique history and set of dynamics and it can be argued that Soweto is not necessarily typical of other South African townships. As such, the thesis findings represent a specific context and sub-population within South Africa. The ways in which the research findings may typify the mobility patterns and educational outcomes amongst children in other urban settings would therefore be speculative. However, the research highlights the importance of exploring these aspects within South Africa, and therefore motivates undertaking similar studies in different South African settings.

5.5.2 Reasons for movement

The thesis endeavoured to investigate broad reasons for movement by asking caregivers to respond to a single open-ended question. However, a number of limitations were identified with the use of these data in facilitating a meaningful understanding of reasons prompting child mobility. Reported reasons were often multifaceted and in some cases caregivers found it difficult to explain why a move had occurred. Social desirability or interviewer bias resulting in inaccurate reporting of reasons was a concern particularly given the personal nature of some drivers of movement. In addition, the broad categories of reasons employed in the analyses may not have been sufficiently nuanced to have captured the detail around mobility drivers. The investigation of reasons for movement at this level would require the use of more focused questionnaires and in-depth interviewing techniques to ascertain amongst other aspects, who the decision-maker was in relation to the child's movements, who accompanied the child in a move and how the child experienced the move. Children themselves would be the appropriate respondents to many of these questions, particularly since an alternative respondent may not recall or have knowledge of a child's full movement history. It would also be of interest to explore the circumstances surrounding some of the non-mobile children and their caregivers in terms of what their movement intentions might be and whether they had encountered any barriers to desired movements. In order to address these gaps, a qualitative study is currently underway and a pilot study completed where a sample of cohort members and their caregivers were interviewed to investigate children's movement histories, their reasons for movement and their experiences of movement in more detail. It is ultimately envisaged that reasons for movement could be integrated into analyses to extend the understanding of how drivers of movement relate to child outcomes.

5.5.3 Patterns of caregiving

The studies undertaken in this thesis adopted a child-centred approach to mobility and analysed children's movements, which may not have coincided with those of a connected adult. However, the understanding of children's movement patterns in relation to closest adults is highly significant particularly in the case of outcome-based research where children who are separated from a primary caregiver may face more severe disruption as compared with children moving together with one or as part of a family unit. Further, while this thesis is concerned with child movers, mobility may affect children in other respects, where for example, a caregiver moves leaving a child behind. Child mobility in South Africa is made highly complex by fluid caregiving arrangements which may result in short-term, circular movements associated with child care (where, for example, a child spends weekends with a grandparent but lives with a biological mother at other times). These forms of movement would best be conceptualised around systems or networks as opposed to the framework of origin and destination that has been outlined here. This investigation was beyond the scope of the thesis and would require more detailed household level data that capture more complex family living arrangements. Research into patterns of caregiving (and corresponding household composition) is currently underway within BT20. Such longitudinal data will allow for these important explanatory aspects to be introduced into outcome-oriented research within the cohort.

5.5.4 Area level factors

The importance of including area level measures into analyses has been discussed in relation to the conceptual frameworks and empirical studies of movement. Incorporating characteristics of residential locations into the empirical analyses undertaken in this thesis was therefore considered. These analyses included a limited area level variable, 'residential area at birth', which was

categorised in accordance with the Apartheid area classifications. These classifications were valid at the onset of the BT20 study but, with the dismantling of the Apartheid system, were found to be inappropriate in the classification of areas over time (following Apartheid, new municipal boundaries have been demarcated and certain areas that were separated on the basis of race have been combined into new municipalities). The population and socioeconomic profile of many areas has undergone and is still undergoing transformation, making it difficult to find a means of classifying areas based on address data over time. Further, because of the heterogeneity in socioeconomic status within any broad area categorisation, a comparison of origin and destination residence is likely to reveal little about whether the destination is a better or worse location than the origin[8]. Therefore although it is acknowledged that this level of data would be valuable, at present, the BT20 study does not have adequate measures describing area level characteristics. This would be an interesting and important avenue of further research.

5.5.5 Further research

In addition to the research priorities discussed above, the study of movement within the BT20 cohort is ongoing. A questionnaire following from the Year 15 RMQ has been administered to verify children's movements from ages 15 to 18 years. These time points will be appended to the existing longitudinal dataset which will enable the continuation of the research theme as the cohort exit the school system and become active participants in the urban economy. Work on impact studies within the cohort is a research priority and there is a need to explore a wider set of outcomes and associations with child well-being. The research undertaken in this thesis presents a point of departure from which further,

[8] Research has been conducted into the development of poverty indices, attached to the small area or 'sub-place' level within Gauteng using a range of socioeconomic data and GIS mapping techniques (Cross, et al., 2005).

more complex multilevel analyses can be based. These would consider the dynamic interplay of community, household and individual level factors on child outcomes.

On a wider scale, further research into dynamics associated with child mobility would be necessary to move the field forward. This work should focus on evolving definitions and frameworks for mobility that allow for greater standardisation and enable comparability across different study samples and locations. The need for longitudinal studies is apparent as mobility requires exploration over time, however, these studies present challenges which have been expanded upon in this thesis. Cohort study designs and DSS sites provide a sound infrastructure from which to research mobility and could potentially evolve methodologies and definitions to allow for a more central focus on children.

5.6 Conclusion

The heart of an investigation of child mobility is the question of how movement ultimately impacts on child well-being. The thesis commenced by characterising the patterns and processes of residential movement amongst a group of South African urban children, revealing dynamics surrounding child mobility and immobility within this setting. The thesis culminated in an exploration of movement in relation to education, a dimension of child well-being. The research provided evidence that within the BT20 study population resident in Greater Johannesburg-Soweto, mobility did not prejudice children in terms of the educational outcomes considered. This observation is important as it is suggestive of children's possible resilience and adaptability in the face of change. It further suggests the potential for mobility to influence children's lives positively. In striving to achieve a more equitable and protective society for children, indicators of social conditions such as children's living situations and residential mobility are highly significant.

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Appendices

Appendix 1

Residential Move Questionnaire
& Methodological Notes

BIRTH TO TWENTY REASERCH PROGRAMME
RESIDENTIAL MOVE CONTACT SHEET
YEAR 15 MOBILE QUESTIONNAIRE

Bt20 ID: _____ Bt20 NAME: _____

Birth to Twenty are conducting an exercise to verify the address information we have collected over the past 14 years of our study. We are also interested in obtaining additional information on any address changes involving the **Birth to Twenty youth** that we may not have on record. Please review the summary of addresses (below) and answer the following questionnaire regarding residential moves.

SUMMARY OF ADDRESSES FOR BIRTH TO TWENTY YOUTH

Address / Time Frame	Interviewee	Address - Street	Address – Suburb/Area/Zone
Address 1 (1989-1990)		*Populated with the participant's address data on file*	
Address 2 (1991)			
Address 3 (1992)			
Address 4 (1993-1994)			
Address 5 (1995-1996)			
Address 6 (1997-1998)			
Address 7 (1999-2000)			
Address 8 (2001-2002)			
Address 9 (2003)			
Address 10 (2004)			

KEY FOR REASONS

A	Work Related	Moved for reasons associated with employment and financial situations e.g. changed jobs, lost a job, retired, change in financial situation
B	Housing Related	Moved for reasons associated with accommodation e.g. lease expired, required bigger/smaller accommodation, relocation of informal settlement
C	Relationship Related	Moved for reasons associated with relationships and family circumstances e.g. marriage, separation, divorce, widowhood, death
D	Child Related	Moved for reason's associated with the Bt20 youth e.g. change of school, health reasons
E	Community Related	Moved for reasons associate with the community/neighbourhood e.g. security concerns, crime, social network
F	Other	Reasons that may not be categorised into any of the above categories

INTERVIEWER:

ADDRESS 1
(Antenatal: 1989 – 1990)

What is your name? _____

What is your relationship to the Bt20 youth? _____

Please have a look at **Address 1** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

Any notes on the address information above:

Additional Notes:

ADDRESS 2
(Year 1: 1991)

Please have a look at **Address 2** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 2 (above) is different from Address 1, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 1*** and ***Address 2***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 3
(Year 2: 1992)

Please have a look at **Address 3** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 3 (above) is different from Address 2, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 2*** and ***Address 3***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 4
(Year 3/4: 1993-1994)

Please have a look at **Address 4** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 4 (above) is different from Address 3, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 3*** and ***Address 4***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 5
(Year 5/6: 1995-1996)

Please have a look at **Address 5** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 5 (above) is different from Address 4, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 4*** and ***Address 5***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 6
(Year 7/8: 1997-1998)

Please have a look at **Address 6** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 6 (above) is different from Address 5, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 5*** and ***Address 6***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 7
(Year 9/10: 1999-2000)

Please have a look at **Address 7** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street: Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 7 (above) is different from Address 6, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 6*** and ***Address 7***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 8
(Year 11/12: 2001-2002)

Please have a look at **Address 8** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street:		YES	NO
Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 8 (above) is different from Address 7, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 7*** and ***Address 8***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 9
(Year 13: 2003)

Please have a look at **Address 9** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street:		YES	NO
Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 9 (above) is different from Address 8, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 8*** and ***Address 9***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

ADDRESS 10
(Year 14: 2004)

Please have a look at **Address 10** and answer the following questions:

If you are the ***interviewee*** ☐ who filled in the address information, the ***biological mother*** ☐ or ***caregiver*** ☐, or if you were a ***member of the household*** ☐ at that time, or have ***knowledge*** of the address information ☐ , please verify the following details?

Caregiver Relationship:			
Street:		YES	NO
Suburb/Zone:		YES	NO

If any of the above details are wrong or incomplete, could you provide us with the correct information?

Street Name:	
Suburb:	
Area / Zone:	
Province:	

If Address 10 (above) is different from Address 9, what was the reason for moving?

A: Work Related		**D:** Child Related	
B: Housing Related		**E:** Community Related	
C: Relationship Related		**F:** Other	
Please provide reason:			

Did the Bt20 child move to any addresses not shown here, between ***Address 9*** and ***Address 10***? (Refer to the summary sheet) If so, please provide details: **YES** **NO**

1. Street name:							2. Street name:						
Suburb & Area/Zone:							Suburb & Area/Zone:						
Province:							Province:						
Reason:	**A**	**B**	**C**	**D**	**E**	**F**	Reason:	**A**	**B**	**C**	**D**	**E**	**F**
Approximate date:							Approximate date:						
Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?							Did the Caregiver mentioned above move with the Bt20 child? If not, who was the new Caregiver?						

Design, Implementation and Data Preparation

Residential Move Questionnaire (RMQ)

- Over the course of the BT20 study, address data has been collected for the purpose of maintaining a contact database of cohort members. The RMQ incorporated this available historical address information, which was used as a base from which to capture any missing or incomplete information on residential moves involving the BT20 cohort member over their first 14 years of life.
- The RMQ was administered in the form of a structured interview to all members of the 'in-contact' BT20 sample during the Year 15 and beginning of Year 16 data collection waves. This amounted to 2158 participants.
- The questionnaire protocol involved verifying the historical address information on file, completing information where address components were missing (for example, a house number or street name which had not been documented) and determining any additional moves that took place involving the BT20 participant over the period which may not have been previously recorded. The secondary purpose of the questionnaire was to ascertain, with respect to each move, the central or key reasons why the move had taken place.
- A decision had to be made concerning who to interview to obtain the relevant address information and movement history of the BT20 participant. The rationale employed was that any family or household member who had knowledge of address information would be in a position to complete the questionnaire. However, first preference was given to completion by a biological mother, father or alternate primary caregiver. In the majority of cases (82%), a biological mother or primary caregiver was interviewed. Where a respondent did not have knowledge of previous address information or reasons for movement, these components were coded as missing.

- The RMQ was structured around a set of discrete time points which corresponded to BT20's data collection waves. This aided the address verification process (which was based on historical data) and allowed for temporal correspondence between address data and other supporting data employed in analyses. The use of discrete time points further necessitated that the addresses recorded on the RMQ referred to the places that the BT20 cohort member had stayed for the majority of the time interval under consideration. Where additional moves had taken place within a discrete time interval (for example, where a child had spent a shorter period of time at an alternative residence), these were recorded in the RMQ as 'additional moves'.
- The additional move section of the questionnaire referred to moves of a shorter duration occurring within the discrete time frame specified (where the 'main' residential address recorded for the period was the one where the child had lived for the majority of the time frame).
- Reasons for moves were investigated very broadly. Respondents were asked to describe the main factors that prompted a move and these were recorded verbatim and coded at a later stage. The questionnaire contained prompts around the broad categories of reasons that may have applied.
- The RMQ was piloted amongst members of staff at BT20 and volunteer participants at various instances during questionnaire development. The final version of the RMQ was the result of an iterative process of testing and amending the questionnaire to arrive at a format that appeared to be optimal in terms of ease of use and presentation, as well as content.
- Training on the RMQ was a continuous exercise that took place at regular intervals throughout the data collection process. Research assistants were initially accompanied to the field by the PhD student in order to receive training and assistance with any problems encountered with the interviews. Subsequently,

group and individual feedback sessions were held periodically to address any problems encountered in the field relating to the questionnaires.

- In order to ensure the quality of collected data, all questionnaires were checked on completion by the PhD student. A verification exercise was also run on a random sample of completed questionnaires, where the information contained in the questionnaire was checked with the respondent to ensure consistency.
- Data preparation activities involved developing a coding scheme in order to consolidate relevant aspects around residential movements. Each RMQ was coded by a single coder (the PhD student) prior to data capture. Codes were assigned by comparing addresses at each discrete time point; moves were coded in accordance with whether they had involved a change in dwelling, a change in street, a change in suburb, a change in town or city, a change in province or a change in country. Residential mobility codes were assigned using the most recent municipal district and area delineations (detailed maps were consulted). Reasons for moving are not mutually exclusive and the coding system had to allow for multiple reasons. For the sake of simplicity, and because a large amount of detail surrounding reasons for moves had not been acquired, a maximum of two reason codes were assigned to each move.
- A database was designed and developed in Microsoft Access for the storage of the longitudinal movement data. In order to minimise capture error, a series of validation rules were built into the database whereby invalid codes could not be entered and required fields could not be left unpopulated.
- Two data capturers were assigned to capture the questionnaires. The database was then cleaned and the data verified according to the following procedure: 1) the database was checked for specific capture problems such as missing codes or a lack of correspondence between a migration and reason code etc., 2) all attrition cases were checked and confirmed, 3) a 10% random sample of questionnaires

was selected from the full list of BT20 participants, excluding attrition cases, 4) these 203 cases were checked for accuracy in the data capture process.

- Data from the RMQ was merged with selected historical data and a series of analytical datasets created.

Appendix 2

Ethics Clearance Certificates

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Ginsburg

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER MO60611**
PROJECT	Residential Mobility in Greater Johannesburg Patterns, Outcomes and Experiences of Children in the Birth to 20 Cohort
INVESTIGATORS	Ms C Ginsburg
DEPARTMENT	Birth to Twenty Programme/Paediatrics
DATE CONSIDERED	06.06.30
DECISION OF THE COMMITTEE*	APPROVED UNCONDITIONALLY

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 06.07.23 **CHAIRPERSON** .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof D Coplan

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS (MEDICAL)
Ref: R14/49 Richter

CLEARANCE CERTIFICATE **PROTOCOL NUMBER** M01-05-56

PROJECT Birth To Twenty: A Longitudinal Population-Based Study of Reproductive And Psychosocial Maturation In Urban South African Youth Aged 10 To 20 Years

INVESTIGATORS Prof LM Richter

DEPARTMENT School of Clinical Medicine, CH Baragwanath Hospital

DATE CONSIDERED 01-05-25

DECISION OF THE COMMITTEE *

Approved unconditionally

DATE 01-07-09 **CHAIRMAN** .....(Professor P E Cleaton-Jones)

* Guidelines for written "informed consent" attached where applicable.

c c Supervisor:

Dept of ,

Works2\lain0015\HumEth97.wdb\M 01-05-56

==========

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10001, 10th Floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 3

Approval of PhD Title Change

Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011)717-2075/6

Reference: Ms Tania van Leeve
E-mail: tania.vanleeve@.wits.ac.za
21 April 2010

Dear Miss Ginsburg

Doctor of Philosophy: Change of title of research

I am pleased to inform you that the following change of title of your research report for the degree of **Doctor of Philosophy** has been approved:

FROM: Residential mobility in greater Johannesburg: Patterns, outcomes and experiences of children in the birth to twenty cohort

TO: Residential mobility in Greater Johannesburg: Patterns, associations and educational outcomes amongst children in the Birth to Twenty cohort.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Original Papers

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Patterns of Residential Mobility Amongst Children in Greater Johannesburg–Soweto, South Africa: Observations from the Birth to Twenty Cohort

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Abstract Frequent residential movement challenges children to adapt to change, amongst others, houses and neighbourhoods, friends and schools, and this may have either or both negative and positive influences on their health and well-being. However, there is currently little knowledge of the patterns of child residential mobility within South Africa's urban environment. This paper uses address data of children in the Birth to Twenty cohort to analyse the frequencies and patterns of residential mobility observed over the first 14 years of these children's lives. Of the 3,273 children enrolled into the cohort in 1990, two thirds of the children (64%) have moved home at least once. Nonetheless, a third of the children never moved,

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indicating some stability among the urban child population. Residential moves by children were found to be associated with both the lowest resourced and the highest resourced households.

Keywords Residential mobility · Migration · Urban children · South Africa

Introduction

Movement patterns in South Africa have assumed a unique form as a result of the country's political and social history (Wentzel and Tlabela 2006). Forced and controlled migration took root in Southern Africa with the British colonial system encouraging circular migration and discouraging permanent urban settlement amongst native populations recruited from rural surrounds as members of an urban work force (Crush 2000; Hargrove 2007). With the onset of the *Apartheid* system in South Africa, a series of legislative initiatives were introduced, which sought to further control the movement and settlement of specifically Black South Africans. The system of movement (influx) control and the introduction of the Group Areas Act, were amongst the segregationalist policies concerned with restricting Black urbanisation and regulating the accommodation of Black workers in urban areas, while simultaneously ensuring that labour demands in urban areas could be met (Giliomee and Schlemmer 1985; Posel 1991). A prominent characteristic of this simultaneous labour market and residential control was oscillatory migration, primarily of men, between urban locations of employment and rural homesteads where women and children remained (Wilson 1972). As a result, residential arrangements fluctuated with fluid household structures of varying sizes and compositions (Murray 1981). The end of *Apartheid* and the years following South Africa's transition to democracy have seen a marked relative rise in rates of urbanisation amongst Black people (Kok and Collinson 2006; Statistics South Africa 2007).

Despite the absence of legal barriers to movement, there is evidence that the oscillatory labour migration trends have not significantly altered, nor have they been replaced by increases in permanent urban settlement that might have been anticipated (Posel 2006). Furthermore, rises in female labour migration have been observed as increasing numbers of women enter the labour market in an environment of changing work conditions and social roles (Posel and Casale 2003; Collinson et al. 2006a).

In the context of a highly mobile adult population, corresponding patterns of movement amongst children have been investigated only minimally. Current South African research has shown that patterns of movement involving children can take place within urban or rural environments, or between rural and urban areas, and that they can be either permanent or temporary (Collinson et al. 2006a). Children have been reported to move either together with one or more primary caregivers or independent of them (Van der Waal 1996). Movement may be prompted primarily by the connected adult/s (who may move to access an employment opportunity, or in response to relationship formation/dissolution). Movement may also be motivated by children's specific needs or circumstances such as movement to gain access to education, or movement in response to the death of a caregiver (Van der Waal 1996;

Ford and Hosegood 2005; Collinson et al. 2006a). Motives for moves are, however, unlikely to be clear cut, and may result from decision-making with consideration of both adult and child factors. In addition, child care arrangements may be fluid with children shifting between homes in order to maximise access to care and resources, or to provide support to extended kin through the mechanism of child fosterage (Jones 1993; Van der Waal 1996). Nevertheless, there is a dearth of research on children's movement patterns in South Africa and in other low- and middle-income countries.

The lack of information about child migration stems from the fact that most data concerning population movements in South Africa have been collected as part of cross-sectional national population censuses, which are primarily concerned with investigating economically active adults and inter-provincial movements (Hosegood and Ford 2003). These surveys pose problems in the investigation of child movements for the following reasons: they are centred on the household rather than the individual as the unit of analysis, there are complexities associated with measuring and defining mobility of children in terms of their connection to related adults or households, and there are difficulties associated with gaining access to mobile children for the purpose of data collection. Studies using demographic surveillance systems such as those based at Agincourt and Mtubatuba have investigated the movements of children as members of households in rural South Africa. However, there is no published research directly exploring residential mobility amongst children born and residing in urban areas of South Africa.

The urban environment is often thought to promise higher standards of living though easier access to health care, social services, employment and educational facilities. However, urban systems frequently reinforce patterns of inequality and poverty, thus increasing the vulnerability of the poor (South African Cities Network 2006). Recent migrants to urban areas have been found to be particularly disadvantaged by negative aspects of urban living such as over-crowding, inadequate housing and amenities, material deprivation and crime (Brockerhoff 1995; Richter et al. 2006). In such circumstances, children are particularly vulnerable to a range of negative health and social consequences (Barbarin and Richter 2001). Research conducted in developing countries has linked high levels of mobility amongst children to a range of negative health and social consequences such as increased child mortality, susceptibility to disease, exposure to violence and increased psychological distress (Magwaza 1994; Brockerhoff 1995; Barbarin and Richter 2001; Garenne 2003). However, mobility may also be associated with improved standards of living and health (Collinson et al. 2006b). The relationship between urbanisation and mobility and their associations with child health and well-being is complex and has been shown to be influenced by the form the migration takes, as well as a range of confounders including residential arrangements, family and household structures and socioeconomic status (Collinson et al. 2006b; Tucker et al. 1998; Garenne 2003). There has been limited research in the developing country context to understand the associations between mobility, household structures and child well-being.

South Africa's largest urban population is based within the Greater Johannesburg/ Soweto area (in the Gauteng Province), which is also the largest receiver of net in-

migrants from other provinces in the country—across all population groups (Kok et al. 2003; Statistics South Africa 2006). The attractiveness of Gauteng as a migration destination stems largely from the fact that the province is the economic hub of South Africa with the highest reported employment growth rates (South African Cities Network 2006). Within the Gauteng Province, relatively high levels of adult residential movement and circular migration have been observed, often in response to opportunities for employment, education, transportation and housing (Rule 2000; Richter et al. 2004). The Greater Johannesburg/Soweto area provides an appropriate context in which to explore patterns of residential mobility amongst a group of urban South African children who form part of the Birth to Twenty cohort.

This paper presents results from a 14-year longitudinal study of child residential movement in the Greater Johannesburg area, using data collected through the Birth to Twenty Research Programme (BT20). BT20 is a longitudinal birth cohort study, and, as such, is in a unique position to address research questions concerning changing social dynamics over time. The paper describes the movement patterns and frequencies of child residential mobility as well as elicited reasons prompting residential change. Key demographic factors associated with differing levels of residential movement are also considered.

Methods

Study Sample and Protocol

The BT20 cohort was defined to include all children born within a 7-week period between April and June 1990 at public delivery centres in the Greater Johannesburg Metropolitan Area, including Soweto and Diepmeadow. The cohort was further refined to include only those women and children who were identified as having a residential address in Johannesburg–Soweto both at the time of delivery, and in the 6 months following the birth of the child, to exclude non-residential women who came into Johannesburg/Soweto only to deliver their baby. Upon inception of the study, the longitudinal sample comprised a residential cohort of 3,273 children. The research aims and goals of the BT20 project, and characteristics of the sample, are described elsewhere (see Richter et al. 2004, 2007).

At recruitment, the BT20 cohort was demographically representative of the area. The largest proportion of children in the cohort was Black (78.5%), born at a public hospital (86.5%) and resident in the Soweto/Diepmeadow area at birth (74.2%). White, Coloured and Asian children made up 6.3%, 11.7% and 3.5% of the cohort, respectively. Biological mothers were primarily aged between 19 and 34 years (79.3%) at the time of the birth of their BT20 child, at which time 56.1% were single and 50.8% had commenced primary but not completed secondary school.

The study of residential movement described in this paper comprised four phases. In the first phase, historical address data were collated and summarised to generate a profile of address information for each participant. In the second phase the historical address data were used as a base for designing and developing a survey instrument to probe children's residential movements. In the third phase, the questionnaire was administered to as many of the contactable cohort members as possible, yielding a

sample of 2,158 complete questionnaires (66% of the original cohort of 3,273). The final phase of the study involved preparing and analysing all available address data relating to both the movement survey respondents and the identified non-contactable cohort members, or attrition cases (amounting to 1,115 members of the original residential cohort). This was an attempt to deal with the methodological limitation of excluding untraceable participants when analysing mobility.

Construction of Historical Address Profiles for Years 1989–2004

Over the 15 years of the BT20 study, address data were collected and maintained in a database for the purpose of corresponding with and locating participants and managing and monitoring study attrition (Anderson and Richter 1994; Norris et al. 2007). At the onset of the BT20 study, data collection was conducted in health centres and by field staff who visited participants' homes and documented addresses. In the later years of the study, addresses were updated when participants visited one of the BT20 data collection sites at the Johannesburg General or Chris Hani Baragwanath Hospitals, or when follow-up and data collection was conducted during a home visit. For the current analysis, address data were available at each of the ten data collection time points that spanned the years 1989 to 2004, commencing when the BT20 child was born, and continuing when the child was aged 1, 2, 3/4, 5/6, 7/8, 9/10, 11/12, 13 and 14 years. These historical address records were consolidated to obtain a longitudinal database describing the movement history for each participant.

Construction of the Survey Instrument

The longitudinal database had several limitations for utilising the data to specifically describe children's movements. For example, contact details on record often reflected the place of residence of the BT20 child's biological mother or primary caregiver, which was found not always to correspond to the BT20 child's place of residence. Therefore, a Residential Move Questionnaire was developed with the aim of addressing these limitations and obtaining further information about children's movements. The questionnaire was designed to incorporate all longitudinal data which could be verified by respondents as reflecting the place of residence of the BT20 child. The questionnaire also allowed for the completion of any missing address components or undocumented moves involving the BT20 child. Finally, the questionnaire included the central reasons prompting movement which were recorded verbatim through an open-ended question to which respondents were free to explain in their own words why the move had taken place. The questionnaire was structured around the set of ten discrete time points that corresponded to BT20's historical data collection waves between 1989 and 2004.

Implementation of the Study Protocol

Data collection on the Residential Move Questionnaire took place at participant's homes and at the BT20 offices during BT20's years 15 and 16 data collection waves. Questionnaires were administered in the form of a structured interview. Preference was

given to conducting the interviews with children's primary caregivers as they were deemed to have the most knowledge of a child's residential movements over time. Questionnaires were administered by members of a team of trained field staff and an ongoing system of training and quality checking of questionnaires was implemented. The majority of questionnaire respondents were biological mothers or primary caregivers (82%), with the balance of questionnaires completed by a family or household member who verified that they had knowledge of the BT20 child's residential movements.

Data Analysis

Due to the strong association between sample attrition and child and family movement, the known residential movements relating to the 1,115 cases of documented cumulative attrition were compiled and included in the current study. Survey data was therefore merged with the residential movement data available from the attrition sample in order to describe the overall movement patterns of children in the cohort. The analytical dataset was then reduced to the sample of 2,158 participants who had completed the Residential Move Questionnaire, where more detail about the classification of moves, reasons for movement and characteristics associated with differing movement profiles could be analysed. A socioeconomic index was derived for each participant on the basis of access to a set of ten services and household assets (house type, house ownership, indoor water, flush toilet, electricity, television, car, fridge, washing machine and telephone), which were summed and participants grouped into quartiles. Data analysis was conducted using SPSS; descriptive statistics were utilised to identify patterns and frequencies of mobility within the cohort, and chi-square tests were employed to establish significance of associations.

Results

Overall Movement Within the Cohort

Based on the pooled sample of 3,273 participants, an analysis of the frequency of children's summed residential movements over the period commencing at birth until the age of 14 years revealed a total of 1,169 (35.7%) children who had never experienced a residential move, with two thirds of children (64.3%) having moved home one or more times. Of the 2,104 children who had experienced a residential move, 60.1% had changed residence only once, 28.9% had moved twice and 10.9% had moved three or more times. The chart presented in Fig. 1 contrasts the frequency of moves for the children who comprised the cumulative attrition group—that is, who were lost to follow-up—and the children who remained in the study and completed the Residential Move Questionnaire. The difference between the movement profiles of the two groups was significant ($\chi^2_{(4)} = 230.149$, $p<0.001$, $n=3,273$) with children who were lost to follow-up having experienced a higher recorded frequency of residential movement (81.3% having moved one or more times, and an average of 13.3% of the group moving home at any one time point) as compared with the children who had remained in contact with the BT20 study

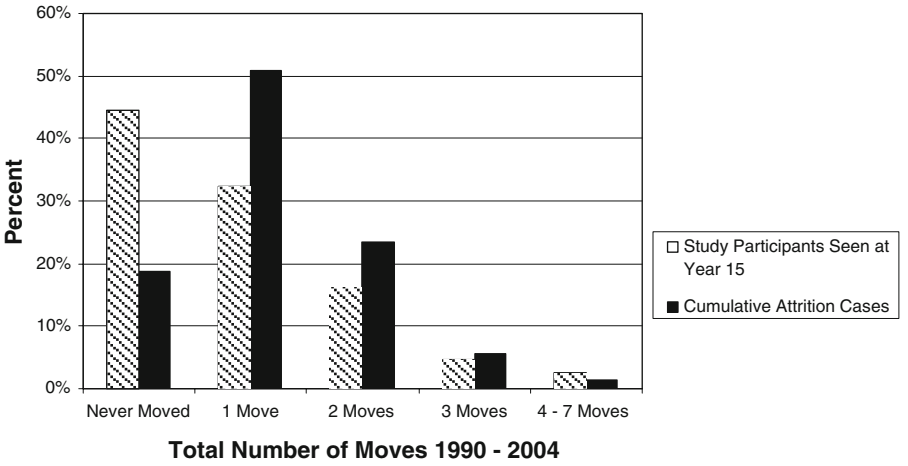

Fig. 1 Longitudinal summary of the frequency of residential movement from 1990–2004

(55.5% having moved one or more times, with an average of 9.9% of the group changing residence at any one time point).

Comparative analyses performed between the cumulative attrition sample and the sample of participants who completed the Residential Move Questionnaire revealed that, in contrast with the study participants seen at years 15 and 16, the cumulative attrition group comprised higher levels of White participants (12.6% as compared with 3.1% for year 15; $\chi^2_{(3)} = 121.597$, $p<0.001$, $n=3{,}273$), children born in private hospitals (16.2% as compared with 12.1%; $\chi^2_{(1)} = 11.010$, $p<0.01$, $n=3{,}272$) and residents in the inner city or suburbs at birth (5.1% as compared with 0.6%, and 20.3% as compared with 5.4% respectively; $\chi^2_{(3)} = 258.953$, $p<0.001$, $n=3{,}273$). Biological mothers whose children were lost to follow-up were more likely to have been married (52.1% as compared with 39.1%; $\chi^2_{(1)} = 50.573$, $p<0.001$, $n=3{,}251$), with either no formal education or a post-school education (3.1% as compared with 0.9%, and 14.0% as compared with 9.8%, respectively; $\chi^2_{(3)} = 36.991$, $p<0.001$, $n=2{,}932$). In addition, the cumulative attrition group comprised relatively higher proportions from the lowest resourced households (with access to three or fewer assets and services) and the highest resourced households (with access to between eight and ten assets and services; 38.0% as compared with 24.9%, and 24.1% as compared with 17.9%, respectively; $\chi^2_{(3)} = 65.709$, $p<0.001$, $n=2{,}054$).

The movement profile and sample characteristics of the two groups over time are displayed in Table 1. The number of attrition cases increased at each data collection wave, with 66 children lost to follow-up at the start of year 1 (2.0% of the cohort) and a total of 1,115 children lost to follow-up by the start of year 15 data collection (34.1% of the cohort). Movement levels in the cohort were highest when children were aged between 3 and 4 years (19.3% of children changed residence at this time), followed by relatively high levels of movement when children were aged between 11 and 12 years (14.9%). Furthermore, the cumulative attrition group accounted for the majority of total residential movement between the ages 2 to 4 years (56.6% and 64.9% of total moves over the two data collection waves were attributed to this group).

Table 1 Sample characteristics and movement profile by data collection wave

	Data collection wave								
	Year 1	Year 2	Year 3/4	Year 5/6	Year 7/8	Year 9/10	Year 11/12	Year 13	Year 14
Total cohort	3,273	3,273	3,273	3,273	3,273	3,273	3,273	3,273	3,273
Sample of participants who completed the Residential Move Questionnaire	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158	2,158
Sample of cumulative attrition cases lost to follow-up (% of cohort)	66 (2.0)	144 (4.4)	293 (8.9)	499 (15.3)	559 (17.1)	670 (20.5)	732 (22.4)	1,013 (30.9)	1,037 (31.7)
Total movement of full cohort (% of cohort)	329 (10.1)	410 (12.5)	630 (19.3)	341 (10.4)	397 (12.1)	289 (8.8)	487 (14.9)	185 (5.7)	199 (6.1)
Movement linked to cumulative attrition sample (% of total movement)	125 (38.0)	232 (56.6)	409 (64.9)	108 (31. 7)	136 (34.3)	44 (15.2)	212 (43.5)	15 (8.1)	56 (28.1)

Number of Residential Moves at Each Time Point by Move Category

The distribution of residential moves by category of move is presented in Fig. 2. The chart depicts, at each of the ten data collection time points, the proportion of total moves that occurred either within the Greater Johannesburg area or outside of it. Moves were accounted for in full. Therefore where a move occurred but knowledge of the destination of the move was uncertain, it was included into the analysis (as a

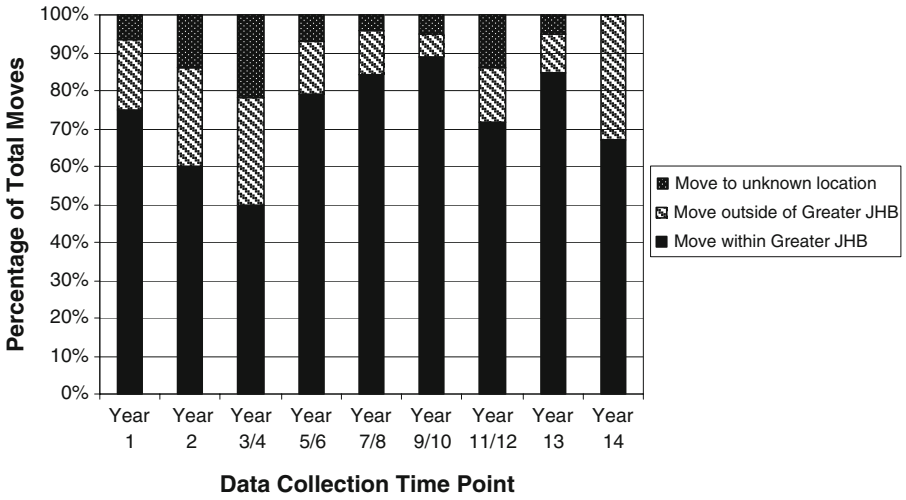

Fig. 2 Cross-sectional number of residential moves at each time point by move category

move to an unknown location). At each of the ten time points, the largest proportion of moves involved intra-urban mobility—movement that took place within the greater Johannesburg area. Moves outside of Greater Johannesburg occurred more frequently in early childhood (below the age of 5 years), or when children were in their 14th year (28.3% and 33.2%, respectively). Amongst the cumulative attrition group, 36.6% of total moves took place within Greater Johannesburg, 37.4% of moves were to destinations outside of Greater Johannesburg and 26.0% of moves were to an unknown destination. In contrast, 94.2% of movements within the group of current participants took place within the Greater Johannesburg area, with only 5.9% of movement within this group involving relocation outside of the study area.

Distribution of Moves Within Gauteng

The Residential Move Questionnaire allowed for a more detailed classification of the spatial dimension of children's residential movements within the Gauteng Province. Moves were grouped according to whether they involved a change in dwelling within the same street, a change in street within the same suburb, a change of suburb within the same town or city, or a change in town or city within the Province (codes were assigned by consulting maps and sources detailing towns, cities and regions of each of the six metropolitan/district municipalities within Gauteng). As illustrated in Fig. 3, the largest proportion of cumulative moves between 1990 and 2004 within the Gauteng Province occurred between suburbs within the same town or city (47.8%), with the lowest number of moves occurring over shortest distances such as moves within the same street (1.1%).

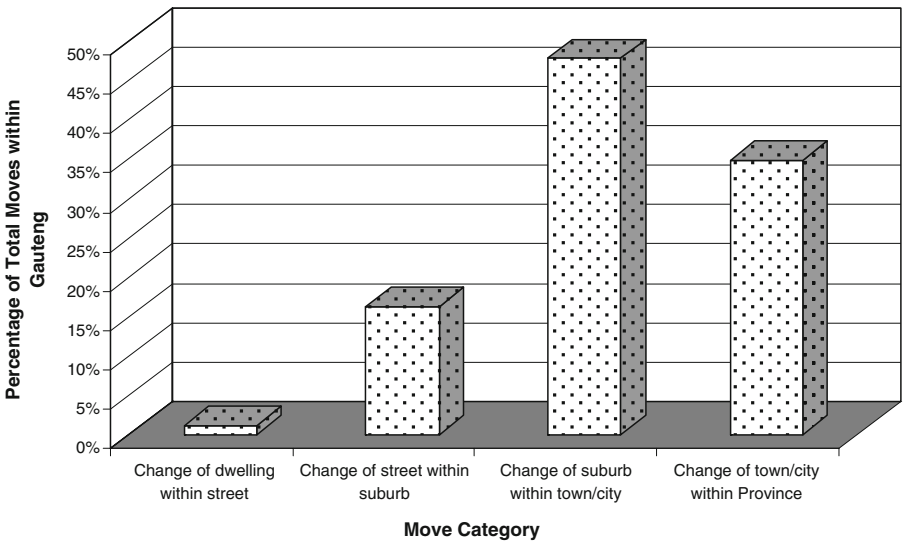

Fig. 3 Cumulative residential move categories for participants seen at year 15

Differences in Characteristics of Movers and Non-movers

In order to generate a profile of children who had experienced a move as compared with children who had not moved home by age 14, a set of demographic variables were tested for significance across the two groups, and the results are displayed in Table 2. Significant differences were found across all the demographic variables

Table 2 Characteristics of movers and non-movers

Characteristics by movement profile		Never moved total (%) n=960	Moved total (%) n=1198
Child gender	Male	484 (50.4)	569 (47.5)
	Female	476 (49.6)	629 (52.5)
$\chi^2_{(1)} = 1.820$, NS, n=2,158			
Population group	Black	776 (80.8)	970 (81.0)
	White	22 (2.3)	44 (3.7)
	Coloured	139 (14.5)	139 (11.6)
	Asian	23 (2.4)	45 (3.8)
$\chi^2_{(3)} = 9.878$, p<0.05, n=2,158			
Hospital of birth	Public hospital	862 (89.8)	1,035 (86.5)
	Private hospital	98 (10.2)	162 (13.5)
$\chi^2_{(1)} = 5.558$, p<0.05, n=2,157			
Residential area at birth	Soweto/Diepmeadow	774 (80.6)	944 (78.8)
	Former Indian/coloured areas	147 (15.3)	164 (13.7)
	Inner city	0 (0.0)	12 (1.0)
	Suburban JHB	39 (4.1)	78 (6.5)
$\chi^2_{(3)} = 16.706$, p<0.01, n=2,158			
Maternal age at delivery	<=18	131 (13.7)	123 (10.3)
	19–34	698 (72.8)	976 (81.5)
	35+	130 (13.6)	98 (8.2)
$\chi^2_{(2)} = 24.942$, p<0.001, n=2,156			
Maternal marital status	Married/living with partner	324 (34.0)	513 (43.1)
	Widowed/separated/divorced/single	628 (66.0)	677 (56.9)
$\chi^2_{(1)} = 18.299$, p<0.001, n=2,142			
Maternal education	No formal schooling	9 (1.0)	8 (0.7)
	Grade 10 or less	530 (61.1)	597 (54.1)
	Grade 11–12	259 (29.8)	375 (34.0)
	Post-school training	70 (8.1)	123 (11.2)
$\chi^2_{(3)} = 11.972$, p<0.01, n=1,971			
Socioeconomic Index	3 or less assets	136 (21.5)	225 (27.6)
	4–5 assets	225 (35.5)	253 (31.0)
	6–7 assets	168 (26.5)	182 (22.3)
	8–10 assets	105 (16.6)	155 (19.0)
$\chi^2_{(3)} = 11.325$, p<0.05, n=1,449			

analysed, with the exception of gender. In contrast with children who had not experienced a residential move, children more likely to have changed residence at least once over the period were either White or Asian (3.7% as compared with 2.3%, and 3.8% as compared with 2.4%, respectively), born at private hospitals (13.5% as compared with 10.2%) and residing in the inner city or suburbs at birth (1.0% as compared with 0.0%, and 6.5% as compared with 4.1%, respectively). A relatively larger proportion of children who experienced a residential move had biological mother's who were married or living with their partner (43.1% as compared with 34.0%) and had completed either Grade 11 to 12 schooling (secondary school) or had post-school education (34.0% as compared with 29.8%, and 11.2% as compared with 8.1%, respectively). As was the case with the attrition group reported on previously, movement was more frequently associated with participants who were lowest resourced and highest resourced in terms of their socioeconomic categorisations (27.6% as compared with 21.5%, and 19.0% as compared with 16.6%, respectively).

The analysis was extended to contrast children who moved once with children who experienced multiple moves (two or more). Significant differences were found between these two levels of movement and the variables 'maternal education' and 'maternal age at delivery'. A larger proportion of repeated movement amongst children occurred in cases where biological mothers were aged between 19 and 34 years at birth (84.8% of repeated movers fell within this category as compared with 79.2% of single movers). Repeated moves were more frequently associated with children whose biological mothers had Grade 11 to 12 schooling or post-school education (50.8% of repeated movers had mothers with these characteristics, as compared with 41.0% of single movers), while very low levels of repeated moves occurred amongst children whose mothers had no formal education (one out of the eight children in this category had moved more than once).

Exploration of Reasons for Moves

On the basis of the qualitative responses to the open-ended question concerning predominant reasons for movement, a set of five broad categories were identified that captured the range of responses into which reasons could be coded (see Kok and Collinson 2006; Wentzel et al. 2006). The following categories were identified: reasons concerning employment or finance, those relating to housing requirements, household or partnership formation or dissolution, community-related reasons and reasons around childcare. Reasons provided were not mutually exclusive and multiple codes were assigned to a given reason in cases where the reason spanned more than one of the above categories. Of the 1,930 residential moves undertaken by BT20 children over 14 years, a total of 2,900 reasons codes were generated from the qualitative data. The most common set of reasons for movement, as reported by respondents, were those associated with relationships and family circumstances. These reasons, which accounted for 38.6% of the total reasons, included (family) household or partnership formation/dissolution, or death of a family member. For example, one caregiver indicated, "I had to move to my husband's family house because I got married." Another caregiver explained that when her husband's grandmother died, she and her child went home to stay with her own mother.

Reasons associated with accommodation or housing were also frequent (36.1% of all reasons). These reasons included moves associated with rental accommodation or housing ownership, or moves relating to specific accommodation requirements or inadequacies. For example, one caregiver explained "We moved to a better place where it was a bigger room than the one in Senaoane." Moves associated with childcare arrangements comprised 14.9% of all reasons. These included movement associated with the death of the BT20 child's primary caregiver, or moves relating to schooling. A grandmother explained that when the BT20 child's mother passed away, the child moved house to live under her care. Another caregiver indicated that the family had moved because of, "Travelling and school for the children. We found a house in Lenasia and sold the Zakariya Park house. Children could get to school easily." Reasons associated with work or finance such as leaving or entering employment made up 6.3% of all reasons cited for a child moving. One caregiver indicated that they moved because they could no longer afford the rent in Randburg. Another explained that she found a job as a domestic worker and was offered an outside room with enough space to accommodate her and the BT20 child. Finally, community-related reasons such as movement because of security concerns in an area, or because of the desire to live in a particular neighbourhood comprised 4.1% of all reasons for residential change. One caregiver explained, "We were too restricted in that neighbourhood because of no safety, so we moved to a safer environment." Another moved because of violence in the hostel in which they were living.

Although the current study does not specifically investigate the movement of children in relation to a biological parent or primary caregiver, the exploration of reasons for movement suggest that the movement of children and primary caregivers do not always correspond to one another. A comparison of the historical address records reflecting primary caregivers' contact details with children's residential addresses recorded in the Residential Move Questionnaire revealed that an average of 7.5% of caregivers' contact addresses at each time point differed from the residential locations of the BT20 cohort members. The rate of correspondence between primary caregiver's and children's addresses tended to decrease as the children became older, with a 6.2% discrepancy in addresses at year 1 and an 11.8% discrepancy at year 14.

Discussion

This is the first study that we could identify that investigates child residential mobility in the Greater Johannesburg/Soweto area over time. The findings of the study describe the frequency of residential movements amongst children born in an urban South African context. The majority of children moved at least once during this period, but a third of children never changed residence in their first 14 years. The study also contrasted the movement patterns of cohort members lost to follow-up with cohort members who continued their participation in BT20. Overall, the largest proportion of moves occurring at each time point took place within the Greater Johannesburg area; however, a large proportion of movement that occurred inter-provincially was associated with study attrition. Residential mobility was found to be associated with high and low household socioeconomic status. That is, better and worse off children were the most mobile.

Patterns and Frequencies

By the age of 14, the majority of children in the BT20 cohort had either never moved residence or had moved home only once (74.4%). On average, 11.1% of children in the cohort changed residence at any single time point. By comparison, in a study of rural South African children, 21.2% of the sample were found to have moved within a 2-year period from 2000 to 2002 (Ford and Hosegood 2005). The lower rate of movement amongst the group of children born in Greater Johannesburg suggests stable patterns of residence, with people potentially becoming more permanently anchored to the urban environment. This is further emphasised by the fact that where movement did occur in the current study, the moves primarily took place across suburbs within Greater Johannesburg. This is again in contrast to the rural study where a larger proportion of moves were to destinations outside as opposed to within the study area (Ford and Hosegood 2005).

The study afforded a unique opportunity to investigate the movement patterns of the group of BT20 participants who have remained in the cohort and the group of BT20 participants who were lost to follow-up. This is of particular relevance given the strong correlation between residential movement and study attrition. A set of differing movement trajectories were evident for these two groups of children. For the cumulative attrition cases, the largest proportion of residential movements occurred when the children were aged 4 years or younger, with a substantial proportion of movements to locations outside of the study area. This finding mirrors similar results from the study conducted by Ford and Hosegood (2005), which showed that the youngest children had the highest probability of moving. This suggests that the commencement of schooling may be a stabilising force in children's lives. The relatively high levels of movement observed in the current study at 3–4 years and at 11–12 years seem to coincide with the commencement of school and the juncture of transfers from primary to secondary school.

In contrast to the group of children lost to follow-up, a large proportion of the children who remained in the BT20 study had never experienced a residential move by age 14. The average residential moves per time point amongst this group of study participants (9.9%) was consistent with the results of the HSRC's national survey of public opinion, in which it was found that 10% of Gauteng-based respondents had changed residence within a 12-month period (Rule 2000). Thus, the study using data from BT20 suggests that urban families and children may be more stable than would be anticipated; however, the length of time since families had settled in the region is likely to be an important factor. A survey of Soweto households conducted in 1997 revealed that many families of migrant origin were currently more permanently established in Soweto, with 41% of household heads born in the metropolitan area. Of the Soweto Survey respondents, few reported to have moved home frequently (Gilbert and Crankshaw 1999). Future research into the length of time that BT20 families have resided in the area is currently underway.

Within the group of retained cohort members, the propensity to move was found to be highest amongst Whites and lowest amongst Coloureds. Furthermore, mobility within the retained cohort group was associated with the highest and lowest socioeconomic indicators, reflecting movement for both economically advantageous and disadvantageous reasons. These findings coincide with the results of analyses

conducted by Kok et al. (2003) using South African Census data, in which they found that migration involving a move of a household was associated with higher education levels and income, while migration involving a movement of an individual for reasons of employment (specifically a labour migration) was correlated with lower levels of education and income. A study of rural South African children found that the likelihood of moving was higher amongst children living in households with fewer assets (Ford and Hosegood 2005). The low level of movement observed in this study may be associated with potential poverty of opportunity, with people lacking incentive or resources to facilitate or motivate residential change. As revealed in Gilbert and Crankshaw's Soweto survey (1999), a large proportion of respondents had not improved their housing conditions since their arrival in the area.

Reasons

The study offered insight into some of the reasons for movement, as well as the potential part of children in decisions around movement. Primary reasons for movement as sited by respondents most frequently centred on changing family and relationship circumstances, or housing requirements. Some parallels may be drawn between these findings and the results of the 2001/2002 HSRC Migration Survey. Although the HSRC survey found that 38% of total reasons provided for internal migrations were employment related, a significant number of female respondents reported that they had moved because of relationship formation or dissolution (Wentzel et al. 2006). Furthermore, the HSRC survey found that migrations occurring within the urban sector were more commonly driven by personal issues and housing, as opposed to the economic issues that more frequently motivated rural to urban movement streams (Cross 2006).

The results of the current study allude to the fact that children may move independently of primary caregivers for reasons linked to accessing care or schooling. These observations concur with findings from the Agincourt 1999–2003 study, which revealed that rural-based children moved most frequently in conjunction with the move of a parent, but moves to live with another family member or to access schooling were also common (Kok and Collinson 2006). Similarly, the Western Cape Migration Study found that children entering the Province may take up residence with extended kin, often to access education (Bekker 2002). The discrepancy between primary caregiver's and children's addresses observed in the current study may also be explained by the movement of a primary caregiver from a household where a child remains, such as may occur when caregivers get work in other areas. Thus the relative stability observed within the urban area may suggest that urban children have access to broader care networks, potentially in the form of an extended family, where movements of a parent from a house shared with an extended family does not necessarily imply a movement for a child.

Limitations

While the study illuminated some of the dynamics around mobility of the group of participants who were lost to follow-up, the extent of their movements are most likely to be under-reported. Further exploration of the patterns of movement amongst this group

was not possible once contact with the families was lost. Furthermore, the exploration of the relationship between child and caregiver movement patterns warrants more detailed investigation. While it is apparent that movements of urban children in the current sample may occur independently of an existing household or caregiver, an understanding of these movement patterns in relation to families and care networks is important. More in-depth research into reasons for movement will form part of a subsequent study within BT20, with the aim of exploring the differential consequences of movement for children within the context of the factors motivating residential change.

Conclusion

In conclusion, the results presented in this paper suggest that the frequency of residential movement amongst urban children in Gauteng is not high, particularly during the primary school years. The findings of the study further indicate that mobile children are either socially advantaged or potentially vulnerable. Future research focusing on outcome-oriented data (such as education and health) would assist in informing this picture, both in relation to mobile children, and in the case of those children whose levels of mobility are low. Indeed, research to investigate the impact of mobility on child outcomes is currently underway within the BT20 cohort. Understanding the mobility of children has important policy implications in the areas of education, health and social security provision. Knowledge of the patterns and reasons for residential mobility can support urban planning initiatives and policy concerning service delivery.

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Modelling Residential Mobility: Factors Associated with the Movement of Children in Greater Johannesburg, South Africa

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ABSTRACT

Conceptualisation of child residential mobility has been influenced by developed country contexts; however, trends and models for movement are likely to differ in transitional societies. This paper uses event-history analysis to model the residential movements of South African urban children in the Birth to Twenty cohort over their first 14 years of life. Associations with mobility of children are tested over a set of domains relating to the child, the child's primary caregiver, and the child's household. A methodological approach is proposed for analysing repeated moves using multi-level models, which are adapted to maximise information from children who dropped out of the study or who had long gaps in their residential histories. The results indicate mobility is associated with economic disadvantage with children whose primary caregivers had no formal education and who lived in households with fewer assets and less access to services being more likely to change residence. The study suggests potential risks for mobile children in urban environments who may be more likely to be exposed to disruption or compromised living conditions.

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Keywords: residential mobility; internal migration; urban children; South Africa; event-history models

INTRODUCTION

The study of residential mobility among children has been recognised as important and has been researched in resource-rich countries, revealing dissimilar levels of mobility in different regions and environments (Long, 1992b). These empirical studies have been underpinned by a range of theoretical models for migration behaviour and processes. Early migration theorists, such as Lee (1966),

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posit that the drivers of migration are selective, with positive selection occurring where movement is motivated by opportunity and negative selection taking place where movement is prompted by necessity or disadvantage. Elaborating on this, more detailed frameworks for movement, such as that developed by De Jong (2000), propose a range of factors at the level of the individual, household, and community that impact on intentions to migrate, which, in turn, influence migration decision making. In the developed country context, where much of the conceptualisation of migration has occurred, movement of children has been assumed to be connected to a parent, and models describing mobility have therefore centred on adults. In low- and middle-income countries, residential mobility in children has been very under-researched; however, studies of children's living arrangements indicate that a proportion of children live independently of parents, with extended family members, for periods of varying duration (Hosegood *et al.*, 2007). In this setting, frameworks for describing mobility among children would need to be expanded to consider individual child characteristics, as well as the characteristics of parents, alternative caregivers, or family members who may be involved in movement decisions concerning children. Knowledge of these dynamics and attributes and how they might be associated with children's movement behaviour would yield significant insights into patterns of movement amongst children and, more importantly, lay the foundation for investigations into the impact of mobility on child health and development outcomes.

South Africa provides an interesting context in which to study internal population movements because of the shift within the country from politically controlled migration to movement based on choice, very often economically motivated. Further, the focus on children has become particularly relevant in the sub-Saharan region as a whole, in light of HIV prevalence and the potential effects of this on children's living arrangements and movements (Hosegood *et al.*, 2007). This paper presents the first longitudinal study of child residential mobility within urban South Africa and, in so doing, lays out methodological challenges to analysing children's movements.

South Africa's apartheid legacy significantly influenced internal population movement patterns through the implementation of policies, such as influx control and the Group Areas Act, which restricted permanent settlement of black[1] people within urban areas (Giliomee and Schlemmer, 1985). These regulations gave rise to a system of oscillatory labour migration between rural homes and urban places of employment where workers were accommodated temporarily (Wilson, 1972). High rates of urbanisation of black South Africans have been observed, immediately preceding and following South Africa's democratic transition in 1994. However, patterns of rural–urban circulation remain prominent, with evidence of increasing mobility within urban areas (South African Cities Network, 2004; Posel, 2006).

Movement to and within urban environments has the potential to render improved circumstances and conditions through better access to education, employment, health care, and social services. However, several studies have cautioned about the potential negative effects of urban living in large cities in low- and middle-income countries (Brockerhoff, 1995; UNICEF Innocenti Research Centre, 2002). In South Africa, for example, urban environments of large cities are associated with overcrowding, crime, unemployment, poverty, and susceptibility to disease (including increased mortality resulting from the AIDS pandemic).

Within these settings, children may be particularly at risk (UNICEF Innocenti Research Centre, 2002). These adverse circumstances may be exacerbated by unstable living arrangements and high residential mobility. For some children in South Africa, family life is characterised by residential insecurity, with frequent changes in household membership and child care arrangements (Murray, 1981; Spiegel *et al.*, 1996). South African children have been reported to move residence independently and/or in conjunction with a connected adult (Jones, 1992; Van der Waal, 1996). The factors prompting movement may be linked to circumstances surrounding the child's primary caregiver or family or to circumstances attached to the child directly. For example, children may move independently in response to the death of a caregiver or to access education by taking up residence with extended family (Ford and Hosegood, 2005; Kok and Collinson, 2006).

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Children may also accompany a caregiver in a move prompted by changes in a parental relationship or employment status (Kok and Collinson, 2006; Wentzel *et al.*, 2006).

In this new phase of South Africa's socio-political development, patterns of urban mobility are of particular interest; however, little research has focused specifically on the analysis of internal migration and movement trends (Kok *et al.*, 2003; Collinson *et al.*, 2006a). South African researchers have highlighted the need for focused, localised survey research that addresses questions concerning residential mobility, life course migration, the profile of mobile groups, and reasons for movement (Kok *et al.*, 2003; Kok and Collinson, 2006). The reason for the dearth of research in this area is primarily the lack of available cross-sectional and longitudinal data concerning internal population movements. While national household and labour surveys and more recent population censuses have incorporated questions investigating internal migration, limitations have been identified with the applicability of these data in analyses of movement patterns (Posel, 2002; Kok *et al.*, 2003; Kok and Collinson, 2006). Furthermore, very few studies have investigated the movement patterns of children, particularly amongst those born and living in urban environments (Ford and Hosegood, 2005). A significant reason for this research gap is the difficulty in measuring child mobility over time and the need for analytical techniques that take account of the complexity of the data. Data sets pose difficulties because of missing data due to permanent or temporary attrition. Dropout is of particular concern in studies of migration because attrition is closely related to the outcome of interest – mobility – leading to bias if children with missing data are excluded.

In response to the research needs highlighted, an analysis of residential mobility amongst urban children was undertaken using data collected from the Birth to Twenty cohort (BT20) study located in Johannesburg–Soweto, in the Gauteng province. Gauteng is South Africa's most densely populated urban centre, containing approximately 8.8 million residents (Statistics South Africa, 2006). The province is regarded as the economic hub of the country and is the largest receiver of migrants from other provinces (Kok *et al.*, 2003; Statistics South Africa, 2006). The Johannesburg–Soweto metropolis consists of an inner city, surrounded by informal settlements and suburban areas comprising formal housing. During the apartheid era, segregation legislation separated regions on the basis of race, resulting in socio-economic inequalities between areas. These restrictions were lifted following democratisation; nevertheless, disparities persist in infrastructure development and service provision in many areas. In 1990, on the eve of South Africa's transition to democracy, a group of Johannesburg–Soweto born children were recruited into a longitudinal birth cohort, BT20. The aim of the study was to track children's physical and social development in the context of rapid urbanisation and social change (Richter *et al.*, 2007). Regular data collection conducted among the cohort generated longitudinal data for a range of child health and development areas, including children's places of residence.

A preliminary analysis of the frequency of residential mobility within the BT20 cohort revealed that the majority of children (64%) had moved home at least once during their first 14 years, with the largest proportion of moves occurring within the Greater Johannesburg urban area (Ginsburg *et al.*, 2009). The principal aim of this study is to model the occurrence of initial and repeated residential mobility of children in the cohort so as to identify factors associated with movement, relating to the child, the child's primary caregiver, and the child's household. Multi-level event-history analysis is used to allow for repeated moves and to explore the effects of time-varying characteristics, such as household socio-economic status and attributes relating to children's current primary caregivers. The paper further proposes a novel approach to deal with permanent and temporary attrition which avoids the exclusion of dropouts, thereby maximising the analysis sample and reducing the potential for selection bias.

DATA

The BT20 Study Sample and Data Collection

The BT20 study was conceptualised and initiated by researchers from the University of the Witwatersrand and the South African Medical Research Council. The study sample was designed to include all singleton children born within a seven-week period between April and

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June 1990 at mainly public clinics and hospitals in the Greater Johannesburg metropolitan area situated in the Gauteng province. Of the total births that took place over the defined period, a sample of 3273 children identified as permanently resident in the area was recruited into the longitudinal birth cohort (Richter *et al.*, 2004). At enrollment, the cohort was demographically representative of the study area and comprised roughly equal numbers of male (48.6%) and female (51.4%) participants. The majority of participants were black (78.5%), with white, coloured, and Asian children comprising 6.3%, 11.7%, and 3.5% of the cohort, respectively. At the birth of their child, the majority of biological mothers were aged between 19 and 34 years (79.3%). Mothers were primarily single (56.5%), and most had not completed secondary school (58.4%).

Data collection activities among the cohort have taken place over a series of waves beginning with questionnaires administered antenatally to pregnant women and continuing at intervals of either one or two years. The study has focused on a set of core themes that include children's household environments, health and nutrition, growth and development, and risk behaviours (Richter *et al.*, 2007). Data collection has taken the form of physical and biological measures and questionnaires, administered to cohort children and their primary caregivers at health care centres and through home visits. Over the course of the study, contact has been maintained with approximately 70% of the original cohort, with an average of 14% of the sample lost to follow-up in any data collection wave (Norris *et al.*, 2007). During the study's 15th wave of data collection, a survey of children's residential movements was conducted. The questionnaire included a section in which all historical address records were verified as correctly reflecting the children's primary places of residence at the time. Missing or incomplete address data and additional data concerning reasons for movement were also collected. This Residential Move Questionnaire (RMQ) was completed by 2158 members of the original residential cohort (66%), with the balance of 1115 cohort members identified as cases of study attrition. A more detailed account of the BT20 data collection processes and the development and implementation of the specific study of residential movement within the cohort can be found in Richter *et al.* (2007) and Ginsburg *et al.* (2009).

Construction of Residential Histories

The analyses conducted in this paper are based on a longitudinal data set of children's residential addresses. These address data were used to construct a residential history for each child from which movements could be identified. Baseline address data reflecting the biological mother's place of residence immediately preceding the birth of the child was collected. Thereafter, residential address data were available for a series of nine intervals when children were aged between 0 and 1 year, 1 and 2 years, 2 and 4 years, 4 and 6 years, 6 and 8 years, 8 and 10 years, 10 and 12 years, 12 and 13 years, and 13 and 14 years. These intervals correspond to the BT20 study's data collection waves, where each cohort member was seen either annually or within a two-year period. The addresses reflect the BT20 child's primary place of residence during the interval. Residential addresses were updated in a database on each occasion that a cohort member was seen or contact attempted. The address data were later verified through the RMQ during the study's 15th year. Based on the address information, it was possible to derive a binary indicator of whether there had been a change in the child's main place of residence between age intervals t and $t - 1$. This variable is taken as the outcome in the analysis of residential mobility. Movement was defined in terms of the child and therefore refers to both independent moves or moves in combination with a primary caregiver or household.

Full movement histories (for each of the nine age intervals) were available for 99% of children whose residential details were confirmed in the RMQ. However, address data corresponding to a particular age interval or set of intervals may have been missing for children who were out of contact with the study at age 15 when the RMQ was administered. At each wave of data collection, a proportion of the cohort was identified as lost to follow-up for reasons such as caregiver or child mortality, study fatigue, or movement (see Norris *et al.*, 2007). In some instances, these losses to follow-up were classified as permanent (such as migrating out of the study area, emigrating to

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Europe, or child death), which meant that the child did not rejoin the study at a later stage. In other cases, non-participation was periodic, with children rejoining the study after a period of absence – for example, after spending some time living with a relative in a rural area. In instances where a child did not return to the study, the child's movement history was treated as censored from the interval corresponding to the first missing address and after which there was no further knowledge of the child's residential locations. In cases where a child left and then returned to the study, missing address data for a particular age interval may have been followed by one or more age intervals for which the residential address was recorded. A move was inferred in these cases through a comparison with the last recorded address, with the assumption that only one move had occurred if the address had changed. This approach allowed for the inclusion of all age intervals in which residential address information was available, with movement histories treated as censored at the last point at which information about children's residences was known. However, cases where address information was missing for seven or more consecutive years were excluded from the analyses on the basis that information was too sparse, and children may have experienced multiple moves within this time.[2]

The completeness of the residential histories of children included in the sample is presented in Table 1.

From the original cohort of 3273 children, 66 permanent dropouts were excluded from the analysis sample as these children were not present at any follow-up after the baseline and therefore no information was available on their residential moves. A further 230 children with address information missing for more than six years were excluded, resulting in a sample of 2977 children observed for 21,830 age intervals.

Explanatory Variables

The selection of explanatory variables considered in the event-history analysis was governed by theory and prior empirical findings. Potential predictors were conceptualised across three domains: attributes of the child, characteristics of the child's biological mother or current primary caregiver, and variables representing features of the child's current household (see Table 2).

The explanatory variables are a mixture of time-invariant and time-varying characteristics. While residential addresses and corresponding movement status was known at each data collection wave, other information was collected periodically. It is therefore necessary to assume that

Table 1. Completeness of residential histories in analysis sample.

Completeness of residential information	No. of children	Percentage
Complete history[1]	2155	65.84
Dropout after baseline	66	2.02
Permanent attrition[2]	306	9.35
Temporary dropout[3]	746	22.79
Total	3273	100
Max consecutive years missing for temporary dropouts		
1	–	–
2	85	11.39
3	87	11.66
4	268	35.92
5	7	0.94
6	69	9.25
>6	230	30.83
Total	746	100

[1]Children present at all nine waves with any gaps filled in from the RQM at age 15.
[2]Children with some mobility information who were permanently lost at any age.
[3]Children who were absent at one or more waves not compensated for by information collected in the RMQ.

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Table 2. Explanatory variables.

Variable	Description
Time invariant	
Child sex	Male, female
Child ethnicity	White, black, coloured, Asian
Residential area at birth	Soweto/Diepmeadow, former coloured/Asian, inner city, suburban
Hospital of birth	Public, private
Maternal age at delivery	<= 18, 19–34, 35+ years
Biological mother born in the Gauteng province	Yes, no
Time varying	
Age of child (*t*)	Intervals in years: [0,1], (1,2], (2,4], (4, 6], (6, 8], (8, 10], (10, 12], (12, 13], (13, 14]
Child moved previously[1]	Coded 0 prior to the first move and 1 after the first move
Duration since child's last move[1]	Length of time between moves in years
Caregiver schooling	No formal schooling, primary school, secondary school
Caregiver marital status	Married/living with partner, single/widowed/divorced/separated
Household socio-economic index	Constructed from the following binary items: Home ownership at birth (owned, other), house type (house, other), water indoors, flush toilet, electricity, TV, car, fridge, washing machine

[1]Only included in the multi-level models where repeated moves are analysed.

the time-varying covariates remained constant between those waves at which information was updated. Starting values of the time-varying variables were derived from questionnaire data collected antenatally or when children were aged 1 year. These values were held constant over the age intervals of [0,1], (1,2], and (2,4] years. Questionnaire data collected in the children's seventh year were then used to update the values of these variables over the three age ranges of (4, 6], (6, 8], and (8, 10] years. Values for the remaining intervals, (10,12], (12, 13], and (13,14] years, were based on information collected when the children were 12 or 13 years of age.

A socio-economic index was constructed from a set of 10 time-varying binary variables measuring access to a range of services and household assets: home ownership, house type, indoor water supply, indoor toilet, electricity supply, and telephone and household ownership of a television, motor vehicle, refrigerator, and washing machine. A probit factor model (see, for example, Bartholomew *et al.*, 2008: Chap. 8) was fitted using Markov chain Monte Carlo (MCMC) methods to incorporate children with missing data under a missing at random assumption (Browne, 2009); estimated factor loadings for each item were then used to compute a 'wealth index'. The socio-economic factor values ranged from –2.22 to 1.71, with a mean of 0.03 and a standard deviation of 0.82. A higher positive score on this index indicates greater relative wealth or household assets.

The multi-level analyses of repeated moves included a binary dummy variable indicating, for each age interval, whether a move had occurred in any previous age interval. Also included in the model was an interaction between the previous move indicator and the duration since the last move. This interaction variable was coded zero up to the first move, so its coefficient is interpreted as a duration effect among movers.

STATISTICAL METHODS

Multi-level discrete-time event-history analysis (e.g. Steele *et al.*, 1996) was used to model the timing of children's residential moves, allowing for the possibility that a child may be exposed to the risk of a move more than once over the observation period of 14 years. Residential histories can be viewed as a type of two-level hierarchical structure with episodes of exposure (periods

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between moves) at level 1 nested within individuals at level 2.

Denote by y_{it}, a binary response coded 1 if child i moves during age interval t and 0 otherwise. We assume that y_{it} follows a binomial distribution with probability π_{it} and denominator n_{it}, where, in the present application, n_{it} equals the length of interval t for child i. A multi-level logit model for the probability of a move, π_{it}, can be written as

$$\log\left(\frac{\pi_{it}}{1-\pi_{it}}\right) = \alpha_t + \boldsymbol{\beta}^T \boldsymbol{x}_{it} + u_i, \quad (1)$$

where α_t is the coefficient of a dummy variable for age interval t, $\boldsymbol{x}_{it}$ is a vector of time-varying and time-invariant characteristics of the child, caregiver, or household with coefficients $\boldsymbol{\beta}$, and u_i is a child-specific random effect assumed to be normally distributed with a mean of zero and variance of σ_u^2. The random effect represents unmeasured time-invariant child characteristics affecting the probability of a move throughout the study period. The child's residential history up to interval t is captured by an indicator of a previous move and the duration since the last move, both included as time-varying covariates in $\boldsymbol{x}_{it}$.

Equation (1) defines a proportional odds model where the effects of the covariates $\boldsymbol{x}_{it}$ are assumed to be constant across age intervals. Non-proportional effects may be accommodated by adding interactions between elements of $\boldsymbol{x}_{it}$ and the age dummies, but in our application, the proportionality assumption was found to be reasonable for all covariates.

When all time intervals are of equal width, the denominator for the binary response, n_{it}, equals 1 for all t and i, and Equation (1) can be estimated as a standard multi-level logit model for binary data. In the present application, however, age intervals vary in width. Children who were present at every wave contribute nine age intervals, where the width of an interval is either one or two years. As described in the Data section, children who dropped out permanently contribute one- or two-year intervals up to the point of being lost to follow-up. If a child temporarily left the study, the interval for the missing wave is combined with the interval for the wave at which the child rejoined the study, and n_{it} is updated to equal the width of the new interval. An adjustment to the coding of the dummy variables for the age intervals being aggregated is also needed. For example, consider a child who is absent at the age 2 interview but present at age 4. Age intervals (1,2] and (2,4] are combined to give a three-year interval, and the dummy variables for these intervals are each coded 0.5. In general, if k intervals are combined, the dummy variables for these intervals will each be coded $1/k$ regardless of the relative widths of the interval (see the Appendix for further details and an example of the required data structure).

The multi-level event-history model in Equation (1) is estimated using procedures for multilevel binomial response data (Steele *et al.*, 2004). We use MCMC methods as implemented in the MLwiN software (Browne, 2009; Rasbash *et al.*, 2009).[3]

To aid interpretation of the fitted model, predicted probabilities may be calculated for a range of values of each covariate (or each value in the case of categorical covariates), holding constant the values of all other covariates in the model. To obtain mean probabilities, it is necessary to average across child-specific unobservables by integrating out the random effect or by simulating random effect values. The simulation approach involves generating a large number of random effect values from a normal distribution with variance $\hat{\sigma}_u^2$, calculating a predicted probability based on each of these values and the estimated coefficients, and taking the mean across the simulated values. This procedure is implemented in MLwiN v2.10 and described in Rasbash *et al.* (2009).

RESULTS

An event-history analysis was conducted to examine the occurrence of the children's first residential move, with cases censored after the first move or at the last time interval when information regarding their movements was available (15,844 age intervals of 3146 children).

The conditional probability of the first residential move in age interval t, given no move occurred before t, is shown in Figure 1. The probability of a first move is highest between ages 1 and 2 years ($\hat{\pi} = 0.147$). By age 4, the probability of a first residential move decreased, with the lowest predicted probability of a first move in age interval (13, 14] ($\hat{\pi} = 0.046$).

While most children had experienced at most one residential move by age 14, 15% moved more

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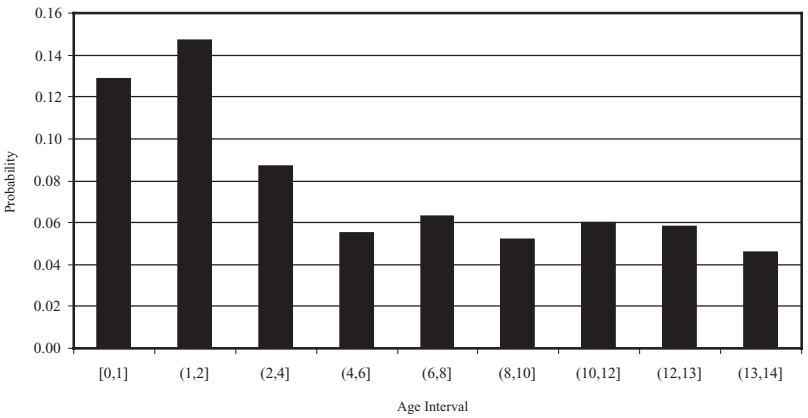

Figure 1. Probability of first move by age interval.

Table 3. Distribution of number of residential moves per child.

No. of moves	No. of children	Percentage
Never moved	1287	43.2
1	1245	41.8
2	368	12.4
3	61	2.0
4	14	0.5
5	2	0.1
Total	2977	100

than once (see Table 3). Multi-level event-history analysis was therefore used to consider repeated moves and to estimate the effect of previous mobility on the probability of a subsequent move.

The first model was based on the complete data set of 2977 children, observed for 21,830 age intervals. Due to a substantial number of missing values, the covariates *caregiver schooling* and *caregiver marital status* were initially excluded. A model was then fitted with these covariates included, where records were dropped from the data set after the first missing value. The reduced sample contains 2853 children who contributed 15,761 age intervals. Although the exclusion of these observations leads to the omission of some repeated moves (the percentage of children with more than one move decreases to 9.6%), the effects of the caregiver variables were of substantive interest because previous research has suggested that movements amongst children have been linked to caregiver characteristics and circumstances. Furthermore, a comparison between the models fitted to the full and reduced data sets revealed little difference in the magnitude and statistical significance of the regression coefficients of other covariates. The results presented in Table 4 are therefore based on the reduced data set with the inclusion of the two caregiver variables.

Other covariates were tested for significance using a combination of forward selection and backward elimination. The covariate *hospital of birth* was excluded from the analysis because it failed to achieve significance in any preliminary analyses. The variable *biological mother born in the Gauteng province* was also excluded from the models because of a substantial number of missing values together with non-significance at the 5% level. This variable had a negative effect on the probability of moving, indicating that

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Table 4. Parameter estimates (and standard errors) from the multi-level event-history model of residential mobility.

Variable	β	Standard error	Wald	p
Female child	0.060	0.047	1.658	0.198
Child ethnicity (ref: white)			3.051[1]	0.384
Black	−0.143	0.171	0.706	0.401
Coloured	−0.326	0.206	2.494	0.114
Asian	−0.146	0.227	0.415	0.519
Residential area at birth (ref: Soweto/Diepmeadow)			16.146[1]	0.001
Former coloured/Asian	−0.039	0.178	0.049	0.825
Inner city	0.658	0.202	10.625	0.001
Suburban	0.317	0.133	5.688	0.017
Maternal age at delivery (ref: <= 18)			41.347[1]	<0.001
19–34	0.197	0.078	6.31	0.012
35+	−0.379	0.119	10.101	0.001
Caregiver schooling (ref: no formal schooling)			8.853[1]	0.012
Primary school	−0.487	0.185	6.968	0.008
Secondary school	−0.534	0.180	8.783	0.003
Caregiver single/widowed/divorced/separated	−0.273	0.049	31.437	<0.001
Household socio-economic index	−0.162	0.031	26.738	<0.001
Child moved previously	0.590	0.083	50.599	<0.001
Child moved previously × duration since child's last move	−0.036	0.020	3.274	0.070
Age of child in years (t)				
Age [0, 1]	−1.375	0.281	23.961	<0.001
Age (1, 2]	−1.139	0.280	16.542	<0.001
Age (2, 4]	−1.781	0.280	40.457	<0.001
Age (4, 6]	−2.343	0.285	67.741	<0.001
Age (6, 8]	−2.257	0.284	63.179	<0.001
Age (8, 10]	−2.235	0.286	61.092	<0.001
Age (10, 12]	−2.246	0.293	58.842	<0.001
Age (12, 13]	−2.220	0.310	51.232	<0.001
Age (13, 14]	−2.311	0.312	54.813	<0.001
Child-level random effect variance	0.006	0.003		

[1] For categorical variables with more than two categories, the results of two types of Wald test are presented: (i) a joint test of the null hypothesis that the coefficients of the dummy variables for each category are simultaneously equal to zero and (ii) individual tests comparing each category with the reference.

children whose biological mothers were born in the province were less inclined to experience residential mobility. The interaction between child ethnicity and household socio-economic status was of interest because of the possible differences in the effect of socio-economic indicators on child movement between more and less advantaged ethnic groups; however, the term was found to be non-significant when tested, and was therefore excluded from the models.

Table 5 shows predicted probabilities of a move during age interval (1,2], the period when moves were most frequent. The probabilities were calculated by varying the values of one variable at a time, holding all other covariates at their sample mean values. In the case of a categorical variable, the dummy variable associated with a particular category takes on the value of the sample proportion in that category instead of the usual 0 or 1 value. The two variables associated with a previous move were fixed at a value of 0 so that probabilities refer to a first move (which is reasonable given the probabilities are calculated for ages 1–2 years). Although the probabilities will be different for other age intervals, their general pattern will be the same because the effects of covariates were found to be independent of age.

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Table 5. Predicted probabilities of a first move between 1 and 2 years of age.

Variable	Probability
Child sex	
Male	0.137
Female	0.144
Child ethnicity	
White	0.161
Black	0.143
Coloured	0.122
Asian	0.142
Residential area at birth	
Soweto/Diepmeadow	0.139
Former coloured/Asian	0.134
Inner city	0.238
Suburban	0.181
Maternal age at delivery (years)	
≤18	0.127
19–34	0.151
35+	0.091
Caregiver schooling	
No. formal schooling	0.216
Primary school	0.145
Secondary school	0.139
Caregiver marital status	
Married/living with partner	0.161
Single/widowed/divorced/separated	0.127
Household socio-economic index	
1 standard deviation above mean	0.125
Mean	0.141
1 standard deviation below mean	0.158

Of the child characteristics, sex and ethnic differences in the probability of a move were found not to be statistically significant. However, controlling for ethnic group, the effect of residential area at birth was found to be significant with a higher chance of moving among children born in the inner city and suburbs compared with those born in former Asian or coloured areas or in Soweto/Diepmeadow. The variables *child ethnicity* and *residential area at birth* are highly correlated due to the racial segregation of residential areas during the apartheid era; nevertheless, a significant effect of area that is independent of ethnic differences was found. Children who experienced a previous residential move were more likely to experience a repeated move as compared with non-movers, and there is some evidence (at the 10% level) that the probability of a move decreases with the duration since the last move.

Children born to older mothers (aged 35 or more) were less likely to move as compared with children born to younger mothers. Children whose biological mothers or primary caregivers were single, widowed, divorced, or separated rather than married or living with a partner were less likely to move. Similarly, a negative effect on the rate of residential movement was found amongst children whose primary caregivers had attained either primary or secondary level schooling as compared with caregivers with no formal education. The probability of a first residential move for children aged 1 and 2 years was highest for the group whose primary caregivers had no formal schooling.

The analysis revealed a significant negative relationship between household socio-economic status (as measured by the socio-economic factor values) and residential mobility. Holding

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household socio-economic status at its lowest level of −2.22, the probability of a first move for a child aged 1–2 years was 0.19, while the probability was 0.11 when household socio-economic status was held at its highest level of 1.71.

After controlling for child, caregiver, and household characteristics, there remains a small amount of unobserved heterogeneity between children ($\hat{\sigma}_u^2$ = 0.006, *SE* = 0.003). As expected, indicators of children's prior residential history – whether they had moved previously and the duration since the last move – explained a large proportion of the between-child variance; before accounting for these variables, the random effect variance was estimated as 0.198 (*SE* = 0.054).

DISCUSSION

This is the first South African study to explore longitudinal patterns of residential mobility amongst urban children. Using data from the BT20 cohort, children's residential movements over the first 14 years of their lives were analysed with the aim of identifying child, caregiver, and household factors associated with movement. The study looked both at the timing of children's first residential moves and at repeated residential mobility, with the conclusion that the more disadvantaged children in the cohort had a higher likelihood of experiencing residential change. Furthermore, standard event-history methods were adapted to handle permanent attrition and gaps in children's movement histories.

Knowledge of the patterns of child mobility in South Africa is scarce, and, consequently, it is important to develop a more detailed understanding of this area. Movement and its timing can have an important influence on future events and transitions in an individual's life course (Amoateng, 2007). In the current study, children's first residential moves occurred most frequently in early childhood (at age 2 years or younger). This finding is consistent with results from rural South African studies, in which movement was found to be highest amongst preschool children (Ford and Hosegood, 2005; Collinson *et al.*, 2006b). Similarly, findings from studies of residential mobility in developed countries have found relatively high levels of movement among one to four year olds, suggesting that the birth and early care of a child may prompt parents to move (Long, 1992a, 1992b). In the South African case, we hypothesise that the higher levels of first movement in very early childhood is reflective of changes in the life cycle of mothers who may be moving to access employment or to enter into cohabitating relationships. In addition, children may move more frequently in their preschool years, after which families attempt to stabilise children's status in the interest of minimising interruptions of schooling. Children who experience a first move early in life are more likely to experience repeated residential relocations during childhood. In the BT20 sample, 15% of the children had experienced repeated residential movement. Although we found that the statistical significance and effects of the covariates were the same regardless of whether children had experienced a single or multiple moves (results not shown), it is possible that the group of multiple movers may be more at risk of disrupted living conditions (by virtue of having shifted households more often).

The multi-level analysis of repeated moves revealed no significant gender differences, and ethnicity was not significantly associated with residential mobility. Previous empirical studies investigating inter-provincial migrations in South Africa have shown strong ethnic differences in the profile of migrants, with higher levels of movement amongst white and black South Africans and lower levels of movement amongst coloureds (Kok *et al.*, 2003). In the current study, a significant neighbourhood effect was present, with children born in Johannesburg's inner city or suburban regions more likely to change residence as compared with children in the areas of the city formerly designated as black or coloured/Asian. The finding is suggestive of a more integrated social geography in these regions following the dismantling of apartheid policy where residential areas were strictly segregated according to ethnic group membership. The higher levels of stability amongst those in the coloured and black township areas is potentially explained by the tendency amongst these communities towards extended family household structures (Amoateng *et al.*, 2007), suggesting that these families may be less inclined to move home.

At any particular time, children whose biological mothers or current primary caregivers were married or living with a partner were more likely to change residence as compared with

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children whose caregivers were single. Research has shown that partnership formation and breakdown are likely to result in residential mobility as part of changes in family cycles (Speare and Goldscheider, 1987; Long, 1992a). In addition, children living with parents or with a caregiver and her partner may be more geographically mobile because employment or accommodation options are increased by the presence of two adults as compared with one. Levels of movement may be lower amongst children being cared for by single women who could have fewer residential choices available to them and are potentially more likely to be living in extended family accommodation.

Mobility among children was found to be associated with lower levels of educational attainment of mothers or primary caregivers. South African studies of inter-provincial migration have found a correlation between labour migration (which may be prompted by instability or vagaries of circumstance) and lower levels of education, while higher levels of education have been associated with relocation linked to economic opportunity and options (Kok *et al.*, 2003; Wentzel *et al.*, 2006). The evidence of a link between intra-urban mobility and lower levels of education is suggestive of a group of children whose movements may be necessitated by limited employment or accommodation options for their mothers or caregivers. Similarly, the association between lower household socio-economic status and higher levels of mobility for children in the cohort further connects residential mobility to economic disadvantage. The negative relationship between household socio-economic status and movement suggests that negative selection, described by Lee (1966), is likely to be occurring within the cohort.

A strength of the current study is the focus on the movement of children. The data suggest an expansion of De Jong's (2000) model of migration decision making in that child individual characteristics, as well as the characteristics of a current primary caregiver and household, need to be taken into account in explaining movements involving children. This must allow for the fact that a child may not necessarily reside continuously with the same primary caregiver and in the same household. South African census data indicate that only 36.4% of black children aged between 5 and 13 years lived in a household together with both parents, 31.5% lived with a mother only, and 25.7% lived in households with neither parents. These rates are higher amongst coloured, white, and Asian children, where 58.7%, 80.0%, and 83.8%, respectively, lived in households with both parents (Statistics South Africa, 2001). In addition to evaluating the relative importance of child, caregiver, and household factors on movement decisions concerning children; the extent of children's broader care networks as well as context specific drivers and constraints would need to be incorporated into a framework explaining mobility in children.

The study contributes to the development of a broader understanding of the principle of migration selection in relation to child mobility by revealing a number of associations with child movement, which could be used to define a set of *a priori* hypotheses for future investigation within different sub-populations. For example, changes in the lifecycle of children's primary caregivers (such as partnership and employment status) may be associated with a higher probability of mobility for connected children. The study also lays the foundation for future research into impact studies. In order to begin to assess the consequences of relocation on child well-being, attributes of movement destinations at the neighbourhood or community level would be significant and may be analysed through the application of more complex multi-level modelling techniques.

Missing data and sample attrition encountered in a cohort study present a complex challenge, but an approach to handle children who drop out of the study and return at a later wave (non-monotone attrition) is proposed. This method of analysing all available data allows for higher levels of data retention than would have been the case if movement histories were censored at the first instance of lost contact. It thus includes into the analysis children who, often due to mobility, may not have been traceable over all data collection time points.

A limitation of the study relates to the potential underestimate in the total number of residential moves per child reported. It is likely that permanent dropouts and children with long gaps in their residential histories are more mobile and may have experienced multiple moves during their time out of the study, which would not have been known. A further limitation relates to lack

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of data concerning shifts in children's caregiving structures and its relationship to child and caregiver movements. Research is currently underway in BT20 to explore caregiving patterns longitudinally, and these will then be mapped onto children's movement trajectories.

In conclusion, the results of the analysis reveal a set of characteristics associated with residential mobility amongst a group of urban South African children that is suggestive of socio-economic disadvantage. For example, children experiencing residential mobility were more likely to have mothers or current primary caregivers with no formal education and reside in households with less access to assets and services. Moves were most likely to occur before the age of 2, and approximately 15% of all children studied experienced repeated moves during childhood. This group of mobile children may therefore have experienced economic adversities and lack of stability in living arrangements.

The study addresses a critical gap in children's developmental research in South Africa and suggests the need for comparative research on child mobility, both in rural regions of South Africa and in other low- and middle-income countries. Insight into the drivers and processes around child mobility within different contexts would contribute to current frameworks describing movement among adults, and thus fill an important research gap. Given that movement may be one response to disadvantage, understanding the consequences of mobility for children is a key priority. Knowledge of the impact of movement on children's adjustment, physical health and education would significantly inform local policy initiatives centred on vulnerable children.

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NOTES

(1) The categories black, coloured (mixed ancestral origin), white, and Asian are carried over from South Africa's apartheid past. While they no longer have legislative force, they have so influenced South African society, and in many ways continue to do so, that there is consensus on the importance of retaining these categories for social analyses. In this paper, we have used these racial categories in our analyses as opposed to ethnic categories (for example, Zulu, Xhosa, Sotho, and Afrikaans).

(2) The analysis was repeated with a different exclusion rule for children with gaps in their residential histories. The results were found to be robust to whether the cutoff was more than four, five, or six consecutive years.

(3) MCMC methods are used to estimate statistical models in a Bayesian framework. In the Bayesian approach, each unknown parameter in the model is viewed as a random variable with an associated probability distribution that incorporates any prior beliefs about the value of that parameter. MCMC methods are simulation-based procedures in which a chain of random draws is taken from the current conditional probability distribution for each parameter. A point estimate of a parameter may be obtained by taking the mean, median, or mode of the parameter values across the chains, while the standard deviation of parameter values corresponds to a frequentist standard error. See Browne (2009) for an introduction to MCMC methods for multi-level analysis. The estimates presented in this paper are from 50,000 chains using approximate quasi-likelihood estimates (Goldstein, 2003: 112–113) as starting values for the sampling.

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APPENDIX: TREATMENT OF RESIDENTIAL HISTORIES FOR TEMPORARY DROPOUTS

Table A1 shows the data structure for two children, where D_1, D_2, ... , D_9 are the dummy variables for age interval t with coefficients given by α_t in Equation (1). Complete information is available for Child 1, who contributes records for the full set of nine age intervals. Child 2 is a combination of a permanent and temporary dropout, being absent at the age 2 interview, then present at age 4, before being lost to follow-up after the age 6 interview. For this child, age intervals (1,2] and (2,4] are combined to give a three-year interval. The values of the dummy variables for these intervals are also changed from the usual (0,1) coding to reflect the fact that the second interval is now an aggregate of intervals $t = 2$ and $t = 3$. Specifically, the dummies for intervals (1,2] and (2,4] are each coded 0.5.

This coding of the dummies for age is based on the following approximation. Consider a simplified specification of the model in Equation (1) with only age effects and no child-specific random effects. Omitting child subscripts, the model can be written as

$$\text{logit}(\pi_t) = \alpha_t. \tag{A1}$$

Combining age intervals t and $t + 1$, the probability of a move in the joint interval is

$$\pi = \pi_t + \pi_{t+1}. \tag{A2}$$

When the probability of a move is small within each interval t, the logit transformation is well approximated by the log transformation, so that

$$\log(\pi_t) \approx \alpha_t. \tag{A3}$$

Exponentiating Equation (A3) and substituting in Equation (A2) gives

$$\pi \approx \exp(\alpha_t) + \exp(\alpha_{t+1}). \tag{A4}$$

We next carry out a Taylor series expansion of $\exp(\alpha_{t+1})$ around α_t:

$$\exp(\alpha_{t+1}) = \exp(\alpha_t) + (\alpha_{t+1} - \alpha_t)\exp(\alpha_t) + O(\alpha^2), \tag{A5}$$

Table A1. Example of data structure for complete and partial residential histories.

Child i	Interval t	n_{it}	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9
1	[0,1]	1	1	0	0	0	0	0	0	0	0
1	(1,2]	1	0	1	0	0	0	0	0	0	0
1	(2,4]	2	0	0	1	0	0	0	0	0	0
1	(4,6]	2	0	0	0	1	0	0	0	0	0
1	(6,8]	2	0	0	0	0	1	0	0	0	0
1	(8,10]	2	0	0	0	0	0	1	0	0	0
1	(10,12]	2	0	0	0	0	0	0	1	0	0
1	(12,13]	1	0	0	0	0	0	0	0	1	0
1	(13,14]	1	0	0	0	0	0	0	0	0	1
2	[0,1]	1	1	0	0	0	0	0	0	0	0
2	(1,4][1]	3	0	0.5	0.5	0	0	0	0	0	0
2	(4,6]	2	0	0	0	1	0	0	0	0	0

[1]Combined interval.

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where $\alpha = \alpha_{t+1} - \alpha_t$. Substituting Equation (A5) in Equation (A4) leads to

$$\begin{aligned}\pi &\approx \exp(\alpha_t) + \{\exp(\alpha_t) + (\alpha_{t+1} - \alpha_t)\exp(\alpha_t) + O(\alpha^2)\} \\ &= \exp(\alpha_t)\{2 + (\alpha_{t+1} - \alpha_t) + O(\alpha^2)\} \\ &= 2\exp(\alpha_t)\{1 + (\alpha_{t+1} - \alpha_t)/2 + O(\alpha^2)\} \end{aligned} \quad \text{(A6)}$$

Using the first-order McLaurin series expansion $\exp(z) = 1 + z + O(z^2)$, we can write

$$\exp\{(\alpha_{t+1} - \alpha_t)/2\} = 1 + (\alpha_{t+1} - \alpha_t)/2 + O(\alpha^2). \quad \text{(A7)}$$

Finally, substituting Equation (A7) in the last line of Equation (A6) and assuming that the difference in the log probability between intervals t and $t + 1$ is small (so that $O(\alpha^2) \to 0$), we have the following first-order approximation for the probability of an event in the joint interval:

$$\begin{aligned}\pi &\approx 2\exp(\alpha_t)\exp\{(\alpha_{t+1} - \alpha_t)/2\} \\ &= 2\exp(0.5\alpha_t + 0.5\alpha_{t+1}), \end{aligned} \quad \text{(A8)}$$

which can be written in log-linear form as

$$\log(\pi) \approx \log(2) + 0.5\alpha_t + 0.5\alpha_{t+1}. \quad \text{(A9)}$$

The log probability implied by Equation (A9) is fitted by including log(2) as an offset term and coding the dummy variables for intervals t and $t + 1$ as 0.5 and the dummies for all other intervals as 0. Reverting to the original logit scale, the width of the joint interval ($n_t = 2$) is included as a denominator for the binary response. Note that the approximation in Equation (A9) holds for combining any two intervals regardless of their width.

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An analysis of associations between residential and school mobility and educational outcomes in South African urban children: The Birth to Twenty cohort

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ABSTRACT

Using data from Birth to Twenty, a cohort of South African urban children, the current paper investigates the relationships between residential and school mobility and a set of educational outcomes. The findings provide some evidence of a positive association between changes in residence and numeracy and literacy scores, and school mobility was found to be associated with grade repetition, however, no relationship was observed between changes in school and competency in numeracy and literacy. The South African study provides a counter example to trends observed in higher-income countries, while highlighting that associations are likely to be context specific.

1. Introduction

1.1. General overview

Education has long been recognised as an important measure and indicator of children's well-being. As such, research into child welfare has included extensive explorations into the factors which impact on educational attainment. Children's living conditions, family circumstances, health status and physical and social environments have been identified as significant determinants of child well-being as well as educational achievement.

Mobility amongst children precipitates change and requires adjustment to a new environment; it therefore has the potential to improve or impair conditions for child well-being. Many international studies have emphasised the detrimental effects of the movement of children on health and development outcomes, including education. For instance, changes of residence during children's school careers have been shown to have a predominantly adverse effect on academic achievement, progression through school and completion of basic education (Haveman et al., 1991; Ingersoll et al., 1989; Simpson and Fowler, 1994; Wood et al., 1993). Similarly, school mobility (either accompanied by or independent of a residential relocation) has been observed in many studies to impact on children's academic performance and progression (Heinlein and Shinn, 2000; Swanson and Schneider, 1999). Studies have shown that the strength and pattern of associations between educational outcomes and child residential and school mobility are likely to be influenced by a series of individual, family, household and school factors (Astone and McLanahan, 1994; Pribesh and Downey, 1999; Tucker et al., 1998; Wood et al., 1993). The effects of these are not necessarily uniform, for example, the impact of mobility on school progression has been observed to be detrimental for children whose parents had lower levels of education, but the opposite (or no) effect has been found for children whose parents had achieved higher levels of education (Long, 1975; Straits, 1987). Researchers have been alerted to the complexity of assessing the independent effects of movement on child outcomes given the number of potentially confounding factors (Alexander et al., 1996; Rumberger, 2002). In attempting to establish the sequence of causal pathways, circumstances surrounding mobility decisions are important as there may be unobserved factors which manifest in a move that ultimately impact on the child, rather than the event itself (Dong et al., 2005).

Research in this area has been conducted primarily in high-income countries and little is known about the effects of residential and school mobility on children's educational progression and achievement in low- and middle-income countries. Given the unique nature of population movements and education provision in these different settings, an exploration of their relationship is of interest, and relevant in light of the United Nations Millennium Development Goals targeting education provision and access (UNICEF, 2005).

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1.2. South Africa

South Africa provides an interesting context in which to investigate relationships between child mobility and education, particularly given its unique policy and political history. In post-Apartheid South Africa, the majority of the population continues to be marked by poverty and unemployment, and education has been emphasised as a vital component in moving toward a more equitable society. However, there is current significant under-achievement in primary education, particularly amongst disadvantaged groups (Fleisch, 2008). This has been substantiated in a number of studies identifying high levels of grade repetition and interrupted progression through school, as well as low competency in numeracy and literacy amongst South African learners (Anderson et al., 2001; Branson and Lam, 2009; Fleisch, 2008; Lam et al., 2008b; Liddell and Rae, 2001; Motala, 1995; Shindler, 2008).

As with education, population movements in South Africa have been significantly influenced by Apartheid policies, which restricted the free movement and settlement of Black[1] people (Wentzel and Tlabela, 2006). Following the new political dispensation in 1994, internal population movements have increased, particularly to and within the country's urban centres (Kok and Collinson, 2006; South African Cities Network, 2004). While mobility amongst adults is frequently prompted by relationship formation/dissolution, or the search for employment or adequate housing and services, children have also been observed to move or be moved independently of adults in order to increase their access to care or educational opportunities (Collinson et al., 2006; Ford and Hosegood, 2005; Paterson and Kruss, 1998; Wentzel et al., 2006).

This is suggestive of a relationship between education and mobility with education acting as a driver of movement amongst children. However, there has been little published research on patterns of residential or school mobility amongst South African children and, as far as we can ascertain, the association between residential and school mobility and educational outcomes has never been expressly investigated.

In order to begin to address this research gap, a study of residential mobility and schooling was undertaken amongst children enrolled in the Birth to Twenty (BT20) cohort. This urban-based birth cohort study, the recruitment and follow-up of which spans South Africa's transition to democracy, has yielded 15 years worth of longitudinal data on children's places of residence, as well as their school enrolment and progression.

Findings from preceding analyses conducted on residential mobility within the cohort have shown that by age 15, two thirds of children had moved residence at least once (Ginsburg et al., 2009). Child movement was also found to be associated with lower-resourced households suggesting that mobile children are potentially vulnerable (Ginsburg et al., 2010). Analyses of the patterns of schooling within the cohort have revealed high rates of grade repetition, particularly amongst male participants and especially in the early years (Fleisch and Shindler, 2009). Following from these findings, the aim of the current paper is to determine whether an association exists between residential and school mobility and a set of educational outcomes measuring progression through school and competency in numeracy and literacy. The paper will explore the relationship between mobility and education within the context of a set of individual child, family background and household factors that have been identified as having a mediating effect in previous empirical studies. The study aims to test the hypothesis that residential and school mobility have a negative effect on educational outcomes, as has been observed in much of the international literature.

[1] The categories Black, Coloured (mixed ancestral origin), White and Asian are carried over from South Africa's Apartheid past. While they no longer have legislative force, they have so influenced South African society, and in many ways continue to do so, that there is consensus on the importance of retaining these categories for social analyses. In this paper we have used these racial categories in our analyses as opposed to ethnic categories (for example Zulu, Xhosa, Sotho, Afrikaans).

2. Methods

2.1. Study sample

The Birth to Twenty cohort study was initiated and developed by a group of researchers from the University of the Witwatersrand and the South African Medical Research Council. Commencing at the onset of South Africa's transition to democracy, the study aimed to track children's physical and social development in a context of rapid social change (Richter et al., 2007). The BT20 cohort comprised all singleton children born within a 7-week period between April and June 1990 at primarily public delivery centres in the Greater Johannesburg-Soweto area situated in the Gauteng Province, South Africa's most densely populated urban centre. The residential cohort of 3273 excluded those children whose mothers relocated from Johannesburg-Soweto within six months following their birth, on the basis that these families were only temporarily resident in the area. At enrolment, the cohort consisted of a majority of Black participants (78.5%) followed by 11.7%, 6.3% and 3.5% Coloured, White and Asian children respectively. Females, comprising 51.4% of the cohort, marginally outnumbered males (see Richter et al., 2004, 2007; Yach et al., 1991 for a more detailed description of the study's research aims and methods).

The study has focused on a set of multidisciplinary themes connected to children's well-being including health and nutrition, growth and development, household environments, and educational progression (Richter et al., 2007). Data collection has taken the form of physical and biological measures and questionnaires, administered to cohort children and their primary caregivers either annually or within a 2-year interval, at health care centres and through home visits. Over the course of the study, contact has been maintained with approximately 70% of the original cohort, with one third of the cohort identified as cases of cumulative attrition (Norris et al., 2007).

The study of mobility and education outcomes described in this paper is presented in two parts centred on two educational outcome variables, the first measuring grade repetition or school progression and the second, competency in numeracy and literacy. The educational progression component is based on data derived from a retrospective questionnaire administered to cohort members in their homes during the study's 15th year. The aim of this questionnaire was to capture information concerning participant's school attendance and progression through school from the commencement of primary education up until the age of 15. The retrospective schooling questionnaire yielded a response rate of 87.3% (n = 2001) of the 2291 cohort members still in contact with the study in its 15th year. The analytical dataset for this study component is based on a sample of 1989 respondents as 12 participants who reported having attended special schooling because of learning disabilities were excluded.

The second part of the paper is based on results from a numeracy and literacy evaluation completed by cohort members at BT20's data collection site a year later, during the study's year 16 data collection wave. The evaluation utilised a standardised instrument that was developed through expert consultation with the Joint Education Trust for the Cape Area Panel Study (Lam et al., 2008a). Participants were given 20 min to complete the evaluation and it was invigilated by a research assistant. The numeracy and

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literacy evaluation was administered to 1761 participants, 76.9% of the cohort still in contact with the study. A total of 17 participants with learning disabilities (and attending special education schools) were once again excluded from the sample, yielding an analytical sample of 1744 participants.

2.2. Variables

Outcome and explanatory variables employed in the analyses are described in Table 1. Both sections of the paper utilise residential mobility data derived from participants records, collected at each contact, and later verified in a Residential Move Questionnaire administered to primary caregivers during the study's 15th and 16th years. The residential mobility variables represent the total number of times the cohort members moved home, split between the number of moves that occurred from birth prior to the commencement of schooling, and the number of moves that occurred following the commencement of schooling until the age of 15 (i.e., calculated with reference to the age that the corresponding cohort member commenced school). The variable representing the number of school changes excludes the school change associated with the transition to secondary school; therefore this variable represents school changes outside of the normal educational progression from primary to secondary school.

The two components of the paper also make use of demographic data describing child, maternal and household characteristics, collected from participants' biological mothers at the onset of the study as part of BT20's routine data collection activities. The selection of the set of explanatory variables considered in the analyses is governed by theory, prior empirical findings and data availability.

2.3. Data analysis

A set of bivariate analyses was conducted for each of the study components presented in the paper. In the case of categorical variables, chi-square tests were performed to establish significance of associations. For continuous variables, *t*-tests or one-way analysis of variance tests were used to compare means. The outcome variable representing grade repeats contrasted those participants who had never repeated a grade over the course of their schooling with those participants who had repeated a grade on one or more occasions. The categories contrasting participants who had repeated a grade on one occasion with participants who had repeated a grade more than once were also considered in analyses. Grade repetition was modelled using binary logistic regression analysis.

The numeracy and literacy scores were standardised by transforming raw scores into *z*-scores, for males and females. The *z*-scores were calculated by taking the raw numeracy and literacy score, subtracting the study population mean (by gender) and dividing the result by the study population standard deviation (by gender). The standardised scores allowed for comparison across the study population, which is justified by the lack of population norms that would enable comparability with the BT20 cohort. Standardised *z*-scores were modelled using multiple linear regression analysis. Data analysis was conducted using SPSS (SPSS, 2007). Unless stated otherwise, statistical significance was tested at the 5% level in all analyses undertaken.

3. Results

3.1. School progression

3.1.1. Sample characteristics

Comparative analyses were conducted between the sample of 1989 cohort members who completed the school progression questionnaire (the analytical sample) and the 1284 remaining cohort members who were either receiving special schooling or were not in contact with BT20 and did not complete the questionnaire during the study's 15th year (see Table 2). The

Table 1
Outcome and explanatory variables.

Variable	Description
Schooling	
Age at school entry	Age in years participant commenced schooling
Grade repeats	Never repeated, repeated/1 repeat, >1 repeat
Numeracy score	Standardised score on numeracy section of evaluation
Literacy score	Standardised score on literacy section of evaluation
Age at assessment	Participant's age on the date of evaluation
Mobility	
Total residential moves prior to school entry	Never moved, moved
Total residential moves following school entry	Never moved, moved
Total school changes (excluding transition from primary to secondary school)	Never changed, 1 change, >1 change
Child, maternal and household characteristics	
Child gender	Male, female
Child ethnicity	White, Black, Coloured, Asian
Hospital of birth	Public, private
Residential area at birth	Soweto/Diepmeadow, former Coloured/Asian, inner city, suburban
Maternal age at delivery	≤18, 19–34, 35+ years
Maternal education at delivery	Grade 10 or less, grade 11–12, post-school training
Maternal marital status at delivery	Married/living with partner, single/widowed/divorced/separated
Household socioeconomic index at birth[a]	Constructed from the following binary items: Home ownership: owned, other House type: house, other Water indoor: yes, no Toilet flush: yes, no Electricity: yes, no TV: yes, no Car: yes, no Fridge: yes, no Washing machine: yes, no Telephone: yes, no

[a] This index was calculated using a probit factor model; estimated factor loadings for each item were then used to compute a "wealth index".

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Table 2
Characteristics of members of the analytical sample and cohort members excluded from the analytical sample.

		School progression sample Total (%)	BT20 participants excluded from analysis Total (%)
Child gender	Male	964 (48.5)	627 (48.8)
$\chi_{(1)}^2 = 0.042$, NS, $n = 3273$	Female	1025 (51.5)	657 (51.2)
Child ethnicity	White	51 (2.6)	156 (12.1)
	Black	1662 (83.6)	906 (70.6)
	Coloured	241 (12.1)	142 (11.1)
$\chi_{(3)}^2 = 175.298$, $p < 0.001$, $n = 3273$	Asian	35 (1.8)	80 (6.2)
Hospital of birth	Public	1780 (89.5)	1051 (81.9)
$\chi_{(1)}^2 = 39.496$, $p < 0.001$, $n = 3272$	Private	208 (10.5)	233 (18.1)
Residential area at birth	Soweto/Diepmeadow	1642 (82.6)	787 (61.3)
	Former Coloured/Asian	244 (12.3)	188 (14.6)
	Inner city	11 (0.6)	58 (4.5)
$\chi_{(3)}^2 = 274.832$, $p < 0.001$, $n = 3273$	Suburban	92 (4.6)	251 (19.5)
Maternal age at delivery	≤18	235 (11.8)	107 (8.3)
	19–34	1542 (77.6)	1053 (82.0)
$\chi_{(2)}^2 = 11.647$, $p < 0.001$, $n = 3271$	35+	210 (10.6)	124 (9.7)
Maternal education at delivery	Grade 10 or less	227 (12.4)	228 (20.6)
	Grade 11–12	1430 (78.3)	719 (65.0)
$\chi_{(2)}^2 = 62.504$, $p < 0.001$, $n = 2932$	Post-school training	169 (9.3)	159 (14.4)
Maternal marital status at delivery	Married/living with partner	740 (37.4)	675 (52.9)
	Single/widowed/divorced/separated	1236 (62.6)	600 (47.1)
$\chi_{(1)}^2 = 75.664$, $p < 0.001$, $n = 3251$			
Household socioeconomic index at birth	Minimum	−2.193	−2.216
	Maximum	1.699	1.673
$t_{(2069.219)} = -1.037$, NS, $n = 3181$	Mean	−0.170	−0.206

analytical sample comprised roughly equal numbers of male and female participants and there were no significant differences between the proportion of males and females in the analytical sample and those who were excluded. However, members of the analytical sample were more likely to be Black, born in the Soweto/Diepmeadow area and delivered in public health facilities. There was a higher representation in the analytical sample of biological mothers who were single at the time of delivery, while those mothers with grade 10 or less education, or post-school training were slightly under-represented in the analytical sample. There were no significant differences in the household socioeconomic index between the group that was analysed and the group for whom school progression data was not available.

3.1.2. Education and mobility

The education and mobility profile of participants who completed the school progression questionnaire is presented in Table 3. The majority of study participants commenced their schooling in their 6th or 7th years (43.4% and 42.7% of the sample respectively), and by the age of 15, the majority of the BT20 study sample had completed primary school, and were enrolled in grade 9 or higher. While most of the study participants had not repeated a grade over the course of their schooling, just over a quarter of the participants had repeated a grade on one occasion, and approximately 5% of the sample had repeated grades more than once (where the maximum number of grade repeats in the sample was 4). All schooling variables differed significantly for males and females. While males and females were equally likely to have started school under the age of 6, males were more likely than females to have commenced primary school at the age of 8 or older (15.8% compared with 9.7%), and they were therefore less likely to have completed primary school or to be enrolled in grade 10 or higher by the time they were 15 years old. In addition, levels of grade repetition differed significantly for males and females in the sample, with males having repeated grades more frequently than females.

Table 3
Education and mobility profile by gender.

		Male (%) $n = 964$	Female (%) $n = 1025$	Total (%) $n = 1989$
Age at school entry	Minimum	5 years	5 years	5 years
	Maximum	10 years	9 years	10 years
$t_{(1987)} = 5.168$, $p < 0.001$, $n = 1989$	Mean	6.774 years	6.601 years	6.685 years
Grade repeats	Never repeated	585 (60.7)	793 (77.4)	1378 (69.3)
	1 repeat	309 (32.1)	205 (20.0)	514 (25.8)
$\chi_{(2)}^2 = 69.696$, $p < 0.001$, $n = 1989$	>1 repeat	70 (7.3)	27 (2.6)	97 (4.9)
Total residential moves prior to school entry	Never moved	663 (68.8)	700 (68.3)	1363 (68.5)
$\chi_{(1)}^2 = 0.054$, NS, $n = 1989$	Moved	301 (31.2)	325 (31.7)	626 (31.5)
Total residential moves following school entry	Never moved	635 (65.9)	622 (60.7)	1257 (63.2)
$\chi_{(1)}^2 = 5.750$, $p < 0.05$, $n = 1989$	Moved	329 (34.1)	403 (39.3)	732 (36.8)
Total school changes	Never changed	390 (40.5)	419 (41.0)	809 (40.7)
	1 change	383 (39.8)	420 (41.1)	803 (40.4)
$\chi_{(2)}^2 = 1.029$, NS, $n = 1986$	>1 change	190 (19.7)	184 (18.0)	374 (18.8)

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An analysis of the rates of residential mobility and school changes amongst the group of BT20 participants revealed that prior to the commencement of schooling, 31.5% of children had moved residence on one or more occasions (where the maximum number of moves was 4). In the period following school entry up until cohort members reached the age of 15, 36.8% of the children had moved home on one or more occasions (up to a maximum of 5 times). The majority of BT20 participants (59.2%) had transferred schools at least once outside of the normal transition from primary to secondary school. By the age of 15, 40.4% of children had experienced one non-promotional related school change, and 18.8% of children had transferred schools more than once (up to a maximum of 5 times). While the levels of residential mobility prior to the commencement of schooling and the rates of school change did not differ significantly by gender, a significantly larger proportion of females in the sample moved residence after the commencement of school as compared with males in the group.

3.1.3. Associations with school progression

Residential mobility prior to the commencement of schooling was not significantly associated with grade repetition ($\chi_{(1)}^2$ = 0.032, NS, n = 1989), nor was residential mobility following school entry significantly associated with repeating a grade ($\chi_{(1)}^2$ = 0.349, NS, n = 1989). Nevertheless, the association between grade repetition and school transfers was highly significant within the analytical sample ($\chi_{(2)}^2$ = 11.248, $p < 0.01$, n = 1986).

To further explore the association between grade repetition and school and residential mobility, grade repeats were modelled using logistic regression. Because of the highly significant differences in the pattern of grade repeats for males and females in the sample, the logistic regression models were stratified by gender. The logistic regression models presented in Table 4 contrast participants who had never repeated a grade over the course of their schooling with participants who had repeated a grade on one or more occasions. Due to small frequencies of multiple repeaters in the sample, the ability of the logistic regression model to predict multiple repeats within this group was limited, however, the substantive conclusions did not differ when contrasting the multiple and single repeaters. The explanatory variables 'ethnicity' and 'residential area at birth' were excluded from the final models on the basis that the frequencies of some categories of these variables were very low once the sample was split by gender (which led to validity issues when estimating the models).

Amongst the male participants, the residential mobility variables were not found to be statistically significant in predicting grade repetition, however, the odds of a grade repeat amongst males who changed schools on multiple occasions was 1.524 times the odds of a repeat amongst males who had not changed schools, and for males who had changed schools once outside of the transition to secondary school, the odds of repeating a grade was 1.707 times the odds of a grade repeat amongst males who had never changed schools. A significant negative relationship was found between household socioeconomic status and the probability of repeating a grade, while higher levels of maternal education reduced the probability of a grade repeat for males (the odds of a grade repeat for males whose mother's had post-school education was 0.395 times the odds of a repeat for males whose mothers had grade 10 or less schooling). The model adjusted for the age at which participants commenced their schooling, revealing a negative association. For example, the odds of a grade repeat for a participant who commenced school at the age of 7, was 0.741 times the odds of a repeat for a male who began school at age 6. The model could correctly predict 61.2% of repeaters in the sample of males.

The logistic regression model applied to female participants revealed far fewer variables that significantly accounted for grade repetition. Residential and school mobility were not found to be associated with grade repetition amongst females. Nor was an association present between grade repetition and household socioeconomic status or any of the variables representing maternal characteristics. There was weak evidence of an association between hospital of birth (a proxy for socioeconomic status)

Table 4
Logistic regression analyses: school progression.

	Grade repeats: males			Grade repeats: females		
	β	Std error	Exp(β)	β	Std error	Exp(β)
Age at school entry	−0.299	0.095[a]	0.741	−0.284	0.116[b]	0.752
Total residential moves prior to school entry (moved)	−0.004	0.156	0.996	−0.004	0.173	0.996
Total residential moves following school entry (moved)	−0.055	0.153	0.947	0.197	0.165	1.218
Total school changes (never changed)						
1 change	0.535	0.162[a]	1.707	−0.114	0.180	0.892
>1 change	0.421	0.200[b]	1.524	0.226	0.221	1.254
Hospital of birth (private)	−0.286	0.297	0.751	−0.668	0.353[c]	0.513
Maternal age at delivery (≤18)						
19–34	0.107	0.230	1.113	−0.277	0.240	0.758
35+	0.545	0.322[c]	1.725	−0.096	0.345	0.908
Maternal education at delivery (grade 10 or less)						
Grade 11–12	−0.740	0.221[a]	0.477	−0.384	0.241	0.681
Post-school training	−0.930	0.329[a]	0.395	−0.578	0.392	0.561
Maternal marital status at delivery (single/widowed/divorced/separated)	0.077	0.162	1.080	−0.085	0.183	0.918
Household socioeconomic index at birth	−0.203	0.100[b]	0.816	−0.025	0.116	0.975
Constant	1.748	0.748[b]	5.741	1.247	0.858	3.482
−2 log likelihood	1135.781 $\chi_{(12)}^2$ = 50.274, $p < 0.001$			984.109 $\chi_{(12)}^2$ = 22.313, $p < 0.05$		

[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.10$.

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and the probability of grade repetition, with the odds of a grade repeat amongst females born in a private health facility 0.513 times the odds of a repeat for females born in a public hospital. As was observed in the sample of males, an increase in the age of school entry was negatively associated with grade repetition amongst females. The model could correctly predict 77.1% of repeaters in the sample of females.

3.2. Competency in numeracy and literacy

3.2.1. Sample characteristics

The sample of 1989 participants in the school progression dataset dropped to 1744 participants who completed the numeracy and literacy evaluation. A series of chi-square and mean comparison tests was conducted to determine if the drop in sample resulted in any significant changes in the profile of participants described in the school progression study component. The proportion of male and female participants did not differ significantly between the two analytical datasets; similarly the distribution of maternal characteristics and household socioeconomic status was congruent across the school progression and reduced numeracy and literacy study samples. However, significant differences were present in the population group, hospital of birth and residential area profile across the two samples. In particular there was a drop in the proportion of White and suburban-born children (from 2.6% to 0.3% and 4.6% to 2.2% respectively), with the participants who completed the numeracy and literacy evaluation most likely to be Black (87.0% of the sample), born in public hospitals (91.8% of the sample) and resident in the Soweto/Diepmeadow area at birth (85.6% of the sample).

3.2.2. Numeracy and literacy

An exploration of the unstandardised results of the numeracy and literacy assessment revealed an average score for male participants of 7.538 (SD = 4.837) out of a possible 23 in the numeracy component of the assessment, and 15.987 (SD = 3.850) out of a possible 22 in the literacy component ($n = 831$). Females obtained similar average scores to males in the numeracy component with a mean score of 7.629 (SD = 4.669) out of 23 ($t_{(1742)} = -0.399$, NS, $n = 913$), however, females in the sample scored significantly higher than males in the literacy component of the assessment with an average of 17.104 (SD = 3.056) out of 22 ($t_{(1581.582)} = -6.669$, $p < 0.001$, $n = 913$).

3.2.3. Associations with numeracy and literacy

A series of analyses of variance was conducted on the numeracy and literacy test scores for males and females to determine if mean scores differed according to whether or not the participants had experienced a residential movement or changed schools. There were no significant differences in mean numeracy and literacy scores amongst the group of participants who had moved residence prior to the commencement of schooling as compared with those who had not experienced a move, nor did average test scores differ significantly for participants who had changed schools once, multiple times or not at all. However, average scores on the male literacy and the male and female numeracy components of the evaluation differed significantly amongst participants who had experienced a residential move following the commencement of school as compared with those who had not (numeracy (males) $t_{(467.972)} = -2.308$, $p < 0.05$, $n = 804$; numeracy (females) $t_{(871)} = -2.488$, $p < 0.05$, $n = 873$; literacy (males) $t_{(802)} = -2.325$, $p < 0.05$, $n = 804$; literacy (females) $t_{(871)} = -1.801$, NS, $n = 873$). In each case, the mean score amongst the group who had changed residence after the commencement of school was higher than the mean score of those participants who had not moved home. For males, movers scored an average of 3.7% higher than non-movers on the numeracy component and 3.1% higher on the literacy component of the evaluation, while female movers obtained average scores of 3.5% higher than non-movers on the numeracy evaluation.

In order to explore the associations between the full set of explanatory variables and the numeracy and literacy scores, a series of linear regression models was run using the standardised z-scores as outcome measures (see Table 5). As was the case with the school progression regression models, variables 'ethnicity' and 'residential area at birth' were excluded from the final models because of unfeasibly small sample sizes; the vast majority of the sample were Black and born in the Soweto/Diepmeadow area.

The results of the multiple regression model of standardised numeracy scores for males revealed that neither residential mobility prior to the commencement of schooling nor school mobility were significantly associated with competency. However, males who experienced residential mobility after the commencement of schooling fared moderately better (with z-scores or standard deviation units of 0.188 higher) in the numeracy evaluation as compared with those in the sample who had not moved. Of the child and maternal characteristics included in the model, a significant positive relationship was found between males born in private hospitals and numeracy scores. In addition, household socioeconomic status was found to be positively related to numeracy amongst males. There was also a significant negative relationship between grade repetition and numeracy with males who had repeated a grade achieving z-scores of 0.601 lower than those who had not repeated a grade (equivalent to a difference in raw test scores of 2.907 points). Increased age at school entry was negatively related to scores on the numeracy assessment, with males commencing school 1-year older achieving scores 0.543 standard deviation units below those who had begun school a year younger. The model's adjusted R^2 value indicates that the set of explanatory variables included in the model explained 32.9% of the variation in numeracy scores amongst male participants. Residential mobility after the commencement of schooling described as significant in the numeracy model for males was also found to be significant in explaining literacy scores, with males who experienced a move after commencing school attaining z-scores of 0.197 higher than those who had not moved house. Maternal education and household socioeconomic status were significant in the model of male literacy scores with increased levels of maternal education and higher household socioeconomic indices associated with higher z-scores. For instance, a male whose mother had completed post-school training achieved z-scores of 0.621 higher on the assessment compared with a male whose mother had not received post-school education (with the difference equivalent to 2.391 raw test points). As was the case in the numeracy model, commencing school at an older age and/or repeating a grade were associated with reduced literacy scores. The set of explanatory variables in this model explained 32.1% of the variation in literacy scores amongst male participants.

The regression model of female numeracy scores revealed a similar set of significant predictors as was found in the model for males. Females in the sample who had experienced residential mobility following school entry achieved z-scores of 0.150 higher on the numeracy evaluation as compared with females who had not moved (equating to a difference in unstandardised test scores of 0.700). In addition, being born in a private health facility to a mother with post-school education and/or in a household with higher socioeconomic status was associated with higher relative assessment scores for females. As was the case in the male numeracy model, the variables 'grade repeats' and 'age at school entry' were negatively associated with numeracy scores, while the set of explanatory variables in this model described a slightly lower

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Table 5
Multiple linear regression analyses: numeracy and literacy.

	Numeracy: males		Numeracy: females		Literacy: males		Literacy: females	
	β	Std error	β	Std error	β	Std error	β	Std error
Age at school entry	−0.543	0.040[a]	−0.414	0.044[a]	−0.535	0.041[a]	−0.566	0.044[a]
Grade repeats (repeated)	−0.601	0.061[a]	−0.513	0.073[a]	−0.658	0.063[a]	−0.494	0.072[a]
Age at assessment	0.071	0.107	0.017	0.116	0.099	0.110	−0.106	0.113
Total residential moves prior to school entry (moved)	0.071	0.066	0.096	0.068	−0.038	0.067	0.060	0.067
Total residential moves following school entry (moved)	0.188	0.065[b]	0.150	0.066[c]	0.197	0.067[b]	0.089	0.065
Total school changes (never changed)								
1 change	−0.063	0.068	−0.090	0.070	0.104	0.070	−0.038	0.069
>1 change	0.015	0.084	−0.077	0.090	0.039	0.086	−0.037	0.088
Hospital of birth (private)	0.473	0.128[a]	0.392	0.128[b]	0.094	0.131	0.377	0.125[b]
Maternal age at delivery (≤18)								
19–34	−0.047	0.094	−0.030	0.097	−0.154	0.097	−0.046	0.095
35+	−0.087	0.132	−0.054	0.140	−0.100	0.135	−0.061	0.137
Maternal education at delivery (grade 10 or less)								
Grade 11–12	−0.117	0.092	0.088	0.103	0.195	0.094[c]	0.272	0.101[b]
Post-school training	0.272	0.143[d]	0.625	0.155[a]	0.621	0.147[a]	0.618	0.152[a]
Maternal marital status at delivery (single/widowed/divorced/separated)	0.052	0.067	−0.033	0.073	0.013	0.069	0.004	0.072
Household socioeconomic index at birth	0.209	0.042[a]	0.200	0.046[a]	0.173	0.043[a]	0.092	0.045[c]
Constant	2.777	1.812	2.488	1.955	2.091	1.861	5.338	1.918[b]
Adjusted R^2	0.329		0.220		0.321		0.251	
	$F_{26.876,\ 14,\ 725}$ $p<0.001$		$F_{17.236,\ 14,\ 790}$ $p<0.001$		$F_{25.914,\ 14,\ 725}$ $p<0.001$		$F_{20.228,\ 14,\ 790}$ $p<0.001$	

[a] $p<0.001$.
[b] $p<0.01$.
[c] $p<0.05$.
[d] $p<0.10$.

proportion of the variation in numeracy scores (22.0%) as compared with the model for males. A similar set of explanatory variables found to be significant in the numeracy model for females also achieved significance in the female literacy model, with the exception that no significant linear relationship was present between female literacy scores and residential mobility following school entry. The set of explanatory variables in the model described slightly more of the variation in female literacy scores (25.1%) than was found in the female numeracy model.

4. Discussion

As far as we can ascertain, this is the first study to consider the association between residential and school mobility and educational outcomes in a cohort of South African learners. The analyses utilise two educational outcome measures, progression through school indicated by grade repetition, and competency in numeracy and literacy measured by scores on an assessment. The study considers the frequency of children's residential change prior to and following the commencement of schooling and also quantifies, for the first time, the degree of school movement occurring outside of the normal educational transition. The relationships between residential and school mobility and educational outcomes were found to differ from those observed in the prevailing international literature. While these studies predominantly link movement to disrupted schooling and lower levels of achievement, the South African study demonstrates no association between residential mobility and transition through school, and a positive relationship between residential mobility and numeracy and literacy scores. School mobility was found to be associated with grade repetition for males, but no relationship was observed between school changes and competency in numeracy and literacy. The South African study provides a counter example to the trends observed in high-income countries, while highlighting the complexity and important influence of context on these relationships.

4.1. School progression

Amongst this cohort of urban children, almost a third had moved residence prior to school entry and over a third of the sample had shifted households at some stage following the commencement of their school careers up until the age of 16. However, residential mobility was not found to be associated with progression through school as indicated by grade failure. The BT20 data provides, for what we think is the first time in a South African study, a quantum of the rates of non-promotional school mobility. Rates of school mobility in the sample were very high with 59.2% of participants changing schools outside of the primary to secondary school transition. While the reasons prompting school transfer were beyond the scope of the current study, it is feasible that a proportion of school mobility can be explained as a response (or a precursor) to grade failure. However, only 33.4% of the sample who had transferred schools on one or more occasions had also repeated a grade over the course of their schooling, suggesting that school changes within the cohort are taking place for other reasons, besides those related to grade retention. We would hypothesise that the high frequency of school change may be attributed to learners shifting schools in order to maximise or improve academic outcomes, as was suggested in Motala's (1995) study of a 1986 cohort of Soweto-based learners. In the context of Soweto, where the majority of the BT20 study sample is resident, a current over-supply of educational facilities (due to an expansion during the Apartheid era followed by an aging population) has resulted in a wide range of schooling options with schools incentivised to accept

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new enrolments. Thus the local environment might offer learners a broad spectrum of choice around schooling. A proportion of learners are also known to be travelling outside of their immediate area to attend schools at a greater distance from their homes, in the interests of accessing schools perceived as superior (Sekete et al., 2001). In order to investigate this hypothesis, issues surrounding school quality and learner migration would need to be considered to determine whether learners are moving from low-achieving schools to higher-achieving schools.

The BT20 data provides further evidence of the large repeater burden in the South African schooling system, and the higher level of grade repeats amongst male learners as compared with females, a finding synonymous with research conducted by Anderson et al. (2001) and Branson and Lam (2009). The analyses revealed a larger set of predictors significantly associated with grade repetition amongst males as compared with females in the sample. For males, a significant relationship was found between grade repetition and school mobility. South African studies have not expressly investigated the relationship between school mobility and academic achievement, however, grade failure has been linked to negative in-school experiences (Department of Education, 2007). Further, international research has demonstrated negative associations between school mobility and school and academic functioning (Alexander et al., 1996; Nelson et al., 1996). Therefore, it seems plausible that males in the sample may shift schools as a response to grade failure at an existing school. Alternatively, a change in school may lead to adjustment issues or disruption, which may in turn result in males being held back a grade. An inverse relationship was found between grade repetition and socioeconomic indicators such as maternal education and household assets for males, and birth at a private hospital for females. This link between socioeconomic status and academic achievement has been well demonstrated in educational attainment literature. For both male and female participants, the higher the age of school entry, the lower the probability of a grade repeat. In previous research findings, BT20 cohort members who commenced school at younger ages (at age 6) were more likely to repeat grades earlier in their schooling with the pattern of grade repeats becoming more uniform for cohort members who began school slightly older (at age 7) (Fleisch and Shindler, 2009). This finding is consistent with provincial-level survey data indicating that grade failure is more common in under-age children, who may be perceived by teachers as immature (Perry and Arends, 2003).

4.2. Competency in numeracy and literacy

One striking difference between the school progression analysis and the analysis of numeracy and literacy scores was the significant positive relationship between the later educational outcome and residential mobility following commencement of schooling. Males who had moved home after entering school achieved significantly higher average scores on both components of the assessment, while females in the sample scored significantly higher on the numeracy component if they had experienced residential change. As suggested in the international literature, an understanding of the effect of mobility on educational outcomes would be assisted by investigating the circumstances driving (and resulting from) movement (Alexander et al., 1996; Dong et al., 2005; Rumberger, 2002). In South Africa, residential mobility has been shown to enable children to gain access to potentially improved care structures and educational opportunities (Paterson and Kruss, 1998; Zimmerman, 2003). Studies have also demonstrated significant associations between educational outcomes and children's living arrangements and household structures (Anderson et al., 2001; Townsend et al., 2002).

In the BT20 study, detailed data describing children's living circumstances were not available, however, results of a longitudinal analysis of factors associated with movement linked residential mobility to lower socioeconomic proxies—suggesting movement within the cohort is more frequently driven by necessity (Ginsburg et al., 2010). Nevertheless we might hypothesise that even in these instances relocation may have the advantageous effect of offering stability to some children, possibly in the form of an alternative schooling or care arrangement, or an improved residential locality. A preliminary exploration of reasons for movement within the BT20 cohort revealed that moves associated with childcare or schooling comprised 14.9% of all reasons cited by caregivers for participants changing residence (Ginsburg et al., 2009). Reasons included moving to be in closer proximity to participants' schools, which would have the effect of reducing transport time and costs associated with travel. This example illustrates a positive consequence of residential movement, which may translate into improved educational outcomes for children.

Controlling for residential mobility, the analyses of BT20 participant's numeracy and literacy scores provided evidence of a positive relationship between household socioeconomic status and competency. In addition, being born in a private hospital, to mothers with higher levels of education was linked to higher outcomes in the assessment. The analysis of numeracy and literacy scores also controlled for aspects of school education, thus connecting the two study components. The relationship between school progression and competency was significant, with those participants who had repeated a grade scoring lower on the evaluation, and those progressing through school without a grade failure achieving higher scores. Nevertheless, while residential mobility was found to be positively associated with competency, the lack of association between school mobility and numeracy and literacy would suggest that changing schools is not translating into improved educational outcomes amongst this group of children, even if this is the intention. As with the school progression analysis, a measure of school quality is likely to have a mediating influence on these relationships and would be of interest. Older ages of school entry were associated with lower relative scores on the numeracy and literacy assessment reflecting the fewer years of schooling completed by learners who had commenced school later.

4.3. Limitations and future research

The current study provides insight into the relationship between residential and school mobility and two educational outcomes, thus offering a new and original contribution to understanding the potential forces impacting education in an urban South African setting. The results reveal certain limitations with the current data and highlight a number of areas warranting further investigation. While the analyses identified some important factors explaining school progression and competency in numeracy and literacy, a number of confounding factors could not be included in the investigations because of a lack of available data. These explanatory models would benefit from the inclusion of school level variables such as measures of school quality in order to ascertain the extent to which movers are shifting from poorer to better quality schools. Neighbourhood and community related factors would also be of interest in understanding the context in which children are living and attending school. Further, knowledge of how residential moves reflect new household formation and composition, as well as the relationships between learners and household heads would add value. A more complete understanding of these dynamics would be greatly assisted by further exploration of the circumstances and reasons prompting both residential mobility and school change.

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The educational outcome variables employed in such analyses may not always provide adequate or sensitive enough measures of educational achievement and academic ability. While grade repetition may be indicative of individual academic ability, it may also be a function of social processes occurring within schools themselves. Numeracy and literacy evaluations are subject to issues of validity and reliability, however, they are considered better proxies of educational attainment and have the advantage of providing a uniform means of comparison for learners attending a range of schools with diverse standards and methods of academic assessment. Finally, the current study provides an initial investigation of the frequency of residential mobility and school changes over time. Following from this paper, a longitudinal analysis incorporating the sequential placement of school and residence would be of interest. This approach would consider the patterns of interaction between residential movement and school change over time, while further incorporating the effects of the timing of a school or residential change on learners' educational outcomes, which has been found to be significant in international studies (Haveman et al., 1991; Swanson and Schneider, 1999). This would also allow for an investigation of the relationship between school mobility and grade repetition to gain clarity on the extent to which school changes are a consequence of a grade failure, and vice versa.

4.4. Conclusion

The results of the analyses presented in the paper reveal that residential mobility amongst South African urban children does not appear to have an adverse effect on educational outcomes. On the contrary, the study provides some evidence of a positive association between changes in residence and educational outcomes, possibility as consequence of movement resulting in improved living circumstances, even amongst the more disadvantaged children. The study demonstrates a high frequency of school change occurring within this cohort of primarily Soweto-based children. While some school mobility may be a response or precursor to grade failure it is likely that a large proportion of this non-promotional school change is occurring as a result of the wide range of educational options available to these children. This environment of diverse choice would allow for children to maximise their schooling outcomes, however, the extent to which school change is linked to improved educational outcomes is not evident.

The South African study reveals a range of generative mechanisms linking residential and school mobility to educational outcomes. It also highlights the complexity of these relationships, illustrating that observed trends are likely to be highly context specific. Given the important role of education in developing human potential, alleviating poverty and unemployment, and promoting future economic growth, a broad understanding of factors that may impact on educational access and outcomes in South Africa and other transitional societies is a priority. This paper provides a new contribution to furthering the understanding of these issues, and proposes a direction for future research into these phenomena.

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