RESTRUCTURING AND HOSPITAL CARE: SUB-NATIONAL TRENDS, DIFFERENTIALS, AND THEIR IMPACTS; NEW ZEALAND FROM 1981

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“A nation’s health can be measured by how long we live and how often we end up in hospital”.

Dr Jim Primrose, Ministry of Health, quoted in
***New Zealand Herald*, 2nd April 2003**

PREFACE

This monograph is an integral part of a long-standing stream of research on mortality and morbidity in the Population Studies Centre, University of Waikato, New Zealand. Under the leadership of Ian Pool, it has produced a wide range of technical monographs, published papers, theses (PhD and Masters), and chapters in books or sections in books on other or more general topics.

This stream of work fitted naturally with, and thus has been integrated into and continued under the Enhancing Wellbeing in an Ageing Society (EWAS) programme, which is coming to a close later this year. This multi-year research programme, which is being carried out by the Population Studies Centre in partnership with the Lower Hutt-based Family Centre's Social Policy Research Unit, has been funded by the Foundation for Research Science and Technology, to whom grateful acknowledgement is made. Health is central to the wellbeing of the elderly, as is clear in separate pieces of work co-authored by Ian Pool, Michael Cameron, Suzan van der Pas and Ben Amey, also emanating from the EWAS programme, which surveyed wellbeing among the elderly. It forms chapters in other monographs, edited by Peggy Koopman-Boyden and Charles Waldegrave, on a wide range of the "dimensions" of wellbeing as defined by the Ministry of Social Development.

What is striking is how the patterns and trends demonstrated by the survey data on health reported by Pool *et al.* in these other studies are independently confirmed by the analyses in the present monograph on a totally different, population-level data set. This present monograph studies the impacts of the health system on population-level outcomes, nationally and for New Zealand regions, over the last two and one-half decades during which the system has undergone radical restructuring. The regions studied are based on District Health Boards (DHBs) or groups of smaller DHBs.

This monograph covers a period in which there was a great deal of policy and structural turbulence in the health sector. Most, if not all, other analyses of this have looked at process and structures: in contrast, this monograph focuses on the impacts on the population in terms of efficiency-, effectiveness- and equity-gains. It thus takes a totally different perspective, one that justifies the reflection that has gone into it and its extended gestation.

As the aged constitute by far the largest group needing access to hospital care, this monograph gives a great deal of attention to them. It uses in particular a life-table methodology that was developed at the Population Studies Centre, and which has been peer-reviewed internationally in three separate publications (an Australian health journal, a WHO publication and a publication of a French scientific organisation) plus in two overseas academic presentations.

This work was initiated, and much of the research carried out, under a grant from the Health Research Council, whose support we gratefully acknowledge, on social differentials in health. It has also produced numerous other publications and papers referred to later in this monograph.

But the focus here on regional differentials has been enhanced by yet another stream of work at the Population Studies Centre, funded by the Foundation for Research Science and Technology, and also directed by Ian Pool: an analysis of demographic, social, economic and other differences between local government regions. This has produced numerous papers, presentations to local government and other agencies, and 12 discussion papers of the Population Studies Centre (available on- line). One of these deals with hospitalisation and health issues for local government regions, thus paralleling the regional analysis in the present monograph, and also allowing spatial correlation between health and a wide range of other factors.

Ian Pool's co-authors all worked at, or in association with, the Centre at some stage. But because of data cleaning, and filtering, the need to formulate and construct a life-table methodology that allowed for both survivorship and admission/discharge (alive) from hospital, the extent, complexity and detail of the empirical analyses, and the need to reflect carefully on the results – all issues discussed in the

Prologue – this project has been spread out over a number of years. Thus all the other authors are now working in other agencies, most related to health in some way. I wish to thank these other people who have contributed so much to the Population Studies Centre's ongoing research: above all, Sandra Baxendine; Jit Cheung; Ngaire Coombs; Arunachalam Dharmalingam; Gary Jackson; Judith Katzenellenbogen; and Janet Sceats. Jenine Cooper, who carried out the editing, is a member of the Centre.

Finally, it is a pleasure to thank Antony Raymont, who provided an external peer review. Medically trained, with a PhD in Community Health and twenty years experience in health services research and policy, who has very recently published on trends in admissions/discharges and related issues, he was ideally qualified for this important task.

In addition to publishing this monograph, we are also publishing a web-based appendix (http://www.waikato.ac.nz/wfass/populationstudiescentre/). This includes detailed tables, figures and methodological issues, which are of limited interest to a wider public. Additionally, Text Appendix C summarises results region by region. This is intended for hospital planners and managers at a sub-national level.

I recommend it to public health and social researchers, and particularly to policy analysts. Because of the need to tease out some critical factors that confound the pure delivery of hospital care, this is a long and detailed monograph. But as the largest sub-sector of one of the largest public policy cost areas, it deserves such an in-depth evaluation in a period in which policy changes were rapid and radical, and the sector was subject to a great deal of turbulence.

Richard Bedford, QSO, FRSNZ
Director, Population Studies Centre

PROLOGUE

This monograph has its provenance in the long-standing interest of the Population Studies Centre (PSC) in the analysis of mortality and health. More immediately, the PSC received two grants that interlocked to provide the inspiration for this monograph.

Firstly, a grant from the Foundation Research Science and Technology (FRST) included among its objectives, analysis of New Zealand's population geography including, of course, analysis by gender, age and ethnicity,[1] as well as region. This resulted in a series of Discussion Papers[2], available both in hard copy and on the web, and drawn upon very heavily in this monograph. Here the role of these analyses was to provide data on the explanatory demographic, social and economic factors that might affect health differentials. One of the discussion papers, number 63, covered hospitalisations and some related health facts, for local government regions, for some of the key indices discussed in the present monograph. We wish here to acknowledge the Foundation's support.

Secondly, a grant from the Health Research Council was gained to explore social differences in health. Regions were used as units of reference. These were composed of District Health Boards (DHBs as presently constituted, 2009) or, where population sizes were small, groupings of geographically contiguous DHBs. Age, gender and ethnicity were also built into this analysis.

The Foundation for Research and Science Technology must also be thanked for their support of the last stage of this research. The elderly represent a major component of the hospital cases, and analyses here devote a great deal of attention to them and their wellbeing. This study contributed to the wider research at the Population Studies Centre, "Enhancing Wellbeing in an Ageing Society" (EWAS). Health is a central factor, reported on here and in one of the chapters in EWAS monographs being edited separately by Peggy Koopman-Boyden and Charles Waldegrave.

This study produced numerous papers, referred to in the text, plus the regional analysis noted above. A number of the papers were methodological: relating to the cleaning or filtering of the data (a major undertaking), plus the construction of an innovative life-table method, analogous to, but not as powerful as, the more familiar health expectancies (HEs). A point of similarity is that they both analyse the health of populations.

The technique developed for the present study, the Hospital Utilisation Expectancy (HUE), is based on Sullivan's observed prevalence techniques. It is really a macro-level technique[3],whereas, the HE is micro-(sample-based). The HUE is at a population level and uses hospital discharges, a readily available source of data. Unlike the HE, it does not require specially commissioned surveys. It also uses data bases with very large numbers that are commissioned for standard hospital and health management purposes. These data allow regional, as against national, analyses to be made, and, as they have been digitalised since 1981, permit long-term analyses.

Because it also takes account of survivorship, the HUE is a more powerful tool than conventional techniques of hospital analysis such as discharge rates. Also behind it, is the well explored domain of life-tables. They are a robust tool and one well adapted to health management analyses. But, to introduce the HUE, this monograph also has several earlier chapters that describe trends using more familiar methodologies.

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[1] Throughout the text of the monograph we have been consistent with the use of the macron in Māori to denote a long vowel sound. Unfortunately, we have been unable to correct some of the figures that were created during the earlier years of this work.

[2] Under the generic title of ***New Zealand Regions 1986-2001***, Discussion Papers number 52-60, 62-63, plus "Population Trends, Connections and Imprisonment: Demographic Divergence, Dichotomy and Diversity" (number 61) and "Components of Regional Growth 1986-2001" (number 44). These papers cover population dynamics, structures and geography; households, families and dwellings; education, employment, industries and occupations; incomes; dependency and social capital; crime and conviction; and health issues.

[3] It relates hospitalisations and survivorship in any region to the population of that region.

The decision to formulate and construct the HUE especially for this study did not come lightly. Its genesis was a technical monograph, written by some of the present authors, plus others then at the Centre.[4] This technical monograph grew out of a report commissioned by the Ministry of Health, a project co-ordinated for them by Dr. Martin Tobias who played an active and positive role in the report's gestation and development. The resulting study was refereed internationally by Emeritus Professor Lado Ruzicka, Australian National University, and Dr. Colin Mathers, then at the Australia Institute of Health, now in WHO (Geneva); two eminent Australasian experts in Population Health, especially life-table analyses.

The present monograph has had a long gestation while methodologies were developed, data cleaned and the analyses undertaken. But, more importantly, it has been slow in reaching a final stage because its methodologies, its theoretical underpinnings, its empirical outputs and the policy implications the results suggested all required a great deal of reflection. These reflections then generated more research as major critical questions were asked and had to be responded to: as is noted in Chapter 14, what seemed a straight forward exercise – we had the data and we developed an appropriate methodology – turned out to be remarkably complex. Questions ranged from small 'm' methodological, to almost metaphysical. For example, this monograph provides further light on one of the great questions of the age – will older people live longer and longer and if so, in good or poor health? It also had to wrestle with the issue of whether live-discharge from hospital represents a gain in quality of life for the patient.

Much of the reflection revolved around attempting to tease out the effects of demand for services from access to and the supply of hospital services. To this end, the monograph attempts to look at discharges and survivorship through many different lenses. Furthermore, it breaks with conventional studies of admissions by reviewing trends in invalid/sickness benefits, which were also analysed, along with other types of benefits, in detail in the regional discussion papers noted earlier.

It became evident that rather than being a simple empirical study of trends in hospitalisation, this was an analysis of the effects on the population of a health system undergoing radical restructuring, not once but several times. To increase the power of this part of the analysis a framework was formulated. An attempt was made to evaluate and parse out efficiency-gains (the accounting measure) from effectiveness (the population health measure), from equity (the social measure).

There was yet another dimension to this. The elderly represent a major component of the hospital cases. Some of the changes and trends reported here affect them disproportionately. Equally well, health that fits the norm of what might be expected at their age is one of the most essential underpinnings of wellbeing for the elderly. This, and the trends in health and wellbeing are documented in a chapter in a monograph being edited as a part of a related research programme at the population Studies Centre, *Enhancing Wellbeing in an Ageing Society* (EWAS). The present monograph is an integral component of the programme as they relate to the role of hospitalisation in health and wellbeing.

Almost inevitably with a project that went through such a long gestation, the personnel engaged on this study changed. Only one person, the author of this prologue, was with the PSC and project at the beginning and almost the end (but is now retired). Others among the *dramatis personae* played a key role, then on leaving typically moved into major roles in the health research field. Most important among them was Sandra Baxendine, now an analyst at the National Centre of Mental Health Research, Information and Workforce Development (Te Pou), whose contribution covered almost every aspect of the work on this monograph from the basic computations, to writing, to being the project's statistical watchdog. Judith Katzenellenbogen, now at the Centre for International Health, Curtin University, Perth, drove the very important task of preparing the data for analysis, particularly the filtering, and also the empirical analysis of discharges. Jit Cheung, now at the Ministry of

[4] Kim Johnstone, now a researcher at Charles Darwin University, Darwin and Sarah Hillcoat-Nalléntamby, now a Senior Lecturer at the University of Wales, Swansea.

Education after serving in the Ministry of Health, developed the HUE and also provided major inputs to the study for some of the theoretical issues, notably on compression of morbidity and mortality. He also showed the utility and robustness of the methodology in a separate study that computed HUEs at a sub-DHB level, and computed the projection reported in Chapter 14. Janet Sceats, now retired, used her extensive knowledge of the health system and data, hospitals in particular, to carry out a detailed edit of substantive issues raised in the monograph, and to provide explanatory data including the policy context. Arunachalam Dharmalingam, now at Monash University, Melbourne, provided technical analyses and the internal peer reviewing of this research. (Dr) Gary Jackson and Janet Sceats made valuable impacts, both methodologically and substantially. Ngaire Coombs' worked on the second substantive edit, and updated the statistical analysis to 2006. Her work was supported by the Economic and Social Research Council (U.K.), whom we wish to thank. Special thanks must be given to Jenine Cooper. She took on the difficult task of copy editing, but added far more to the publication than this might suggest. Last but not least, (Dr) Antony Raymont peer reviewed this monograph. His background and experience as a medical practitioner and health services researcher made his input particularly useful. Additionally, he brought to this task specialist knowledge about discharge data gained very recently in research and publication on this issue.

The remainder of this monograph reviews the issues to be discussed and looks at the social and demographic structuring of the regions analysed. Regional differences for conventional measures of survivorship and hospitalisation are then described. Next it turns to the HUEs themselves, generically and for different sub-groups. Trends are then explained by analysing the various questions raised in this prologue. Finally, it synthesises the findings, extends the study nationally to 2006, and then presents some projections linking future demographic change to projections.

Ian Pool FRSNZ

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PART I:

INTRODUCTION

CHAPTER 1

Mapping Sub-National Differences in Health

1.1 CHANGES IN AND ISSUES RELATING TO NEW ZEALAND'S HEALTH CARE SYSTEM

1.1.1 The Research Questions

An analysis of the 'nation's health' is the central concern of this study. Its genesis was a detailed, technical, time-series research on regional and ethnic differentials in health in New Zealand. But as this work progressed it became increasingly evident that the results of this more narrow analysis could make a wider contribution to the development of a knowledge-base on health trends and on the impacts of policy on these. In a sense, the analysis provides a demographic audit of health trends over the last two decades.

The focus here is different from that in most other studies on restructuring of the New Zealand health system as their concern was either to review in detail the rewriting of policy *per se*, and attendant structural and institutional changes (Fougere 2001), or to identify how these changes relate to changes in mortality (Blakely *et al.* 2008). The research question reported here was, instead, to analyse the most crucial of health outcomes, 'how long we live and how often we end up in hospital', identified in the earlier quotation, to report patterns and trends in hospital use nationally and sub-nationally over the period under review, and to determine the degrees to which various sub-populations benefited, or did not benefit, from these changes. The analysis focuses on the hospital sector in the system, but it will also show relations between this and other sectors, formal (e.g. primary health) and less formal (notably the healthcare afforded sickness and invalid beneficiaries).[5] Thus two questions are addressed:

1. whether or not the nation's population health improved over the period and;
2. whether or not there was a convergence in patterns of health gain across its constituent sub-populations defined geographically and ethnically.

This monograph deals with sub-national differences in health in New Zealand over a period of substantial socio-economic restructuring and associated radical changes in health policy, health systems and their related information systems (see also, Text Appendix A). It complements the recently published analysis of national ethnic trends in mortality (Blakely *et al.* 2004), but differs in several critical respects. That study reviewed health status by emphasising aetiologies and causes of death. In contrast, the present analysis focuses on actuarial dimensions of both mortality and morbidity and on health as measured by functional capacity rather than the disease orientated 'burden of disease'. It goes beyond health status issues to look at the system itself, to assess whether health policy outcomes were generated more through efficiency-gain (economic or service delivery, such as those resulting in a convergence sub-nationally of supply and demand effects), or through health gains, or ideally, by both.

To do this, and as a by-product to analyse changes in health status and the system in an era of restructuring, innovative methodologies and composite time-series indices combining the two dimensions of a 'nation's health', needing hospital care and longevity, have had to be custom-designed. To achieve this objective, the ensuing analysis is often technical, and may introduce concepts that are unfamiliar to some readers. In order to look at possible inequalities of outcome, comparisons were made between regions and ethnic groups, as well as age-groups and genders, and as a result, in places the analysis becomes rather complex.

[5] We use 'informal' to denote where there is less direct systematic and structural access to healthcare. This distribution between formal and less formal will be used throughout this study, but become very important in Chapter 13.

1.1.2 The Period 1981 - Early 2000s in Historical Context

Over the period covered in the research reported here the institutional structures of New Zealand's health care system underwent very significant and multi-dimensional changes (Gauld 2001; Scott 1994; Ashton 1999; Fougere 2001). This restructuring followed a long period of relative institutional equilibrium running from the early 20th century until the decade between the 1960s and 1980s. The structures and functions implanted at the dawn of that century in the *Public Health Act*, 1900 remained remarkably intact, although the form of the system altered with the 1938 *Social Security Act* and related legislation. The following years also saw a plethora of new regulations mainly in public health fields (Pool 1982).

The structures that were to be maintained across much of the twentieth century had been introduced at a time when the majority Pakeha population, at least, had already achieved their most rapid decline in mortality (prior to 1900). But the momentum effects of these survivorship gains were carried forward to the 1920s and 1930s as the cohorts that had been exposed to rapid improvements at childhood ages moved through their life-cycles (Pool and Cheung 2003).

As a result of these survivorship gains New Zealand was an early leader in increases in life-expectancies (Pool and Cheung 2005). Over the twentieth century it gradually ceded this position to other countries. Nevertheless, the period during and after World War II through to the 1960s saw major gains in health, above all accelerated improvements for Māori that allowed their survivorship levels to converge towards Pakeha. The system that produced these changes was one that was based around virtually free and universal health care, a product of the *1938 Social Security Act*, and delivered through institutions, hospitals controlled by territorial Boards and with primary health care coming from general practitioners (GPs) or various publicly funded nursing agencies.[6] These structures had been implanted under the *1900 Public Health Act*, the most high profile change to which had been the reforms coming from the *Social Security Act 1938*, which introduced a publicly funded fee for services paid to general practitioners. This period was also notable for the way in which health policy and services were embedded into wider social policy (Pool 1994).

Despite two World Wars, a severe depression (1930s), a period of low fertility (1910-1940s), a baby boom (1943-1973), and, prior to World War One and following both World Wars, large migration in-flows, the geographical distribution of the population also maintained a form of equilibrium. New Zealand's population geography was intimately bound to its economic functioning: essentially an external economy dependent on the export of primary products to one dominant market, the United Kingdom, from which many manufactured goods and foreign investment came. The domestic economy was strongly affected by the external economy, yet was also cushioned by Empire preferences, tariffs and similar instruments. The 1880s to the 1920s was a period in which, so Belich argues, New Zealand voluntarily went through 'recolonisation' (Belich 2001: 53-86; Pool 2002), the effects of which were felt through much of the 20th century. These factors reinforced the others just noted in sustaining the *status quo* in the health system.

1.1.3 The Last Three Decades: Context

Over the last three decades New Zealand has gone through a period of turbulence affecting most social, cultural and economic sectors. The health system was certainly far from immune from this; indeed, it also instituted its own endogenous changes, not once but several times. The determinants of turbulence were sometimes external forces, such as globalisation, sometimes domestic societal change, including shifts in demographic, economic and cultural values, dynamics, institutions and structures, and sometimes because of policy interventions. The triggering mechanisms for the timing of the onset of turbulence seem to have been partly economic, notably the entry of the United Kingdom into the European common market that effectively undermined the props for the country's

[6] e.g. the Public Health Nursing Service. The Plunket system, directed at infant and childhood health, was administered both by professionals and volunteers, and, in the main, funded publicly.

economic development (Hawke 1985), and swung the country brutally away from the comfortable re-colonisation that had characterised its ethos in the years of equilibrium (Belich 2001: 394-460). But there were also far-ranging shifts in value-systems for many different aspects of social and family behaviour, some home-grown, others imported from or imitating what was happening abroad, particularly in Britain and the United States. It should be remembered that the full impact of television was not felt in New Zealand until the late 1960s/early 1970s (Belich 2001: 426-427; Pool *et al.* 2000).

Over the last three decades New Zealand's demography has gone through numerous shifts. Pakeha fertility rates have fluctuated from baby-boom to baby-bust, to baby-blip, and Māori levels of reproduction went through a dramatic decline (Pool *et al.* 2007). After a long period of stagnation (1960s to 1980s) Pakeha survivorship improved significantly, whereas, by contrast Māori levels improved then stagnated, while what is termed cohort deterioration occurred (Pool and Cheung 2003).[7] The population geography went through a period of severe disequilibrium. There was out-migration from, and a slowing of growth in most regions and even population decline in a few, with increasing concentration in several metropoli, especially Auckland (Pool 2002). Also, international migration flows fluctuated wildly over the period, as a function both of inflows of overseas born and returning New Zealanders, and outflows of New Zealand-born or residents. The net impact of these flows was to increase the diversity of the population-mix, and in particular to see the rapid growth of Asian and Pasifika minority populations, especially in Auckland and to a lesser degree in Wellington. This had an impact on both health planning and on New Zealand's regional geography, and is discussed further in Chapter Two and Three.

The economy also went through major restructuring across most sectors and for most factors of production and exchange. In part this was a response to globalisation, to radical shifts in overseas market destinations and in source countries for imports, and to a differing profile of export goods, albeit still heavily weighted towards primary commodities. But in part it also resulted from a change across the developed world and elsewhere from the so-called 'old economy', geared towards production and exchange of commodities that were now being produced more efficiently or in low-wage economies, to the 'new economy' that was built around the highly-skilled service sectors, such as finance and information, and attendant supporting industries, such as cleaning and catering. Along with this went further shift-shares in the labour force that saw the growth of new economy jobs, but also major changes in the way paid employment was organised, with casualisation, increases in part-time work increasing resort away from industry-wide negotiations about wages and conditions, to individual or enterprise-wide contracts. Beyond this there were both macro- and micro-economic policy shifts, directed at deregulating the economy, to opening it to international market forces and to decreasing the size and responsibilities of the public sector (Castles *et al.* 1996).

At an operational level, managerialism became not only the dominant instrument for social and economic organisation, especially in the public sector where business models (e.g. market forces, profit) were to supplant administration of the Weberian type, but the occupation 'manager' became so widespread that it represented almost a sub-sector. A search for durable outcomes, through planning and a longer-term perspective were seen as less urgent goals than efficiency, accountability and performance (i.e. more immediate processes), the measurement all of which became ends in their own right. For New Zealand's public sector this was enshrined in a major piece of legislation, the *State Sector Act, 1988*, which was of critical importance for the health sector (Castles *et al.* 1996).

There can be no doubt that both the economic and the public sector restructuring permitted important substantive changes to be implemented. Whether they would have occurred anyway remains a moot question beyond the scope of the present research, for which it is sufficient to associate the restructuring with the efficiency gains, and some accompanying health gains, that may be identified here. It is not our brief to make a critical analysis of the 'reforms'. That said, it is important to note a

[7] As these trends are important for setting the research questions for the rest of the monograph they will be discussed later in the present chapter. 'Cohort deterioration' is when cohorts at various life-cycle stages have lower possibilities of survival than those preceding them: intuitively, with progress, each cohort's probability should be higher than those going before.

fact that is germane to the present analysis: across the public sector, and perhaps no more so than in health, these three decades were a period of marked structural instability as different 'experiments' (to use the term employed by Castles *et al.* (1996)) were unfolded, sometimes retracted and at other times redesigned.

The introduction of this wide-sweeping act and other associated restructuring, in health and elsewhere, was done at great speed and with zeal on the parts of their advocates, who were very successful in implementing a true revolution. But perhaps more importantly, as in a key document advocating a shift to business models (Gibbs 1988), in many cases restructuring was implemented without the existence of an adequate evidence base, either relating to substantive or managerial issues. The most rapid changes and much of the emphasis in rectifying this was put on the managerial aspects, and this was reinforced by the contractual models that dominated health management in the 1990s. Retrospectively, it seems incredible that such far-reaching changes could have been entertained in the absence of empirical information on the very thing being restructured, on health trends.

These *lacunae* also affect the present study, for it must be stressed that much of the research here, concerned as it is with the more substantive question of the nation's health, has been rendered difficult by the lack of data, or by having to analyse what are far from robust data sets. Unfortunately, this holds true for some absolutely key areas relating to the supply and demand of services. Thus methodological strategies (see also Text Appendix D) have had to be developed to attempt to overcome this problem, as a result often making the analysis rather more complex and technical than would otherwise have been the case. But a caveat must be entered here - that some of the results (e.g. analyses of day-patient trends, a factor of significance in the restructuring) must be seen as conditional rather than definitive. Moreover, as some data shortfalls varied from place to place, as will be shown, this has a particular effect on a study looking at regional differences.

The health system restructuring also took place in an era in which many aspects of the society itself changed significantly, often in ways that had implications for health. The 1970s seem to have been a pivotal decade in which, for example, income inequalities that had systematically declined since World War II started to increase again. The wage-price freeze of the early 1980s temporarily stalled what would become a marked trend (Martin 1998), in which both individual and regional differences mounted (Pool *et al.* 2005a). Accompanying this was a rapid rise in unemployment, especially in the late 1980s/early 1990s, a trend which reversed in the later 1990s, but not with sufficient force to bring rates back to early 1980s levels (Pool *et al.* 2006a). A demographic accounting exercise showed that there were fewer jobs in 1996 than there had been in 1986 (Honey 1998). Joblessness, discouraged worker effects, and other related factors became more apparent, as did an increase in individual and regional differentials. Co-varying with these were shifts in value systems, as for example a rapid growth of secularisation (Young 1997). At a macro-level the net result of these changes was a growing dichotomisation, or even trichotomisation (Pool and Baxendine 2006) between the 'have' regions, those just getting by, and 'have not' regions. These divisions occurred not just for factors of human capital and income inequality, but for those relating to social equity and cohesion (Pool *et al.* 2006b; see also Text Appendix C).

Parallel to these changes were shifts in family structures and forms. The baby bust noted above, and its associated lower fertility, introduced major structural changes, and including: family sizes, delayed childbearing and reproductive polarisation (Pool *et al.* 2007; Dharmalingam and Pool 2004). Again, there were inter-regional as well as inter-family differences. In the media, however, more attention was focussed instead on the changes in family forms, most notably the increases in sole-parenting and the shift to cohabitation as against marriage as a preferred form of first union (Pool *et al.* 2007).

To summarise, the turbulence of the last three decades has produced a New Zealand that is very different from that of around 1970. This turbulence touched every aspect of the society and economy, and the policy environment, including the health sector to be discussed below. Social change also manifested itself at the individual, ethnic group and regional levels – the next chapter will discuss the last two factors.

1.1.4 The Last Three Decades: The Health Sector

From the 1960s, there had been growing concern over two issues in the health sector. Firstly, the institutional structures, including the large number of Hospital Boards some of which served very small populations, and secondly, whether the supply of services was in accord with emerging population patterns and trends and new technologies. A White Paper dealing with these issues was released in 1975, and, although there was severe opposition to its recommendations, a number of its features were being implemented by the early 1980s, formally so in 1983. But in the 1980s and 1990s, as a part of general economic and social policy restructuring, New Zealand's health system went through a series of radical reforms. Only the key features can be noted briefly here (see Laugesen and Salmond 1994; Scott 1994):

- In 1983, legislation was passed to restructure the health system. Area Health Boards (AHBs), 14 in total, replaced Hospital Boards, and attempts were made to integrate public health and secondary and tertiary care systems. The reorganisation was completed by the late 1980s. The restructuring involved far more than simply setting up new structures on the foundations of existing institutions. For example, there was a shift from in-patient procedures to day-care (an issue that will be detailed later). To take another case, there were numerous changes intended to improve accountability and management processes.
- Also starting in 1983 was the move to population-based funding (PBF) for hospital care. Prior to this funding was based on historical allocation plus negotiated additions each year; and was becoming increasingly inequitable. In a remarkably clear and lucid analysis, the 1980 Shanks report laid out a method for the fairer funding of hospitals. This began in 1983, but the path to equity was long and slow. The main effect was to shift growth funds from the South Island to the upper half of the North Island. As we will demonstrate in this monograph this had a profound effect on reducing the relative over-supply of hospital services in the South Island. After the change to Regional Health Authorities (RHAs), a new formula was derived, and RHAs reached 'equity' in 1997/98, but with the advent of the HFA this became obscured. A new formula produced in 2001 for DHBs began implementation in 2003/04 and by 2007/08 New Zealand was near target - at least the target set by the PBF formula.
- Accident Compensation Corporation (ACC) also underwent significant changes as a result of the restructuring in the 1980s. Free market economics influenced changes to ACC legislation in 1992 including adjusting employer levies on the basis of costs of their claims, prescribing entitlements for claimants, privatising the employers' account and introducing work testing for the claimant (Armstrong 2007).
- Perhaps the most radical organisational change over the two decades came out of policy shifts signalled in the 1991 budget (Shipley *et al.* 1991). It instituted a major new principle, a 'purchaser-provider split'. Following this a Public Health Commission, that had only a brief existence (see below), and four Regional Health Authorities (RHAs) were created to fund services so as to produce 'health gains' for the populations of their regions. To do this they were to "purchase" health care from a wide range of 'providers'. Efficiency in purchasing was to be achieved through contracting, and this sometimes involved adversarial-type negotiating that was not always compatible with the implicit public health goal of population-health gains. It was this aspect of the restructuring, particularly where it involved restructuring the facilities or services of providers (e.g. "cottage" and other small community hospitals) that created the most friction and received much of the media attention. Theoretically and in keeping with the pervasive philosophies of that day, these geographically distinct entities were to compete on the 'health market', and thus were instructed to develop independent processes and structures. For fairly obvious reasons 'competition' never took off, but it did mean that a coordinated and coherent approach was difficult to develop.

- Notable among providers were “Crown Health Enterprises (CHEs)”, virtually the former Area Health Boards, whose services were mainly at a secondary and tertiary level. The 23 hospital-based CHEs were operated as State Enterprises and in the new policy climate were required to “return a profit”. As CHEs were also expected to report to both the RHAs, whose mandate was population health gain as was just noted, and to the Crown Corporations Monitoring and Advisory Unit, whose mandate was to ensure public sector accountability and efficiency based on business models, there was yet another source of inherent tension. The structures and legislative framework for these came from other reforms covering all aspects of public policy and not just health.
- Beyond this a wide range of disability and geriatric rest home care services that had been functions of the Department of Social Welfare were transferred to the health sector to be among the services contracted by Regional Health Authorities.
- Both the authorities and the Crown Health Enterprises were to be directed by appointed boards (as against elected), frequently including persons chosen to implement market-type processes. The Department of Health became a Ministry and was to allocate funds to the authorities on a population-base, and to develop overall policy. Finally, the Public Health Commission was established to purchase public health and health promotion services, but this body was short lived and its functions assumed by the Ministry and the regional Health Authorities.
- In 1998 the four Regional Health Authorities were combined as one entity, the Health Funding Authority.
- In 1999, a shift back towards the Area Health Boards was made by the creation of 21 District Health Boards, with elected directors, and with a mandate to cover both primary and other health care sectors (Gauld 2006).
- There have also been major health care reforms in the primary sector. In 2002 not for profit Primary Health Organisations (PHOs) were established and primary health reforms aimed to move from fee-for-service to capitation funding, encourage community involvement, and as noted above, shift from individual- to population-targeted funding (Hefford *et al*. 2005).

The major point for this monograph is that over two decades the system had no stability as it went rapidly through various processes of restructuring, each succeeding one being different from the last. The task of this research is not to analyse these processes but to see whether this instability had implications for trends in the nation’s health.

1.1.5 The Analysis of Sub-National Health Data in an Era of Restructuring

The present research immediately had to confront a practical consequence of the multi-stage restructuring. In both its institutional and geographical dimensions, this had major implications for the information-bases on which this monograph draws. Thus, as will be detailed, mainly in the appendices, achieving a time series analysis that is consistent across the period became a major underlying task.

A major problem for the regional analysis was the changing of the geographical regions for the data (hospital, mortality and population counts) over time. This was further confounded by the radical changes in 1988 in local government boundaries, which were dictated by river basins rather than population factors, thereby creating new administrative structures that are not in accord with historical associations. For example, Taumaranui has cultural, economic, social and health linkages to the north (Waikato), but became part of the Wanganui local government area in 1998 simply because the Wanganui River passed through the town.[8]

Furthermore, numerous changes were made to data collection systems to enable increased monitoring of financial and other objectives. These were introduced as part of the drive towards achieving greater efficiency and cost effectiveness in the health system. Both the numerators and denominators of key

[8] For health purposes only, after a great deal of protest, Taumaranui was able to keep its links with the Waikato.

health status indicators were affected making the monitoring of trends difficult. Ethnic definitions also changed, at different times for numerators and denominators, and have never been set out in totally compatible ways.

These points become particularly apposite because restructuring frequently involved policy changes at the sub-national level. It is of interest to see what the impacts have been on population at that level, yet as noted data problems make this task difficult.

There is a need, firstly, to assess whether sub-national differences in health levels and needs, and the supply of services have been diminished or enhanced by these administrative and policy changes. Secondly, it is important to know whether there are sub-national inequalities in health linked to regional socio-economic disparities (Howden-Chapman and Tobias 2000).

To address these questions, particularly the first, the monograph draws both on conventional analyses and a newly developed life-table technique. It also reviews some social covariates of health, and looks at whether there appears to be an association between health and social change.

As the emphasis here is on sub-national or regional differences, the analysis is thus very much at macro- or population-level; unlike epidemiological studies – we do not take a disease or risk-factor approach. Nor, with the exception of simple rate analyses in Chapters 5 and 6, is it the sum of individual characteristics. The analysis is based on aggregated data and the empirical results derived from techniques that typically integrate in the one measure two or more different sets of aggregates. In sum, the indicators used in this study generally are true macro-level measures.

This apparent abstraction to a higher level of aggregation has enormous advantages. It is true that it does not attempt to address issues that epidemiologists normally analyse – at best macro-level analyses can be the basis of hypotheses about relationships that are more appropriately investigated using micro-level data sets. But the higher level of aggregation does instead relate to the universe of policy–makers and planners. Health policy is directed at populations whether they are geographically defined, nationally or residents in any sub-national area; socially or culturally defined (e.g. the Māori or Pakeha populations); or even clinically or functionally defined (e.g. the population of persons with cancer, or with disability). Policy is not a micro-level undertaking. Thus methodologies and analyses that provide macro-level results are more directly integrated into the policy and planning process. Our study, therefore, is very highly applied.

Nevertheless, as we will discuss below, this research also addresses major theoretical concerns. These revolve, essentially, around the limits of human longevity and the health status of those surviving at any age (outlined in section 1.2.1 below) - is it survivorship in good health or poor health? These questions also have major implications for policy. Beyond this, it adds to the literature on social inequalities in health, in our case geographic and ethnic, in New Zealand.

1.2 HEALTH TRENDS 1901-2001

1.2.1 Epidemiologic Transition

The period covered by this monograph comes at the end of an epidemiologic transition that started in the 19th century, spanned the entire 20th century, and saw New Zealand life-expectancies reaching far above anything seen in history before, or that might have been imagined at the start of the 20th century. Some authors argue that human longevity could well rise even further (Oeppen and Vaupel 2002; Manton *et al.* 1991).

The transition saw major increases in levels of life-expectation, a change in the force of mortality from younger to older ages, and a shift-share in the burden to disease from communicable to non-communicable causes. Any further transition would require the force of mortality to move to very old ages, and the postponement of risks of death from non-communicable causes to those same 'grand old ages'. Related to these shifts is arguably a compression in the ages at death (that is a decrease between quartile one and the median (Cheung *et al.* 2005), and changes in the relationships between the onset of major episodes of morbidity and death. The jury is still out on this last issue. Some see a compression in the duration of periods of severe morbidity, others an extension, and others no change at all – as the age at death increases, the age at onset of debilitating illness will increase in tandem (Fries 1989; Olshansky 1985; Manton *et al.* 1991). This discourse is of more than academic interest for each of these theories holds different implications for the health services and their costs, and this issue is discussed further in Section 7.4.

1.2.2 The Components of the Epidemiologic Transition

Figures 1.1 to 1.3 provide key summary statistics on the epidemiologic transition in New Zealand. They use life-table data to highlight the shifts in the force of mortality: the greatest changes are in life-expectation at birth (e_0), whereas at older ages (e_{45} and e_{65}) there are limited changes. The major changes at older ages have only started to occur very recently. In the past the problem was to survive to age 65. In assessing these figures, it must be recognised that e_0 represents the effects of changes spread across the whole of life, e_{45} only late adulthood, and e_{65} only the oldest ages. High levels of mortality, and thus the capacity for large shifts in values are found at the youngest and oldest ages and this affects e_0. The most rapid changes will occur at the youngest ages.

The figures clearly illustrate that there have been two very different transitions in New Zealand, the net result of which has been convergence in levels of life-expectancy. For non-Māori levels of life-expectation at birth improved slowly over the century to 1981, but accelerated in the last two decades. This recent trend was mainly due to changes at 45 years and over. The most rapid changes at younger ages had occurred in the late 19th century, although these then flowed on to older ages because of cohort momentum effects (see below).

For Māori, there were two periods of acceleration: in the first two decades of the century, and then from 1941 to 1961. Changes since 1981 have been slower. Recently, shifts have been seen at older ages but still not at a velocity comparable to what has been seen for non-Māori. Historically, differences between Māori and non-Māori were far less marked at older ages. In 1901 when non-Māori e_0's were almost double those of Māori, life-expectancy at older ages was merely 50 percent greater, and in 1941 when the gap at birth was still 20 years, the gap at older ages was only four to six years. But as non-Māori longevity has increased this has been most significant at older ages, so that by 2001, at age 45 a gap with Māori had opened once again. In fact, for both genders and most ages Māori expectancies barely moved, or even declined in the 1990s. A considerable amount of attention will be paid to this issue of Māori – non-Māori differentials later in the monograph when four alternative hypotheses will be examined.

1. That the differential in the 1990s was a function of long-term cohort and other trends.
2. That this pattern was an artefact of definitional problems (who is defined as Māori).
3. That Māori were highly vulnerable to the economic restructuring of the period and that this affected their health status[9] (Blakely *et al.* 2004, 2005, 2008).
4. That health restructuring was uneven and impacted unfavourably on Māori.

In this transition changes did not occur uniformly across all ages. In part this was due to period effects whereby gains were achieved that were highly age-specific, rapid improvements in survivorship at childhood ages from 1876-1901 for Pakeha is one such example. A parallel shift occurred for Māori children from 1945 to 1961, even though the underlying demographic and political factors were very different for Māori and Pakeha, such as a rapid shift in fertility levels for Pakeha (Pool and Cheung 2003) and public health measures for Māori (Pool 1991). But there were also cohort effects that show up in life-table changes (Pool and Cheung 2005).

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[9] And that of Pasifika peoples. Some attention will be paid to them but, because of data problems, only at a national level not at the regional level employed to the total population and for Māori.

Figure 1.1: Life-Expectancy at Birth (e_o)

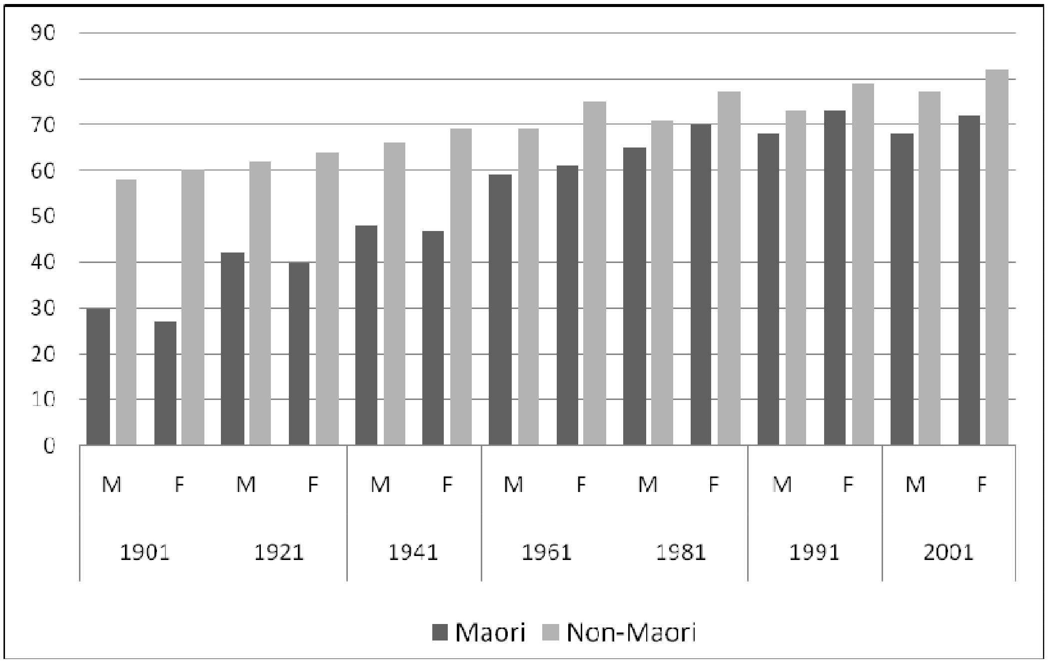


Figure 1.2: Life-Expectancy at 45 Years (e_{45})

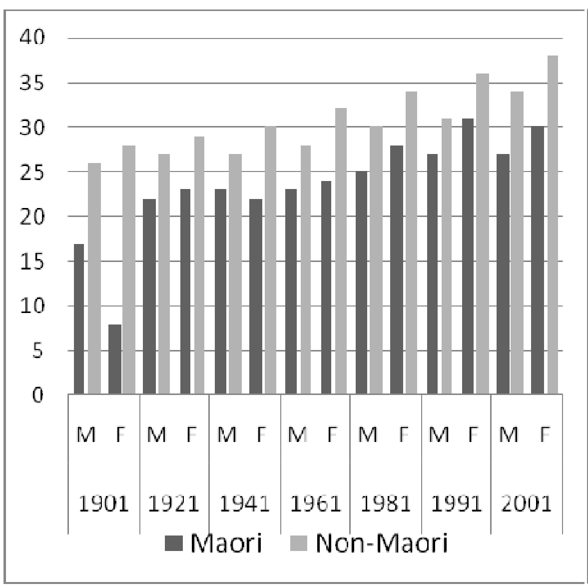
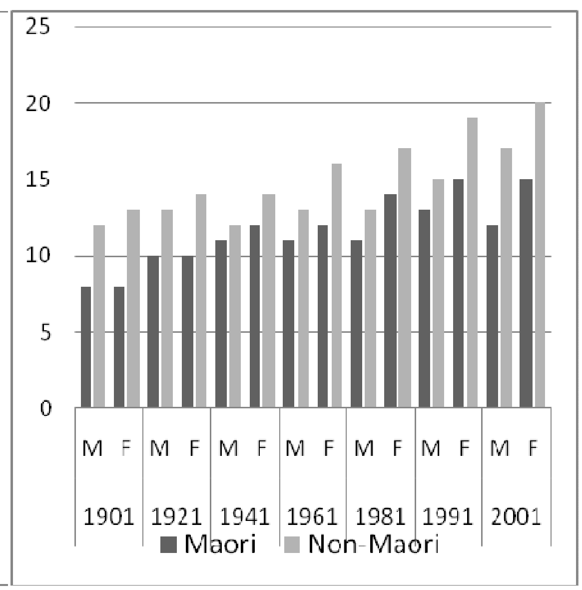


Figure 1.3: Life-Expectancy at 65 Years (e_{65})



It was noted earlier that this monograph's interest is 'bi-focal': on life-expectations and on hospitalisations. We have developed a methodology that, in the one summary index, relating to those persons surviving combines the prevalence of hospitalisation with the duration spent in hospital. It is called a Hospital Utilisation Expectancy (HUE). Suffice to say for the moment that a great deal of attention will be paid to the theoretical underpinning and methodological functions and features of HUEs, and to the substantive findings their analysis generates.

1.2.3 Summary

These various indicators show that the period covered in this monograph is one in which changes have occurred mainly at older ages. The focus is also on non-communicable disorders, typically in the past involving long stays in hospital. Yet, in the period since 1980 HUEs have decreased very significantly. At the same time for non-Māori, at least, life-expectancy has improved so that some measure of health gain has been achieved. Alongside this the 'closing of the gaps' between Māori and non-Māori life-expectancy seen between World War II and 1981 was not maintained at the same velocity in the last three decades (see also Blakely *et al.* 2005). Thus, this sets the objectives for the present study: to dissect in detail these last three decades to see why Māori did not advance more rapidly and whether there were shortfalls in the system.

1.3 POPULATION HEALTH STATUS MEASURES

To meet the last objective adequate measurement of change is needed. The importance of health, both economically and in terms of the quality of human capital, means that governments and various agencies must have robust evidence-bases for policy. Good policy must address issues of efficiency (the best outcome for the lowest cost) and effectiveness (outcomes which lead to population health gains). In order to build appropriate evidence-bases two aspects of health must be both measured to provide evidence of current needs and evaluation of the impact of past changes, and projected to provide estimates of likely future needs and costs: These measures relating to health *per se* (to health status, need and the potential for gains) and those relating to the economic and management aspects of the health sector. This monograph discusses an attempt to develop and apply methodologies that meet the first of these objectives, and which will also have an innate capacity to address the development of an evidence-base for policy. In the following chapters a number of conventional health status measures are presented, and also a new methodology that builds upon and synthesises the conventional indices including those based on data collected primarily for management purposes. A more detailed technical report on these measures as applied to New Zealand is also available (Johnston *et al.* 1998).

This monograph is thus firstly a methodological study. However, it also presents results that point to sub-national differentials in the indices we are presenting. These sub-national differences are related in part to regional differences in population health need, and in part to variations in the supply of services. Both of these determinants produce inequities in health and health care, and thus address a theme underlying the present work: social determinants of health. This study, therefore, also addresses issues of health equity and demonstrates sub-national differences.

The analysis of health status need and potential for gains (Sceats *et al.* 1995) has classically been addressed by mortality-based measures of population health status. It is widely recognized that indices of mortality in a sense measure only the final outcome of health and not the many intermediate stages from good health, to poor health, to death. While mortality provides an indirect measure of prevalent population health issues, its use as an indicator of morbidity is often challenged especially when chronic degenerative diseases are the leading causes of death. The practical reality is, however, that mortality and its inverse, survivorship, still provide the best documented and most standardised indices of health.

Morbidity can be viewed as a more profound, and in a sense more precise, national health indicator than mortality. However, morbidity is a multi-dimensional concept and difficulty exists in finding an operational, universal definition of health/ill-health (Johnstone *et al.* 1998). In addition, data on different states of health are not readily available and where available, are often better suited to the measurement of acute rather than chronic conditions (Ruzicka and Kane 1990). They also tend not to be standardised and this makes benchmarking and cross-comparative analysis very problematic. In practice, it is the incidence of disease that is usually reported rather than the time spent in ill-health (Riley 1990). Good health has been an almost neglected dimension of most studies.

In more recent years, attempts have been made to synthesise mortality and morbidity measures to achieve a more global and relevant measure of health status. Thus research on population health status indices has concentrated on quantifying the relationship between mortality and morbidity in order to predict future health trends. Health Expectancy (HE) (Robine and Michel 1992) and Disability Adjusted Life Years (DALY) (Murray and Lopez 1996) are two macro-level indices developed over the recent decades and these are being used ever more frequently by governments and health planners to describe the health status of the population. Since 1993 the OECD has included HE in its official health statistics, and the *World Health Report*, 1997 (WHO 1997) emphasised HE as a key indicator of population health. Life-table methodologies like that used in the HE can be useful in several ways. They can measure health *per se*, but also their actuarial functions make them very suitable tools by which management and thus economic issues can be addressed (see below).

The research reported here is underpinned by methodological analyses carried out over the last three to four years in the Population Studies Centre at the University of Waikato. This multidisciplinary work has drawn from the disciplines of demography, epidemiology and human ecology, and has applications in health systems research and policy. After a theoretical and methodological assessment of health status measures (Johnstone *et al.* 1998) and a review of data available in New Zealand, a new method called Hospital Utilisation Expectancies (HUE) that is an extension of conventional Health Expectancies has been developed which is both methodologically powerful and theoretically grounded. It uses life-table methodology to combine mortality and morbidity data into a single population health status measure. The utility of this approach comes from a number of properties of HUEs. They use management data; they are population not sample based; they permit time-series analysis and thus cohort component projections (the most robust projections techniques); they combine morbidity and mortality; and they combine incidence and duration (Cheung 1999; Pool *et al.* 2000). Much of the second part of the monograph relates to the presentation and analyses of HUEs.

Hospital Utilisation Expectancies complement the other conventional measures presented here but also permit the analysis to go further to study the links between health status and other factors, specifically demographic, health service and socio-economic, at both a regional and national level. In this way, this measure is able to contribute more broadly to understanding the determinants of health. In low mortality, developed countries, the underlying theoretical issues increasingly relate to debates around the most important social determinants of health. These are the bio-social determinants and consequences of changing longevity, and the linkages of these to morbidity at older ages where a high proportion of deaths and indeed hospitalisations occur. This is of particular importance for the Pakeha population.

The analysis of this has major implications not just for theory, but more importantly for health services. The link between meta-theory and highly applied health services research comes from the use of actuarial techniques which allow the testing of theories relating to the linkages between health and survivorship. Beyond this, these same actuarial properties permit the outputs to be applied to population data to obtain analyses and projections of factors such as bed-days, and thus to provide management information. The fact that hospital utilisation data forms an intrinsic part of the outcome measure, means that HUEs also reflect health resource use. Applications at the health service level will develop with time. The study of health service factors as a determinant of health status also makes this relevant to health management and services research, particularly in periods of structural change. The universe for health managers and policy makers is the population not the individual, with other factors such as the composition of the population at risk (age, ethnicity and gender) and the users of health services being of interest.

1.4 OUTLINE OF THE REMAINDER OF THE MONOGRAPH

Part II provides the context for the HUE results by providing geographical and socio-demographic descriptions of the 12 regions used in later analyses and reviews the available data. National and regional health status and hospital utilisation indices, which underpin the HUE calculations, are presented so that the HUEs presented in Part III can be interpreted appropriately.

Part III presents and discusses the substantive HUE results. First it reviews the theoretical and methodological foundation to the HUEs. Then it presents substantial results, both over time and for sub-populations, regional, ethnic and by age. Part IV then disaggregates by function to attempt to explain the variance demonstrated in Part III. Finally, the last part makes a synthesis, with an epilogue which extends the key findings to 2006 and then projects into the future.

PART II:

BACKGROUND

CHAPTER 2

The Social and Economic Demography of New Zealand Regions

2.1 INTRODUCTION

In this monograph, health status measures are presented for both national and regional populations. This chapter describes the 12 regions of New Zealand used in this study and outlines at the national and regional level, demographic and socio-economic factors that could be associated with the health trends discussed in later chapters, thus setting the context for the analyses described there. In the next chapter national and regional ethnic differentials in the same socio-economic factors are presented. This analysis and particularly some aspects of the population geography of the regions will be shown in later chapters to be of some importance in explaining some of the inter-regional variance we will be reporting.

Socio-demographic information from the 1981 to the 2001 census is the baseline for the present analysis. These dates represent the earliest and latest censuses conducted during the years covered in this study. It draws on a number of regional analyses published by the Population Studies Centre (Pool *et al.* 2005a, 2005b, 2006a, 2006b). It must be noted, however, that there is inconsistency in the information available at every census.

2.2 DEFINING 'HEALTH' REGIONS

In order to analyse regional differentials in health, we have divided New Zealand into 12 regions (see Figure 2.1). The regions normally used in statistical analyses in New Zealand vary enormously in size and, as already noted, the administrative areas used in the health system have changed over this period. The regions to be used in this analysis have been selected to reduce the variance in size, and combine geographically contiguous local authorities that have some degree of community of interest (see Appendix Table 2.1 for the Territorial Authorities which make up these regions). Where possible, the regions cover current District Health Board (DHB) boundaries, although some of these have had to be combined (**Hawke's Bay/Tairawhiti, Taranaki/Wanganui/Manawatu, Tasman/Nelson/ Marlborough, Canterbury/Westland and Otago/Southland**) to ensure that numbers were sufficiently large enough for the analysis. In contrast, we sub-divided the Auckland region into its three DHBs, each of which has a large enough population to allow robust analyses. To do so, we used as approximations, Auckland's northern and western urban areas for **Waitemata**, **Central Auckland** for Auckland and **South Auckland** as Manukau-Counties, but retained the name South Auckland. These areas were used in all the substantive analyses in this report, except for those dealing with ethnicity where larger regions had to be drawn on to ensure sufficient numbers of Māori in the analyses, regardless of their total population size. For the projections in Chapter 14, the unit of reference was the DHB.

None of these regions are homogenous, either in terms of the health indications of its sub-populations, or in terms of any social indicator. This point is made repeatedly in the studies drawn on in the present chapter (see numerous entries under Pool, Baxendine *et al.* in References). For example, the eastern, western and southern parts of **Bay of Plenty Lakes**, or the eastern, western and southern parts of **South Auckland** contain very different populations. But these 'health regions' are the reference areas for policy implementation and service delivery, which thus, addresses very different needs.

Figure 2.1: Map of the Regions

2.3 THE DEMOGRAPHIC CHARACTERISTICS OF HEALTH REGIONS

2.3.1 Patterns of Settlement

New Zealand regions differ significantly in terms of their patterns of settlement and levels of urbanisation, as reflected by population size. The distribution of the population is an important indication of ease of access to health services. In general, people living in rural areas need to travel further to obtain health services. This affects utilisation of services in two ways: on the one hand, it may discourage access but, on the other hand when they are accessed, services (like hospital care) may have to be utilised more intensively for longer durations of stay because of the difficulties involved in travelling to and from facilities.

At the time of the 2001 census,[10] Statistics New Zealand categorised urban areas as follows:[11]

- **Metropolitan Areas:** These are main urban areas which are considered to be the chief cities in New Zealand. They include the following urban zones: Auckland; Hamilton; Napier and Hastings; Wellington; Christchurch; and Dunedin.
- **Large Urban Areas:** These are all other main urban areas that are not defined as metropolitan, for example Palmerston North, Tauranga, Whangarei, and Invercargill.
- **Secondary Urban Areas:** These had a minimum population of 10,000 and a maximum population of 29,999. They include, for example, Pukekohe, Taupo, Timaru and Oamaru.
- **Minor Urban Areas:** These had a population size between 1,000 and 9,999. These include such places as Queenstown and Bluff in the South Island and Featherston and Te Aroha in the North Island.
- **Rural**: These include all areas that are not urban areas. This is the residual "left-over" from the aggregation of the other settlement types.

Table 2.1: Percentage of Population of Each Region in Different Forms of Settlement, By Region, 2001

Region	Urban				Rural	Total
	Metropolitan	Large	Secondary	Minor		
Northland	0	33	0	18	49	100
Waitemata	92	0	0	2	6	100
Auckland Central	98	0	0	2	0	100
South Auckland	86	0	5	2	8	100
Waikato	52	0	5	20	24	100
Bay of Plenty/Lakes	0	54	14	11	21	100
Hawke's Bay/Tairawhiti	61	17	0	5	17	100
Taranaki/Wanganui/Manawatu	0	51	14	17	18	100
Wellington	80	8	5	4	4	100
Nelson/Marlborough	0	44	22	12	22	100
Central South Island	65	0	10	9	16	100
Southern South Island	39	17	8	12	23	100
NEW ZEALAND	57	13	7	8	14	100

Source: 2001 Census of Population and Dwellings, Statistics New Zealand.

Metropolitan and large urban areas have secondary and/or tertiary hospitals. In contrast to the smaller centres, these areas also offer more alternatives in terms of private hospitals or specialist care. Secondary urban areas usually have a range of primary care services and hospitals that provide limited treatment options. Minor urban areas normally have a general practice and pharmacy services with more limited hours. Rural inhabitants usually need to travel to the nearest urban area for services. How well these rural areas are serviced depends on how close they are to an urban area and the size of the urban area. This is explored in detail in Pool *et al.* (2005b).

All regions had a mix of settlement types, but this varied significantly. Regions with most of their population in metropolitan areas are **Waitemata**, **Auckland Central**, **South Auckland** and **Wellington** (see Table 2.1). Regions with relatively high proportions living in rural areas are **Northland**, **Waikato**, **Bay of Plenty/Lakes**, **Taranaki/Wanganui/Manawatu**, **Nelson/ Marlborough** and the **Southern South Island**. These areas also have a high proportion of their population living in minor urban areas. Two mainly urbanised regions but with significant rural minorities are **Hawke's Bay/Tairawhiti** and the **central South Island**. The latter includes New

[10] For the 2006 Census Statistics New Zealand introduced a new, experimental urban/rural classification, and also changed the regions for which data summaries were presented. This made it problematic to split the data into the 12 regions used for this analysis. Due to this, 2001 Census data will be presented throughout this chapter.

[11] If an urban area moves from one category to another due to population change, there may be a time lag before Statistics New Zealand changes them to the appropriate category. For example, Gore and Greymouth no longer meet the Secondary Urban Area criteria but are still classified as such.

Zealand's third largest metropolis (Christchurch), but also some very isolated rural areas. This factor of its population geography seems to affect some aspects of its health system, as will be shown in later chapters. **Hawke's Bay/Tairawhiti** includes the metropolis of Napier-Hastings (following recent Statistics New Zealand practice, we prefer to view them as the one metropolitan node), the fifth largest urban area in New Zealand behind Hamilton and ahead of Dunedin in size. **Hawke's Bay/Tairawhiti** also has a large urban area, Gisborne, but additionally has more isolated rural areas.

2.3.2 Population Size and Growth

In 2001, the 12 regions varied in size between 122,472 (**Nelson/Marlborough**) at the lowest extreme and 510,159 (**Central South Island**) (Table 2.2). Between 1981 and 2001 the Total New Zealand population increased by about 594,000 (19 percent). The three regions around Auckland (**Waitemata**, **Auckland Central** and **South Auckland**) had the largest absolute increases in population, with the **Waitemata** population growth being the largest 140,754. **Bay of Plenty/Lakes**, **Northland** and **Nelson/Marlborough** also had large percentage increases. The only region where the population declined was the **Southern South Island** (-10,286).

Table 2.2: Usually Resident Total Population, By Region, 1981-2001 (Numbers) and Change 1981-2001

Region	Population					Percentage Change
	1981	1986	1991	1996	2001	1981-2001
Northland	110,001	122,799	126,771	137,052	140,130	27.4
Waitemata	288,999	313,371	344,466	394,215	429,753	48.7
Auckland Central	285,527	294,162	306,207	345,768	367,734	28.8
South Auckland	255,889	276,753	304,914	341,730	375,534	46.8
Waikato	281,732	291,129	298,401	312,927	317,751	12.8
Bay of Plenty/Lakes	205,059	219,954	235,248	258,279	274,122	33.7
Hawke's Bay/ Tairawhiti	182,372	184,938	182,532	188,463	186,801	2.4
Tauranga/Wanganui/ Manawatu	309,725	319,104	321,132	325,023	313,845	1.3
Wellington	387,522	392,307	400,281	413,955	424,416	9.5
Nelson/Marlborough	95,781	100,977	105,624	116,610	122,472	27.9
Central South Island	455,706	461,661	468,426	499,383	510,159	11.9
Southern South Island	284,396	284,958	279,504	284,016	274,110	-3.6
NEW ZEALAND	**3,143,307**	**3,263,283**	**3,373,929**	**3,618,300**	**3,737,280**	**18.9**

Sources: 1981-2001 Censuses of Population and Dwellings, Statistics New Zealand.

2.3.3 Age and Gender Structure

Besides total population size, it is important to outline regional age and gender composition, as some age-gender groups have a greater need for services than others. Regions with different profiles will require different mixes of services. In general, populations with a greater percentage of older people will see more demands on their health services than regions with more people in the younger age groups.

Gender Profiles

There was little inter-regional variance in the sex-ratio for age groups under 65 years (data not shown here). As females live longer than males (see Chapter 5), females constitute a higher proportion of the population 65 years and over than males, and thus the age-profile has some bearing on gender structures. Those regions with high proportions at 65+ years, and especially 85+ have lower masculinity ratios.

Differences in Age Structures

Table 2.3 illustrates inter-regional differences in age structure. Between 1981 and 2001 most regions in New Zealand had a decrease in the percentage of their total population who were at the childhood ages (under 15 years), and increases in the percentages at the 45-64 years and 65 years and over age groups.

In general, northern regions are younger, and southern older, but changes occurred over the period 1981-2001 with **Northland** and the **Bay of Plenty** joining those with higher percentages at 65+ years. To a large degree the age-pattern is a function of the percent of the population who are Māori and Pasifika. But it suffices here to draw a distinction between northern regions with larger and younger Māori and Pasifika populations, and southern regions with smaller Māori and Pasifika populations.

Table 2.3: Percentage of the Usually Resident Population in Broad Age Groups, By Region, 1981 and 2001

Region	1981					2001				
	Under 15	15-44	45-64	65+	Total	Under 15	15-44	45-64	65+	Total
Northland	30.0	42.3	18.5	9.1	100.0	25.1	37.4	24.2	13.3	100.0
Waitemata	27.3	46.0	18.2	8.6	100.0	22.6	44.4	22.2	10.8	100.0
Auckland Central	20.0	45.6	20.4	14.0	100.0	19.7	49.7	20.3	10.3	100.0
South Auckland	31.7	46.0	15.8	6.6	100.0	26.6	44.2	20.5	8.7	100.0
Waikato	29.5	45.3	17.1	8.1	100.0	24.2	42.3	21.6	11.9	100.0
Bay of Plenty/Lakes	30.2	43.4	17.8	8.6	100.0	24.4	39.4	22.5	13.6	100.0
Hawke's Bay/ Tairawhiti	29.4	43.2	17.6	9.8	100.0	25.0	39.5	22.4	13.0	100.0
Tauranga/Wanganui/ Manawatu	27.5	44.3	17.8	10.4	100.0	23.3	41.0	22.0	13.7	100.0
Wellington	25.9	46.6	18.3	9.2	100.0	21.9	45.5	21.6	11.1	100.0
Nelson/ Marlborough	26.1	43.1	19.5	11.3	100.0	21.6	39.6	24.5	14.3	100.0
Central South Island	24.8	44.6	19.5	11.1	100.0	20.4	42.7	23.1	13.8	100.0
Southern South Island	26.3	44.6	18.5	10.6	100.0	20.2	43.1	23.0	13.7	100.0
NEW ZEALAND	**26.9**	**44.9**	**18.3**	**9.9**	**100.0**	**22.7**	**43.2**	**22.1**	**12.1**	**100.0**

Sources: 1981 and 2001 Censuses of Population and Dwellings, Statistics New Zealand.

The region that differed the most from this pattern was **Auckland Central**. In 1981, the percentage of this population under 15 years was comparatively low and the percentage older was high. It was also the only region in New Zealand where the percentage of children and those aged 45-64 years were similar in 1981 and 2001, while the percentage of 15-44 year olds increased and the percentage of people 65 years and over decreased over this period. Another regional population that varied substantially from the rest of New Zealand was **South Auckland**, which had the highest percentage of children and the lowest percentage of elderly for both 1981 and 2001. These differences will affect the configuration of services in this region compared to other regions in New Zealand.[12]

Population at Older Ages

The age distribution of older people in the regions has changed over time (see Table 2.4). The proportion of New Zealand's population aged 65 and over has increased over the time period 1981-

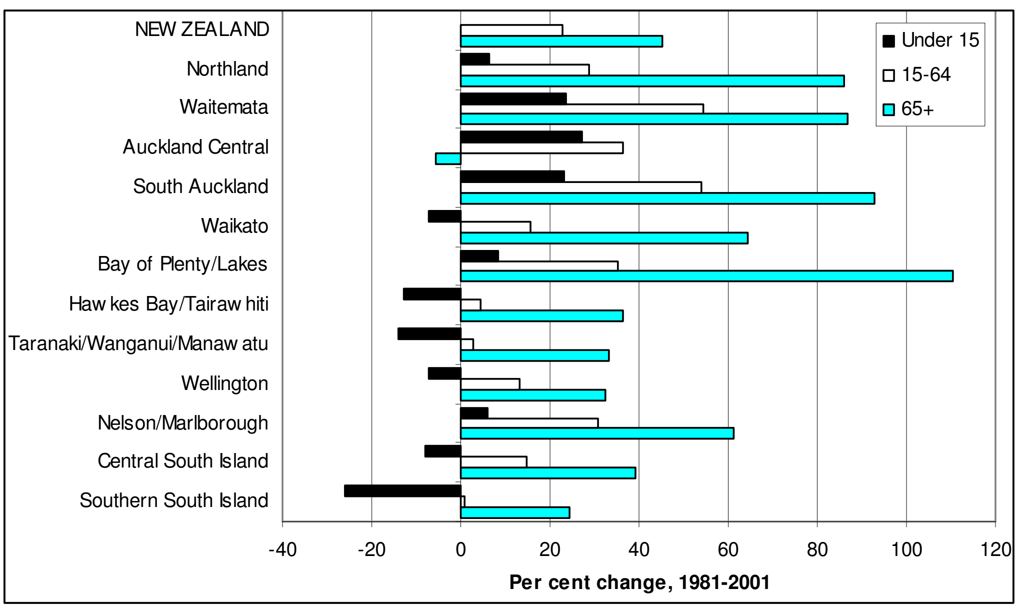
[12] It should be noted that the age-distribution of the Southern South Island is affected by the inflow to Dunedin of persons aged 15-24 years as students. They are short-term residents temporarily affecting any cohort as it passes through these ages, but not influencing cohort sizes over the remaining life span.

2001, as is true in all regions except **Auckland Central**, which had the highest percentage over 65 in 1981. **Auckland Central** is the only region where the percentages at older ages are declining and the percentages at economically active ages are increasing. The decrease is especially noticeable in the 65-74 years age group, constituting, in the main, healthy and active elderly who move elsewhere to retire (see Appendix Table 2.2 for a regional and age-specific breakdown of change at ages 65+). All other regions show that they have structural aging of their populations with increasing proportions of people at older ages. **South Auckland** had the lowest percentage of older people in both the 1981 and 2001 censuses. Other areas that had low percentages of older people in 1981 were **Waitemata**, **Waikato** and **Bay of Plenty/Lakes**, but over the period the inflows of retirees into some regions has changed this pattern, so that the **Bay of Plenty/Lakes** region, for example, came to have one of the highest percentages of people 65 years and over. The areas with the highest percentage of people 65 years and over in 2001 are the three South Island regions, particularly **Nelson-Marlborough**. These areas also have high percentages of the population that are non-Māori.

Changes in Size of Age Groups
A more detailed examination of population change shows that there are large regional variations in the percentage change in the sizes of different age groups (Figure 2.2 and Appendix Table 2.3). This has major implications for the volume of age-related services required.

For New Zealand as a whole, there was a slight decline in the number of children under 15 years, while the numbers of people aged 15-64 years and 65 years and over increased by 23 and 45 percent respectively, indicating the numerical aging of the population over this time period. Six regions had an increase, and six a decrease, in absolute numbers of children under 15 years. The three regions around Auckland had the highest percentage increase in this age group while **Southern South Island** had the highest decrease.

Figure 2.2: Age-Specific Percentage Change in Numbers, By Region, 1981-2001



Sources: 1981 and 2001 Censuses of Population and Dwellings, Statistics New Zealand.

All regions had an absolute increase in the size of the population in the working ages of 15-64 years. **Waitemata** and **South Auckland**, had the largest percentage increase in this economically active age group while **Southern South Island**, **Taranaki/Wanganui/Manawatu**, **Hawke's Bay/Tairawhiti** and had the smallest.

Auckland Central was the only region with negative growth among people 65 years and over, reflecting the migration of older people to high growth retirement areas both close at hand (**Waitemata**) or further away (**Bay of Plenty/Lakes**). All other regions had substantial growth in this age group, with **Bay of Plenty/Lakes** numbers doubling over the time period; **South Auckland** and **Waitemata**, **Northland**, **Waikato** and **Nelson/Marlborough** all had increases of more than 60 percent in the numbers of older people.

2.4 SOCIO-ECONOMIC INDICATORS

The relationship between health and socio-economic status is well documented internationally and locally (Blakely *et al.* 2004, 2005, 2008; Reinken *et al*. 1985; Mackenbach and Looman 1994; Pearce *et al.* 1993; Smith and Pearce 1984). Labour force participation, income support, household income and over-crowding have been selected here as indicators of socio-economic and living conditions.

2.4.1 Labour Force Participation

For New Zealand as a whole, there was a trend towards a reduction in full-time employment and total employment between 1986 and 2001. Along with this, there was an increase in part-time employment, unemployment and non-labour force participation (Table 2.4a).

In both 1986 and 2001, **Northland** had the lowest proportion of its working age population in employment and the highest unemployment and non-labour force participation. In this region there was a 9 percentage point decrease in full-time employment compared to the 5 percentage point decrease experienced nationally between 1986 and 2001.

Table 2.4a: Standardised[1] Labour Force Participation Rates (%) By Region, 1986 and 2001

	1986					2001				
	Labour Force			Non-Labour Force	Total	Labour Force			Non-Labour Force	Total (2)
	Full Time	Part Time	Unem-ployed			Full Time	Part Time	Unem-ployed		
Northland	57.6	10.1	5.7	26.7	100.0	49.0	15.6	8.5	26.9	100.0
Waitemata	63.6	10.5	3.9	22.0	100.0	57.5	15.1	5.4	22.0	100.0
Auckland Central	62.1	9.1	4.8	24.0	100.0	55.2	13.4	6.1	25.3	100.0
South Auckland	61.7	9.5	4.7	24.2	100.0	54.6	12.9	7.1	25.4	100.0
Waikato	59.7	10.1	4.9	25.3	100.0	54.4	15.9	6.7	23.0	100.0
Bay of Plenty/Lakes	58.9	10.5	5.6	25.0	100.0	52.4	16.3	7.8	23.5	100.0
Hawke's Bay/ Tairawhiti	58.3	11.8	5.4	24.5	100.0	53.8	15.9	6.9	23.3	100.0
Tauranga/Wanganui/ Manawatu	58.9	10.9	5.0	25.2	100.0	53.6	16.5	6.5	23.5	100.0
Wellington	63.9	9.9	4.0	22.1	100.0	57.9	15.4	5.9	20.8	100.0
Nelson/Marlborough	59.4	11.6	4.3	24.7	100.0	57.8	17.7	4.2	20.3	100.0
Central South Island	58.0	11.2	4.9	25.9	100.0	55.3	17.4	5.0	22.3	100.0
Southern South Island	58.1	11.9	4.6	25.5	100.0	55.4	17.2	5.0	22.5	100.0
NEW ZEALAND	**60.3**	**10.5**	**4.7**	**24.4**	**100.0**	**55.2**	**15.6**	**6.1**	**23.1**	**100.0**

(1) Standardised by age and gender to 1996 New Zealand population 15-64 years. This removes the effects of different age and gender structures from the analysis.
(2) Those who had unidentifiable labour force status were excluded from the total.
Sources: 1986 and 2001 Censuses of Population and Dwellings, Statistics New Zealand.

Regions in the South Island showed an increase in employment between 1986 and 2001, although a growing proportion of this employment was part-time. In **Nelson/Marlborough**, while overall employment increased and unemployment showed little change over the period, this region had the highest part-time employment and total employment and the lowest unemployment and non-labour force participation of all the regions in 2001. In 1986, **Wellington** and **Waitemata** (predominantly urban areas) had the highest full-time employment and total employment, and the lowest unemployment and non-labour force participation. By 2001, these indicators were still at relatively favourable levels but the **South Island** region had surpassed them. In **Auckland Central** and **South Auckland** the percentages of the working age populations who were employed were similar to national levels in 1986 but had dropped below these by 2001.

2.4.2 Income Support

The variable 'income support' relates here to the proportion of the population of working age that received the three main groups of benefit within the 12 months prior to the census, indicating the proportion of the population that is directly dependent on public funding. The three main benefit groups are Unemployment Benefit, Domestic Purposes Benefit (DPB), and Sickness and Invalid Benefit. These benefits indicate the level of socio-economic disadvantage of the population at working ages, often supporting dependents, even though there are other benefits like Student Allowance that are not considered here. As a person can receive more than one benefit type in a year, a priority system was used.[13] People aged 65 years and over have been excluded from this part of the analysis as they universally receive national superannuation as of right, although over the time period the age of eligibility increased from 60 as the new age of 65 was gradually introduced.

Table 2.4b: Standardised(1) Percentage at Working Ages Receiving Three Main Benefit Types, By Benefit Type and Region, 1981 and 2001

	1981			2001		
	DPB	**Unem-ployment**	**Sickness /Invalid Benefit**	**DPB**	**Unem-ployment**	**Sickness /Invalid Benefit**
Northland	2.1	4.1	1.7	6.5	9.9	5.0
Waitemata	2.0	1.9	1.1	3.5	4.7	2.7
Central Auckland	2.4	3.0	2.4	2.7	6.1	3.5
South Auckland	2.4	2.6	1.5	4.8	5.9	3.7
Waikato	2.0	2.5	1.5	5.2	8.1	4.3
Bay of Plenty/Lakes	2.3	2.5	1.4	6.3	9.1	3.9
Hawke's Bay/ Tairawhiti	2.5	2.8	1.5	7.0	9.5	4.4
Tauranga/Wanganui/ Manawatu	2.2	2.3	1.6	5.4	8.7	4.6
Wellington	1.8	1.7	1.3	3.7	7.1	3.1
Nelson/Marlborough	2.0	2.4	2.0	4.5	7.5	4.6
Central South Island	2.3	2.8	1.7	3.9	7.4	4.6
Southern South Island	1.8	2.0	1.4	3.7	8.4	4.3
NEW ZEALAND	**2.1**	**2.4**	**1.6**	**4.4**	**7.3**	**3.9**

(1) Standardised by age and gender to 1996 New Zealand total population (both genders) 15-64 years. This removes the effect of different age structures from the analysis and allows comparisons between years.

Source: 1981 and 2001 Censuses of Population and Dwellings, Statistics New Zealand.

There has been a dramatic increase between 1981 and 2001 in the proportions of the population receiving income support (see Table 2.4b). Nationally the level for 1981 was less than half that of 2001 with the highest regions being **Northland** and **Central Auckland**, and the lowest regions being **Waitemata**, **Wellington** and **Southern South Island**. In 2001, levels of income support for males and females were highest for **Northland**, **Hawke's Bay/Tairawhiti**, **Bay of Plenty/Lakes** and **Taranaki//Wanganui/Manawatu**, indicating the impact of the economic restructuring of the intervening years on predominantly peripheral areas of New Zealand. **Waitemata** remained the area with the lowest levels of income support in 2001. Other (predominantly urban) areas which tended to need low levels of income support in 2001 were **Wellington**, **South Auckland** and **Central**

[13] Methodology developed in Pool *et al.* 2006b. This progressed from Domestic Purposes Benefit to Unemployment to Sickness/Invalid benefit so that if a person, for example, received the Unemployment and the Domestic Purposes Benefits in one year they would be counted in the figures for Domestic Purposes Benefit only.

Auckland. **Central Auckland** went from being one of the regions with the highest levels of income support in 1981, to one of the lowest 20 years later.

When considering the three main benefit types which make up the total pattern of income support a trend is evident (Table 2.4b). The unemployment benefit was the largest component of income support in all regions, especially in 2001, and generally the three components followed the same general patterns in any given region, being all relatively high or all relatively low.

The age specific Sickness/Invalid benefit and its relationship with hospital utilisation will be considered in more detail later.

2.4.3 Household Income

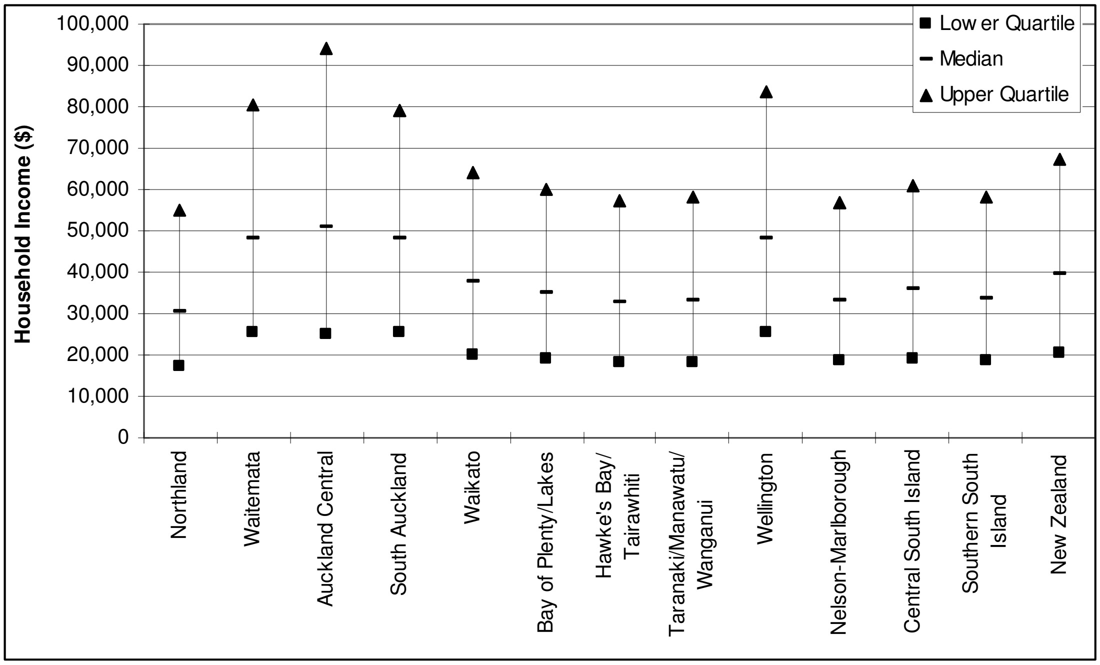
'Household Income' is the combined total income received by persons aged 15 years and over in any household. The median and the upper and lower quartile incomes for private dwelling were investigated.[14] Only 2001 data are presented here[15].

There is a clear divide between **Wellington** and the three regions around Auckland (**Auckland Central**, **Waitemata** and **South Auckland**), and the rest of the regions. Median household incomes and both the quartiles were highest in **Wellington** and in the three regions around Auckland with **Auckland Central** being the highest (see Figure 2.3). This is not necessarily a true reflection of disposable income levels, as age and household structural-composition effects weight these areas towards younger, often childless couples, which suggests that disposable income in these areas may be even higher. The interquartile range of incomes is also much greater in **Wellington** and the three Auckland regions. The other regions have much smaller interquartile ranges (indicating less variation in income), substantially lower median and quartile incomes, with **Northland** having the lowest household income. The areas with the next lowest household income were **Hawke's Bay/Tairawhiti**, **Nelson/Marlborough**, **Southern South Island** and **Taranaki/Wanganui/Manawatu**.

However it is worth noting that in areas such as **Bay of Plenty/Lakes** and **Waikato**, there are marked sub-regional differences (Johnstone and Baxendine 1998) (not shown here). Incomes in **Northland** and **Bay of Plenty/Lakes** are affected to different degrees by a similar profile: with a high percentage of Māori and of retired people. In **Hawke's Bay/Tairawhiti** the prime reason is the high proportion of Māori, who are much more likely to be on low incomes than Pakeha. For **Nelson/Marlborough** it is the effect of retirees, often on fixed incomes.

[14] On a scale from low to high income the lower quartile is what the 25th household in 100 earns, the median is what the 50th household in 100 earns and the upper quartile is what the 75th household in 100 earn.
[15] It was not possible to get comparable data for 1981.

Figure 2.3: Household Income ($), Median and Quartiles, By Region, 2001



Source: 2001 Census of Population and Dwellings, Statistics New Zealand.

2.4.4 Overcrowding

Overcrowding is a sensitive index of unsatisfactory living conditions, conventionally seen as related to higher risks of both respiratory disorders and to diseases linked to poor sanitation (Midland Health 1995; Ranson 1991 and Ambrose 1996 quoted by Gray 2001). The unit of observation for this indicator is the household. Because overcrowded conditions usually occur in larger households, the proportion of the population living in such conditions will be higher than the number of households subject to this condition. We were able to compute a crude index of overcrowding (people/bedroom), but could not refine these data for a measure of density (e.g. cubic meters/resident). Thus the overcrowding indicators used here should be interpreted with some degree of caution.

Overcrowding has been defined as follows:

- *Moderate Overcrowding (approximately 3 people per bedroom)*, measured by
  - 3-4 people/1 bedroom
  - 5-7 people/2 bedrooms
  - 6-8 people/3 bedrooms
  - 9 or more people/4 or more bedrooms
- *Serious Overcrowding (approximately 4 people per bedroom)*, measured by
  - 5 or more people/1 bedroom
  - 8 or more people/2 bedrooms
  - 9 or more people/3 bedrooms

The **South Island** regions had a low percentage of households subject to overcrowding. **South Auckland** had the highest level of both moderate and serious overcrowding, and therefore total overcrowding (see Table 2.5). Other areas with high levels of overcrowding were **Northland** and **Auckland Central**.

Table 2.5: Percentage of Households that are Overcrowded, By Region, 2001

	Overcrowding			Not Specified
	Moderate	Serious	Total	
Northland	3.0	0.2	3.2	7.5
Waitemata	2.0	0.1	2.1	4.5
Auckland Central	3.4	0.3	3.6	6.4
South Auckland	5.5	0.6	6.1	6.1
Waikato	2.2	0.1	2.3	3.9
Bay of Plenty/Lakes	2.3	0.1	2.5	4.9
Hawke's Bay/Tairawhiti	2.5	0.2	2.6	4.4
Taranaki/Wanganui/Manawatu	1.5	0.1	1.5	3.5
Wellington	2.0	0.1	2.1	3.6
Nelson/Marlborough	1.2	0.1	1.2	3.7
Central South Island	1.0	0.0	1.0	2.9
Southern South Island	0.8	0.0	0.9	2.8
NEW ZEALAND	2.2	0.2	2.4	4.3

Source: 2001 Census of Population and Dwellings, Statistics New Zealand.

2.5 OTHER REGIONAL DIFFERENCES IN SOCIO-ECONOMIC FACTORS, 1986-2001

Importantly for this monograph there were also major shifts sub-nationally in the social and economic co-variates of health determinants. This has been tracked in a detailed analysis covering demographic, social, workforce, family, income, health and a range of other factors in a study completed by the Population Studies Centre, running parallel to the health analysis discussed in the present monograph (Pool and Baxendine 2006; Pool *et al.* 2004, 2005a, b, c, d, e, f, g, 2006a, b, c). As the results are covered in 11 different discussion papers of varying length, it would be impossible to include them here. Nevertheless, it is important to summarise them as they provide an important backdrop to this monograph.

These studies show that only two metropolitan regions plus some small retirement zones showed significant population growth over the period 1986-2001. The two metropoli of **Auckland** and **Wellington** also gained concentrations at the young working ages, occasioned in part by the rapid growth of their tertiary workforces, especially in the finance, management and related occupations. Average incomes in these metropoli also diverged increasingly from those of other regions to levels well above those of other regions. Both intra- and inter-regional income differentials grew significantly in this period, with the upper quartile groups in the favoured regions diverging markedly from levels seen elsewhere. In fact, New Zealand's social and economic geography trichotomised in this period: the two regions **Auckland** and **Wellington** prospered, diverging above the national patterns in factors that gave them advantage; a number of other regions such as **Canterbury** and **Waikato** got by, and were close to national patterns; others such as the **southern North Island** outside Wellington also got by, but not as favourably; and some, notably the peripheral regions of **Northland**, **Bay of Plenty**, **Gisborne** and **Westland,**[16] three of which have large concentrations of Māori , diverged markedly from New Zealand as a whole, overwhelmingly in negative ways. These same regions have a further disadvantage that a significant proportion of their population lives further than 30 or 60 minutes travelling time from major social and health care facilities, and lower numbers of medical personnel per 100,000 population (Pool *et al.* 2006c).

[16] In our study Westland has been combined with Canterbury into the Central South Island. But as we show in a separate study, West Coast is definitely among disadvantaged regions in terms of most health care measures (Pool *et al*. 2006c).

2.6 CONCLUSION

This chapter has shown the diversity of population and socio-economic trends among the different regions of New Zealand. The regions around Auckland show the greatest increase in absolute population size. Unlike other regions, the **Southern South Island** had a decline in total population numbers and **Auckland Central** stands out as an exception to the general trend of an aging population. Outside the **Auckland regions** and **Wellington**, a substantial proportion of people live in minor urban and rural areas.

These demographic changes, especially the spatial realignments of population, were very important affecting every aspect of health service delivery, including hospitalisation. To add to this, New Zealand has a peculiar population geography, perhaps closest to Norway among Western Developed Countries. We have a small population, dispersed over a long narrow country, but with a concentration around Auckland and several other smaller nodes. This unchangeable reality increases health planning problems.

Specialised services are also not evenly distributed but clustered in the largest nodes. We deal, of course, with place of residence, but recognise that distance from a specialised service has flow-on effects for patients and their families.

CHAPTER 3

The Factor of Ethnic Composition

3.1 INTRODUCTION

Ethnic diversity is a feature of New Zealand's demography and a relationship between health status and ethnicity has been shown repeatedly, with the health status of Māori and Pasifika people standing out as being poorer than that of other New Zealanders (Ministry of Health 1999a, 2001a). The ethnic composition of a region, and the demographic and socio-economic attributes of its ethnic sub-populations, can thus determine health status and health care utilisation patterns, the focus of this monograph. Furthermore the very different age structures and geographical distribution of the various ethnic groups have major impacts on their health status profiles. Changes in the contribution various ethnic groups make to the national population structures overall, and by age is yet another dimension of sub-national difference.

Despite the importance of studying ethnicity in relation to health status, ethnic analyses are fraught with technical problems that reduce their utility. This chapter starts by describing some of these problems, with special reference to Māori in the New Zealand censuses. Although many of the technical problems apply also to other ethnic groups (namely Asian and Pasifika peoples), defining Māori, who form the largest single ethnic 'minority' in New Zealand, is of prime importance here. Moreover, in most New Zealand regions, the focus of this monograph, Māori and Pakeha together constitute more than 90 percent of the population; other ethnic groups make up 10 percent or less: the exceptions to this are in the Auckland region and Wellington. More importantly, Māori have a particular socio-political position in New Zealand society by virtue of their indigenous status and their statistics are used to inform policy planning and evaluation for various Government departments.[17]

3.2 DATA ISSUES

It is necessary to pay considerable attention to this methodological issue as it affects the substantive results to be presented in later chapters. Here the denominator statistic of most rates to be used in later chapters, derived from census data, is analysed. In the next chapter this denominator statistic will be examined in greater detail, while numerator statistics, derived from various types of continuous reporting of health events (e.g. death, admission/discharge from hospital) will also be analysed.[18]

The definitions of ethnicity have changed over time so that consistency between each census, and between enumerations and other data sources, has remained a problem. A major change in the principles relating to ethnic questions was made in the 1986 census: a shift, shown in Table 3.1 from a 'degree of Māori blood' definition to one of ethnic identity. From 1986, however, the question was changed in detail and this had some quite significant and unforeseen effects. Moreover, the possibility of recording more than one ethnicity has posed tabulation problems for official statistics. For much of the period since 1986 published data have been based on a hierarchical prioritisation system,[19] but in

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[17] These issues are also covered in a Ministry of Health publication (Ministry of Health 2001a) and in Te Rōpū Rangahau Hauora a Eru Pōmare (2000).

[18] In passing it should be noted that one health indicator – receipt of a Sickness/Invalid Benefit - comes from the census and thus is affected by the ethnic definitional problems identified for enumerations. This variable is also subject to problems in defining benefit status, but these difficulties will be referred to as they arise. That said, the statistic does have an inherent advantage: that prevalence rates draw their numerator and denominator from the same source and thus avoid incompatibility in definitions.

[19] The hierarchical procedure for assigning ethnicity is as follows (Department of Statistics 1993):

- If New Zealand Māori is one of the ethnic groups reported, the person is assigned to NZ Māori
- Otherwise, if any Pacific peoples group (e.g. Samoan, Fijian) is one of the ethnic groups reported, the person is assigned to the Pasifika group
- Otherwise, if any group other than the European/Pakeha group is one of the ethnic groups reported, the person is assigned to 'Other' (this does not include 'not specified')

2001 many publications moved to using total responses for ethnicity, meaning that people could be counted more than once if they ticked more than one ethnic group. In this report prioritised ethnic groups will be used.

Definitions of Māori have changed between censuses. To make comparisons between censuses and also to use census figures for the calculation of a range of rates, two Māori ethnic categories are used. In general, 'sole Māori' refers to those people who record Māori as their only ethnic affiliation, whereas 'socio-cultural Māori' refers to those who identify partly as Māori and partly as belonging to another ethnic group as well as those who are coded as 'solely Māori'. Some health analysts have argued that one should use the 'sole Māori' definition as their denominator (Harris *et al.* 2000). It is our view that this deflates the denominator and thus may exaggerate levels of mortality and ill-health. We will return to this point in the next chapter, but the principle is that when several data sources are to be used in calculating an ethnic-specific health index, a major requirement is that the ethnic definitions used in different data sources be as compatible as possible, and that comparability of definitions over the time period is essential. A change in the definition used in one type of count should be consistent relative to the other types of count. The quality and comparability of Māori-specific data in relation to data items that are used to calculate counts of population, deaths and discharges are discussed further in Chapter 4.

The way 'sole Māori' and 'socio-cultural Māori' categories were defined changed, depending on the census question asked. Table 3.1 outlines how the ethnicity questions have changed and how the terms 'sole Māori' and 'socio-cultural Māori' were defined.

Table 3.1: Māori Definition Changes in Censuses, 1981-2001

Year	Question type	Elicits	Sole Māori	Socio-cultural Māori	Effect of change
1981	Quantum measure	Biological ancestry	'Full' Māori	50% or more Māori 'blood'	This is the same as previous censuses except 1976[20]
1986	Tick boxes of ethnic *origin*	Biological ancestry or cultural identity	Tick Māori box only	Tick Māori plus other boxes	Not strictly comparable to 1981: completely different question
1991	Tick boxes of ethnic *group*;	Cultural identity	Tick Māori box only	Tick Māori plus other boxes	Similar to 1986
1996	Tick boxes of ethnic group – wording encourages multiple responses	Cultural identity	Tick Māori box only	Tick Māori plus other boxes	Increase in multiple responses: increase in socio-cultural Māori, decrease in sole Māori
2001	Tick boxes of ethnic *group*;	Cultural identity	Tick Māori box only	Tick Māori plus other boxes	Slight decrease in multiple response: socio-cultural Māori more in keeping with 1991

Table 3.2 shows the numbers of people belonging to these groups between the years 1981 and 2001**.** The impact of the definition changes is especially significant in the 1996 census where the proportion of sole Māori dropped dramatically and the total socio-cultural Māori proportion rose. The differences in numbers do not reflect a real change in Māori populations but are an artefact of the 1996 census question, which allowed more multiple responses to the ethnicity question. This raises questions about using the 1996 census Māori population count in time series analyses. The results for 2001 were different to those in 1996 with socio-cultural Māori fitting more with the time series from 1991 though the levels of sole Māori have dropped from 1991.

- Otherwise, if any Asian group is one of the ethnic groups reported, the person is assigned Asian
- Otherwise, the person is assigned to European/Pakeha

[20] The 1976 Census asked two questions: fraction Māori blood, and Māori ancestry. However this caused confusion and was dropped. See Statistics New Zealand 2004, Appendix B. This distorted trends, and the 1976 census is often not included.

It is easy to criticise the quality of ethnic data, but that eschews a far more fundamental issue. The boundaries in New Zealand's ethnic mosaic are extremely fluid and thus the statistics are a serious attempt to record a constantly changing scene with the variants within an ethnic group (sole versus socio-cultural) being the most volatile, as is clear in Table 3.2. At the margins of the socio-cultural Māori group are persons who might or might not in another context see themselves as solely Pakeha or solely Pasifika, while as Kukutai (2001) has shown, those socio-culturally Māori, as prioritised, include significant numbers of persons whose prime affiliation is, say Pakeha or Pasifika. However, while the socio-cultural definition includes those who see themselves as primarily Pakeha or Pasifika, it follows a fairly steady increasing trend over the time period, compared to the numbers for sole Māori which fluctuate substantially from census to census indicating artefact effects due to changing census questions. It is clear that the sole Māori category is not suitable as a measure of the Māori population over time.

Despite the cross-over between Māori and Pakeha in the socio-cultural Māori category, there are two distinct major ethnic populations in New Zealand. For numerous social factors there are distinct differences and this certainly carries across into health. Most importantly, despite all these problems the population enumerated and termed 'socio-cultural' here in most years approximates the trajectory projected forward from the 1960s. A major exception is 1976 (due to a change in the ethnicity question), and less extreme exceptions are 1991 and 2001 (data not shown). This theme will be revisited in the next chapter.

Table 3.2: Māori Population in New Zealand at Censuses, 1981-2001

Year	Male		Female	
	Sole	Socio-cultural	Sole	Socio-cultural
1981*	-	139,837	-	139,246
1986	148,023	201,894	147,294	202,881
1991	160,770	214,431	162,720	220,416
1996	135,897	258,000	137,541	265,371
2001	147,735	257,484	146,994	268,797

Sources: 1981-2001 Censuses of Population and Dwellings, Statistics New Zealand.
*The definition of 'socio-Cultural Māori' was different in 1981 census; it was based on 50% or more Māori 'blood', compared to selecting Māori as one of two or more ethnicities in censuses after 1981.

3.3 REGIONAL DIFFERENTIALS IN ETHNICITY

In 2001 the **South Island regions** had the largest proportion (85 percent) of Pakeha and the smallest proportion in any other ethnic groups (see Table 3.3). **Auckland Central** and (especially) **South Auckland** are the most ethnically diverse regions in New Zealand, with large numbers of Pasifika peoples as well as high numbers of Māori and Asian people. The areas with a high percentage Māori population are **Northland**, **Hawke's Bay/Tairawhiti**, **Bay of Plenty/Lakes**, and to a lesser but significant degree, **Waikato** (Lepina and Pool 2000) and **South Auckland** (see also Table 3.4). In 2001, the Māori population between the last three regions was 38 percent of the Total Māori population.

Table 3.3: Ethnic Composition, (%) By Region, 1986 and 2001

Region	Pakeha	Māori	Pasifika	Asian	Other	Not Specified	Total
				1986			
Northland	72.5	25.0	0.7	0.4	0.1	1.3	100.0
Waitemata	86.2	7.5	3.9	1.3	0.1	1.0	100.0
Auckland Central	73.9	9.7	11.3	3.3	0.2	1.6	100.0
South Auckland	67.6	17.2	11.9	2.0	0.1	1.2	100.0
Waikato	79.3	17.0	1.6	1.0	0.1	0.9	100.0
Bay of Plenty/Lakes	72.0	25.5	1.0	0.6	0.1	0.9	100.0
Hawke's Bay/ Tairawhiti	73.2	24.1	1.1	0.7	0.0	0.8	100.0
Taranaki/Wanganui/ Manawatu	84.4	12.7	0.8	1.0	0.1	1.0	100.0
Wellington	80.1	10.4	5.1	2.9	0.2	1.3	100.0
Nelson/Marlborough	92.7	5.3	0.5	0.5	0.0	1.1	100.0
Central South Island	92.0	4.8	1.0	1.0	0.1	1.1	100.0
Southern South Island	91.3	5.5	1.1	0.9	0.1	1.1	100.0
New Zealand	81.2	12.4	3.7	1.5	0.1	1.1	100.0
				2001			
Northland	60.5	29.1	1.1	1.2	0.2	8.0	100.0
Waitemata	69.8	9.2	6.2	9.4	1.0	4.3	100.0
Auckland Central	56.1	7.9	11.9	17.2	1.4	5.5	100.0
South Auckland	47.9	16.3	18.4	11.3	0.9	5.2	100.0
Waikato	70.4	20.2	2.1	3.3	0.5	3.5	100.0
Bay of Plenty/Lakes	65.3	26.6	1.4	1.8	0.2	4.7	100.0
Hawke's Bay/ Tairawhiti	64.4	27.5	2.3	1.6	0.2	3.9	100.0
Taranaki/Wanganui/ Manawatu	76.5	16.1	1.4	2.3	0.3	3.4	100.0
Wellington	70.9	12.1	6.6	6.2	0.8	3.3	100.0
Nelson/Marlborough	86.2	8.1	0.8	1.2	0.2	3.5	100.0
Central South Island	84.9	6.7	1.5	3.7	0.4	2.7	100.0
Southern South Island	86.2	7.5	1.2	2.3	0.3	2.5	100.0
New Zealand	69.8	14.1	5.4	6.1	0.6	4.0	100.0

Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

Since the 1986 census there has been a significant increase in ethnic diversity in the three Auckland regions and to a lesser extent for **Wellington**. This has been because of a rapid increase in the number of Asians in the three **Auckland regions**, while **South Auckland** also had a large increase in its Pasifika population: over six percentage points. There has been around three to four percentage point growth in the Māori population of **Northland**, **Waikato**, **Hawke's Bay/Tairawhiti** and **Taranaki/Wanganui/Manawatu**. These changes have important implications for the provision of health services, as different ethnic groups have different requirements. Māori and Pasifika populations have higher levels of need, and this leads to higher rates of utilisation. The implications of the growing Asian population on the health system are unknown at this stage as data have only recently been collected. In this monograph only indices for Māori have been calculated from and analysed for regions because of the small numbers involved at the sub-national level for the other ethnic groups, but some national-level indicators are provided.

Table 3.4: Number of People of Māori Ethnicity by Region, 1981-2001

Region	1981[1]	1986[2]	1991[2]	1996[2]	2001[2]
Northland	22,026	30,705	35,610	41,502	40,734
North Auckland	13,946	23,649	27,510	38,031	39,684
Auckland City	19,730	28,590	27,231	31,632	29,139
South Auckland	35,672	47,553	50,886	59,463	61,395
Waikato	36,609	49,563	52,851	62,808	64,296
Bay of Plenty/Lakes	44,057	56,067	61,833	72,573	72,978
Hawke's Bay/Tairawhiti	34,491	44,586	46,041	51,012	51,429
Taranaki/Wanganui/Manawatu	26,258	40,413	43,722	51,249	50,436
Wellington	26,982	40,623	42,072	49,662	51,501
Nelson/Marlborough	2,268	5,313	6,114	9,534	9,888
Central South Island	9,917	22,062	24,279	34,155	34,116
Southern South Island	7,056	15,543	16,626	21,651	20,649
NEW ZEALAND	**279,083**	**404,775**	**434,847**	**523,374**	**526,281**

(1) 50% or more Māori in the 1981 census.
(2) Socio-cultural Māori.
Source: Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

3.4 AGE STRUCTURES OF DIFFERENT ETHNIC GROUPS

National Patterns

There are some major differences in the age structures of the various ethnic groups (see Table 3.5). Pakeha have the largest percentage of people aged 45 years and over, especially those 65 years and over. In 1986, 32 percent of the Pakeha population was aged 45 years and over, increasing to 40 percent in 2001, whereas Māori and Pasifika populations had only around 12 percent in this age group in 1986 and 17 percent in 2001. The Asian and 'Other' ethnic groups fall between these two extremes, but were notable because they had high percentages at younger working ages. The low percentage aged 45 years and over for Māori and Pasifika peoples is balanced by a high proportion in the under 15 years age group (35-40 percent), dropping slightly between the 1986 and 2001 censuses. For Pakeha the corresponding percentage is around 20 percent, also with a slight decline.

Table 3.5: Age Structure by Ethnic Group, New Zealand 1986 and 2001

Year	Ethnicity	Age Group (years)				Total
		Under 15	15-44	45-64	65+	
1986	**Pakeha**	21.6	46.2	20.0	12.2	100.0
	Māori	39.0	48.3	10.4	2.3	100.0
	Pacific	36.7	51.7	9.8	1.8	100.0
	Asian	27.6	56.2	12.8	3.4	100.0
	Other	27.4	56.5	10.9	5.0	100.0
2001	**Pakeha**	19.0	41.0	24.9	15.1	100.0
	Māori	37.3	46.0	13.3	3.4	100.0
	Pacific	34.8	47.8	13.7	3.7	100.0
	Asian	22.5	55.9	17.4	4.2	100.0
	Other	28.0	54.5	14.4	3.2	100.0

Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

These differences between ethnic groups in their age structure have huge implications for demands on the health system. The Pakeha population, being older has larger numbers of people in the high health utilisation ages, whereas Māori and Pasifika peoples, being younger means the focus of the services they need will be for conditions more likely to affect children and younger adults. While the percentage of Māori in the older age groups is small, it is increasing and will grow very rapidly because of momentum effects (referred to earlier) and this has implications for service configurations in some areas.

Regional Patterns
When looking at the age structure by ethnicity for the regions (see Table 3.6), the focus will be on Māori and non-Māori only. As the majority of Māori live in regions in the north of the North Island only key differentials in the age structures of these regions are noted here.

- In both 1986 and 2001 **Northland** Māori had the highest percentage of any regional Māori population in the age groups 45-64 years and 65 years and over with a corresponding low percentage at the 15-44 years age group.
- **South Auckland** Māori had the highest percentage in the under 15 years age group with a correspondingly low percentage in the age groups 45 years and over in both 1986 and 2001.
- **Auckland Central** had the highest percentage in the 15-44 years age group for Māori and the lowest in the under 15 years age group, suggesting the pattern of young Māori going to Auckland to work and leaving to move into retirement elsewhere, such as **Northland** or **Tairawhiti**. This may also apply to 'discouraged urban workers' (see below).
- The other northern regions that have significant Māori populations, such as **Waikato and Bay of Plenty/Lakes**, have age structures that are very similar to Māori for New Zealand as a whole

For non-Māori the pattern generally follows that of the Total Population, with increasing proportions at older ages and decreasing child and young adult populations (see earlier discussion).

Table 3.6: Age Structure for Māori and Non-Māori, By Region, 1986 and 2001

Region	Māori					Non-Māori				
	<15	**15-44**	**45-64**	**65+**	**Total**	**<15**	**15-44**	**45-64**	**65+**	**Total**
	1986									
Northland	38.5	44.3	13.0	4.1	100.0	23.7	44.6	20.6	11.2	100.0
Waitemata	38.7	50.4	9.3	1.6	100.0	22.4	47.5	19.8	10.3	100.0
Auckland Central	33.8	52.5	11.0	2.6	100.0	17.7	47.7	19.6	15.0	100.0
South Auckland	41.0	48.9	8.8	1.3	100.0	24.7	48.0	18.7	8.6	100.0
Waikato	39.8	47.6	10.4	2.2	100.0	24.0	46.7	19.0	10.3	100.0
Bay of Plenty/Lakes	38.8	46.6	11.8	2.7	100.0	22.7	44.2	20.6	12.4	100.0
Hawke's Bay/ Tairawhiti	39.0	46.2	11.8	3.0	100.0	23.2	44.2	19.7	12.8	100.0
Taranaki/Wanganui/ Manawatu	40.0	47.7	9.9	2.4	100.0	23.3	45.9	18.7	12.2	100.0
Wellington	38.7	50.6	9.1	1.6	100.0	21.8	48.2	19.3	10.7	100.0
Nelson/Marlb.	38.8	48.0	10.6	2.3	100.0	22.5	44.9	19.9	12.6	100.0
Central South Island	38.9	50.0	8.9	2.0	100.0	21.3	46.2	20.0	12.5	100.0
Southern South Island	39.6	49.1	9.2	1.9	100.0	23.1	46.4	19.0	11.6	100.0
NEW ZEALAND	**39.0**	**48.3**	**10.4**	**2.3**	**100.0**	**22.3**	**46.6**	**19.5**	**11.6**	**100.0**
	2001									
Northland	38.3	41.4	15.1	5.2	100.0	19.7	35.7	27.9	16.7	100.0
Waitemata	37.2	49.0	11.7	2.2	100.0	21.1	43.9	23.3	11.7	100.0
Auckland Central	31.0	51.9	13.8	3.3	100.0	18.7	49.5	20.8	10.9	100.0
South Auckland	39.0	46.3	12.4	2.2	100.0	24.2	43.8	22.1	10.0	100.0
Waikato	37.8	45.7	13.1	3.4	100.0	20.8	41.4	23.8	14.0	100.0
Bay of Plenty/Lakes	37.6	44.2	14.1	4.1	100.0	19.6	37.7	25.6	17.1	100.0
Hawke's Bay/ Tairawhiti	37.2	43.9	14.4	4.4	100.0	20.4	37.9	25.5	16.3	100.0
Taranaki/Wanganui/ Manawatu	38.5	45.1	12.8	3.5	100.0	20.4	40.2	23.7	15.7	100.0
Wellington	36.4	48.4	12.7	2.5	100.0	19.9	45.1	22.8	12.2	100.0
Nelson/Marlb.	38.7	45.4	13.2	2.7	100.0	20.1	39.1	25.5	15.3	100.0
Central South Island	37.2	47.4	12.6	2.7	100.0	19.2	42.4	23.9	14.6	100.0
Southern South Island	36.4	47.4	13.2	2.9	100.0	18.9	42.7	23.8	14.6	100.0
NEW ZEALAND	**37.3**	**46.0**	**13.3**	**3.4**	**100.0**	**20.3**	**42.7**	**23.5**	**13.5**	**100.0**

Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

3.5 SOCIO-ECONOMIC INDICATORS FOR MĀORI

As discussed in Chapter 2, socio-economic indicators are important co-variates of the health status of the population. In this section two indicators, shown in Chapter 2 to be significant, will be investigated for Māori and non-Māori: income support for 1986 and 2001 and labour force participation in 1981 and 2001. The aim is to look at the interaction between ethnicity and socio-economic factors.

3.5.1 Income Support[21]

National Patterns
The same categories will be used here as in section 2.4.2 covering the three main benefit groups at working ages: Unemployment; Domestic Purposes; and the group that includes Sickness and Invalid benefits. Because of definitional changes the Māori time series starts in 1986, whereas the Total population series (see Table 2.4.2) starts in 1981.

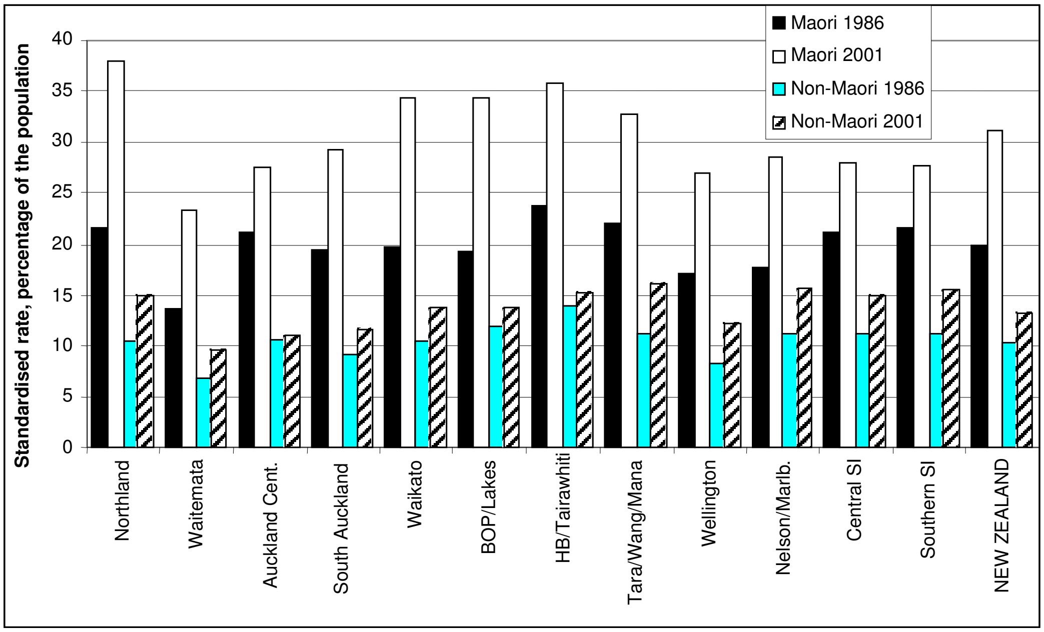
Between 1986 and 2001 benefit use increased for both Māori and non-Māori, but so too did the gap between them (see Figure 3.1). By 2001 the levels of income support for Māori were more than double those for the non-Māori New Zealand population (see Figure 3.1). The level of receipt of the Domestic Purposes Benefit (DPB) was more than three times higher among Māori than non-Māori (see Appendix Table 3.1). Over the fifteen year period 1986 to 2001 there was a significant increase in the percentage of Māori who received some form of income support. Reliance on all three benefit types increased, with the largest growth occurring for the Unemployment Benefit.

Regional Patterns
Regional differentials in the levels of income support received by Māori and non-Māori in 1986 and 2001 are presented in Figure 3.1 (see also Appendix Table 3.1 which shows sub-national differences both in the levels and types of income support received). Level of benefit use increased between 1986 and 2001 for both ethnic groups. But as in the case of New Zealand as a whole, it is the growth of relative as well as absolute differences between Māori and non-Māori that stand out. Some key trends are listed below.

- Compared to Māori levels for New Zealand as a whole, **Hawke's Bay/Tairawhiti** had the greatest levels of overall benefit receipt for Māori in 1986, with the levels also being high in 2001 particularly for DPB.
- In 2001 **Northland** had the highest overall level of benefit use for Māori at working ages and also had the highest level for the Unemployment and Sickness/Invalid Benefits.
- Other areas which had high levels of income support for Māori in 2001 were **Waikato** and the **Bay of Plenty/Lakes** although these regions had been just below the national Māori level in 1986.
- In 1986 **Auckland Central** Māori had the highest levels of receipt of Sickness/Invalid benefits, with levels of DPB also being elevated, though by 2001, the DPB level was one of the lowest. **South Auckland** had the highest level of DPB for Māori in 1986.
- On the other hand **Waitemata** Māori had the lowest overall levels for both 1986 and 2001, with levels of Unemployment benefit being especially low.
- The **Southern South Island** had two conflicting results in 1986 with the highest levels of Unemployment benefit and the lowest levels of Sickness/Invalid benefit, and in 2001 the region had the lowest levels of DPB.

[21] The variable "income support" relates to the proportion of the population of working age that received the three main groups of benefits (Unemployment, Domestic Purposes, and Sickness/Invalid) within the 12 months prior to the census, indicating the proportion of the population that is dependent on government transfer payments. It is important to note that, as in Chapter 2, a priority system was used because a person can receive more than one benefit type in a year going from Domestic Purposes Benefit to Unemployment to Sickness/Invalid Benefit. See section 2.4.2 and Table 2.4 for more details. The methodology applied here is derived from Pool *et al.* 2006b.

Figure 3.1: Standardised[1] Percentage at Working Ages Receiving Three Main Benefit Types for the Māori and Non-Māori Population, By Region, 1986 and 2001



(1) Standardised by age and gender to 1996 New Zealand Total population (both genders) 15-64 years. This removes the effect of different age structures from the analysis and allows comparisons between years.

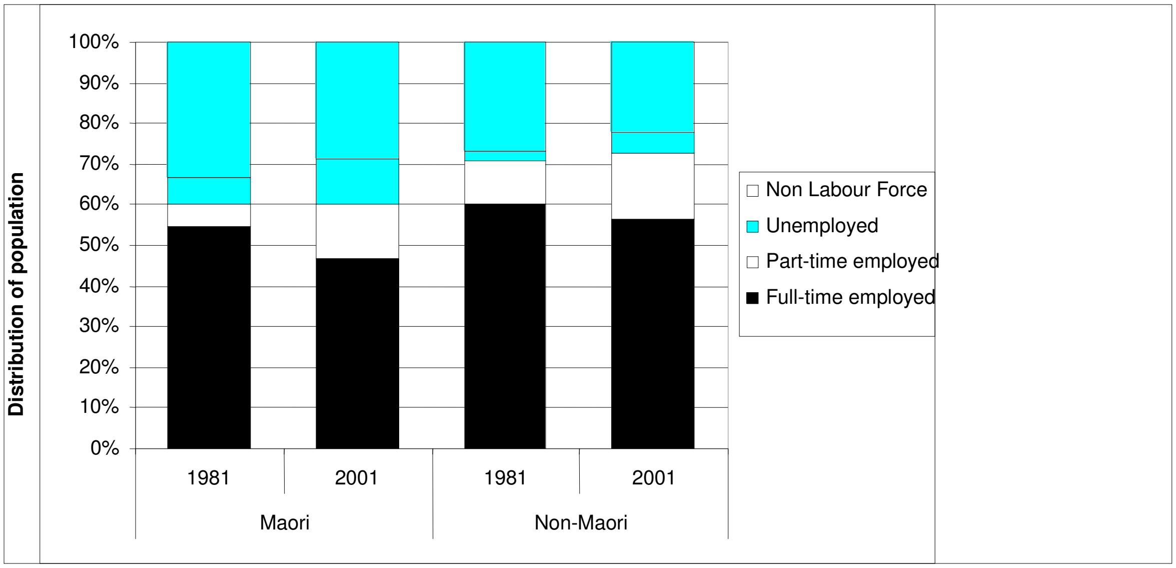
Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

3.5.2 Labour Force Status

National Patterns

Between 1981 and 2001 Māori faced a decline in the percentage of the population in full-time employment, with a corresponding increase in the proportions employed part-time and unemployed. In 2001 the age-standardised unemployment rate was six percentage points higher for the Māori than for the non-Māori population and the non-labour force participation rate was seven percentage points higher (see Figure 3.2 and Appendix Table 3.2). This means that Māori were also less likely than the non-Māori population to be in full-time employment with a level ten percentage points lower than that for the non-Māori population, and with a part-time employment level three percentage points lower.

Figure 3.2: **Standardised[1] Percentage of Labour Force Status[2] at Working Ages for the Māori[3] and Non-Māori Population, New Zealand, 1981 and 2001**



(1) Standardised by age and gender to 1996 New Zealand Total population (both genders) 15-64 years. This removes the effect of different age structures from the analysis and allows comparisons between years.
(2) Not included in the population are those whose labour force status was not specified in 2001.
(3) 50% or more Māori blood in 1981.
Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

Regional Patterns
In Table 3.7 sub-national labour-force participation rates are presented (Appendix Table 3.2 gives further detail in terms of full and part-time employment, unemployment and non-labour force status).

- Every region (except **Auckland Central** for non-Māori) experienced increases in labour force participation between 1986 and 2001, but (with the exclusion of **Nelson/Marlborough** in 1981) Māori rates were consistently below non-Māori rates in every region and at both dates.
- The ethnic structures of the labour force are affected by migration, both international flows and internal mobility. With downturns some 'discouraged workers' might move away from metropoli, typically to rural areas: this has been reported for Māori (Pool 1991: 206). This might have negative effects on health patterns both at the region of origin, the urban area from which one assume the less well off left, and at destination, which drew in the less healthy. This labour market health issue requires further analysis.
- **Auckland Central** went from having one of the highest labour force participation levels for non-Māori in 1981, to the lowest in 2001.
- **Northland** had the lowest labour force participation rates for Māori for both 1981 and 2001, with **Waikato** and the **Bay of Plenty/Lakes** also tending to be lower. **Northland** and **Bay of Plenty/Lakes** also had high unemployment and non-labour force participation (Appendix Table 3.2). Conversely, **Waikato** and **Bay of Plenty/Lakes** saw some of the higher levels of labour force participation for non-Māori in 2001.
- **Wellington, Waitemata, Auckland Central** and the three **South Island regions** had high labour force participation for Māori for both 1981 and 2001. **Nelson/Marlborough** had the highest labour force participation levels for both Māori and non-Māori in 2001.
- Māori in **Waitemata** had the highest percentage in full-time employment. Other regions with a high percentage of Māori in full-time employment were **Auckland Central, South Auckland, Wellington** and the three **South Island regions**.
- **South Island** Māori had the highest percentages in part-time employment and the lowest percentages unemployed in contrast with the three **Auckland regions** which had the lowest percentage of Māori in part-time employed.

Table 3.7: Standardised[1] Labour Force Participation Rates (%) for Māori and Non-Māori Population, By Region, 1981 and 2001

	Māori		Non-Māori	
	1981[2]	2001	1981	2001
Northland	62.0	64.5	71.3	76.8
Waitemata	70.4	75.1	73.7	78.2
Auckland Central	70.4	73.4	75.2	74.7
South Auckland	65.8	71.9	73.1	75.1
Waikato	63.7	68.7	72.3	78.9
Bay of Plenty/Lakes	64.1	69.1	71.8	79.3
Hawke's Bay/Tairawhiti	66.7	70.2	72.8	79.1
Taranaki/Wanganui/Manawatu	66.8	69.8	72.5	77.7
Wellington	74.1	75.1	75.9	79.8
Nelson/Marlborough	71.4	76.2	71.2	80.0
Central South Island	69.0	73.6	70.9	78.0
Southern South Island	69.7	74.6	71.9	77.7
NEW ZEALAND	66.9	71.1	72.9	77.8

(3) Standardised by age and gender to 1996 New Zealand population 15-64 years. This removes the effects of different age and gender structures from the analysis.
(4) 50% or more Māori blood in 1981.
Source: 2001 Census of Population and Dwellings, Statistics New Zealand.

3.6 CONCLUSION

There is a great deal of discussion and concern over Māori population data. The key issues revolve around shifts in question design and definitions, coupled with some major changes in perceptions about ethnic identity. But the analysis presented here raises an issue that cannot be fully elaborated here: whether or not the concern over precision in ethnic statistics, and the apparent shifts in this precision, may obscure a more critical trend. This is whether the trajectory of change in the Māori population may be more consistent, at least in terms of census enumeration, than anxiety about data quality would suggest. One might add that while there is a very extensive literature on Māori definitional problems in so far as these affect censuses, there is far less analysis about other census questions whose quality might well be even more debateable (e.g. hours worked, religious profession).

Northern regions have the highest levels of ethnic diversity, most generally in the percentage of Māori, but in the case of the three Auckland metropolitan regions and Wellington, Asian and Pacific groups also affect the mix. The proportion of Māori may relate not just to general disadvantage, but to inequalities within the Māori population. Disadvantages and inequalities within the Māori population and between Māori and non-Māori have increased, often very significantly, over the reference period covered in this monograph.

CHAPTER 4

Data Sources and their Quality

4.1 INTRODUCTION

The quality of health indices that are derived from secondary sources is strongly dependent upon the availability of good mortality and hospital discharge data. When such measures are to be calculated over a long period, the data used need to be comparable over time. This issue is particularly pertinent in this report in which regional differences in a range of indicators are tracked over the period 1981 to 2001.

As already discussed with respect to the population data (see Chapter 2 and 3) there have been significant changes in the definition of ethnicity and in the boundaries of the catchment areas for hospitals. Shifts in health policy and attendant administrative changes over the last 20-30 years (see Chapter 1 and Appendix A) have also had a significant impact on the comparability of hospital discharge counts and rates over time. When working with data covering such a time span, it is essential to identify these changes and the effect they have on the data. In this chapter we describe and graphically present important policy and data collection 'milestones' that have influenced the way hospital data were prepared, analysed and interpreted.

4.2 DATA USED IN THE HEALTH INDICES

The raw data used to calculate the health indices include:

- hospital bed-days (a function of numbers of discharges and length of stay)
- population counts, and
- mortality counts

These counts are obtained for each age group and are used to compute a range of conventional health indices that allow the monitoring of population health and hospital utilisation and various life-table functions.

All indices were calculated separately for males and females. The following age groups were used for the calculation of age-specific rates. These age groups represent important life stages:

Under 5 years
5 – 14 years
15 – 24 years
25 – 44 years
45 – 64 years
65 – 74 years
75 years and over

'Direct' age-standardisation is a statistical technique used to provide a summary measure that is free of age composition effects when making comparisons between rates at different times or between populations (Siegel and Swanson 2004: 291-293). All age-standardised rates were standardised to the 1996 New Zealand combined male and female population as enumerated at the 1996 census.

Decisions had to be made about which types of hospital discharges to include and which to exclude for this analysis. Certain categories (e.g. obstetrics) do not contribute to an understanding of health issues, as defined for this monograph, and thus these types of discharges are 'filtered' out of our analysis. In Appendix B the criteria used to 'filter' the discharge data to exclude certain categories are presented.

4.3 HISTORICAL OVERVIEW OF THE NATIONAL MINIMUM DATASET (NMDS)

The major source of morbidity data comes from the records of in-patient public hospital stays that have been collected since the late 1800s. Manual systems were used until computerisation in 1978 (Finlay 1987). From 1978 to 1992 the national hospital data collection was a by-product of the Patient Management System (PMS). At that time there were separate (unlinked) systems for cancer registration and deaths. The National Minimum Data Set (NMDS) brought all the collections together in the same linked database (J. Fraser, New Zealand Health Information Service, personal communication). The reasons for collecting the data and the applications of the data have varied over time, as have the methods and technology available to capture and analyse the data. They also are used to study trends and differentials, particularly geographic variations (Raymont 2008).

Hospital discharge record systems have always provided information about hospital patients, the reason for their admission and duration of use of hospitals. This information was initially collected to track population health status and hospital utilisation. As the macro-environment has changed, hospital data have been analysed for new purposes. Increasingly the data are being exploited for management intelligence and as a tool in deciding volumes of service provision to be purchased by the government health authorities from public hospitals (Raymont 2002). Further applications of the analysis of discharge data will continue to develop over time, often making demands on data collection that were not initially intended. Their application in the new measure of Hospital Utilisation Expectancies (HUEs) in this report is an example of this, and thus it is important to understand how the baseline dataset has been augmented and altered over the period 1980 to the present covered in this report.

The changes affecting the information in the NMDS can be grouped into four types: health policy changes; registrations of patient/client types not previously registered on the NMDS; changes in coding practice; and other changes. These are each discussed below to provide a context for the processes used to modify and interpret the discharge data in order to have more valid comparisons over time. Figure 4.1 provides a graphical representation of the key 'milestones' for the NMDS in New Zealand from 1980 to 1999.

4.3.1 Health Policy

The health policy environment forms part of the context in which health care takes place. As such it is important to understand changes in policy over the two decades that may have had an impact on hospital discharges and the use to which hospital data were put. In Figure 4.1 the main health policy changes are shown above the time line and have been discussed earlier and in Appendix A.

Many of the health policy changes documented emanated from attempts to restructure social spending in New Zealand. Radical economic and social policy reforms over the decade starting 1984 had an impact on the type of data that was collected in hospitals and the use to which the data were put. The Area Health Board Act of 1983 and (later) the next set of Health Reforms starting with the budget exercise in 1991 were two such macro-structural changes.

4.3.2 Registration of New Patient Types

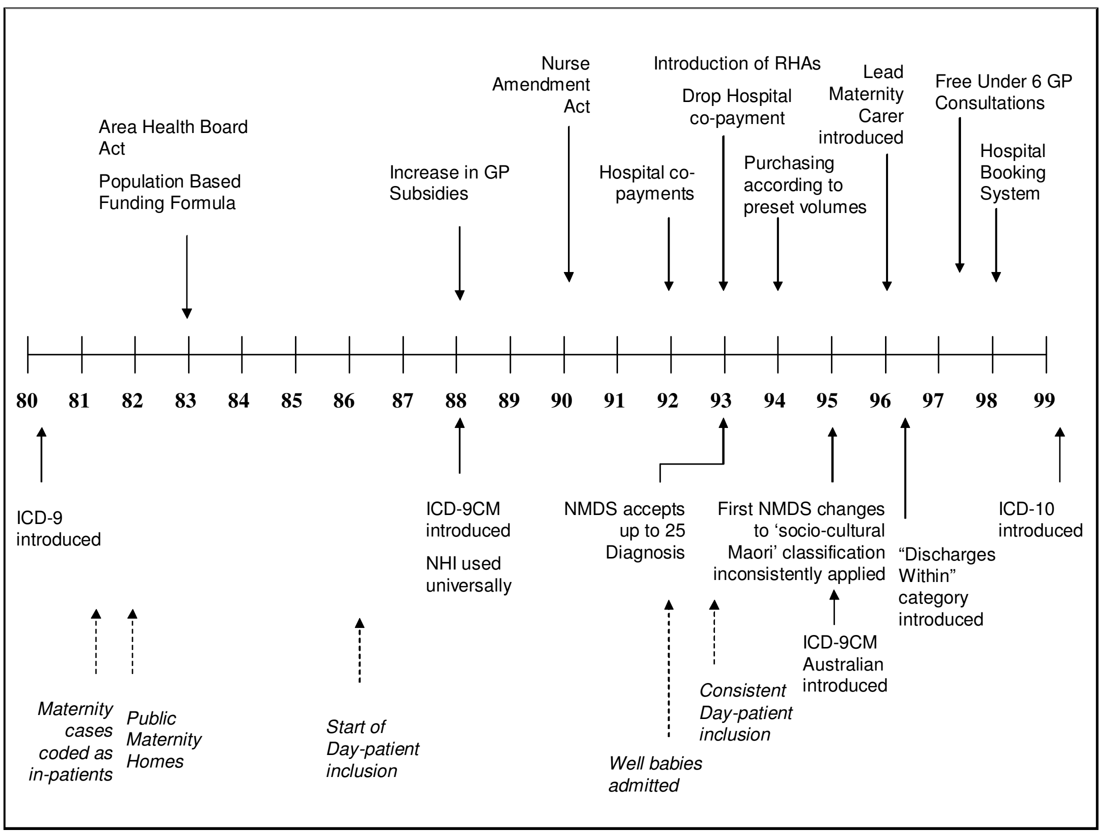
Over the last two decades the actual categories of patients and health episodes included in the hospital dataset have increased, providing a fuller picture of hospital utilisation. However, because of these changes over time, information on crude discharges cannot be compared without accommodating these new types of patient registrations in some way. In Figure 4.1, these patient groups appear below the timeline in italics. The following changes in registration conventions had the largest 'artificial' effect on discharges, showing increases in discharges that did not involve real events of 'sickness'.

- Firstly, data on women giving birth without medical/surgical procedures were initially included in 1981. Clearly most of these patients were healthy and thus their inclusion, while necessary for accounting purposes, is not relevant for this study.
- Secondly, before 1988, day-patients had been counted as a special category of out-patients. They were first registered on the NMDS as admissions from 1987, although this was applied inconsistently across regions until 1992.
- Thirdly, children born in hospital and requiring no medical treatment ('well babies') were first registered as in-patients in mid-1991. All newborn infants were included in this category by the beginning of 1994.

4.3.3 Changes in Coding Practice

Changes in coding practice do not change the total number of discharges, but affect shift-shares in the number of discharges in particular categories. Important coding changes are shown below the timeline in Figure 4.1.

Figure 4.1: National Minimum Data Set Milestones



The series of changes to the coding of medical diagnosis has had a substantial influence on hospital discharge data. The NMDS has used four different versions of the ICD over the last 20 years. ICD-9, introduced in 1980, was discarded in favour of ICD-9CM in 1988. In 1995, the Australian version of ICD-9CM was introduced, only to be changed to ICD-10 in 1999.

Increasingly, the NMDS has been used as a tool to determine resource use that is directly linked to payment for services by government agencies. Through the use of the ICD and specialty codes, a system of Diagnosis Related Groups (DRGs) has been developed which allocates a resource use code to each discharge. The Australian version (AN-DRG) is used in New Zealand. Other additions to the

NMDS refine the ability of health managers to ensure that resource uses are accurately reflected in the data.

For example, a new type of discharge category was introduced fully in May 1996 to allow the identification of transfers *within* a particular hospital: these discharges are called 'discharges within' (DW) and can be differentiated from routine discharges (DR), death on discharge (DD) and discharge transfer (DT). Before 1996, a patient who changed from one ward to another (e.g. from a medical ward to a rehabilitation or long-term ward) was counted as a single discharge with a single DRG code corresponding to that of the diagnosis/ward from which they were discharged. This means that the single DRG code often suggested a lower resource use for the earlier time period during which in reality there may well have been more intensive use of resources. With the introduction of the DW code, the portion of the hospital stay spent in a medical or surgical ward is counted among 'Medical-Surgical' discharges, separately from the other non-'Medical-Surgical' portion. The result of this coding change is that, compared to previous years, there is a small increase in the total recorded discharges because prior to this, these discharges had not been differentiated and were not counted separately.

A National Health Index (NHI) number was introduced uniformly in 1988 allowing records of a particular individual to be linked. This allows discharges related to a single health episode to be merged as, for example, in the case of transfers from one hospital to another. It also allows the identification of re-admissions.

The criteria and categories used for ethnic classification have changed several times over the time period. This renders the comparison of ethnic groups across time problematic (Harris *et al.* 2000; Johnstone *et al.* 1998). As was implied in the conclusion to Chapter 3, this problem may have been given a higher profile for Māori than may realistically be the case. However, the smaller the sub-population, the more significant this becomes. Displacement to and from Pakeha barely affect their rates, but displacement to and from Pacific or Asian may be critical, a point shown for both hospital and abortion data (Sceats 1988).

4.3.4 Other Changes

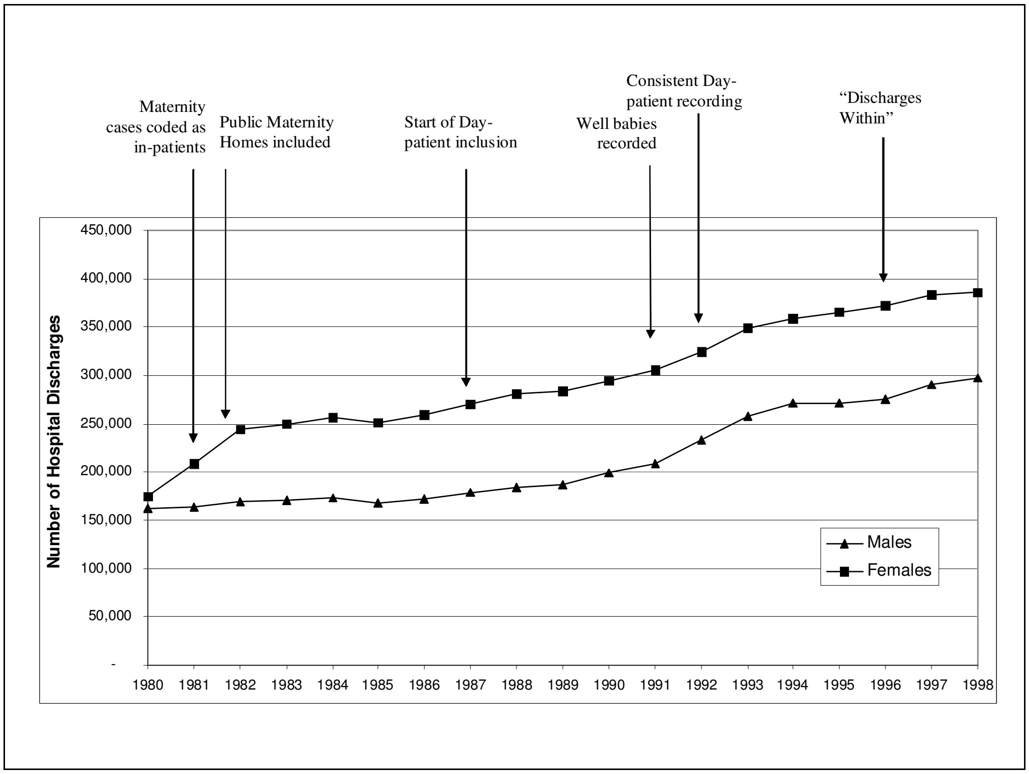
Since the mid-1990s, the number of so-called "publicly purchased discharges from private hospitals" has increased. These are recorded in the NMDS, and private providers are relied upon to forward their discharge data to the same level of detail as public hospitals. This applies to both short-stay and long-stay hospital events. There is evidence that the quality of data from some of these private hospitals is sub-optimal. For example, many Disability Support Services (DSS) patient records in the private sector are inadequately flagged so that these patients are included in the dataset as medical-surgical patients with bed stays in excess of 10 years.

Mental health discharges were excluded as, historically, different hospitals that provide mental health care have submitted data to one of the two national collections, with each collection having different data specifications (Ministry of Health 2000). As there is no uniformity across the country, selected mental health discharges are excluded.

4.4 EFFECT OF CHANGES ON CRUDE DISCHARGES

The milestones outlined above significantly influence the results and interpretation of data analysis (Katzenellenbogen *et al*. 2001a). This can be seen in Figure 4.2 which shows trends in the crude hospital discharges between 1980 and 1998. It shows a steady and substantial increase in hospital discharges for men and especially for women. But, for example, the inclusion of day-patients is reflected in a gradual increase between 1987 and 1992.

Figure 4.2: Number of Discharges for New Zealand Before Filtering, By Gender, 1980-1998

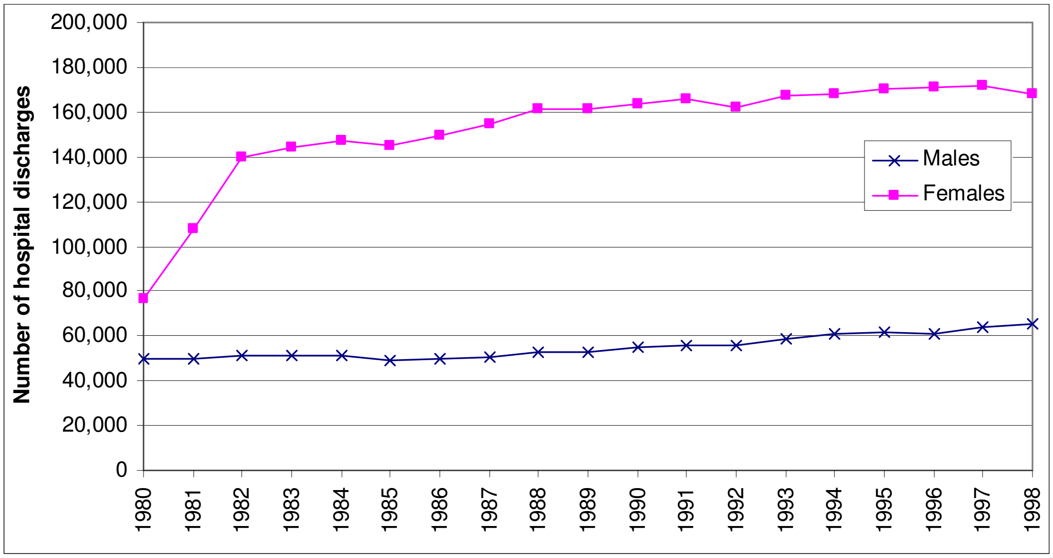


Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges

Significant increases in discharge numbers coinciding with important milestones are shown by the arrows in Figure 4.2. Interestingly, the most notable changes in trends are associated with amendments in coding and registration practices, and not with policy shifts. The effects of major changes in registration protocols are noted below. This point is very important for the subsequent analysis because the effects of shifts in protocols can be quantified directly, whereas the impact of a factor exogenous to registration *per se* (policy-induced changes) can only be implied.

It is evident that the steepest increase in crude numbers relates to the inclusion of maternity cases in 1981-1982, accounting for most of the male-female discrepancy in crude discharges after 1982. This can be seen most clearly in an example, in the graph on discharges in the 15-44 years age group (Figure 4.3).

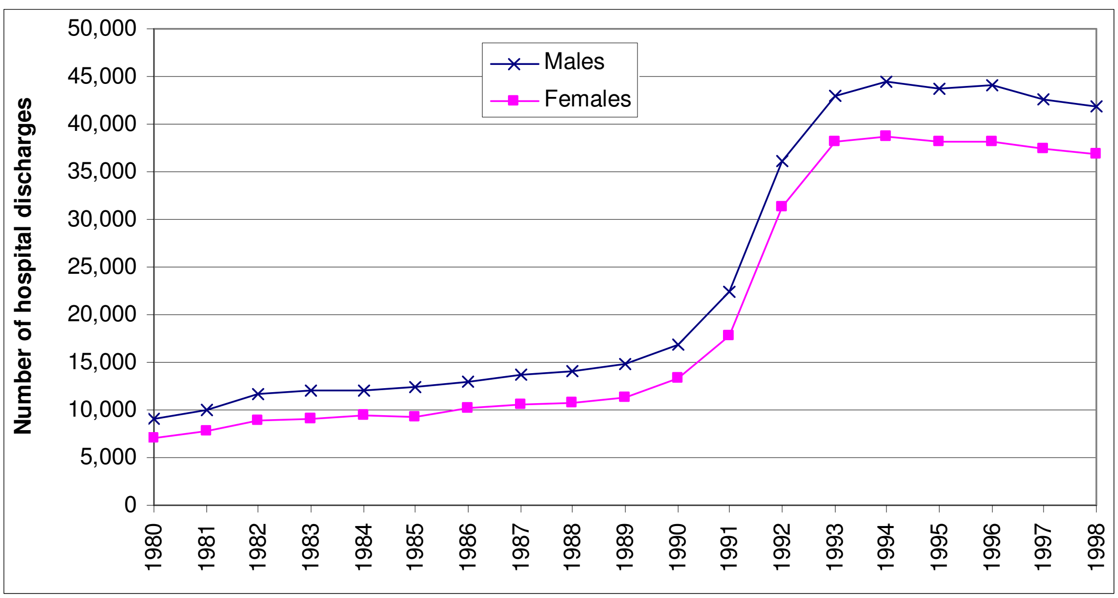
Figure 4.3: Number of Hospital Discharges in the 15-44 Year Old Age Group, By Gender, 1980-1998



Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges

The inclusion of well babies in 1991 also contributes to the increase in numbers during this period. Figure 4.4 gives a more detailed view of the increase in admissions for male and female infants under one year starting in 1991.

Figure 4.4: Number of Hospital Discharges in the Under 1 Year Old Age Group, By Gender, 1980-1998



Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges

The relationship we have shown between NMDS changes and increases in crude discharges, highlights the fact that longitudinal comparisons of discharges are invalid without some adjustment to the data. Clearly, some form of standardisation must be introduced in order to ensure comparability of the data over time and to remove anomalies that are artefactual rather than real.

4.5 FILTERING TO ENSURE COMPARABILITY OF DATA OVER TIME

In this study, adjustments to the data were carried out in a series of steps that filtered out certain categories of discharge. Our filtering differed, however, from that used routinely by the Ministry of Health (MOH) (1998), mainly (but not exclusively) because this analysis covers a longer time-span (19 years). The main differences in approach result from the fact that we have employed data from an earlier period during which certain variables or codes were not recorded (for example, NHI number, DRG codes). In addition, our interest is not in hospital volumes *per se,* but in hospital bed-days as a central component of the health status measure described in this monograph (HUEs). The filtering decisions were based on our understanding of the NMDS-related changes occurring during the time period as well as on an analysis of the variables that play an important role in the computation of health status indices.

The New Zealand Health Information Service (NZHIS), from whom the data were purchased, routinely attach different 'flags' or pointers to discharges that need to be adjusted in some way, depending on the type of discharge. While some steps in our study used these flags, other steps used our own filters by excluding discharges, for example, according to diagnosis code or length of stay.

The exclusions to the NMDS were done in a series of ten steps. A full discussion of each filtering step and its rationale can be found elsewhere (Katzenellenbogen *et al.* 2001a, 2001b). Table 4.1 describes what categories of data were excluded in each of the separate steps.

Table 4.1: Filtering Steps That Were Undertaken*

Step	Data excluded
1	Boarders
2	Pregnancy-related discharges and obstetrics
3	Well babies and baby boarders
4	Ministry of Health day-patient exclusions
5	All other day-patients
6	Mental Health
7	Disability Support Services (DSS), respite care and rehabilitation
8	Non-CHE medical discharges for people over the age of 1 year
9	Supplementary codes reflecting other excluded categories
10	Hospital stays >365 days

* Reasons and codes for filters can be found in Appendix A

In Table 4.2 the technical differences between filtering approaches used in this project and those in MOH analyses are listed. In this table the steps in Table 4.1 are used as references. Critical differences were based on our inability to use NHI and DRG codes (not available prior to 1988), our exclusion of any obstetric/pregnancy events and complete exclusions of day-patients. Also, categories that had been overlooked by MOH were filtered out, such as baby boarders and stays over 365 days.

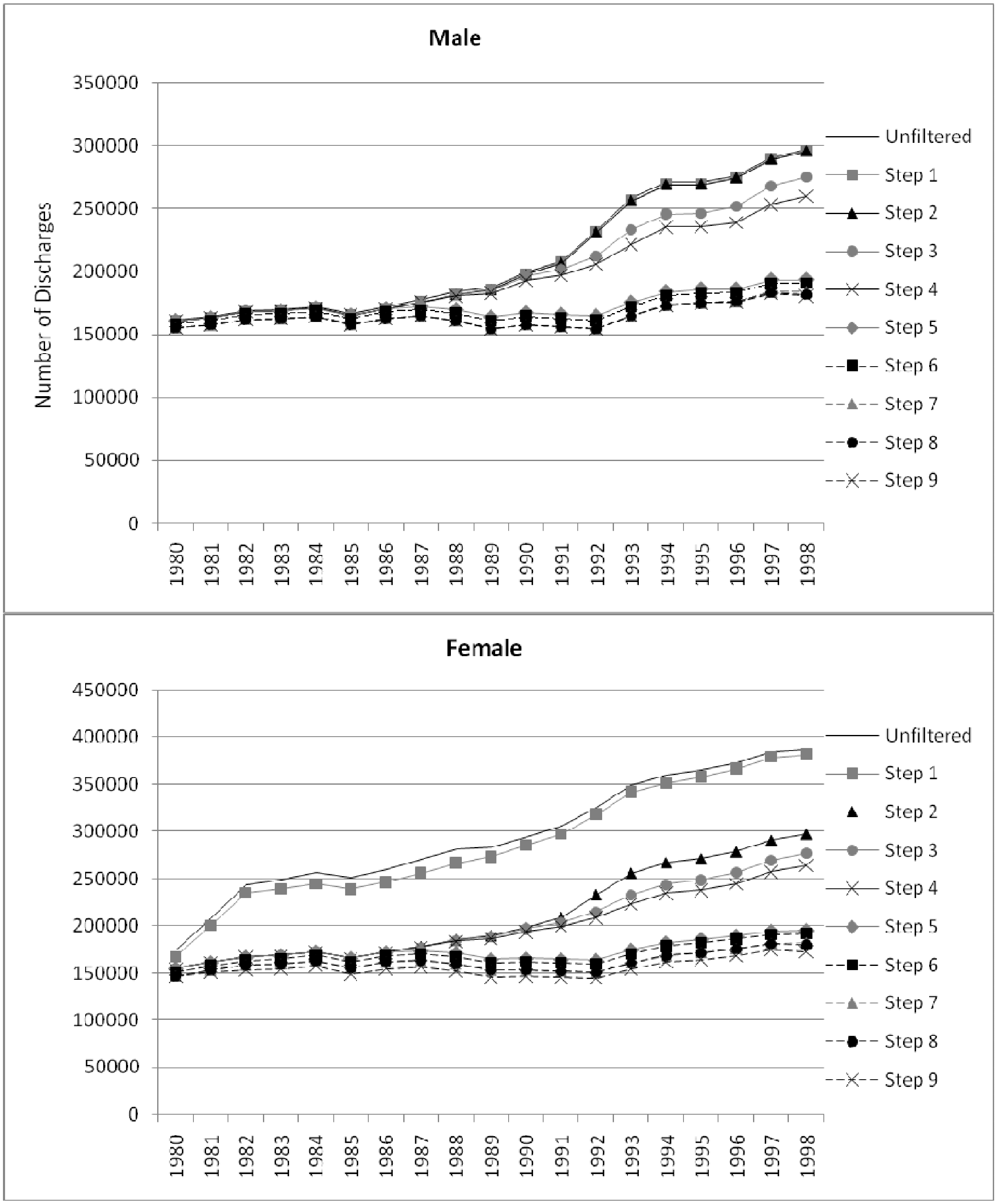
Table 4.2: Deviations from Ministry of Health Filtering

MOH	Population Studies Centre – dataset
• Merged transfers between hospitals into single discharge	• No merging
• Removed duplicates	• No ability to reliably delete duplicates
• Day-patients of selective categories removed	• All day-patients removed except for Discharged Dead
• Day-patients of selective categories removed	• All day-patients removed except for Discharged Dead
• Non-procedure maternity cases removed	• All maternity and pregnancy-related discharges removed
• Mental Health cases removed by DRG	• Mental Health cases removed by diagnosis (comparable)
• Not excluded	• Relevant supplementary codes excluded
• Not excluded	• Baby boarders excluded
• Not excluded	• Trimmed the data to discharges <366 days
• Prior to July 1993 all non-CHE excluded, but after that date all cases included	• Excluded non-CHE medical discharges for people over the age of one year

4.6 STEP-BY-STEP EFFECT OF FILTERING

Figure 4.5 shows the 1980-1998 public hospital (medical-surgical) in-patient discharge time series for males and females after filtering for each of the separate steps outlined in Tables 4.1 and 4.2 above. Overall, the filtering steps that have the largest effect on female discharges are those relating to obstetrics/pregnancy (Step 2) and day-patients (Step 5). For males, the largest decline as a result of filtering comes with the exclusion of day-patients (Step 5), and to a lesser extent the removal of well babies and baby boarders may not have been routine (this is unclear) (Step 3).

Figure 4.5: Filtering Steps for Total Population, By Gender, New Zealand, 1980-1998

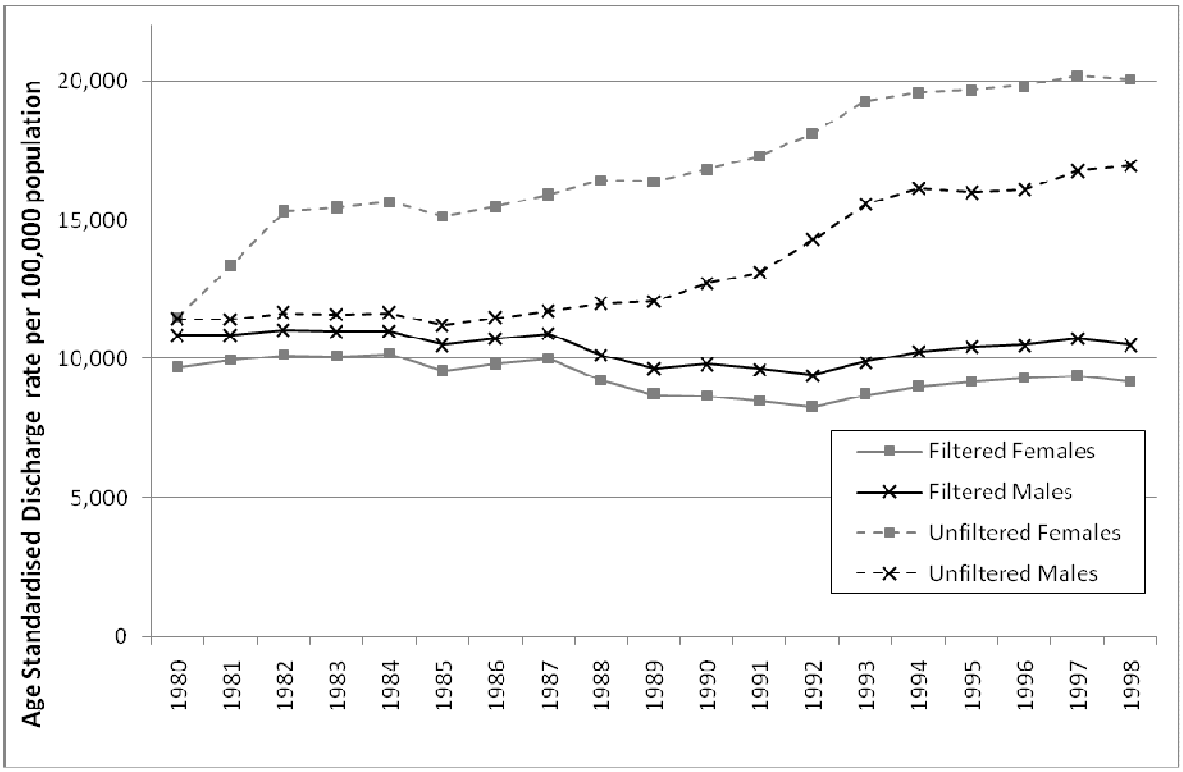


Note: Different scales
Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges

Different filters have different effects, depending on the age and gender of the group. An analysis of the effect of filtering steps on different age groups can be found elsewhere (Katzenellenbogen *et al.* 2001a, 2001b). In summary, the exclusion of day-patients has the effect of reducing the number of discharges in all the different age groups. In children (under 15 years) the removal of well babies/baby boarders caused the largest reduction in discharge numbers. For people aged 15-44 years the removal of obstetrics halved the number of discharges for women and for the age group 65 years and over. The removal of DSS, Rehabilitation and Respite care caused a sizeable reduction in the number of discharges.

For all ages combined, what initially appeared in Figure 4.2 to be a 2- and 2.5-fold increase over the period in crude discharges for males and females respectively, has been reduced to only a small increment. Moreover, when these discharges are expressed as age-standardised rates to take account of age-compositional shifts over the period, there is actually a small reduction for both males and females between 1980 and 1998, with females having lower age-standardised discharge rates over the whole period (see Figure 4.6). There also appears to be a dip in age-standardised discharge rates between 1988 and 1992 after which the rates again rise.

Figure 4.6: Age-Standardised Hospital Discharge Rate (Filtered and Unfiltered), By Gender, for New Zealand, 1980-1998



Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges

4.7 ETHNICITY DATA

Ethnicity coding changed markedly in the 1980s and 90s. Table 4.3 shows how Māori definitions compare for each data source over time and how the data sources compare with each other. The lack of comparability between ethnic data from different sources is compounded when a continuous time-series is done.

Table 4.3: Ethnic Definition Changes for Different Data Sources, 1981-1996

	1981	1986	1991	1995	1996
Mortality	→	Single code	→	Sept 1995 multiple option	
Hospital Discharges	→	Single code	→		July 1996 multiple option
Census	% Māori: 50% or more Māori blood was coded as Māori	Multiple options: socio-cultural and sole Māori	Same as for 1986 →		Small changes to question changes ethnic mix

This section looks at the changing ethnic coding of mortality data and hospital discharge data, and then discusses the implications for this research.

4.7.1 Mortality Data

It is important to recognise a number of issues that affect Māori mortality statistics. This is because over the period under review there were significant shifts in the definition of Māori ethnicity. To confound the issue, the exact form of the reporting of ethnicity on death certificates was different from that used in the census, while the definitions used and changes made to these over time differed between numerators (drawn from vital registration) and denominators (estimated from the census). These differences were not reconciled over the period under review, although there has been some convergence. Moreover, the timing of changes has not been co-ordinated, so that the major shift for census data came at the 1986 census, while for vital registers it was 1995 (Pool 1991).

To complicate the matter further, the means by which reporting of ethnicity occurs in mortality data differs from the census, where the respondents themselves determine their ethnicity and that of their children. While reports on the ethnicity of the deceased perforce are second-hand, there has been inconsistency in this. The mortality statistics maintained by New Zealand Health Information Services are based on death certificates completed by medical practitioners, coroners' reports and death registration data (New Zealand Health Information Service 2004), often completed by undertakers on behalf of families. There is a tendency of unknown magnitude for funeral directors and others to avoid direct questioning of relatives and thus to assign ethnicity themselves. The ethnicity of the dead who are discharged from hospital are then classified using supplementary data sources, such as hospital admission records or the New Zealand Cancer Registry, that are subject to yet more inconsistencies. The assigning of ethnicity is the responsibility of the admissions' clerk who should ask this when possible, but often does not (Pool 1991, Chapter 2). Furthermore, when ethnicity information is sought, the definitions used may be different to other data sources. The net result has been displacement in varying directions, some of which are contrary to one another, as we will outline below.

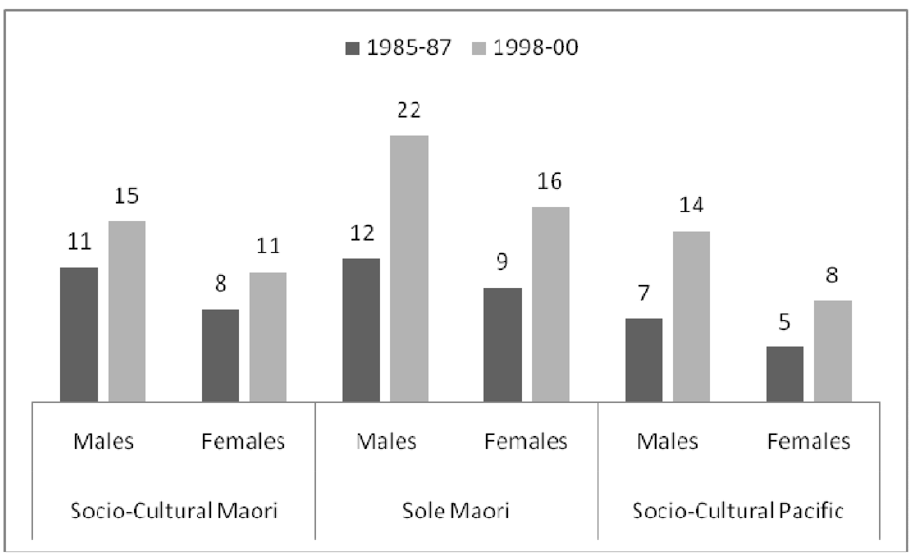
Before 1995, the death registration form allowed the identification of only one ethnic group and recent research has shown substantial undercounting of Māori and Pasifika mortality prior to 1995 (Ajwani *et al.* 2003; Blakely *et al.* 2004). In September 1995, changes were introduced to the death registration process which allowed more than one ethnic group to be identified and also increased awareness of ethnic coding among the people who record ethnicity (Sporle and Pearce 1999). The introduction of dual ethnicity in mortality statistics and the greater awareness of ethnicity coding resulted in a decline in undercounting of Māori and Pasifika deaths, and an increase in numbers of Māori and Pasifika deaths due to more than one ethnicity being recorded for socio-cultural Māori who in the past would have been recorded as either Māori or Pakeha, not both. The substantial rise in Māori mortality figures between 1995 and 1996 (see Chapter 5, 5.2.3 and Table 5.2) is due to these changes rather than a real increase in the numbers of Māori deaths. This is discussed in more detail below.

Nevertheless, in 1996 when the multiple response option on death registration forms became fully available, it was not widely used. This is shown by the fact that only about 10 percent of Māori deaths had multiple ethnicity recorded while the same was true of almost 50 percent of Māori recorded in the census. The difference is not surprising given the different means for determining ethnicity (see above) but it raises questions about the comparability of Māori death counts with Māori population counts in the census and about deciding which denominator to use for Māori rates.

All this may result in ethnic displacement either because of inter-ethnic mobility, or because of clerical errors. In the absence of collecting accurate ethnicity information, there has been a tendency to incorrectly report Pasifika (and sometimes even Asian) deaths as Māori (Blakely *et al.* 2004). This resulted in an understatement of Pasifika mortality and an overstatement of Māori. Certainly, in some periods, Pacific peoples have had unexpectedly low levels of mortality. The effects of ethnic displacement to the Pakeha population would be dampened because the numbers involved would make up a small proportion alongside those correctly assigned.

These points are illustrated when age-standardised mortality rates for Māori and Pasifika are compared for the period 1985-87 and 1998-2000 (Figure 4.7). The changed registration system around 1995 has three effects. Firstly, Māori socio-cultural rates increase but not dramatically. Sole Māori rates increase to almost double the level in 1985-87, but in such a way that this can only be an artefact of data definition.[22] In contrast, Pasifika socio-cultural rates more than doubled. It is clear that the changes in 1995 resulted from improved attribution of Pacific peoples and Māori deaths. What is clear is that ethnic data are significantly affected by reporting problems. Nevertheless, these results also show that the use of the socio-cultural definition (or 50 percent or more Māori blood prior to 1986 when the socio-cultural definition had not been introduced) gives the most consistent and robust results.

Figure 4.7: Age-Standardised Mortality Rates per 1,000, By Ethnicity, 1985-87 and 1998-00



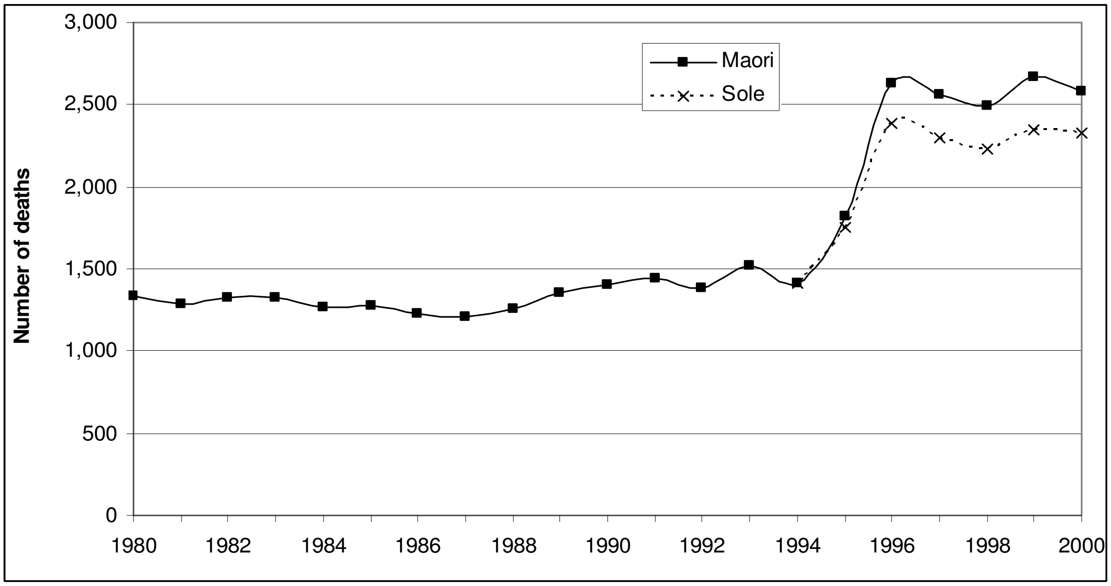
Source: New Zealand Health Information Service, National Minimum Data Set – Mortality

Between 1980 and 1994 there was a slight rise in Māori mortality (crude numbers) however this was partly offset by a noticeable drop in the number of recorded deaths in the mid-1980s (Figure 4.8). This may have been due to a reporting shortfall, but this did not occur evenly across New Zealand. The overall increase in numbers of deaths reflected the fact that the Māori population was gradually increasing and also ageing. Between 1994 and 1996, however, there was an almost doubling of Māori

[22] The denominator coming from the census was probably deflated; and the numerator from vital statistics inflated.

deaths due to an artefact of ethnicity coding on death records. Between 1996 and 2000 the results remained reasonably steady.

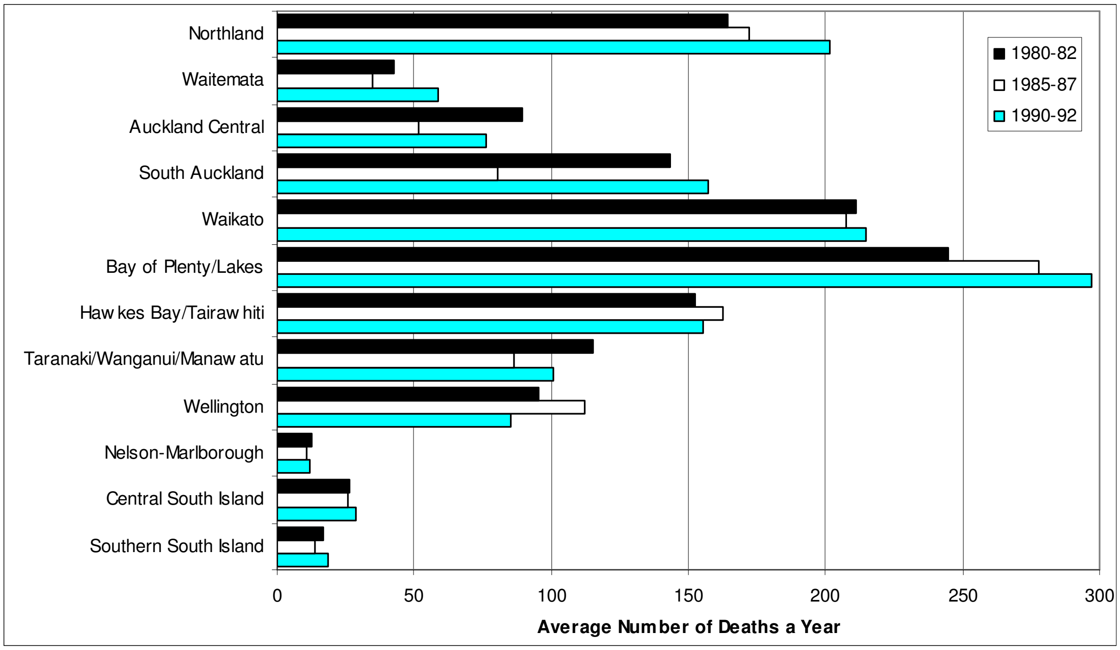
Figure 4.8: Māori Deaths, Crude Numbers, New Zealand, 1980-2000



Source: New Zealand Health Information Service, National Minimum Data Set – Mortality

The drop of reporting of Māori deaths in the mid-1980s again shows up in Figure 4.9. Figure 4.9 compares the average number of Māori deaths per year around three different censuses for 12 regions in New Zealand. The sharp declines in 1985-1987 deaths in **Waitemata, Auckland Central** and **South Auckland**, and to a lesser degree in **Waikato, Taranaki/Wanganui/Manawatu** and **South Island regions**, seem to be an artefact of mis-application of ethnicity coding in these regions. However there was substantial regional variation in Māori deaths over the time period, with some of the regions with high numbers of Māori deaths seeing no or little decline between 1985-87 (**Northland, Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti** and **Waikato**). In addition, many regions have very small numbers of Māori deaths (such as South Island regions) and this may compromise the reliability of regional Māori mortality-based statistics. It was therefore necessary to further aggregate the regions to allow cell sizes to be sufficiently large to allow the calculation of other mortality based health indices.

Figure 4.9: Number of Māori Deaths, By Region, 1980-1992



Source: New Zealand Health Information Service, National Minimum Data Set – Mortality

4.7.2 Hospital Discharge Data

In July 1996 the way in which ethnicity was recorded in hospital discharges changed, and recording of multiple ethnicities (up to three) was introduced. As with mortality data, the collection process may be a factor affecting data quality as typically it is a third party who records this variable on admission. It is not clear whether the question about ethnicity is asked of all patients, or whether the receptionist estimates ethnicity with equal efficiency and rigour across the system (Sceats 1988). If changes in data collection had been implemented as recommended, the discharges since 1996 should have risen, reflecting increased reporting of socio-cultural Māori discharges made possible by the introduction of multiple ethnicity coding. However, the increase in Māori discharges was slight, indicating that multiple ethnicity coding was not being fully implemented in hospitals (Figure 4.10).

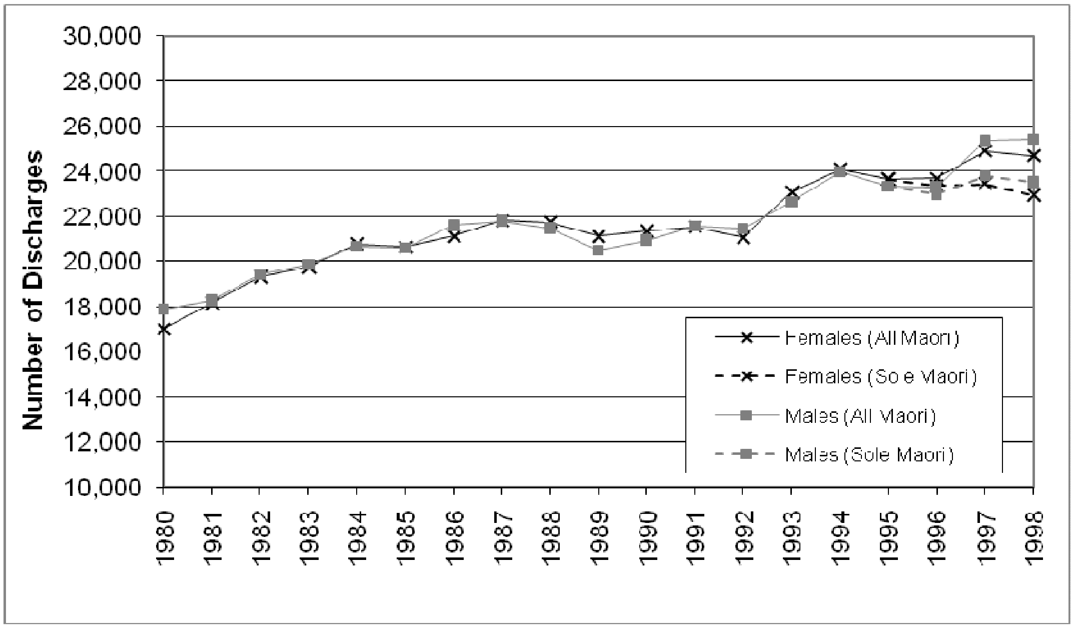
In an attempt to reduce the effects of definitional changes affecting Māori data, a number of steps have been taken. Firstly, the number of regions for the analysis of Māori data was reduced from 12 to 7 to ensure that cells have sufficient numbers for the calculation of Life-Expectancies (LEs) and Hospital Utilisation Expectancies (HUEs). Regions with large Māori population sizes were maintained in the form used earlier, while those with smaller populations were aggregated as follows:

- Auckland – Waitemata, Auckland Central, South Auckland
- Lower North Island – Taranaki/Wanganui/Manawatu, Wellington
- South Island – Nelson/Marlborough, Central South Island, Southern South Island

Secondly, averages across calendar years were used to dampen random perturbations in the data. Thus the 1980-1994 time-period was initially divided into 3 periods: 1980-1984, 1985-1989 and 1990-1994. The 1995-1998 years were excluded due to the changes in definitions during this period.

Thirdly, our initial time-series analyses pointed to inconsistencies that suggested 1985-1989 Māori death rates were problematic (see Section 4.7.1). For that reason, only the first and third periods were studied.

Figure 4.10: Number of Māori Public Hospital Discharges, New Zealand, 1980-1998



Source: New Zealand Health Information Service, National Minimum Data Set – Mortality

Thus the LEs and HUEs for Māori should be seen as indicators and interpreted with caution as more exact estimates are not available. Above we outlined how censuses have allowed multiple responses for ethnicity over the years, while other data sources have not. Moreover, there are crucial differences in the actual recording process. For example, census questions are usually self-reported while death, and to a lesser extent, hospitalisation data, are proxy-reported. To accommodate this incongruity, the sole Māori population has been assumed by public health analysts (Harris *et al.* 2000) to more closely estimate the source population for Māori deaths and hospitalisations, and has traditionally been used as the denominator for mortality and discharge rates. This means that numerator and denominator definitions are not the same and rates calculated in this way may not reflect the true Māori rates but will be inflated. The dramatic drop in the number of sole Māori at the 1996 census from the 1991 levels has put this practice further into question.

4.8 CONCLUSION

Most developed countries have hospital discharge data for the period since the Second World War, and some developing countries may well have such data for major cities. However, the baseline information often changes over time independently of real shifts in health status, as an artefact of adjustments to registration protocols. This is particularly apparent for Māori and Pasifika mortality data, where firstly artificially low, then artificially high mortality rates are seen either side of a change in coding practice. To add to this problem, changes in coding practice do not necessarily occur at the same time as changes in policy, as is highlighted by the lack of a rise in Māori hospital discharge rates that would be expected following the introduction of multiple ethnicity coding. Changes in coding do not happen at the same time or in the same way for different data sources, and even similar changes in policy (introduction of multiple ethnicities) may not have the same effect.

This chapter has also shown the effects of filtering New Zealand public hospital discharges and has demonstrated that this is a necessary process for any longitudinal analysis of discharge rates. The filtering proposed here effectively allows direct comparison between short-stay (e.g. non-DSS) medical and surgical public in-patient hospital discharge rates over a 19-year period of considerable administrative change. The next chapter explores the mortality experience in New Zealand between 1980 and 2000. This will act as a background against which to interpret hospital utilisation over the period.

CHAPTER 5

National and Sub-National Trends in Mortality and Life-Expectancy: 1980-2000

5.1 INTRODUCTION

This chapter provides a summary of the national and regional trends for three key health status indices: mortality rates, life-expectancy, and survivorship. For reasons of space not all the results can be presented in the text of this chapter, but more detailed information on the trends for each regional index over the period 1980 to 2000 is included in Appendix C. Because the national figures are used as benchmarks against which regional indices are compared, the national results will be presented graphically and discussed in some detail. The pattern for the regional indices in relation to the national figure will then be commented on briefly.

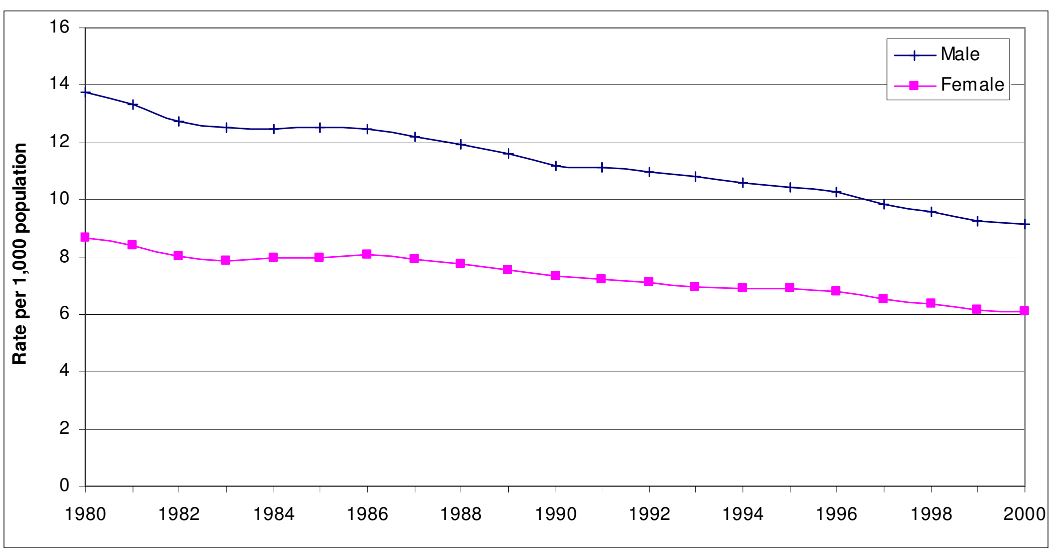
5.2 MORTALITY RATES [23]

5.2.1 Age-Standardised Mortality Rates

National Trends

All health indices in this report are gender-specific in order to take account of the markedly different patterns of morbidity and mortality of males and females, particularly after childhood. Male rates have remained consistently and significantly above female, although there was a narrowing of the gap over the period. Both male and female age-standardised mortality rates dropped substantially (34 percent and 30 percent respectively) between 1980 and 2000 (see Figure 5.1 and Table 5.1). Nevertheless, in 2000 the female rate was still about two-thirds of the male rate.

Figure 5.1: Age-Standardised Mortality Rates per 1000, By Gender, New Zealand, Three-Year Averages[1], 1980-2000



(1) 1980 and 2000 based on three year averages.
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

[23] Due to the relatively small number of deaths in any year, the mortality data presented here are central rates computed from three year averages around a reference year. This is to dampen down annual fluctuations (for 1980 and 2000 a two year average is used). The year reported in the tables is the middle of the interval.

Regional Trends and Differentials

Rates for all regions tracked down fairly consistently over the period, more or less in line with national trends, as is shown in Table 5.1. Key findings are:

- The lowest mortality rates were consistently seen in **Waitemata** during the 1980-2000 time period
- Above average mortality rates were seen in **Hawke's Bay/Tairawhiti**, **Northland**, and **Southern South Island.**
- **Taranaki/Wanganui/Manawatu**, **Central South Island** and **Nelson/Marlborough** mortality rates were similar to the national level in 1980, but over time **Taranaki/Wanganui/Manawatu** mortality rose and **Central South Island** and **Nelson/Marlborough** mortality declined relative to the national level.
- Mortality rates in the other regions **(Central South Island, Waikato, Wellington, Auckland Central, Bay of Plenty/Lakes** and **South Auckland)** were similar to those for the country as a whole throughout the time period.

Table 5.1: Age-Standardised[1] Mortality Rates per 1,000 Population, By Gender and Region, Selected Years, 1980-2000[2]

Region	**Males**					**Females**				
	1980[2]	**1985**	**1990**	**1995**	**2000[2]**	**1980[2]**	**1985**	**1990**	**1995**	**2000[2]**
New Zealand	13.8	12.5	11.2	10.5	9.1	8.7	8.0	7.4	6.9	6.1
Northland	14.1	12.6	11.6	11.1	10.1	9.0	8.2	7.8	7.5	6.3
Waitemata	12.5	11.0	10.0	9.4	8.0	7.7	6.9	6.6	6.3	5.5
Auckland Central	13.7	13.1	11.2	10.5	9.1	8.6	8.2	7.3	6.7	5.9
South Auckland	13.7	12.0	11.1	10.4	9.1	8.9	8.1	7.2	7.0	6.2
Waikato	13.4	12.3	11.2	10.3	9.5	8.8	7.9	7.4	6.7	6.3
Bay Of Plenty/Lakes	13.7	12.4	11.1	10.6	9.4	8.6	8.4	7.9	7.0	6.3
Hawke's Bay/ Tairawhiti	14.7	13.3	11.8	11.3	10.1	8.9	8.6	7.7	7.4	7.1
Tauranga/Wanganui/ Manawatu	13.7	12.7	11.5	10.9	9.8	8.6	8.3	7.5	7.1	6.4
Wellington	13.9	12.3	11.4	10.2	9.1	8.5	7.8	7.6	6.8	6.1
Nelson/Marlborough	13.7	12.1	10.4	10.2	8.6	8.9	7.6	6.8	6.8	5.9
Central South Island	13.7	12.6	11.2	10.5	8.7	8.9	7.8	7.2	6.9	5.8
Southern South Island	14.8	13.5	11.8	10.8	9.4	9.1	8.3	7.6	6.9	6.3

(1) Standardised by age to 1996 total New Zealand population (both genders).
(2) Based on three year averages.
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

5.2.2 Age Specific Mortality Rates

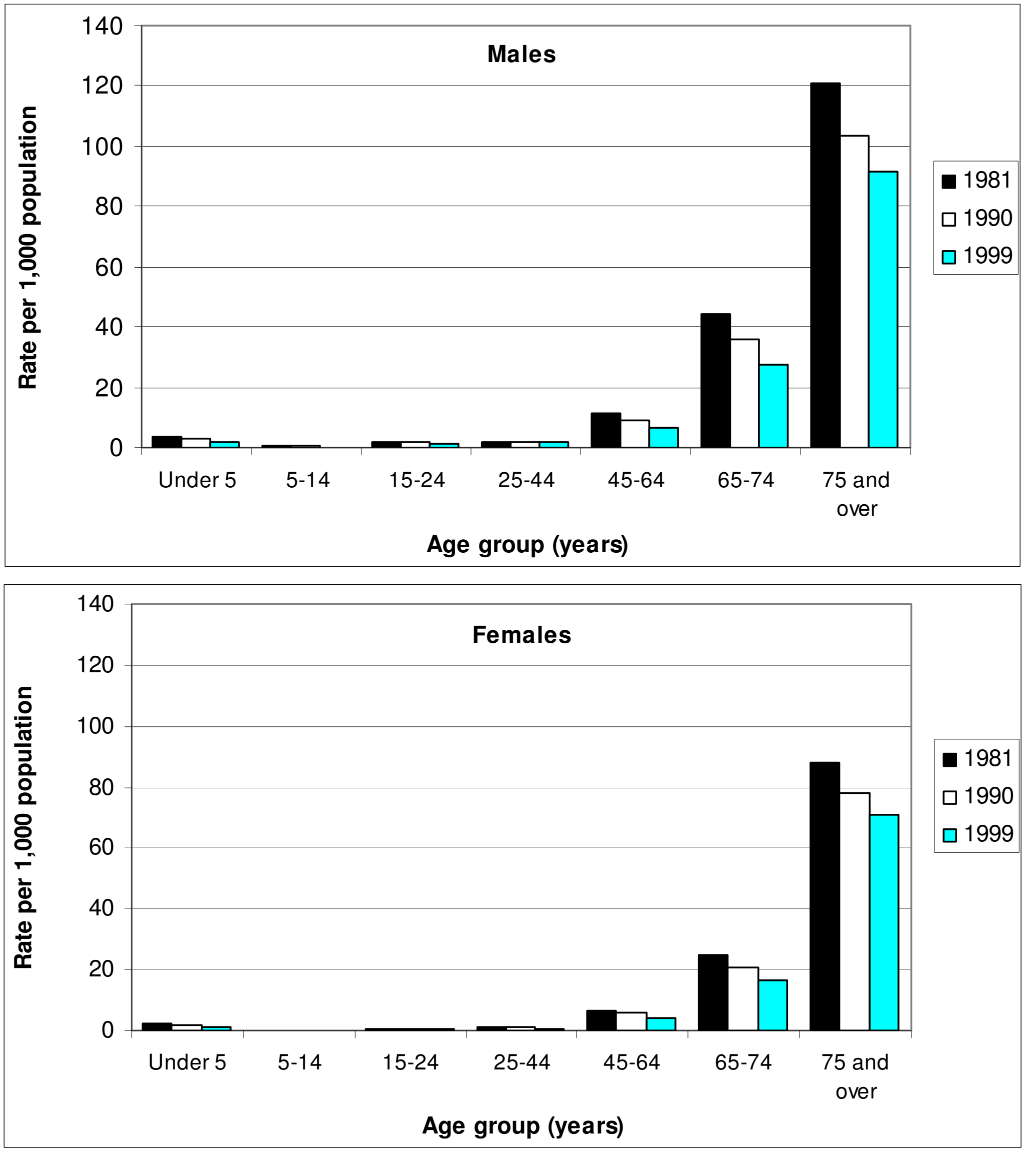
National Trends

In Figure 5.2 age-specific mortality rates for broad functional age groups are shown for the three periods. Detailed age-specific mortality rates are shown in Appendix Table 5.2. Until age 65 mortality rates are very low, although they begin to increase from age 45. Mortality rates are low even in infancy and early childhood although these rates are slightly higher than those at older childhood and for the early and middle adult years.

Rates at all ages were lower at the end of the review period than they had been at the beginning. The declines were most marked at older ages, and very limited at younger ages. But this is to be expected as the major decreases in mortality at younger ages had occurred earlier in the 20th century and even in the 19th, as was outlined in Chapter 1. By 1980, the only major possibilities for change came at older ages. It can be seen from detailed data in Appendix Table 5.2 that there are, however, some fluctuations for some age groups over the twenty year period. For example, there was a slight increase in the mid 1980s for both males and females in the 75 years and over age group, and for males aged

15-24 years. The detailed data for 5-year age groups in Appendix Table 5.2 also show that the changes in mortality rates were of different magnitudes for different age groups.

Figure 5.2: Age-Specific Mortality Rates per 1,000 Population, New Zealand, Three Year Averages, 1981, 1990 and 1999



Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Trends and Differentials

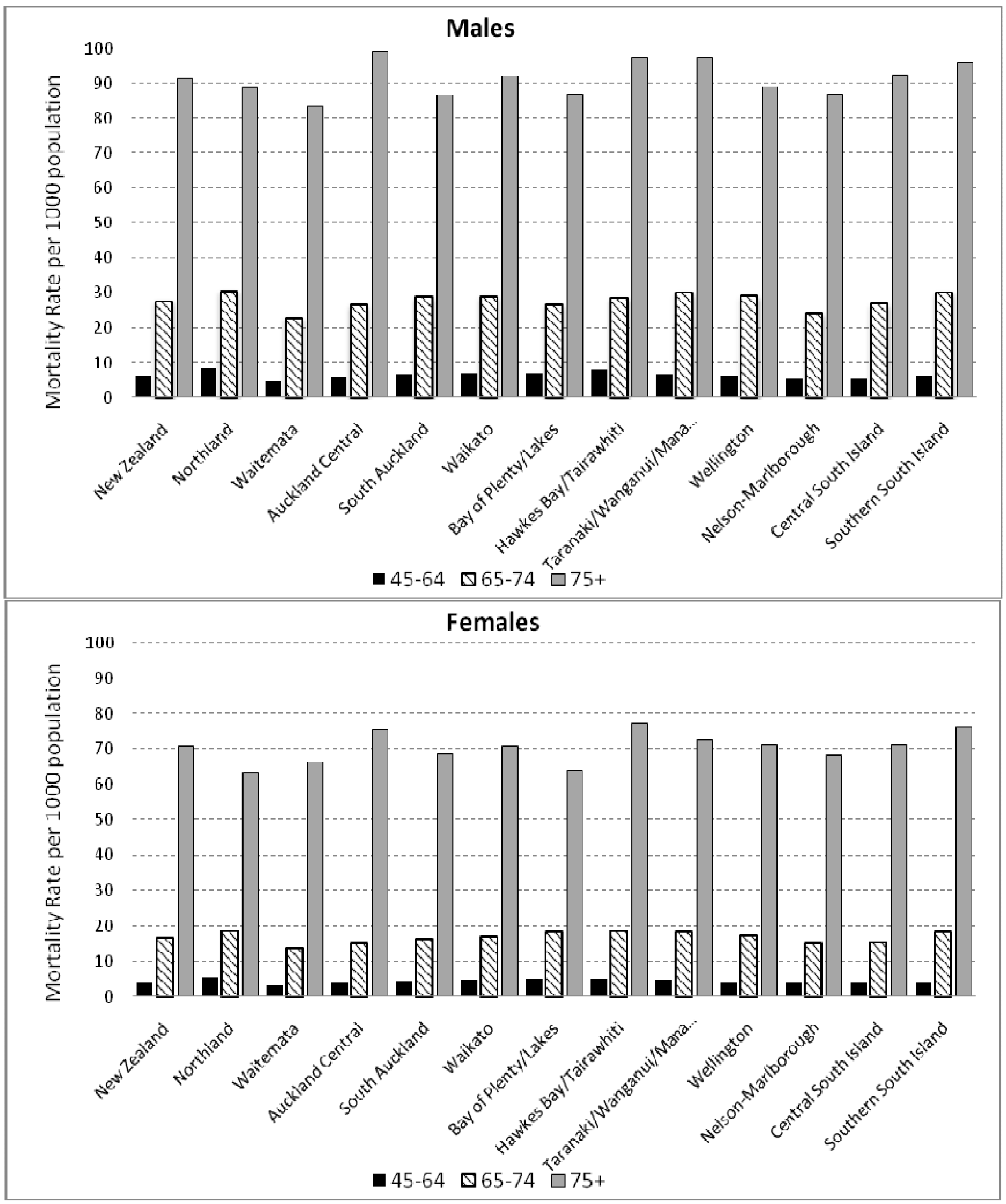
As has been shown for the national age-specific rates, mortality rates are high only at ages 45 years and over. Rates for these ages are shown for 1998 – 2000 in Figure 5.3 and for all years and age groups in Appendix Table 5.2. All rates declined significantly over the period. Key regional findings are:

- Regions with mortality rates above the NZ average were **Hawke's Bay/Tairawhiti, Taranaki/Wanganui/Manawatu** and **Auckland Central**, with **Hawke's Bay/ Tairawhiti** having one of the highest mortality levels of all regions. However, mortality rates in

Taranaki/Wanganui/Manawatu were only higher than the average in later years (see Appendix Table 5.2).

- Below average mortality rates were seen in **Waitemata** and **Nelson/Marlborough,** with **Waitemata** consistently having the lowest mortality rates across both genders and all ages
- **Wellington's** mortality rates were close to the national level across most age groups.
- **Northland, Bay of Plenty/Lakes, Waikato** and **South Auckland** all had higher mortality in the younger age groups and lower mortality at the older age groups than New Zealand levels. The first two regions had particularly high absolute levels of mortality. In contrast, **Central** and **Southern South Island** had above average mortality rates at older ages, but not at younger ages.

Figure 5.3: Age Specific Mortality Rates per 1000, Population 45 Years and Over, By Gender and Health Regions, 1998-2000[1]



(1) Based on a three year average.

Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

5.2.3 Ethnic Differences in Mortality Rates

For the analysis of Māori, Pasifika and Asian mortality data, three time periods: 1980-84, 1990-94 and 1996-2000 will be investigated using five year averages to reduce error levels in the data, as discussed in Chapter 4. For Pasifika and Asian, the last time period used is 1999-2000. Regional analysis is only possible for Māori mortality; Pasifika and Asian mortality will only be analysed nationally due to low numbers of Pasifika and Asian deaths in many regions. Definitional changes and other data issues should be kept in mind in the following analyses. Rates for the first period will use the '50% or more Māori blood' definition of the 1981 census, for 1990-94 and 1996-2000 the socio-cultural Māori population will be used as the denominator.

National Trends

There was a sustained decline in mortality rates for the total New Zealand population over the time period, from 13.7 to 9.2 for males, and 8.7 to 6.1 for females. While Māori mortality rates for both males and females were lower at the end of the review period than they were at the beginning, the rates show an increase over the levels recorded in the early 1990s (see Table 5.2). In spite of the declines, Māori rates are still substantially higher than those for the total population, and the apparent convergence with the rate for the total population in the 1990s has not been sustained. The improvements in Māori mortality have been of a much lower magnitude than those seen for the total population. Until the most recent time period (1999-2000) Pacific peoples had mortality rates consistently and substantially lower than the total population, but in 1999-2000 Pasifika mortality rates were far in excess of rates for the total population. For both Māori and Pacific peoples there appears to have been a decline in mortality in 1990-94, followed by an increase. The available data for Asians in 1999-2000 indicates very low mortality compared to the total population. The mortality rates for Māori and Pacific peoples seen in 1990-94 are very low compared to the preceding and following time periods, and may be an artefact of data problems. There is also the possibility there may be selective migration of the more healthy, but we cannot measure this.

Table 5.2: Age-Standardised[1] Mortality Rates per 1000 Population for Māori and Total Population, By Gender, 1980-2000[2]

	Males			Females		
	1980-84[3]	1990-94[4]	1996-00[5]	1980-84[2]	1990-94[3]	1996-00[4]
Total Population	13.7	11.2	9.2	8.7	7.4	6.1
Māori	16.7	11.4	14.8	12.3	8.0	10.8
Pacific	9.8	7.9	15.0[6]	5.1	4.5	8.2[6]
Asian	-	-	6.2[7]	-	-	4.5[7]

(1) Standardised by age to 1996 total New Zealand population (all ethnic groups and both genders).
(2) Five year averages
(3) 1981 50% or more Māori population is used as denominator for Māori.
(4) 1991 socio-cultural Māori population is used as denominator for Māori.
(5) The Māori denominator for 1998 is obtained by linear interpolation using the socio-cultural Māori population at the 1996 and 2001 censuses.
(6) Two year average, 1999-2000
(7) Two year average 1999-2000, data not available for previous years due to insufficient numbers.
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Trends: Māori

As noted in Chapter 4, a reduced number of regions have been used for the regional analysis because the small numbers of Māori in some areas would subject the results to statistical errors of a random nature. Even so, the numbers of Māori in the South Island are so small that the South Island has been excluded from the regions, although it is included in the New Zealand figure (see Table 5.3). No region emerges as consistently having the highest or the lowest rates across the time period, but regions can be divided into better than average mortality rates, and worse than average.

- In 1980-94 and 1990-94, three regions had Māori mortality rates below the New Zealand average (**Auckland Metropolitan, Hawke's Bay/Tairawhiti**, and **Taranaki/ Wanganui/Manawatu/Wellington**) but in 1996-00 mortality rates in **Hawke's Bay/Tairawhiti** had risen above the New Zealand total. **Auckland Metropolitan** had the lowest rates in 1996-00.
- Regions with Māori mortality rates consistently above the New Zealand average were **Northland**, **Waikato** and **Bay of Plenty/Lakes**. **Northland** had by far the highest mortality rates in 1996-2000.

Table 5.3: Age-Standardised[1] Mortality Rates per 1000 Population for the Māori Population, By Gender and Larger Health Regions, Selected 5-Year Averages, 1980-2000

Region	Males			Females		
	1980-84[2]	1990-94[3]	1996-00[4]	1980-84[2]	1990-94[3]	1996-00[4]
New Zealand	**16.7**	**11.4**	**14.8**	**12.3**	**8.0**	**10.8**
Northland	19.6	15.1	19.1	15.3	10.0	13.3
Auckland Metropolitan	15.2	10.6	13.7	10.8	8.1	9.8
Waikato	20.2	15.1	16.1	14.6	10.1	12.4
Bay of Plenty/Lakes	18.6	15.3	16.8	14.3	10.8	11.4
Hawke's Bay/Tairawhiti	16.0	9.6	16.4	10.3	7.0	11.8
Taranaki/Wanganui/ Manawatu/Wellington	14.5	8.6	14.1	11.3	5.9	10.3

(1) Standardised by age to 1996 total New Zealand population (all ethnic groups and both genders).
(2) 1981 50% or more Māori population is used as denominator.
(3) 1991 socio-cultural Māori population is used as denominator.
(4) 1998 linear interpolated population using the socio-cultural Māori population of the 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

5.3 LIFE-EXPECTANCY AT BIRTH

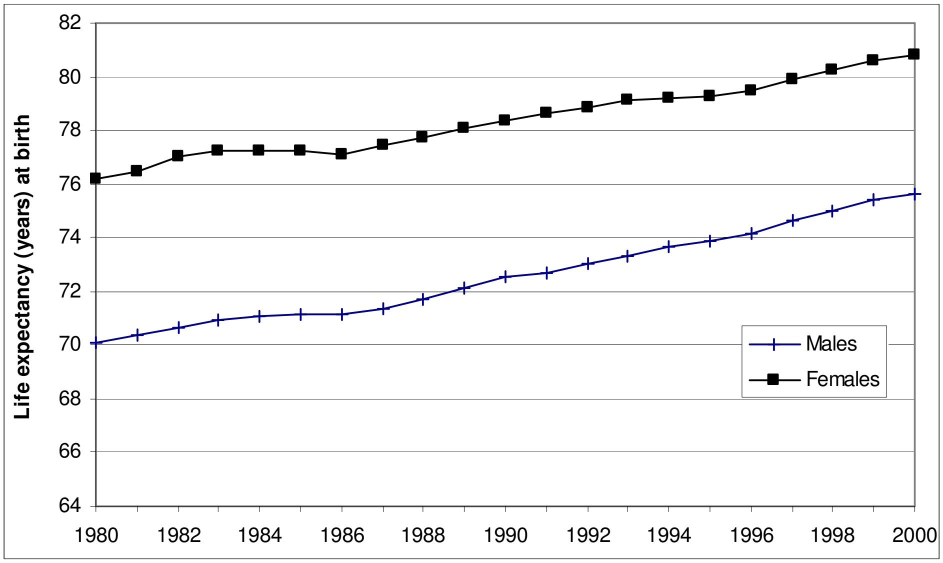
Life-expectancy (LE) is the average remaining lifetime (in years) for a person who has survived to an exact age x at the beginning of an indicated age-interval (Pool 1991). The analysis here uses life-expectancies computed for a given period. These indicators come from synthetic or period life-tables rather than true cohort or generation tables.[24] Life-expectancy in a synthetic table is thus a summary measure of the mortality experience of a population in a given period. When cited as 'at birth' it is a summary measure free of age composition effects; at older ages it summarises the experience over the remaining part of the age-span. A conventional abridged life-table is used here which draws on wider age-spans instead of single years of age. Synthetic life-tables are based on three-year averages to provide stability of results (for 1980 and 2000 a two year average is used).

5.3.1 National Trends and Gender Differentials in Life-Expectancy at Birth

Over the period 1980-2000, the life-expectancy at birth of New Zealanders increased by 8 per-cent (or 5.5 years) for males and 6 percent (or 4.6 years) for females, from 70.1 and 76.2 years respectively in 1980 (see Figure 5.4). In 2000, female LE at birth (80.8 years) was 5.2 years higher than for males (75.6 years). Different time periods had different rates of increase in LE at birth. The early 1980s showed a small increase followed by a flattening of the curves between 1983 and 1986. The period from 1987 to 1993 showed the greatest annual increase, followed by a more gradual increase (greater for males) from 1994 to 1996 with again, a rapid increase in 1997 and 2000.

[24] In a synthetic table, data for a given period are applied to a hypothetical cohort as if it is proceeding through its life-span.

Figure 5.4: Life-Expectancy at Birth, By Gender, New Zealand, 1980-2000



Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

5.3.2 Regional Differentials in Life-Expectancy at Birth

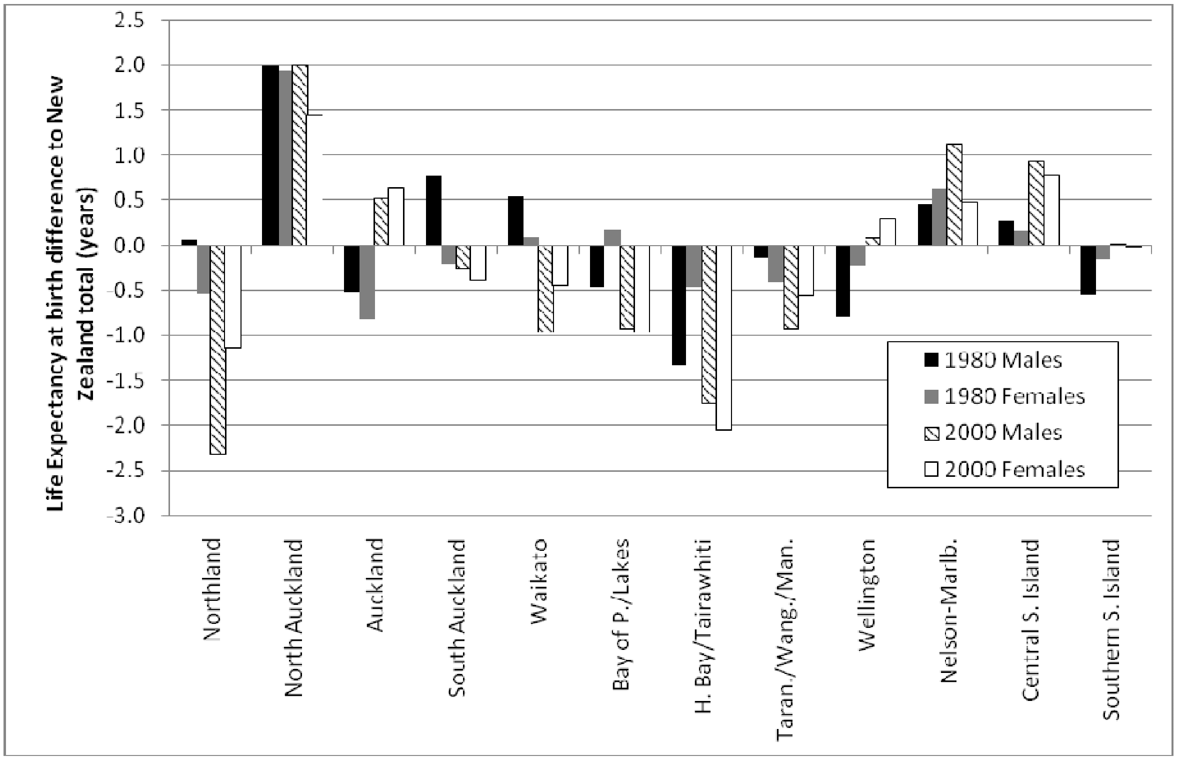
In Figure 5.5 differences between each of the regions and New Zealand in life-expectancies at birth in 1980 and 2000 for males and females are graphed (see also detailed data on life-expectancy at birth for each region for each year between 1980 and 2000 based on a three year rolling average in Appendix Table 5.3).

- LE in **Waitemata, Nelson/Marlborough** and the **Central South Island** was consistently above that for New Zealand, with the former being substantially so. For example, female life-expectancy in **Waitemata** was 2.0 years higher than that for all New Zealand women in 1980 and 1.4 years higher in 2000.
- For both genders, **Auckland Central** and the **Central South Island,** LE relative to the total population improved between 1980 and 2000.
- Throughout the period under review, levels for **Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti**[25] and **Northland** were well below and worsened relative to New Zealand levels. In **Northland**, for example, male life-expectancy was 0.8 years lower than that for all New Zealand males in 1980, but this had increased to 2.3 years in 2000.

What is interesting is that compared with the national level, the ranges of life-expectation at birth increased over the period- that is, inequalities magnified. But this did not occur consistently both between regions and between sexes. The regions that were worse off in 1980 typically saw their disadvantage worsen, and some that were well-off gained, although this trend was not as unambiguous as the first. Moreover, in most but not all cases, the changes relative to New Zealand were less for females than for males, but there were exceptions (**Waitemata**, **Bay of Plenty/Lakes**).

[25] The two regions Gisborne (Tairawhiti) and Hawke's Bay were at a similar level in 1986 but by 1996 the life expectancy gap has widened with Gisborne being about 2.5 years lower than Hawke's Bay (Pool *et al.* 2005c).

Figure 5.5: Differences in Life-Expectancy at Birth, Regions Compared to New Zealand Average, Three Year Averages, 1980 and 2000



Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

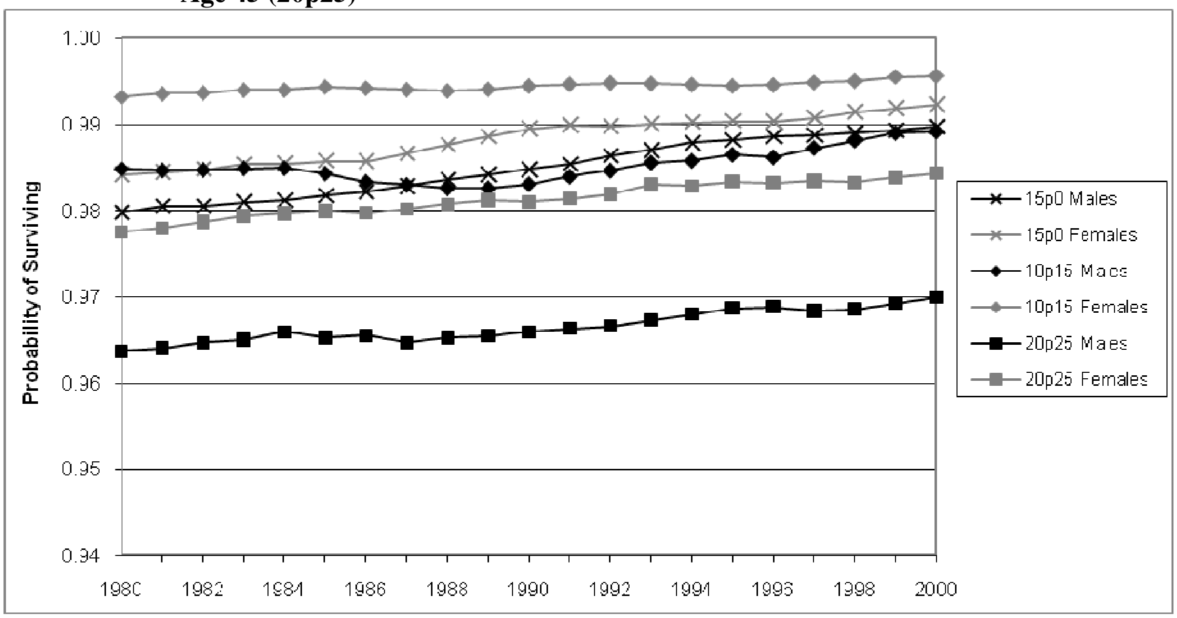
LE at birth by ethnicity, nationally and by region, followed very much the same trends as shown for age-standardised mortality rates in section 5.2.3. As such they are not presented here (see Appendix Tables 5.4 and 5.5 for figures). As with age-standardised mortality rates, life-expectancy at birth is a fairly crude measure as it does not take into account the ages when people die. A low e_o may be due to high infant mortality, high mortality at older ages, or a combination of the two. To break down the mortality experience of a population, age-specific mortality rates or LE at different ages may be used. Mortality rates at ages after 45 years (as discussed in section 5.2.2) and life-expectancy at older ages provide an indication of health status at older ages. As mortality rates at ages after 45 years have already been discussed, life-expectancy at older ages will not be presented here (see Appendix Table 5.6 and Appendix Figure 5.1 for e_{65} by region between 1980 and 2000). However, one point of interest is that **Northland** and **Bay of Plenty/Lakes** had higher than average life-expectancy at 65 years compared to lower than average life-expectancy at birth. This indicates that in these regions the population 65 years and over experience better health than the population under this age (see Appendix Tables 5.3 and 5.6). The reasons will be returned to in later chapters, but suffice to say that these two regions have two totally contrasting populations at younger ages. Māori are disproportionately represented, as are Pakeha at older ages. Moreover, the Pakeha tend to be retirees who have actively migrated into these areas. The older age groups often migrate/re-migrate to be near tertiary health facilities in larger centres.

5.4 PROBABILITY OF SURVIVING BETWEEN SPECIFIC AGES

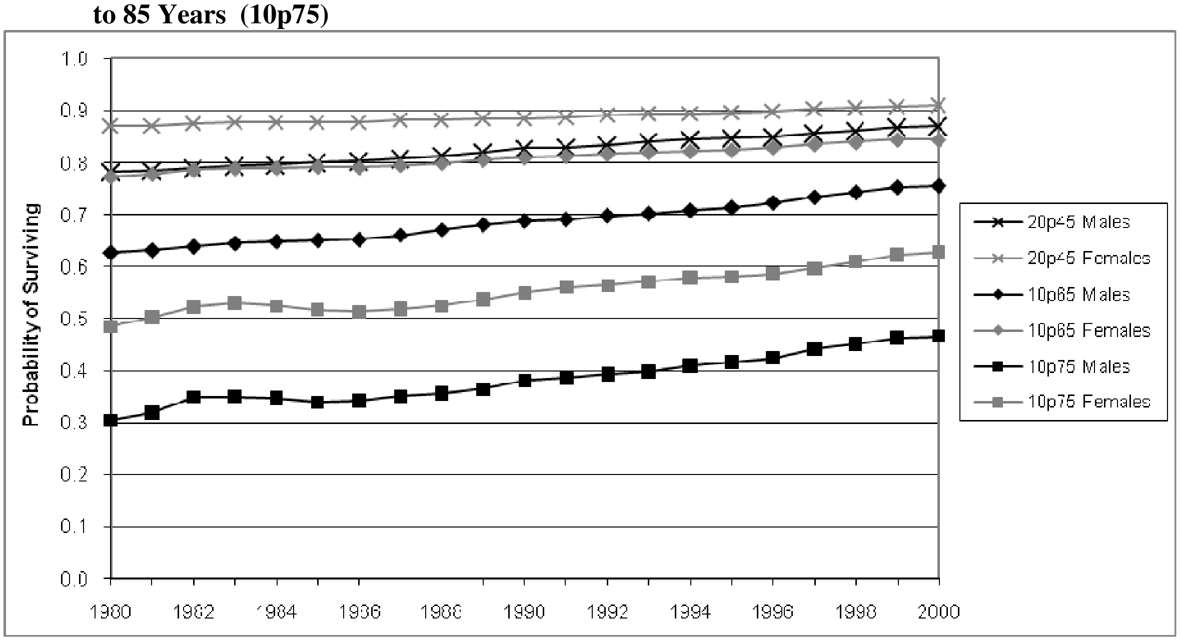
Life-expectancy is a relatively blunt measure. A more precise and analytically more valuable indicator is survivorship, a life-table function that measures the probability of surviving a given number of years having reached a particular age. Figures 5.6 (a) and (b) show that for both sexes there were improvements in survivorship at every age, and these improvements were relatively even across the period except for males aged 15-24 years and both sexes at 75-84 years. However, there were regional variations that are described below. For the New Zealand population, across all age groups the probability of surviving was consistently lower for males than for females, although again there were regional variations. Because regional variance in survivorship is relatively low until older ages we merely summarise regional trends at younger ages, for more detail see Appendix Table 5.7.

Figure 5.6: Probability of Surviving to Exact Age x to Having Age x (npx), New Zealand, 1980-2000

a) From Birth to 15 Years (15p0); From Age 15 to Age 25 (10p15); From Age 25 Years to Age 45 (20p25)



b) From Age 45 Years to 65 Years (25p45); From Age 65 to 75 Years (10p65); From Age 75 to 85 Years (10p75)



Note: Different scales used
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

5.4.1 Survivorship: Birth to Age 15 Years

National Patterns

For both males and females in New Zealand, the probability of surviving childhood from birth to 15 years is very high and increased between 1980 and 2000. In 1980 this probability for males was 0.980 and for females was 0.984; by 2000 the probabilities were 0.990 and 0.992 respectively. More than 99 percent of children will reach their 15th birthday.

Regional Patterns

The range of survivorship variation between regions for both males and females was never more than 0.011, which is fairly small. There were small numbers of deaths in this age group and no systematic patterns were obvious with none of the regions being consistently above or below the New Zealand level. The only region in which both males and females in this age group tended to have an exceptionally high probability of surviving was **Waitemata.**

5.4.2 Survivorship: 15 to 25 Years of Age

National Patterns

For the New Zealand population the probability of surviving through the young adult years from age 15 to 25 years only increased slightly from 1980 to 2000. For males the probability dipped to a low of 0.983 in the mid to late 1980s and reached the highest level of 0.989 in 2000. For females the probability of surviving was 0.993 in 1980 and 0.996 in 2000, and there was no decline in the 1980s. Males consistently had a lower probability of surviving compared to females for this age group.

Regional Patterns

The data on females show that the range of variation among the regions was never more than 0.006, but for males the range was greater (0.016 in 1980). For the period 1980 to 2000 male probabilities of surviving between these ages in **Northland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** were consistently below the New Zealand level. For males the probability of surviving tended to be higher than the New Zealand level in **Waitemata, Auckland Central, Wellington, Central South Island** and **Southern South Island**.

5.4.3 Survivorship: 25 to 45 Years of Age

National Patterns

For both males and females in the New Zealand population the probability of surviving from ages 25 to 45 increased slightly from 1980 to 2000. For males the probability of surviving increased from 0.964 in 1980 to 0.970 in 2000, and for females it increased from 0.978 in 1980 to 0.984 in 2000. As for the previous age group, the probability of surviving was consistently lower for males than for females, with female probabilities consistently about 0.015 above the probabilities for males. The highest level reached by males was lower than the lowest level for females.

Regional Patterns

- For females the range of variation among the regions was never more than 0.014, but for males the maximum range was 0.023.
- For males the regions with probabilities consistently above the New Zealand level were **Waitemata, Wellington** and **Nelson/Marlborough**.
- Regions that had probabilities of surviving consistently lower than the New Zealand level were **Northland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti**.
- For females the probability of surviving was consistently higher than the New Zealand level for **Waitemata** and **Central South Island** and for **Southern South Island.**
- In the **Auckland Central** region, for females the probability of surviving was centred around the New Zealand level until 1989 and then the probability converged with the New Zealand level.

- In **Northland, South Auckland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** the probabilities of surviving for females were below the New Zealand level.

5.4.4 Survivorship: 45 to 65 Years of Age

National Patterns
It is at these ages, that the survival probabilities start to decline as the risk of premature death increases. Nevertheless the probability of surviving through the later working ages from 45 to 65 years improved steadily from 1980 to 2000. For males the probability of surviving increased from 0.782 in 1980 to 0.870 in 2000 and for females it increased from 0.871 to 0.911 in the same time period. As with the previous age group there was a consistent gender gap with the highest level for males not reaching the lowest level for females.

Regional Patterns
For females the range of variation among the regions was never more than 0.047, but for males the range was as large as 0.075 in 1986.

- For three regions, **Waitemata** and **Nelson/Marlborough** and **Central South Island,** the probability of surviving for both males and females was above the New Zealand level. Also consistently above the New Zealand level was the probability of surviving for females in **Southern South Island**
- For males and female, the regions with survivorship below the New Zealand level were **Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti, Auckland Central** until 1997 (males only), **Northland** (not in the early 1980s for males) and **Taranaki/Wanganui/ Manawatu** (females only).

5.4.5 Survivorship: After Age 65 Years

National Patterns
The probability of surviving between ages 65 and 75 years and between 75 and 85 years increased substantially for both males and females between 1980 and 2000. In 1980 for males the probability of surviving from age 65 to 75 years was 0.628 and for females 0.773; but by 2000 the probabilities of surviving had risen to 0.755 and 0.844 respectively. For males the probability of surviving from 75 to 84 years went from 0.305 in 1980 to 0.465 in 2000; and for females from 0.486 in 1980 to 0.628 in 2000. As was true for the younger age groups there was a gender difference, in this case marked, with the probability of surviving for males being much lower than that for females

Regional Patterns
At the regional level, the range of variation in the probability of surviving between 65 and 75 years of age for males was never greater than 0.084 and for females was never above 0.061, but all regions showed improvements in survival over the twenty year period.

- Two regions, **Hawke's Bay/Tairawhiti** and **Southern South Island**, had probabilities of surviving for both males and females that were consistently below the New Zealand level. Also below the New Zealand level was the probability for females in **Northland** and for males in **Taranaki/Wanganui/Manawatu**.
- **Waitemata**, had probabilities of surviving for both males and females that were consistently above the New Zealand level as was the probability for females in the **Central South Island** and males in **Bay of Plenty/Lakes.** It is at this age that the presence of a retirement in-migrant population of lower risk older people is felt in the **Bay of Plenty/Lakes** region.
- In **Nelson/Marlborough,** for both males and females the probability of surviving changed in the mid to late 1980s from being below the New Zealand level to being above the New Zealand level.

For all regions throughout the time period the probability of surviving between **75 and 85** years of age was greater for females than for males. The maximum range of variation between the regions for males and females were 0.095 and 0.096 (in 1982 and 1983 respectively).

- **Waitemata** had a probability of surviving between ages 75 and 84 years above the New Zealand level for the whole period. Other regions that were mainly above the New Zealand level were **South Auckland** for males and **Bay of Plenty/Lakes.**
- Regions that tended to be below the New Zealand level were the **Southern South Island, Hawke's Bay/Tairawhiti, Central South Island and Taranaki/Wanganui/Manawatu** (males).

5.4.6 Probability of Surviving Between Specific Ages by Ethnicity

The trends in survivorship seen for the total population were markedly different for Māori, Pacific peoples and Asian (see Table 5.4).

Table 5.4: Probability of Surviving by Ethnicity and Gender, Selected 5-Year Averages, New Zealand, 1980-2000

Surviving from age x for n years	Males			Females		
(npx)	1980-84[1]	1990-94[2]	1996-00[3]	1980-84[1]	1990-94[2]	1996-00[3]
Māori						
15p0	0.976	0.983	0.981	0.979	0.989	0.986
10p15	0.984	0.989	0.983	0.992	0.997	0.993
20p25	0.938	0.957	0.941	0.957	0.974	0.969
20p45	0.645	0.748	0.686	0.737	0.803	0.774
10p65	0.516	0.622	0.569	0.612	0.728	0.654
10p75	0.249	0.407	0.292	0.395	0.526	0.423
Pacific						
15p0	-	-	0.983	-	-	0.987
20p15	-	-	0.950	-	-	0.967
20p45	-	-	0.728	-	-	0.850
20p65	-	-	0.137	-	-	0.379
Asian						
15p0	-	-	0.993	-	-	0.994
20p15	-	-	0.972	-	-	0.986
20p45	-	-	0.910	-	-	0.946
20p65	-	-	0.484	-	-	0.569

(1) 1981 50% or more Māori population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
(4) 1999-2000 Two-Year average used for Pacific and Asian populations, insufficient data for previous years.
Sources: New Zealand Health Information Service, National Minimum Data Set – Mortality
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

The probability of surviving for Māori between ages 0 and 15 in 1996-00 was substantially lower than both the national average (0.989 and 0.990 for males and females respectively in 1996), and any regional average over this period. The decrease in Māori mortality in the early 90s (as discussed in section 5.2.3) is shown here in artificially high survival rates for this period, with survival rates in 1996-00 dropping back to only marginally above 1980-84 levels. As with the general population, improvements in survival over time were greater at older ages however the magnitude of these improvements for Māori were much smaller, especially for females. Between 1980-84 and 1996-00, Māori survivorship between ages 75 and 85 improved by 0.043 and 0.028 for males and females respectively. By comparison, improvements for the total population between ages 75 and 85 over the same time period[26] were 0.115 and 0.095 for males and females – in excess of two and three times greater than Māori improvements for males and females respectively. The gender differences in survivorship increase with age. Between ages 75 and 85, gender differences are more marked for Māori than for the total population, with Māori men 44 percent less likely to survive in 1996-00, compared with a difference of 35-38 percent for the total population.

Pacific peoples experienced only marginally better survivorship from birth to age 15 years than Māori (still substantially below the national average), whereas Asian survivorship in this age group was above the national average (0.993 and 0.994 for males and females respectively). Asian survivorship remained high throughout the age groups, while Pacific people's survivorship remained low. The gender difference in survival for Pacific people at older ages was higher than for any other ethnic group, Pasifika men were 64 percent less likely to survive from age 65 to 85 years than Pasifika women. In contrast, the gender difference for Asians in this age group was only 18 percent.

5.5 CONCLUSION

In general, mortality-related measures in New Zealand improved over the 1980-2000 period, but the gender differential favouring females continued. There were however marked differences in mortality experience by region and age group. Large ethnic differences in mortality patterns were observed, with Māori and Pacific peoples experiencing higher mortality at all ages (apart from in the early 1990s), and Asians experiencing lower mortality than the total population. There are concerns over the quality of Māori and Pasifika data in the early 1990s, when spuriously low mortality was reported.

The implications of changes in mortality will be discussed further in the conclusion to Chapter 6, where they will be viewed alongside changes in patterns of hospitalisation.

[26] Using the average survivorship for 1980-84 and 1996-2000 and subtracting one from the other.

CHAPTER 6

National and Sub-National Differences in Patterns of Hospital Utilisation: 1980-2001

6.1 INTRODUCTION

As was previewed in Chapter One, the second part of this monograph deals with a composite measure that brings together mortality (in this study survivorship) with morbidity (here represented by hospitalisation). As an indicator of sickness or injury, hospitalisation is at the extreme end. Of course not all deaths involve hospitalisation as an intermediate stage between contracting an illness or suffering an injury and death, nor do most hospital discharges occur because of death. Nevertheless there is usually a serious reason for an admission to hospital (as noted in Chapter 4, we have filtered out those cases which do not meet these criterion), and discharge in most instances is associated with an improvement in quality of life.

In Chapter 5 mortality differentials were looked at in detail but in a uni-variate way. This chapter repeats this analysis but for the sickness and injury component of the measures we will be presenting later.

This chapter thus covers patterns of hospital utilisation for the period 1980 to 2001. The three aspects of hospital utilisation covered in this chapter are: discharge rates,[27] length of stay; and bed-day rates. All indicators are explored by gender, age and ethnicity.

6.2 DISCHARGE RATES

Discharge rates are simply the ratio of discharges (of cases not people) to a defined population. As noted earlier, for the whole time period 1980-2001, the New Zealand data set does not permit the linking of discharges to individuals and thus we could not identify multiple admissions and transfers between hospitals and between specialties, many of which show up in the data set as separate discharges. The results shown here refer to public hospital medical and surgical discharges, which were obtained by filtering the hospital discharge data set in the manner described in Chapter 4. As noted there, private hospital data are excluded.

6.2.1 Age-Standardised Discharge Rates

National Patterns

As has already been discussed in Section 4.4, despite a substantial increase in crude numbers of discharges between 1980 and 2001, the national age-standardised discharge rates showed a generally decreasing pattern but with some variation during the period (see Figure 6.1, Appendix Table 6.1, and Figure 4.6). The early 1980s was the period with the highest level of public hospital discharge. From 1986/7 there was a steady decrease in rates until 1992 after which they rose again, remaining fairly consistent from 1994 to 1998 then increasing towards the end of the period. The rates in the 2000-2001 period reached levels similar to those of the 1980-1984 period.

Male age-standardised discharge rates were consistently above those for females. The discrepancy between the genders widened over the 19-year period, with the gap being widest in the early to the mid 1990s. This may be taken to imply that hospitalisation rates are a function of higher male mortality, but as we will noted later the situation is much more complex than this might suggest.

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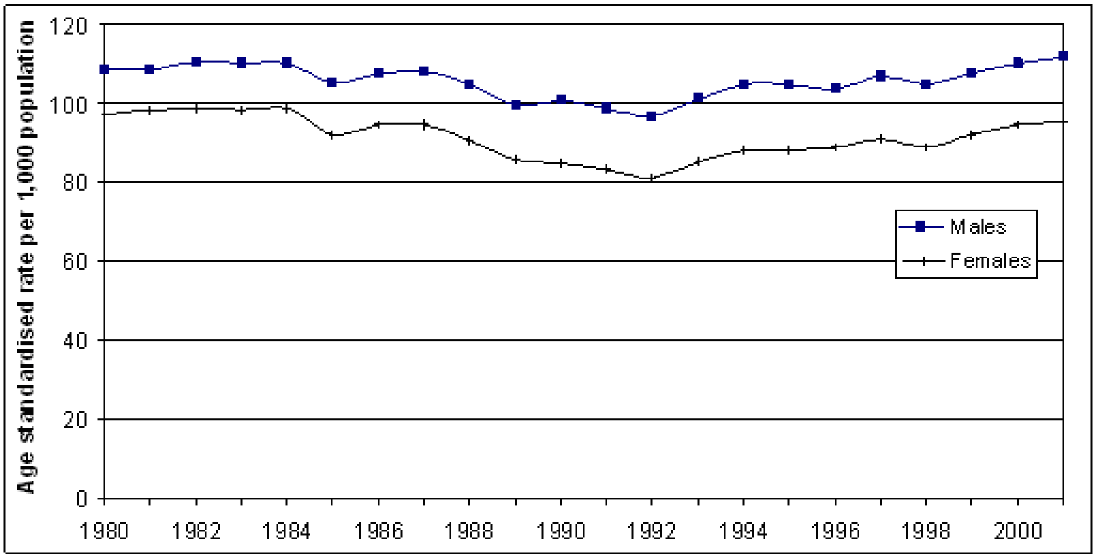
[27] As was noted in Chapter 4, the analysis of hospitalisation is derived from the end of the stay, rather than the start.

Figure 6.1: Age-Standardised Hospital Discharge Rates, By Gender, New Zealand, 1980-2001



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Differences

Age-standardised discharge rates for selected years for the regions and for New Zealand are presented in Table 6.1 (and the full results are presented in Appendix Table 6.1). There is a general trend of convergence in discharge rates over time, and a reduction in regional variation.

- Throughout the period under review, the rates for **Bay of Plenty/Lakes** and **Taranaki/Wanganui/Manawatu** were consistently above those for New Zealand and **Hawke's Bay/Tairawhiti** and **Northland** rates started well above the national rates. While these last two regions converged towards the national level it still remained above. **Northland** rates for both genders were among the highest rates observed throughout the period.
- Rates for both males and females for **Waitemata, Auckland Central** and **South Auckland** in 1980 were substantially below the national level but have converged over time. By 2001, however, while the **Waitemata** rates were still below those for New Zealand, those for **Auckland Central** and **South Auckland** were just above the national level. **Waitemata** had by far the lowest discharge rates of the three regions right through the time period. This point will be elaborated in later chapters, which suggest these changes have been driven by supply-side improvements in hospital capacity as population-based funding allowed a more equitable distribution to the Auckland region's health services.
- Rates for **Waikato** and the **Central South Island** were generally similar to the national levels with the **Central South Island** being just below the New Zealand rates and **Waikato** just above throughout the 1990s.
- Over the time period, discharge rates in **Nelson/Marlborough**, **Wellington**, and the **Southern South Island** declined relative to the average. **Nelson/Marlborough** started the time period with slightly higher than average rates, and dropped substantially below the national level, especially from 1988. Discharges in **Wellington** started at about the New Zealand level in the 1980s, and finished below. The **Southern South Island** rates were well above those for New Zealand until the mid-1990s, when they decreased sharply, ending at around the national figure.

Table 6.1: Age-Standardised[1] Public Hospital Discharge Rates per 1,000 Population, By Gender and Health Regions, Selected Years, 1980-2000

Region	Males					Females				
	1980	**1985**	**1990**	**1995**	**2000**	**1980**	**1985**	**1990**	**1995**	**2000**
New Zealand	**109**	**105**	**101**	**105**	**110**	**97**	**92**	**85**	**88**	**95**
Northland	137	138	121	115	131	135	136	111	99	111
Waitemata	69	69	78	86	98	64	60	63	71	85
Auckland Central	86	83	82	95	108	78	71	64	74	90
South Auckland	91	81	87	101	117	81	70	71	84	100
Waikato	109	102	102	106	111	102	90	88	93	98
Bay Of Plenty/Lakes	131	123	127	126	132	116	110	110	106	111
Hawke's Bay/ Tairawhiti	139	136	131	130	121	122	124	111	111	99
Taranaki/Wanganui/ Manawatu	119	115	113	118	117	105	98	97	99	98
Wellington	107	109	94	98	98	94	93	77	83	86
Nelson/Marlborough	116	113	96	87	93	102	101	80	73	80
Central South Island	112	110	96	98	107	95	95	84	86	95
Southern South Island	129	119	116	115	107	119	106	98	96	89

(1) Standardised by age to 1996 Total New Zealand population (both genders).
Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Patterns by Ethnicity

There have been changes in the definition of ethnicity which can affect the relationship between numerators and denominators when calculating rates. In this case the socio-cultural definition is used, as was explained in Chapter 4. Alternative rates using sole Māori in 1990-94 are shown in Appendix Table 6.2. As with mortality, larger regions are employed here to ensure there are sufficient numbers of cases and the **South Island** is excluded because the small numbers of Māori there generate a result that is prone to random errors.

The Māori population has a higher discharge rate than the overall population but this gap has closed to a degree over time (see Table 6.2). Auckland has the lowest rates for Māori for the first two periods with **Taranaki/Wanganui/Manawatu/Wellington** lowest in 1997-2001. **Northland** had the highest rates for 1997-2001, but also has high rates for males and the highest rate for females in the other two time periods. **Hawke's Bay/Tairawhiti** had the highest rates in the first two time periods for males and the rate was also high for females.

Table 6.2: Age-Standardised[1] Public Hospital Discharge Rates (1,000) for the Māori and Total Population, By Gender and Larger Health Regions, Selected 5-Year Averages, 1980-2000

Region	Males			Females		
	1980-84[2]	1990-94[3]	1997-01[4]	1980-84[2]	1990-94[3]	1997-01[4]
New Zealand	**173**	**134**	**136**	**167**	**127**	**125**
Northland	229	168	181	222	168	160
Auckland	136	115	127	131	106	119
Waikato	155	138	137	149	128	126
Bay of Plenty/Lakes	175	153	163	163	142	147
Hawke's Bay/Tairawhiti	228	180	160	214	161	141
Taranaki/Wanganui/ Manawatu/Wellington	171	121	124	174	119	114
New Zealand	**111**	**102**	**108**	**99**	**85**	**93**
Northland	148	122	127	144	110	109
Auckland	83	86	104	75	69	87
Waikato	110	105	108	103	91	98
Bay of Plenty/Lakes	131	127	128	121	108	109
Hawke's Bay/Tairawhiti	146	134	122	129	110	103
Taranaki/Wanganui/ Manawatu/Wellington	114	102	106	101	86	92

(1) Standardised by age to 1996 Total New Zealand population (both genders and all ethnic groups).
(2) 1981 50% or more Māori blood population is used as denominator.
(3) 1991 socio-cultural Māori population is used as denominator.
(4) Estimates for 1999 by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

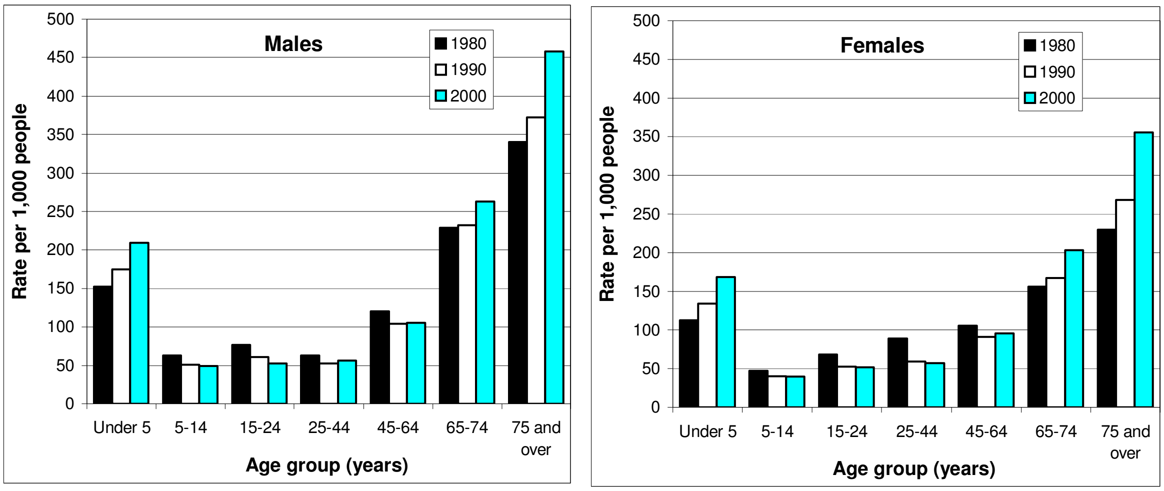
6.2.2 Age-Specific Discharge Rates

National Patterns
As one would expect for populations that are well advanced in their epidemiological transition, in general, national age-specific discharge rates increase with age (see Figure 6.2 and Appendix Table 6.3).

- The under 5 years discharge levels were the exception to the trend of increasing discharge rates, ranking third highest for males and females, and are higher than those for all other age groups under 65 years. The under 5 years age group had the highest percentage increase of discharge rates for males and second highest for females between 1980 and 2000. This was caused by the doubling of the discharge rate for infants (not shown in Figure 6.2).
- In the 15-24 years age group males initially had higher discharge rates than females; however by 2001 rates were approximately the same for males and females. At all other age groups except 25-44 years, males had higher discharge rates than females, particularly at the youngest and oldest age groups, with the gaps remaining reasonably consistent.
- The only age group where female rates were higher than males was for those 25-44 years, however the difference was slight. The gap was wider in 1980, but over time narrowed considerably.
- Discharge rates for the 65 years and over age groups, and the under 5 years age group increased over the 1980-2001 period, while for all other age groups they decreased slightly.

- The rise in the rate for the 75 years and older age group was substantial (58 percent for females), showing a particularly sharp increase in the 1990s.

Figure 6.2: Age-Specific Discharge Rates Per 1,000, By Age, New Zealand, 1980, 1990 and 2000



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Differences

Age-specific discharge rates for each of the regions generally reflect the pattern described for the age-standardised rates and thus are presented in Appendix Table 6.3 rather than in the text. Some main trends are listed.

- All **Nelson/Marlborough** rates decreased dramatically from the late 1980s starting from a position above the New Zealand level to end below, although there were slight increases in the 1999 to 2001 period.
- All three **Auckland regions** discharge rates for all age groups (except under 5 years in **Auckland Central**) were well below the New Zealand rates in 1980 and converged towards the national rates over time, especially at the 65 years plus age group. **Auckland Central**'s rates at all age groups over 25 years increased in the late 1990s. Most of **South Auckland**'s age-specific rates ended just above those for New Zealand. **Waitemata** remained below New Zealand throughout.
- Age-specific rates for **Bay of Plenty/Lakes, Northland** and **Hawke's Bay/Tairawhiti** were all substantially above those for New Zealand, with some convergence towards the New Zealand levels over the time period, especially in the late 1990s.
- **Taranaki/Wanganui/Manawatu** and **Southern South Island** (age groups 15 years and over) age-specific rates converged towards those of New Zealand from a position just above the national rates.
- The rates for **Wellington, Waikato** and **Central South Island** approximated New Zealand rates at most ages, though **Wellington** tended below, and **Waikato** tended above the New Zealand level.

Patterns by Ethnicity

The lowest age-specific discharge rate for Māori is at 5-14 years, with the highest rate being for the age group 75 years and over for New Zealand. In 1997-01 rates for Māori for age groups under 25 years are quite similar to the Total population, but for age groups 25-74 years, Māori rates are considerably higher than those for the Total population. There appears to be a slight convergence of Māori and Total population discharge rates over the time period, for most age groups.

Table 6.3: Age-Specific Public Hospital Discharge Rates (1,000) for the Māori and Total Population, By Gender, Selected 5-Year Averages, New Zealand, 1980-2001

Age group (years)	Males			Females		
	1980-84[1]	1990-94[2]	1997-01[3]	1980-84[1]	1990-94[2]	1997-01[3]
	Māori Population					
Under 5	278	214	212	203	154	161
5-14	83	54	51	65	42	39
15-24	111	63	56	105	58	56
25-44	104	74	73	148	88	80
45-64	187	158	163	194	168	162
65-74	353	335	361	304	290	306
75+	551	447	474	413	379	402
	Total Population					
Under 5	171	186	208	126	140	166
5-14	62	51	50	47	41	40
15-24	76	57	52	70	52	53
25-44	63	51	55	90	57	59
45-64	121	103	103	106	93	94
65-74	237	245	257	162	173	197
75+	358	389	447	250	280	346

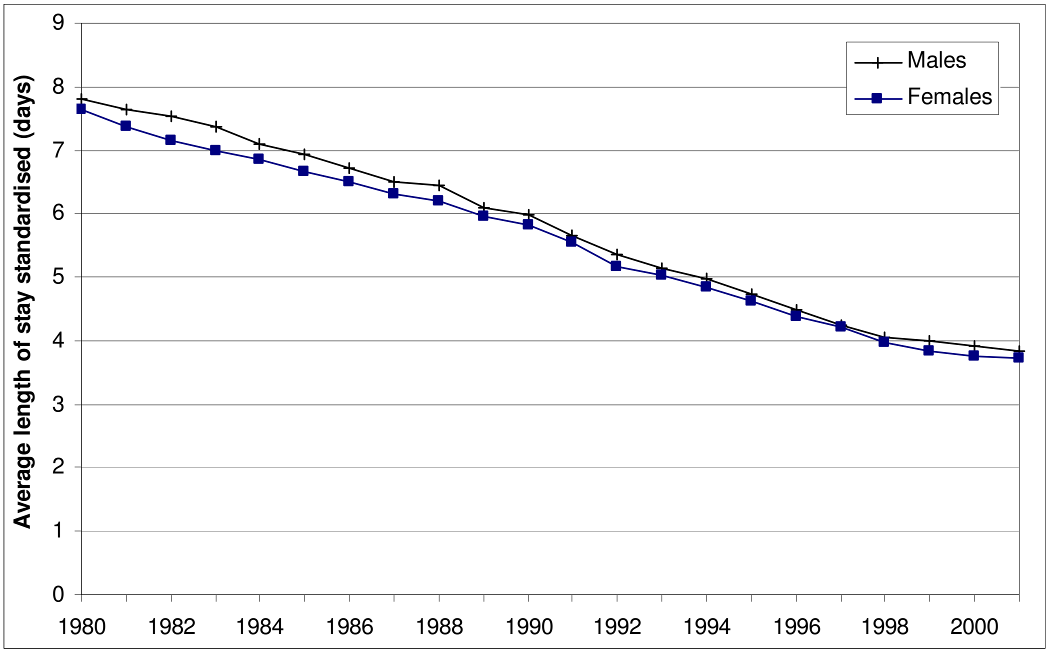
(1) 1981 50% or more Māori population is used as denominator.
(2) 1991 socio-cultural Māori blood population is used as denominator.
(3) Estimates for 1999 obtained by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

6.3 LENGTH OF HOSPITAL STAY

While discharge rates reflect how frequently hospital discharges occur in a population, the index *mean length of stay* (LOS) documents the average duration of use of hospital facilities. The average length of stay measure divides the *sum of hospital bed-days* by the *number of discharges* and thus limits the index in both the numerator and denominator to those who use hospitals. By limiting the index to users, it is not a population-based measure. LOS data also provide some insight into both the severity of the condition resulting in hospital admission, as well as the amount of resources used by patients. A more useful index, however, is the 'hospital bed-days per capita' (discussed below) so only national trends in LOS are presented here. In both cases, only bed-days linked to the discharge data set *after filtering* are considered.

National Patterns
Over the last two decades, the age-standardised average length of hospital stay almost halved – from just below eight days to below four days (Figure 6.4). Reasons for this included changes in technology, medical practice, post-discharge support services in the community and pressures to reduce hospital expenditures. Male average LOS was slightly higher than for females, but converged in the most recent data.

Figure 6.4: Age-Standardised Average Hospital Length of Stay, By Gender, New Zealand, 1980-2001



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

6.4 HOSPITAL BED-DAYS PER CAPITA

While LOS data have some uses, other health indices can better reflect hospital use by incorporating the concepts of frequency[28] *and* duration of stay. Hospital bed-days per capita is one such measure. It is the *sum of all the bed-days spent in hospital* in a year in relation to *population numbers.*[29] The key advantage of this measure is that it is not affected by multiple admissions or by transfers between hospitals and specialities.

6.4.1 Age-Standardised Hospital Bed-Days Per Capita

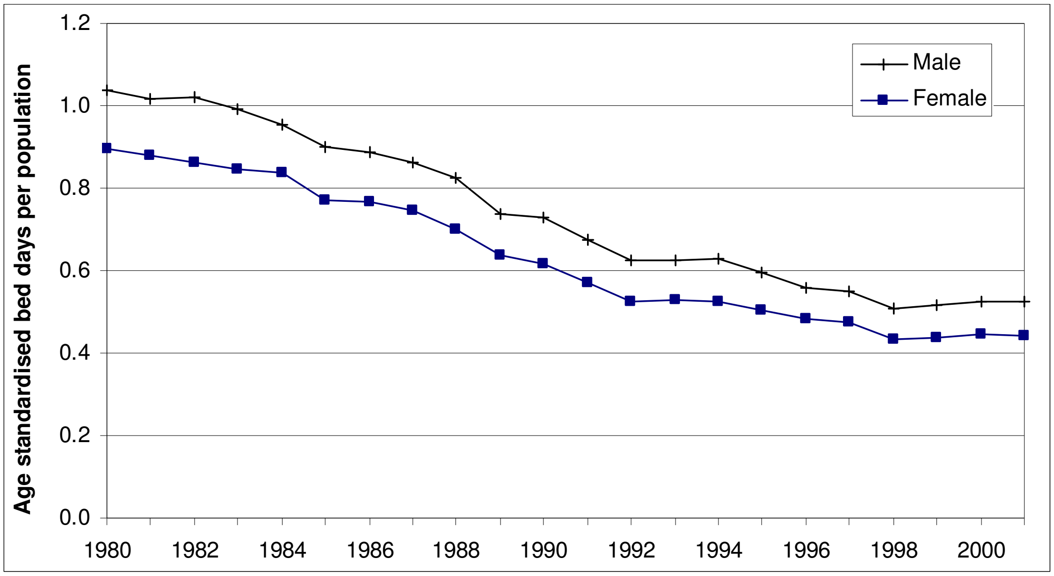
National Patterns

In the context of increasing crude discharges, fluctuating age-standardised discharge rates and decreasing average LOS, the age-standardised bed-days per capita showed a definite decreasing trend over the 22-year period (Figure 6.5 and Appendix Table 6.4). The years 1980-2001 can be roughly divided into four periods characterised by different crude annual rates of change in hospital bed-days per capita. There was a gradual drop during the early 1980s, followed by a sharper reduction from 1985 to 1992 coinciding with the dip in hospital admission rates over that period (possibly due to increased day patient services). From 1992 to 1998, the annual hospital days per capita continued to decline but more gradually. Between 1998 and 2001, levels appear to be reaching a plateau.

[28] We cannot measure incidence (first-ever/new cases or events) directly. Instead we use discharge data, more correctly called admission/discharge rates.

[29] This rate is calculated by summing the length of stay of each discharge and then this sum of days is divided by the population at risk.

Figure 6.5: Age-Standardised Hospital Bed-Days per Capita By Gender, New Zealand, 1980-2001



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Differences

All regional age-standardised bed-day rates declined over the period under review, and converged towards the national level so that differentials were reduced substantially (see Appendix Table 6.4).

- **Waitemata** had the lowest per capita rate for all but the end of the period. **Nelson/Marlborough** rates dropped substantially below the national level especially from 1988 onwards, ending with the lowest rates nationally in 2001.
- **South Auckland** started from well below New Zealand in 1980, converging with the New Zealand rate over time to end just above
- The highest rates were in **Hawke's Bay/Tairawhiti,** and **Bay of Plenty/Lakes,** while **Northland** and **Southern South Island** started well above the national rate but declined throughout the period. The first two regions remained above or just at the New Zealand level whereas the other two regions finished with rates similar to those for New Zealand.
- **Taranaki/Wanganui/Manawatu, Waikato** and **Central South Island** started just above the New Zealand level but converged towards it over the time period.

Māori Patterns

The Māori bed-day rate is higher than that for the Total population, but there has been a degree of convergence over time (see Table 6.4, see also Appendix Table 6.2 which shows the alternative rate using 'sole Māori' in 1990-94).

- The **Auckland Metropolitan** region had the lowest bed-day rates for the first two periods with the 1997-2001 period also tending low.
- **Taranaki/Wanganui/ Manawatu/Wellington** had the lowest levels for the last period.
- **Hawke's Bay/Tairawhiti** had the highest rate for the first two periods and a high rate for the last period. **Bay of Plenty/Lakes** had the highest rate in 1997-2001.

Table 6.4: Age-Standardised[1] Public Hospital Bed-Day Rates per Capita for the Māori and Total Population, By Gender and Larger Health Regions, Selected 5-Year Averages, 1980-2001

Region	Males			Females		
	1980-84[2]	1990-94[3]	1997-01[4]	1980-84[2]	1990-94[3]	1997-01[4]
	Māori Population					
New Zealand	**1.76**	**0.95**	**0.69**	**1.52**	**0.85**	**0.60**
Northland	1.97	1.02	0.80	1.69	0.94	0.67
Auckland Metro. Region	1.30	0.77	0.67	1.07	0.69	0.57
Waikato	1.61	0.99	0.71	1.46	0.81	0.62
Bay of Plenty/Lakes	1.82	1.08	0.82	1.47	0.97	0.74
Hawke's Bay/Tairawhiti	2.52	1.36	0.81	2.07	1.16	0.70
Taranaki/Wanganui/ Manawatu/Wellington	1.83	0.92	0.62	1.69	0.83	0.55
	Total Population					
New Zealand	**1.02**	**0.67**	**0.53**	**0.88**	**0.56**	**0.45**
Northland	1.20	0.70	0.54	1.10	0.59	0.46
Auckland Wide	0.73	0.55	0.51	0.62	0.45	0.43
Waikato	1.08	0.66	0.53	0.96	0.56	0.47
Bay of Plenty/Lakes	1.28	0.79	0.60	1.12	0.69	0.51
Hawke's Bay/Tairawhiti	1.32	0.87	0.59	1.10	0.72	0.50
Taranaki/Wanganui/ Manawatu/Wellington	1.10	0.70	0.50	0.95	0.59	0.42

(1) Standardised by age to 1996 Total New Zealand population (both genders and all ethnic groups).
(2) 1981 50% or more Māori blood population is used as denominator.
(3) 1991 socio-cultural Māori population is used as denominator.
(4) Estimates for 1999 obtained by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

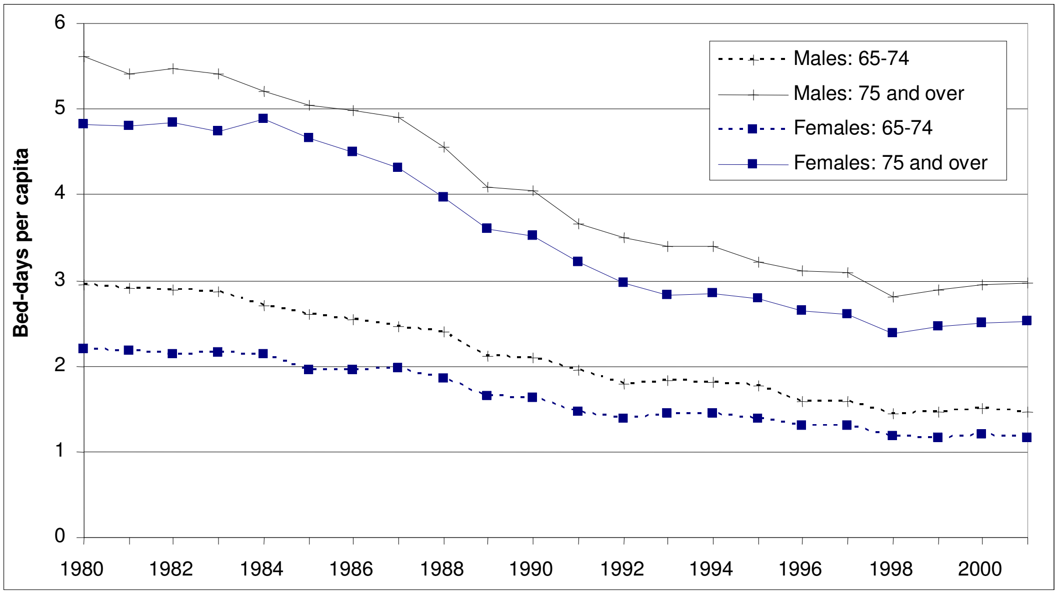
6.4.2 Age-Specific Hospital Bed-Days Per Capita

National Trends: Gender Differences
Male bed-day rates remained higher than those for females for all age groups except at 25-44 years (see Appendix Table 6.5). Nevertheless, across all age groups except at 75 years and over there was a convergence of male and female rates over the time period. This was most marked for the 15-24 and 25-44 year age groups. The 25-44 year age group was the only one where male rates started at a lower level than those for females, but by 1990 the two groups had converged.

National Trends: Age Differences
Over the entire period the hospital bed-day rates correlated directly with age, and decreased at all ages except for children under 5 years, whose rate changed only minimally. This age group was, however, made up of the under 1 year and 1-4 years age groups which had different patterns. The age group 75 years and over had bed-day rates well in excess of those of other age groups (see Appendix Table 6.5). A high proportion of hospital costs relate to the elderly. For example, 45 percent of lifetime hospitalisation for women occurs at that age (see Section 8.4). Internationally it is recognised that a high proportion of lifetime healthcare expenditure occurs in the last years of life which, for most people, will be at old age (Scitovsky 1984). Thus, in this section of the monograph we show graphically only data for the two oldest age groups (see Figure 6.6).

From the mid-1980s, the bed-day rate decreased at all ages except for children under 5 years whose rate changed minimally. At younger old ages (65-74) the decrease was only marginal, in contrast there was substantial absolute and relative decrease in bed-day rates for the 75 years and over group (see Figure 6.6). These changes are highly significant as there were also gains in survivorship for this age-group (see Figure 5.6b).

Figure 6.6: Age-Specific Hospital Bed-Days per Capita By Gender for 65-74 Years and 75 Years and Over, New Zealand, 1980-2001



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

National Trends: Percentage Change

A more detailed analysis of the annual percentage change in national hospital bed-days per capita for various age categories allows comparisons between age groups over time (Table 6.5). The under 1 year age group was the only one at which hospital bed-days per capita increased over the period. This is particularly evident in the period 1980-1984 when bed-day rates increased by 7.3 percent per year for infants. This may have been partly due to the change in registration practices whereby mothers (and presumably some sick babies requiring treatment) had not been registered as in-patients prior to 1981/2 but were registered from then on. While the filtering process excludes healthy babies, minimising the effect of the change in coding on infant discharges, babies requiring treatment are included here. Nevertheless, there was also some real increase in bed-day rates over the 1984-2001 period.

Hospital bed-day rates for females 75 years and over increased by 0.3 percent per year during the 1980-1984 period, but decreased subsequently. Even though the rates decreased proportionately for this age group, there was a relatively large absolute numerical increase in bed-days because of the growing number of people in this age group. In general other age groups showed a rather persistent pattern of decrease in bed-day rates. They went from small declines in the years 1980-1984 to large in the period 1984-1992 and then back to smaller annual decreases, between 1992 and 2001. This is reflected in the overall decreases among males of 1.3 percent, 3.8 percent, and 1.2 percent per year over each period respectively. The exception to this pattern was the age group 15-49 years, which also showed a considerable decrease in the 1980-1984 period, especially for females but also for males. This age group also showed the greatest reduction overall for females in the 1980-84 and 1984-92 periods. In the 1980-1984 period annual reductions in male bed-day rate were much higher than those of females, except for the 15-49 years age group.

Table 6.5: Average Annual Percentage Change in Hospital Bed-Days per Capita, By Age Group, New Zealand, 1980-2001

Age Group (years)	Average annual percentage change in hospital stays per capita				Total Percentage Change
	1980-1984	1984-1992	1992-2001	1980-2001	
			Males		
Under 1	7.3	0.3	1.7	2.5	+52.3
1-14	-2.0	-5.0	-2.6	-2.7	-57.7
15-49	-3.0	-4.9	-1.8	-2.6	-54.9
50-64	-1.9	-4.8	-2.8	-2.7	-57.1
65-74	-2.2	-4.2	-2.1	-2.4	-50.7
75 and over	-1.8	-4.1	-1.6	-2.2	-46.9
Total	-1.3	-3.8	-1.2	-2.0	-41.6
			Females		
Under 1	4.8	0.5	1.9	2.1	45.0
1-14	-1.4	-4.9	-1.9	-2.5	-52.7
15-49	-3.7	-5.3	-2.0	-2.8	-59.6
50-64	-1.6	-4.5	-2.5	-2.6	-53.6
65-74	-0.8	-4.4	-1.8	-2.2	-47.2
75 and over	0.3	-4.9	-1.7	-2.3	-47.8
Total	-0.6	-4.1	-1.3	-2.0	-42.5

Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Regional Differences

In general, there was convergence of the regional age-specific bed-day rates per capita towards the national level (see Appendix Table 6.5).

- Age-specific bed-day rates were highest for **Northland, Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti** and **Taranaki/Wanganui/Manawatu,** and were lowest for the three **Auckland** regions.
- The remaining regions fluctuated around the New Zealand level except for **Nelson/Marlborough**, where the levels dropped to be extremely low at all ages. That said, for this group of regions, the regional patterns across various age groups were not uniform in the trends they followed.
- In some cases regional rates for older age groups converged markedly towards the New Zealand level, but for other age groups there were few or no gains relative to that of New Zealand. This was the situation with **Northland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti**. Suffice to say here that decreases in levels at older ages were driven by Pakeha who constitute the vast majority of that population, whereas Māori are a substantial minority, but constitute more of the persons at younger ages.
- **Auckland Central** rates for the under 5 years age group were high compared to those for New Zealand. Those for 75 years and over went from below New Zealand levels to above, while the rates for other age groups started below New Zealand and converged over time.
- Rates for the age groups under 15 years in **South Auckland** were very similar to those for New Zealand. The other age groups started below but converged towards the New Zealand levels.
- Rates for **Centra**l and **Southern South Island** regions converged towards New Zealand levels – those for the younger ages from being lower and those for the older ages from being higher than the national level.
- The decline in the adult **Nelson/Marlborough** rates intensified with age, so that by 2001 bed-day rates at all age groups, especially the oldest age group, were extremely low relative to New Zealand levels.

- These trends seem intuitively reasonable, but we cannot totally ignore age differences between populations within the oldest age groups we use here. These age-groups could be structurally different regionally, ethnically and in other ways. That said, the magnitude of age-reporting errors may be a more severe problem. Age-reporting by the oldest-old in New Zealand is not as correct as in some European countries (Kannisto 1994). In sum, data for the elderly must be handled with some degree of caution.

Māori Patterns

Māori per capita bed-day rates are far higher than those for the Total population at most ages for all three dates (see Table 6.6). An interesting exception is for the under five age group for the most recent period. It should be stressed that this is not likely to be an artefact of data; the pattern is, in fact, counterfactual to some of the definitionally induced changes discussed in Chapter 4. The lowest age-specific bed-day rate for Māori is at 5-14 years and the highest rate being at age group 75 years and over (see Table 6.6).

Table 6.6: Age-Specific Public Hospital Bed-Day per Capita for the Māori and Total Population, By Gender, Selected 5-Year Averages, New Zealand, 1980-2000

Age group (years)	Males			Females		
	1980-84[1]	**1990-94[2]**	**1997-01[3]**	**1980-84[1]**	**1990-94[2]**	**1997-01[3]**
			Māori Population			
Under 5	1.71	0.99	0.82	1.31	0.75	0.63
5-14	0.53	0.23	0.16	0.40	0.18	0.11
15-24	0.74	0.31	0.21	0.51	0.22	0.16
25-44	0.79	0.40	0.31	0.89	0.40	0.29
45-64	2.11	1.22	0.89	1.92	1.23	0.82
65-74	4.81	3.03	2.15	3.90	2.46	1.85
75+	8.33	4.32	2.93	6.72	3.68	2.54
			Total Population			
Under 5	0.93	0.90	0.86	0.73	0.73	0.72
5-14	0.31	0.19	0.14	0.23	0.15	0.11
15-24	0.48	0.27	0.18	0.34	0.20	0.16
25-44	0.41	0.26	0.21	0.50	0.26	0.21
45-64	1.14	0.70	0.50	0.98	0.63	0.46
65-74	2.88	1.95	1.49	2.19	1.49	1.20
75+	5.64	3.70	2.94	4.99	3.16	2.50

(1) 1981 "50% or more Māori Blood" population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) Estimates for 1999 obtained by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharge
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

By comparing the 1997-01 rates for Māori to the Total population rate for 1999, the age groups under 25 years are seen not to be very different, with the age group under 5 being higher for the overall population. The largest difference occurs in the age groups 45-74 years but with little difference occurring in the 75 years and over age group

Table 6.7 raises another issue. As was true for the Total population, the decrease in hospital stays, even at 0-4 years in the case of Māori, had occurred prior to 1992 after which the more radical institutional restructuring took place. Thus, the need for efficiency gains in the health sector, the driving force for restructuring in the 1990s, had already been addressed, particularly in the hospital system.

6.5 CONCLUSION: HEALTH STATUS AND HOSPITAL UTILISATION

In looking at hospitalisations covered in this chapter, it is useful also to refer back to the findings on mortality in the previous chapter. In these two chapters a number of health indices have been examined at both the national and the sub-national level. It has been seen that health status, as measured by mortality rates, improved as mortality at all ages decreased. Female mortality was consistently lower than male mortality, but male-female differences decreased because of the more marked improvements for males. The greatest mortality reductions occurred in the under 10 years age group and in the 40-64 years age groups. This translated into increases, especially from the mid- to late 1980s, in life-expectancy at birth and in the probability of surviving beyond age 65. Age-standardised bed-day rates halved over the period, at first gradually, and later more rapidly, especially in the 1985-1991 period. This was due to the small decrease in discharge rates, and an almost halving of the average length of hospital stay. The greatest differential between Māori and the Total population for these indices occurs at ages 45-74. This may be an indication of where the greatest potential for further improvements in Māori health might be achieved.

Regional differences in health-related indices, as have been discussed in the last two chapters, are summarised in Table 6.7. These provide a background to the factors driving the regional HUEs to be presented in later chapters. Relative to New Zealand, a number of regions changed levels in either their hospital utilisation rates and/or health status, as measured by life-expectancy and survivorship, over the period.

Waitemata and **Nelson/Marlborough** were the only regions with consistently low utilisation and good health status. **South Auckland** and **Auckland Central** fell into the low utilisation-average health status category. In **South Auckland** life-expectancies reduced relative to national levels from a higher than average position, while those in the **Auckland Central** region were close to those for New Zealand. However, while there was low hospital utilisation in **Auckland Central** and **South Auckland**, bed-day rates in these regions converged with those for New Zealand.

Health status and hospital utilisation in **Wellington** and **Waikato** generally approached national levels, but there are some exceptions in some age groups. While the **Central South Island** region had health status indicators similar to those for New Zealand, hospital utilisation was slightly higher than the New Zealand level for the early part of the period, but converged towards New Zealand levels during these two decades.

The regions with poorer mortality measures generally also had high levels of hospitalisation. This applied particularly to **Bay of Plenty/Lakes** and to **Hawke's Bay/Tairawhiti**. The exceptions to this pattern were **Northland, Taranaki/Wanganui/Manawatu** and **Southern South Island,** which had poorer health status indicators and utilisation levels that started higher but ended at about the New Zealand level. **Northland** had high levels of discharge but a bed-day rate around the New Zealand average at the end of the period.

Declines in bed-day rates per capita were far greater at the oldest ages (75 years and over) than at younger old age (65-74), and this was accompanied by increases in life-expectancy at ages 75 and over. As was discussed earlier there is a hypothesis that gains in longevity may be accompanied by longer durations in ill-health (the Olshansky theory). Logically, the older someone is, the longer the period of exposure to risk of being hospitalised for whatever reason. Yet these data suggest something different. One explanation would be that compression of periods of severe ill health while still surviving is actually occurring (the Fries theory). This would indicate real health gains for elderly New Zealanders. Alternatively, although the gains in life-expectancy at older ages dispute this, if shortened durations in hospital have been produced purely in order to achieve efficiency gains, then this may not signal health gains. The analysis of HUEs later in this study will allow us to investigate further this question that has very significant policy implications.

Table 6.7: Utilisation and Health Status Summary, By Region (1980-2001)

	Utilisation Summary	Health Status Summary
Northland	Medium utilisation – bed-day rates started above but dropped to the New Zealand level from 1990s.	Poor health status – Low e(0) and worsening e(0) relative to New Zealand. e(65) around New Zealand.
Waitemata	Low utilisation – very low bed-day rates throughout the period.	Good health status – highest e(0) and e(65) throughout.
Auckland Central	Low to medium utilisation – low bed-day rates until 1995 then converging to the New Zealand level.	Average health status – low to medium at e(0) and e(65)) years.
South Auckland	Low to medium utilisation – low bed-day rates at beginning of period, converging to New Zealand by 1994.	Average to low health status – e(0) started above but dropped below New Zealand rate from 1990 for males. Female e(0) consistently just below New Zealand rate. e(65) at New Zealand levels to above. Younger people have poorer health status.
Waikato	Medium utilisation – bed-days started above New Zealand level but soon dropped to about the New Zealand level	Average health status – e(x)s at about or just above New Zealand level with gains mainly in older age groups.
Bay of Plenty/ Lakes	High utilisation – high bed-day rates especially for age groups under 65 years.	Poor health status – e(0) consistently below New Zealand level, with the gap widening especially for males; e(65) fairly consistently above New Zealand rate. Poor health status refers to younger rather than older people.
Hawke's Bay/ Tairawhiti	High utilisation – high bed-day rates throughout	Poor health status – e(x)s below New Zealand levels for duration, at times diverting further.
Taranaki/ Wanganui/ Manawatu	High to medium utilisation – initially high bed-day rates, reducing to New Zealand level by 1996.	Poor health status – e(x)s just below New Zealand level.
Wellington	Medium utilisation – overall bed-day rates reflected New Zealand level though dropped below New Zealand from 1998.	Average health status – e(x)s were generally at the New Zealand level and female e(65) dropped somewhat relative to the New Zealand.
Nelson/ Marlborough	Low utilisation – Started at new levels but became low from early 1980's.	High health status – e(0) above New Zealand level throughout; e(65) started below but goes above New Zealand level.
Central South Island	Medium utilisation – generally slightly higher bed-day rates until 1989 when the New Zealand level reached. Relative to New Zealand rates, lower rates for younger people and higher for older people.	Average health status – e(0) slightly higher than New Zealand level and e(65) at about the New Zealand level.
Southern South Island	High to medium utilisation – bed-day rates start well above New Zealand levels and converged consistently towards New Zealand rates which they met in 1998.	Poor health status – e(0) started below New Zealand and converged to New Zealand level. e(65) was below New Zealand for the duration.

Source: Compiled from text and data, Ch5, 6 and Appendix Tables.

To confound this picture even further, in the last two years the rates at older ages went up (see Figure 6.6). This sets questions to be elaborated in later chapters: was this a long-term trend or merely a brief fluctuation? Whether or not it was part of a wider trend? If so, this raises other questions as to whether efficiency gains had to be at the expense of effectiveness. If that were so, then we could expect rebound effects – e.g. older people presenting at a more advanced stage in an illness, or re-presenting because they were not 'cured' at a first efficient but ineffective consultation. These patterns would both infer increases in prolonged treatment, or in discharges as deceased.

PART III:

HOSPITAL UTILISATION EXPECTANCIES: METHODS AND RESULTS

CHAPTER 7

Hospital Utilisation Expectancies (HUEs)

7.1 INTRODUCTION

In previous chapters, analyses of conventional measures of health status: mortality, life-expectancy and hospital utilisation have been presented. In this chapter a new health index which combines elements of all these is introduced. This measure is of particular importance when considering the implications of the aging of the population as it addresses the impact of increasing numbers of older people, who are the heaviest users of public hospitals, on the health system. Not only are the larger post-war birth cohorts now entering the stages in the life-cycle when they are at increased risk of hospitalisation, but proportionately more people now are surviving into these older age groups. The Hospital Utilisation Expectancy (HUE) is a technique that has been developed at the Population Studies Centre of Waikato University.[30] It is derived from the family of life-tables called health expectancies, but is a methodological extension that has some distinct advantages, mainly in terms of data availability, over its parent methodology (Cheung 1999; Pool *et al.* 2002; Cheung 2001). It also has an advantage over conventional methods for analysing hospital data because it combines mortality and morbidity.

A general overview of health status measures and rationale for a life-table measure, such as HUEs was presented in Chapter 1. This chapter is devoted to a general description of HUEs. First, a brief computational guide is provided followed by a description of the properties of this measure. A more detailed analysis of the theoretical and methodological features of the HUE approach is set out in Appendix D. This chapter concludes with a discussion on the application and possible future extensions of the HUE approach. National and sub-national results are presented in the next chapter.

7.2 DESCRIPTION OF THE HOSPITAL UTILISATION EXPECTANCY INDEX AND HOW IT IS COMPUTED

Health Expectancies (HE) are generally labelled, and thus classified, according to the type of input morbidity data they employ (generally sample surveys on, for example, disability, dependency, institutionalisation, self-perceived health status, etc.). The HUE differs from the more commonly calculated health expectancies not only in terms of the source of input data - population-based hospital utilisation data (see discussions below) - but also the manner by which a measure of hospital stay is derived and incorporated into the life-table.

The underlying idea for health expectancies, and thus for the HUE, is very simple. In any cohort of people and at any given age group, there will be persons who will survive to the next age group. At younger ages this will be most of the cohort, and then at successive older age groups proportionally fewer of the cohort will survive until no members of the cohort remain alive. Among the survivors at any age will be those in 'good health' (or in the case of the HUE, not in hospital), and those in 'poor health' (or, in this case, in hospital).

Thus hospital utilisation replaces the conventional morbidity measure in the HE calculation. In our study, the hospital utilisation component of the HUE is obtained from hospital discharge data that have been collected more or less systematically, by modern standards, and published in New Zealand since the 1950s, and mortality data collected efficiently since the 1880s. The numbers of days of

[30] Previous work on HUEs by the present authors has been peer reviewed at two international meetings and following refereeing, subsequently published in conference proceedings (Pool and Cheung 1999; Pool *et al.* 2002), one of which was organised by the WHO with a special focus on health expectancy. Moreover, a methodological paper was published in Australia in a peer-reviewed journal (Cheung *et al.* 2001)

hospitalisation for the population is summed and divided by the total in the population to obtain the expected hospital days per capita.

Data for the mortality component is obtained from counts of the official mortality registrations. Both morbidity and mortality rates are calculated using as denominators census population counts (for census years) and inter-censual estimates. The quality of these sources of data was discussed previously in Chapter 4.

For each age group, age-specific rates for hospital discharges are combined with the age-group specific average lengths of hospital stay to calculate the period prevalence of hospital utilisation in the population. This set of period prevalence rates is then incorporated into the life-table using Sullivan's observed prevalence life-table method (Sullivan 1971). This allows the disaggregation of life-expectancy into time spent either in, or outside, public hospitals by survivors.

The key statistics derived from these two measures are based on the ratio of one to the other: the proportion of survivors who are in good health (or outside hospital), or conversely the proportion who are in poor health (or in hospital). Normally, the aim is to study the degree to which the population is in good health, and thus the first of these ratios is employed. In the present case, however, where we are interested in patterns and trends in hospital utilisation and also for methodological reasons explained below, the second ratio is more appropriate.

Building on the Sullivan's methods (Sullivan 1971) and conventional Health Expectancies, HUEs incorporate the period prevalence of hospital utilisation into a conventional life-table format by partitioning the person-year exposure (nLx) on the life-table into different states of hospital utilisation. The resultant HUE is defined as the "number of days while still surviving, that a person of a particular age can expect to spend in hospital" (Cheung 1999; Pool *et al.* 2002, Cheung *et al*. 2001). The same methodology can be extended to other population health variables, for example, time in a disabled state or on a benefit.

The number of days is selected as the unit of measurement because the results tend to be suppressed superficially to insignificance when expressed in number of years. Essentially, this reflects reality: few people spend a long period of their life in hospital, particularly at younger ages, but when they do so this is a major event that involves intensive use of resources. The focus is thus on the time spent in extreme ill-health, rather than on capturing durations spent in a state of positive health which is the normal focus of the general family of health expectancy methods.

7.3 PROPERTIES OF THE HOSPITAL UTILISATION EXPECTANCY INDEX

Like their parent health expectancy methodology, HUEs are empirically grounded and therefore not heavily dependent on assumptions, and this distinguishes them from both DALYs and QALYs, two other commonly used measures synthesising mortality and morbidity (Johnstone *et al.* 1998). As noted, health expectancies usually draw their empirical data from special surveys that yield standardised variables and are relatively cost-efficient. Thus they have been carried out in many countries including developing countries. Unlike health expectancies, however, HUEs use existing population-based discharge data that are collected routinely. This is a property that has major advantages, particularly the use of readily accessible data sets involving large numbers and going back decades, thus permitting time series analyses. For sub-national analyses such as the present study, this property is also very valuable, as there are sufficient numbers in cells to allow regional analyses spanning two decades. The inclusion of information on place of residence, socio-demographic characteristics and diagnosis of cause of hospitalisation means detailed studies at a lower level of aggregation are possible. Finally, because data sets already exist for hospital management purposes there is no need to collect information in special surveys. This is therefore a cost-efficient alternative.

Since numbers are typically small in sample surveys, health expectancies can only be satisfactorily computed for New Zealand as a whole and only for one point in time (1996/7). Only relatively few countries have sufficient data to calculate health expectancies over a period of time at the regional level. In New Zealand, HUEs have been taken back at a national level as far as 1951 (Pool *et al.* 2000; see also Chapter 1) but because of a lack of geo-coded data prior to 1978, this cannot be done at a regional level before that time.

There is one other very important difference between health expectancies and HUEs alluded to in the last paragraph: the difference between sample and population data. The use of population data for the HUEs means that numbers in the cells are typically very large and thus problems akin to sampling error are avoided. As we note, however, for smaller regions or for sub-populations this can become an issue. In addition, data are collected routinely so that cost is less of an issue.

Perhaps the most useful property of HUEs is that they combine both average length of stay per discharge and the total number of discharges, thereby increasing their analytical power and their utility for health services management because the results are not affected by problems of multiple admissions (Cheung 1999). Further, they are not compromised by the lack of National Health Index (NHI) numbers before 1988 or changes in the coding of inter-hospital and inter-specialty transfers

In countries where national population-based health statistics and survey-based estimates of health and disability status are rare or limited to certain districts/cities, the HUE even offers the potential for a reliable health status indicator (Pool *et al.* 2002). Analysis of HUEs by different discharge clusters can provide health planners with additional tools with which to identify opportunities for health gain (Portal 1999a, 1999b, 1999c and1999d). These studies, it should be noted, have also used HUEs at a sub-regional (hospital catchment) level and have been found to be robust. A limitation however is the quality of the hospital discharge data due to the changes in collection protocols over time and differences in their application between regions noted in Chapter 4. In this report and those noted above, the hospital data have been filtered so as to ensure comparability of the data over a 19 year period (see Chapter 4). In Chapter 14 we extend this to 2006. Because of this filtering, the HUEs reported exclude long-stay public hospital discharges. While the entire New Zealand hospital experience is thus not represented, the distorting effect of a relatively small number of very long durations is avoided.

As noted already, the private sector deals almost entirely with elective procedures, mainly surgical. While the admissions/discharges data are incomplete because private hospitalizations are not systematically included, the effect on results will be limited.

In addition, HUEs reflect not only health status (demand factors) but also health system (supply) factors. This property has both applications in and challenges for health systems research, as changes in the HUE can reflect both changes in health status and changes in the availability of health services in general and hospital beds in particular. This property is both an advantage and a limitation of HUEs, and the challenge is in unravelling these two sets of factors from each other (see Chapter 10).

7.4 GENERAL APPLICATIONS AND POSSIBLE EXTENSIONS

Beyond their analytical potential, HUEs are also useful tools for planning and monitoring. The ratio between HUE and life-expectancy can help to gauge the relative levels of hospital resource consumption after giving due attention to the levels of mortality. Furthermore, the series of probabilities drawn from HUE computations can be applied to cohorts through probability models, which incorporate both incidence and duration dimensions. The actuarial properties inherent in such models can then be used to construct an analytical framework, which is an essential step towards hospital management and financial planning.

At a policy level, the monitoring of population health trends is also greatly facilitated by time series data permitting the computation of HUEs (Pool *et al.* 2002). The most critical information will be the way in which the relationship between life-expectancy and HUE is changing.

As a health status measure, HUEs have particular value with respect to the ageing of the population. They permit the researcher to address some of the most important theoretical issues both for social determinants of health and for health systems analysis in developed countries. As discussed in Section 1.2.2 some population health experts argue that as survivorship improves this gain will not be accompanied by improved health status among survivors, and thus periods in poor health (or in hospital) will increase; others argue that the two will shift in tandem, while others again suggest that both death and poor health will be compressed into an increasingly narrow range of ages (Olshansky 1985, Manton *et al.* 1991, Fries 1989).

HUEs provide data that can contribute to these debates. Some of the most common issues are as follows:

- What are the implications of increases in longevity for the health system?
- What are the linkages between survivorship and good/poor health and are there different trajectories in the gaining of longevity?
- Will survivorship increase in a limited way, and the average duration spent in ill-health (disability = unable to perform certain functions) before death decrease (compression hypothesis)?
- Or will survivorship be extended significantly, yet the age at average onset of disability remains the same, thus extending ill-health (extension hypothesis)?
- Or will both be extended in tandem (hypothesis of dynamic equilibrium)?

These are the major underlying theoretical positions and they carry very different implications in terms of what might be the relative burdens imposed on health budgets. The Compression (Fries 1989) or dynamic equilibrium hypotheses (Manton *et al.* 1991) would be favourable for the provision of health care for the elderly. These hypotheses appear to describe what is emerging for mortality, at least in New Zealand (Pool 1994; Cheung 1999; Pool *et al.* 2002). If they were linked to decreased durations in states of poor health then this would mean lower demands for services and a better quality of life for surviving elderly. In contrast, the extension hypothesis implies greatly expanding costs with increased demands on resources and a reduction in quality of life. (Olshansky 1985). The health expectancy methods and thus HUEs have been developed in an attempt to provide planners with the tools to undertake theoretically robust yet empirically derived analyses which will give a sound evidence-base for service planning and for testing these alternative hypotheses. We will return to these issues in Chapter 14.

In this regard, HUEs throw new lights on these questions. Firstly, because time series analyses can be carried out with HUEs it is possible to examine directly changes over time and also to compare HUEs and life-expectancies (LEs). Secondly, HUEs relate to situations equivalent to the most severe level for HEs. Generally this severe level involves greater costs for the health system. Thus, patterns and trends in compression or extension, as demonstrated by HUEs, are indicators of shifts in the most costly areas of the health system.

7.5 CONCLUSION

Changes in hospitalisation patterns are a result of the interaction of five separate sets of factors: i) trends and patterns of demographic composition, ii) changes in population health, iii) shifts in policies associated with admissions and discharges, and related factors, iv) changes in health technology and procedures, and v) improvements in health care efficiency and effectiveness, such as increased use of primary and preventive care, thereby reducing the need for in-patient care. The latter four factors are successfully captured by the HUE, and combined with projected demographic changes, the HUE methodology can provide a very useful tool for service planning (see Portal 1999 a, b, c, d; which projects bed-days for the population of the central North Island).

It needs to be stressed, however, that HUE is not the only instrument of use in studying population health status. A more constructive approach will involve the analysis of HUE in conjunction with a range of other measures of population health as elaborated in earlier chapters in this report, and as shown by Cheung (1999) in his study of health patterns and trends of the non-Māori population.

CHAPTER 8

Hospital Utilisation Expectancies: National and Regional Analysis

8.1 INTRODUCTION

This chapter is the first of several to provide a synthesis of mortality and morbidity patterns afforded by the use of HUEs, as described in the previous chapter. These chapters attempt to answer some of the questions posed in Chapter One, questions which cannot easily be answered by the analysis of discrete factors such as morbidity or mortality alone. The results of national and regional HUE analyses for both Māori and Total populations are presented here and include a comparison of age-specific HUEs at three time-points in the period under study together with the contribution of expected hospital days at different ages to the total HUE(0).

Appendix tables provide the results for each region separately, along with a fuller region-by-region profile of demographic and health indices.

8.2 LIFETIME HOSPITAL UTILISATION EXPECTANCIES AT BIRTH (HUE (0))

National Trends
Over the period 1980-2000, the total number of days on average that New Zealanders could expect to spend in hospital over the course of their life-time decreased by 35 percent (from 79 days to 51) for males and by 39 percent (from 88 to 53 days) for females (see Table 8.1 and Appendix Table 8.1).

Table 8.1: HUE at Birth (Days), Health Regions and New Zealand, By Gender, Selected Years, 1980-2000

Region	Males						Females					
	1980	1985	1990	1995	2000	diff	1980	1985	1990	1995	2000	diff
New Zealand	**79**	**72**	**62**	**54**	**51**	**-28**	**88**	**81**	**67**	**56**	**53**	**-34**
Northland	87	84	64	46	48	-39	103	99	71	48	50	-53
Waitemata	52	49	48	46	49	-3	57	55	51	47	53	-4
Auckland Central	57	54	49	50	54	-3	58	55	48	50	55	-3
South Auckland	66	57	53	51	55	-11	64	60	56	54	56	-9
Waikato	88	74	61	51	50	-38	100	80	64	54	53	-47
BoP/Lakes	101	84	76	58	57	-44	111	93	77	62	59	-52
H. Bay/Tairawhiti	92	83	76	64	51	-40	104	102	84	69	50	-54
Taran./Wang./Man.	91	81	70	59	49	-41	107	96	78	61	52	-55
Wellington	77	81	62	54	43	-34	86	95	67	58	44	-42
Nelson-Marlb.	82	68	54	45	40	-42	92	80	59	45	42	-49
Central S. Island	82	77	66	53	57	-25	94	91	73	57	62	-32
Southern S. Island	86	75	70	61	50	-35	98	81	80	67	49	-49

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

The decrease in HUEs roughly followed the pattern of decrease in population-based hospital day rates except that this was mediated by life-expectancy changes over time. Figure 8.1a presents changes in standardised bed-day rates and life-expectancy at birth between 1980 and 2000, and Figure 8.1b shows HUE at birth and at 65 years for the same time period. As life-expectancy increased between 1980 and 2000, bed-days per capita declined. Longer life-expectancy results in a longer period 'at risk' of hospitalisation, so it could be expected that HUEs would increase over this period. However as is show in Figure 8.1b, increased life-expectancy was more than offset by declines in bed-days per capita, resulting in a decline in HUE at birth, and at age 65 years over the time period.

Figure 8.1a: Life-Expectancy at Birth (Years) and Standardised Bed-Days per Capita, By Gender, New Zealand, 1980-2000

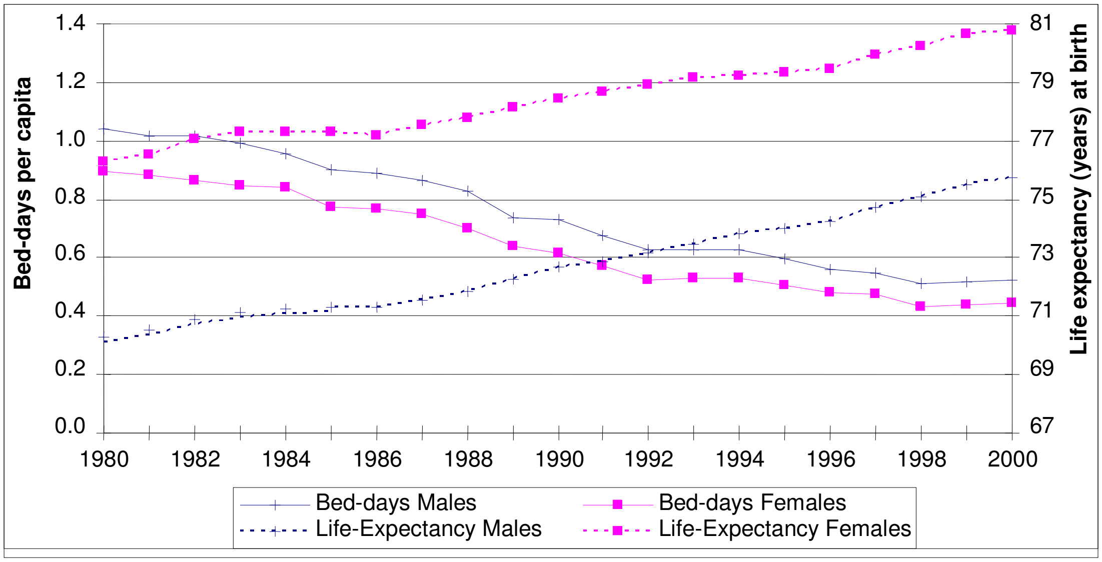
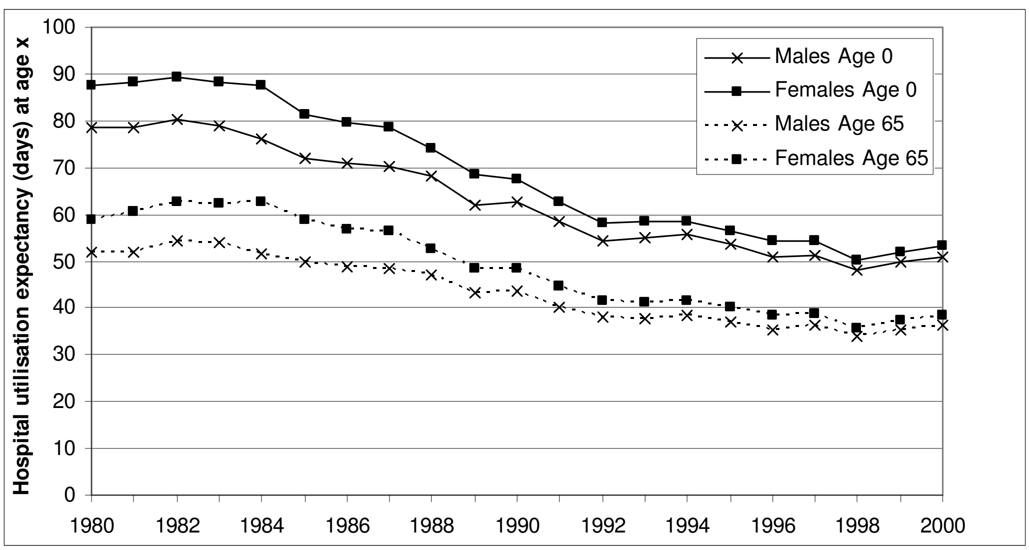


Figure 8.1b: Hospital Utilisation Expectancy at Birth (Days) and at Age 65 Years, By Gender, New Zealand



Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

During the years 1980 to 1984 there was minimal change in HUE(0), and this period was followed by another (1985-1992) in which there was a sustained decrease in HUE(0). The 1993-1996 period was characterised by a one day increase that was driven by a slight increase in e(0)s and by a temporary plateauing of bed-day rates. This was then followed by a decline in the HUE(0) until 1998 when there was a reversal.

In 1980, HUE at ages 65 years and over made up approximately two thirds of HUE over the lifetime (HUE(0)). By 2001, despite the converging of HUE for males and females and the considerable reduction in HUE at birth and at 65 years (down to about 50 and 40 days respectively), HUE(65) accounted for an even larger proportion, four fifths of the HUE at birth, indicating a compression of lifetime hospital use into the 65 and over age group. HUE at birth is thus clearly driven largely by hospital use at older ages, and much of the analysis in the remaining chapters will focus on what happens at older ages (see also Section 8.3 below).

Gender Differentials
The lifetime female HUE remained consistently above that for males. This is opposite to the trend found for the age-standardised hospital bed-days per capita where this measure for males was higher (see also Chapter 6.4.1). This reflects the effect of the longer life-expectancy of females giving them a greater period of exposure to the risk of being hospitalised. In 1980, the female HUE(0) was 11 percent higher than that for males but by 2000 the female HUE at birth was only 4 percent higher, showing that the gender disparity in HUEs had narrowed substantially.

Regional Differentials
Over the 1980-2000 period, in most regions, there were substantial annual decreases in hospital bed-day rates and increases in life-expectancy at birth. As has been mentioned, the increase in life-expectancy at birth was more than offset by decreases in bed-day rates, resulting in the lifetime hospital expectancies (HUE(0)) decreasing for all 12 regions, although the extent of the decrease varied from region to region (see Table 8.1). This widespread decrease was produced by the substantial decrease in the national HUE(0) for males and females, while regional variation in HUEs decreased, with the most rapid change occurring between 1985 and 1993 (see detailed data in Appendix 8.1).

Regional variations from the national HUE(0)s were less for males than females, so the convergence is more marked in the female figures. While female HUE(0)s were consistently higher than those for males, the male-female discrepancy declined over the time period in most regions.

In the early 1980s the 12 regions could be roughly divided into three groups according to their HUE(0) level relative to the New Zealand level:

1. **Hawke's Bay/Tairawhiti**, **Bay of Plenty/Lakes**, **Taranaki/Wanganui/Manawatu** and **Northland** which had HUE(0)s considerably higher than the New Zealand level.
2. **Wellington**, **Waikato**, **Southern South Island**, **Nelson/Marlborough** and **Central South Island** which were at about the New Zealand level.
3. The **Waitemata**, **Auckland Central** and **South Auckland** which had HUE(0)s much lower than the New Zealand level.

Convergence of the regions in the first group towards the New Zealand level over time was very marked.

- **Northland** HUE(0) reduced substantially to well below the national level in the early 1990s but finished just below.
- **Hawke's Bay/Tairawhiti** maintained the highest HUE(0) level from 1988 to 1997 ending at about the New Zealand level.
- At the end of the review period measures for **Taranaki/Wanganui/Manawatu** HUE(0) finished at around the New Zealand level and **Bay of Plenty/Lakes** just above.

The regions in the second group displayed a variety of patterns.

- **Nelson/Marlborough** started just above the New Zealand level and from 1988 reduced steeply to the lowest position relative to other regions. By 2000, HUE(0)s were 21 percent and 20 percent lower than the national levels for males and females respectively.

- In the late 1990s the **Wellington** region HUE(0) dropped relative to the New Zealand level finishing below with the lowest female HUE(0).
- **Waikato, Central South Island** and **Southern South Island** started just above New Zealand finishing with **Waikato** and **Southern South Island** around New Zealand level and **Central South Island** above New Zealand level.

The third group, comprising the three regions in the Auckland area, is characterised by extremely low HUE(0) levels relative to the New Zealand level in the early to mid-1980s.

- Unlike the other regions, the absolute levels changed little over the period. **South Auckland** HUE(0) converged towards the New Zealand levels in the mid 1990's, and finished just above.
- From 1993, **Auckland Central** levels increased in absolute and relative terms to end at a level above that for New Zealand.
- **Waitemata** remained below the New Zealand level but by a much smaller margin.

8.3 CONTRIBUTION OF VARIOUS AGE GROUPS TO LIFETIME HOSPITALISATION EXPECTANCY

Table 8.2 shows the proportionate contribution of different age groups to the total lifetime HUE. More than half the total hospital bed-days that a person can expect to spend over a lifetime are likely to occur after the age of 65 (Appendix Table 8.2 shows detailed age groups). This percentage has increased over time with the contribution for males going from 48 percent in 1980 to 59 percent in 2000 and that for females 56 percent in 1980 to 64 percent in 2000.[31] The proportional contribution to the total lifetime HUEs by the 75-84 years, 85 years and over have increased significantly, as has that for the under 1 year age group. Infants (under one year for both genders) and males 85 years and over were the only categories to show increases in the actual number of bed-days contributed to the total HUE. The percentage contribution to total HUE(0) for the remaining age groups declined, with ages 15-44 and 45-64 years having the greatest reduction in percent contribution. Because of the importance of hospitalisation of older people, trends and differentials in the numbers of days expected to be spent in hospital after age 65 are presented in the next section. In Chapter 9 further disaggregation by age group is considered.

Table 8.2: Absolute Contribution (%)[32] of Age Groups to Lifetime Hospital Utilisation Expectancy, New Zealand, 1980, 1990 and 2000

Age Groups (yrs)	Males			Females		
	1980	**1990**	**2000**	**1980**	**1990**	**2000**
Under 1	2.9	4.7	6.9	2.3	3.8	5.6
1-14	6.7	5.4	4.4	4.4	3.9	3.3
15-44	16.5	14.0	11.5	16.0	11.9	10.1
45-64	25.8	21.9	18.6	21.3	18.9	16.9
65-74	22.7	22.4	21.6	18.8	19.1	18.6
75-84	19.4	22.6	24.5	24.2	25.7	26.0
85+	6.1	9.0	12.6	13.0	16.8	19.4
Total	100.1	100.0	100.1	100.0	100.0	99.9

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

[31] It must be stressed that these data are filtered and exclude maternity cases, so this decline is real and not a function of decreased confinement rates.
[32] The contribution each age group's hospitalisations had to the overall HUE.

8.4 HOSPITAL UTILISATION EXPECTANCY AT AGE 65 YEARS (HUE (65))

National Trends

Over the period 1980-2000, the number of days, on average, that New Zealanders at age 65 years can expect to spend in hospital over the rest of their lives decreased by 30 percent (from 52 days to 36 days) for males, and by 35 percent (from 59 to 38 days) for females (see Table 8.3 and Appendix Table 8.2). The percentage decrease in the expected number of days to be spent in hospital at age 65 (HUE(65)) was slightly lower than the number expected at birth (HUE(0)) showing that greater decreases occurred among younger people.

The early 1980s were characterised by a small increase in HUEs at age 65 years. This was due to relatively stable hospital day rates at older ages but in conjunction with an increase in life-expectancies. The net result was that the period of exposure to the risk of hospitalisation has increased, while the discharge rates remained the same. From 1985, the HUE (65) decreased more or less continuously until 1998, except for a flattening of the curve between 1992 and 1994, but there was a slight increase from 1998 to 2000. The 5-year period from 1987 to 1992 was a period of substantial decrease, accounting for two thirds of the total decrease in HUEs over the entire 20-year period. As already noted, HUEs at the age of 65 years accounted for over half of the HUE at birth, for both females and males.

Table 8.3: Hospital Utilisation Expectancies (Days) at Age 65 Years, By Gender and Region, Selected Years, 1980-2000

Region	Males						Females					
	1980	1985	1990	1995	2000	diff	1980	1985	1990	1995	2000	diff
New Zealand	**52**	**50**	**44**	**37**	**36**	**-16**	**59**	**59**	**48**	**40**	**38**	**-21**
Northland	54	60	43	28	31	-23	67	68	51	31	33	-35
Waitemata	35	33	34	32	37	2	37	40	36	33	41	3
Auckland Central	30	32	31	34	38	8	30	34	32	36	41	11
South Auckland	38	37	35	35	38	-1	38	41	38	37	39	1
Waikato	63	52	41	35	34	-28	67	57	45	38	36	-31
BoP/Lakes	62	54	51	40	39	-23	73	62	50	43	42	-30
H. Bay/Tairawhiti	58	54	51	43	37	-21	68	75	61	50	35	-32
Taran./Wang./Man.	62	56	47	41	34	-28	76	69	55	44	37	-40
Wellington	56	62	44	38	31	-25	63	75	52	42	32	-31
Nelson-Marlb.	51	44	35	31	27	-24	61	56	42	32	31	-31
Central S. Island	59	59	51	38	43	-16	70	72	56	41	47	-24
Southern S. Island	56	50	51	44	36	-20	65	55	58	47	35	-29

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Gender Differentials

The female HUE at age 65 years was consistently above that for males. In 1980 female HUEs were 13 percent higher than those for males. By 2000, the female HUE at age 65 years (37 days) was only 6 percent higher than that of the male HUE (35 days) showing that, as with HUE(0), the gender disparity in HUE had narrowed substantially.

Regional Differentials

The Hospital Utilisation Expectancy at age 65 years decreased over time for 9 out of 12 regions with the three Auckland regions being the exception. The relative rankings of the regional HUE(65) are similar to those for HUE(0) with the following exceptions (see Table 8.3 and Appendix Table 8.3):

- Females in **Central South Island** had mid-level HUE(0) rankings across the entire period, whereas HUE(65) rankings were very high throughout.

- **Northland'**s HUE(65) was closer to the New Zealand average than HUE(0) early in the period, and (as with HUE(0)) saw a decline over the time period, dropping to below the New Zealand average by the 1990s. This decline in HUE(65) was probably a function of in-migration of well-off retired persons (Lepina and Pool 2000).

8.5 HOSPITAL UTILISATION EXPECTANCIES BY ETHNICITY

8.5.1 Lifetime Hospital Utilisation Expectancies at Birth (HUE (0))

Of the various health indices presented in this report HUEs will be most affected by the issues surrounding Māori data noted in Chapters 3 and 4. This is because the HUE is reliant on three separate sources of data whereas mortality measures such as life-expectancy rely on only two sources. Due to this, the results presented here should be viewed as indicative rather than definitive. Because numbers are small variance could also be a function of random statistical effects rather than real differentials. To limit this effect, larger regional groupings were used in order to dampen random statistical variations. However, as presented in the last section and previous chapters, there is substantial regional variation in health measures, and an uneven distribution of Māori population between regions. Thus differences between Māori and total population HUEs could be partly an artefact of region of residence and must therefore be interpreted carefully. Because of smaller numbers and similar data issues, Pasifika and Asian HUEs are fraught with far greater problems than for Māori, and thus no regional analysis is undertaken here. As with the other indicators analysed earlier in this report the South Island has been excluded from the analysis because of small Māori numbers.

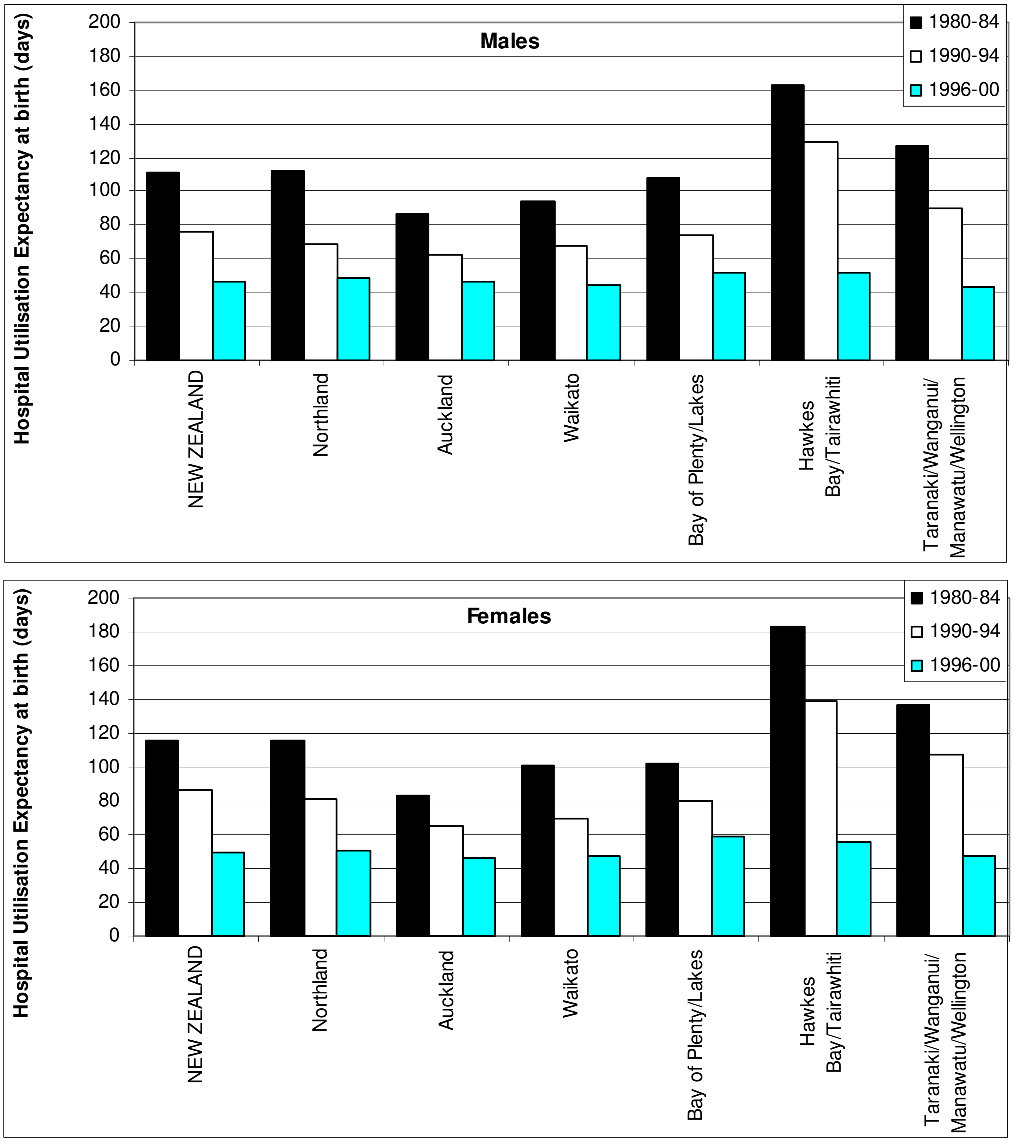
The results relate to the socio-cultural Māori population (except for 1981) as explained in Chapters 3 and 4 (the alternative sole Māori population denominator for 1990-94 shown in Appendix Table 8.4). Figure 8.3 and Appendix Table 8.4 show national and regional Māori HUEs at birth for the 1980-84, 1990-94 and 1996-2000 periods.

There is considerable variation in Māori HUEs between regions, some of which could be an artefact of different practices in the coding of ethnicity, for mortality data as well as hospital discharge data. Caveats about variable data quality aside, however, there is a clear indication that Māori HUEs at birth are initially substantially higher than HUEs for the total population of New Zealand (see Table 8.3). In this regard, this involves higher bed-day rates in the context of lower survivorship, although by 1996-2000 the Māori HUE is lower than that for the total population. This is discussed in further detail later on.

Regionally, in 1980-84 and 1990-1994 Māori HUEs were higher than the total HUEs for all regions. In 1996-2000 the opposite occurred with most regions having a higher total than Māori HUE, the exceptions being **Northland**, both genders, and **Hawke's Bay/Tairawhiti** (females only). [33]

[33] Data problems may account in part for the extremely high HUEs seen for the Hawke's Bay/Tairawhiti region. The male-female HUE discrepancy for this region is also very wide for 1980-1984. This gap was not apparent in1996-2000. All this indicates that data quality and quantity has a greater effect on Māori HUEs than on those for the total population making direct comparisons more difficult.

Figure 8.3: National and Regional Māori Hospital Utilisation Expectancies at Birth (Days), By Gender and Larger Health Regions, Selected 5-Year Averages, 1980-2000



Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

8.5.2 Hospital Utilisation Expectancy at Age 65 Years (HUE(65))

Elderly Māori, (both genders and all regions) at the beginning of the period could expect to spend longer in hospital than the Total elderly population (see Table 8.4). However, as with HUE(0), HUE(65) for Māori decreased so markedly that by the end of the 1990s they were lower than those for the total population, both nationally and regionally. In general, both Māori and Total population in the **Auckland** and **Waikato** had the most favourable HUE(65)s, and those in **Hawke's Bay/Tairawhiti** and **Bay of Plenty/Lakes** the least favourable. Both groups of elderly in **Manawatu/Wellington** showed dramatic improvements in this measure, being above the national levels at the start of the review period but below this benchmark at the end. This synchronicity between Māori and total population in regional trends may in part be explained by variations in provision of services for the elderly.

Table 8.4: Māori and Total Population Hospital Utilisation Expectancy (Days) at Age 65 Years (Hue (65)), By Gender and Larger Health Regions, Selected 5-Year Averages, 1980-2000

Māori Population

Region	1980-84[34]		1990-94[35]		1996-2000[36]	
	Males	Females	Males	Females	Males	Females
NEW ZEALAND	**111**	**115**	**77**	**86**	**46**	**49**
Northland	112	115	69	81	49	51
Auckland Metro	87	83	63	65	47	46
Waikato	94	101	68	70	44	48
The Bay of Plenty/Lakes	108	102	74	80	52	59
Hawke's Bay/Tairawhiti	163	183	129	139	52	56
Taranaki/Wanganui/ Manawatu/Wellington	127	137	90	107	43	47

Total Population

Region	1980-84		1990-94		1996-2000	
	Males	Females	Males	Females	Males	Females
NEW ZEALAND	**79**	**89**	**58**	**62**	**50**	**53**
Northland	91	109	57	63	47	48
Auckland Metro	57	60	48	50	50	52
Waikato	85	97	57	61	48	53
The Bay of Plenty/Lakes	97	112	67	72	55	58
Hawke's Bay/Tairawhiti	97	108	71	76	54	56
Taranaki/Wanganui/ Manawatu/Wellington	84	100	61	65	48	51

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

8.6 CONCLUSION

One of the key features of how HUEs behave with respect to their underlying components is illustrated by the findings for males and females. Despite males having characteristically lower LE (due to higher male mortality) and higher hospital bed-day rates, male HUEs are consistently lower than those of females. This highlights the fact that, on a population base, males can expect to spend fewer days in hospital because they have less opportunity to be hospitalised than females, a function of their shorter life-expectancy. The narrowing of differences in both male and female mortality and hospitalisation accounts for the narrowing of gender-specific HUEs.

The unexpectedly low Māori HUE seen in 1996-2000 could be interpreted in many ways. It could be related to Māori having lower life-expectancy even though the bed-day rate is higher,[37] however evidence in Chapter 6 found that age-standardised bed-day rates per capita for Māori , while above those seen for the total population, were declining over this period (see Table 6.5). Alternatively it may be a factor of declining Māori bed-day rates per capita regardless of life-expectancy, a 'real' improvement in health. However supply and demand factors must be considered when interpreting HUEs in relation to health outcomes. The low Māori HUEs may be an artefact of the ethnicity coding, or a further possibility is that they are a result of the spatial distribution of Māori in New Zealand. It could be that Māori disproportionately live in areas with either low demand for, or poor supply of hospital services.

[34] 1981 59% or more Māori population is used as denominator
[35] 1991 socio-cultural Māori population is used as denominator
[36] 1999 estimated by linear interpolation using the socio-cultural Māori population at the 1996 and 2001 censuses
[37] Research in progress by Ian Pool on the relationship between HEs and cohort survivorship is relevant here. Māori and non-Māori HEs at older ages vary little, but Māori survivorship to these older ages is much lower (Pool 2009).

This example illustrates an important point. HUEs can be low as a result of both high levels of mortality and low levels of hospitalisation and therefore reflect both. Thus, such HUEs are a measure that truly combines health status and hospital utilisation, and as such need to be interpreted with reference to health status and utilisation. They do not summarise either component on their own. Interpretation of HUEs and disaggregation of the supply and demand factors that influence them are discussed further in Chapter 10.

The relatively stable HUE(0) in the early 1980s is a function of decreasing mortality (as measured by age-standardised rates) in conjunction with the slight drop in bed rates occurring at the time. The corresponding HUE(65) which increased slightly from 1982 to 1983 is due to the slight increase in bed-day rates for people 75 years and over, in conjunction with constant LE(65).

The results presented support the Fries hypothesis of increasing longevity accompanied by decreasing morbidity. A combination of rapid decreases in the hospital bed-day rates (age-standardised) and constant decreases in mortality (corresponding to a substantial increase in life-expectancy at birth especially from 1986 to 1991) accounts for the significant drop in HUE(0) in the 1984-1992 period. This indicates that despite the increased period at risk of being hospitalised, the age-specific decrease in hospital bed-day rates more than offset this, leading to an overall decline in lifetime HUE. The slightly less dramatic decrease in HUE(65) during this period is due to the larger survivorship gains made in the age groups under 65 years. The gradual but constant further decrease in HUE(0) and HUE(65) from 1992 to 1998 reflects the continuing declines in both mortality and bed-day rates during that time. The slight increase in HUE(0) and HUE(65) between 1998 and 2000 is a function of the still increasing life-expectation yet stabilisation of bed-day rates.

Thus the substantial reductions in HUEs over the 21 years can be explained by changes in health status as reflected in mortality patterns (and thus LEs) and hospital utilisation. The latter, in turn, was also influenced by significant changes in clinical and hospital management practices driven by political, economic and technological transformations. In general, as will be shown in the next chapter, the percentage reduction in HUE was greater for younger than older people. This was because improved life-expectancy for older people meant that this, paradoxically, extended the length of time they were at risk of hospitalisation. In contrast, for younger people most longer-term improvements in survivorship had been achieved by the 1980s, and thus their HUEs were most affected by hospitalisation.

This chapter has highlighted the importance of looking at HUEs at different ages, and the large contribution of hospitalisation at older ages to lifetime HUEs. The next chapter looks at this in more detail, investigating trends in HUEs for different stages of the life-cycle. Chapter 10 and those following then attempt to tease out the contributing influences of supply and demand on HUE levels and discusses interpretation in greater depth.

CHAPTER 9

Life-Cycle Stages and Hospital Utilisation Expectancies

9.1 INTRODUCTION

In order to provide a perspective on the relative contributions of different life-cycle stages to the HUEs and to changes in these over time, it was decided to split the HUE into age group specific HUEs, that we have termed 'tranches'. The notion and methodology resemble what is termed in the literature 'local' life-expectation (Keyfitz 1977, 1982), or a computation of life-expectation covering only part of the age-distribution. However, given that this monograph refers to regions, and as the word 'local' could be seen as geographical rather than a section of the age-pyramid, we picked a more apt alternative 'tranche' used widely in the finance industries to refer to a portion or 'slice' (as in French).[38] It should be noted that a tranche HUE is not the same as an age-specific rate spanning a wide range of ages. Whereas an age-specific rate of this sort would be subject to composition effects, the partial life-table methodology eliminates these.

Thus a tranche HUE is a segmented component of the overall HUE, but as used here covers age-spans of varying length. For example, the tranche HUE for 0-14 years shows the expected duration of hospitalisation for anyone surviving the 15 years of that life-cycle stage; the tranche 15-44 years is based on the probability of a person having reached age 15 years, and the number of days they will then be expected to spend in hospital over the 30 year duration spanning ages 15 to 44 years; and so on. In this chapter trends in national and regional tranche HUEs coving the whole life-cycle for Māori and the total population are presented, followed by an analysis of cohort trends in tranche HUEs. As for other analyses of HUEs these are period tables, relating to synthetic cohorts, and thus do not refer to time cohorts. But at the end of this chapter we turn to time cohort analysis.

9.2 TRANCHE HUEs

9.2.1 The Tranche Spanning 0-14 Years of Age

National Trends
For New Zealand as a whole, in 1980 males would expect to spend on average 7.6 days in hospital in the period between birth and age 14, while for females it would be 5.9 days (see Table 9.1). Both male and female levels have declined over time, but modestly, with the gender gaps narrowed, so that by 2000 the hospitalisation expectancy for males in this period of their lives had dropped to 5.8 days and that for females 4.8 days, a more modest decline.

This decline is made up of two opposing trends. Neonatal care made great strides over this period, with greatly improved survival at the cost of extended hospital stays for some infants. Older children have had rapidly reducing hospital stays, with a paediatric community firmly of the view that hospitals are not good places for children and their exposure should be minimised. For example, the average length of stay for children aged 0-14 (excluding neonates) was 1.4 days in 2006.

Regional Trends and Differentials
The national trend was accompanied by regional convergence. The ranges across the regions for this tranche HUE reduced considerably. In 1980, for males the range was between 5.2 and 11.2 days; but by 2000 it had decreased to between 3.7 and 7.1 days. There was a similar trend for females.

- While there was some fluctuation in the relative ranking of the regions over the period, the trends were relatively consistent with higher values being found systematically in **Northland**, **Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti.**

[38] "Chiefly *Econ*. A portion of something, esp. of income: a block of shares or of government stock" (OED 1993 v2:3365).

- Lower values compared to New Zealand as a whole were found in **Waitemata** and **Central South Island.**
- In 2000 this tranche HUE rate for **Nelson/Marlborough** was much lower than those for other regions in New Zealand.

Table 9.1: Tranche Hospital Utilisation Expectancy (Days) at 0-14 Years By Gender, New Zealand and Regions, 1980, 1990 and 2000

Region	Males			Females		
	1980	1990	2000	1980	1990	2000
NEW ZEALAND	**7.6**	**6.3**	**5.8**	**5.9**	**5.2**	**4.8**
Northland	8.5	7.2	7.1	5.9	5.9	5.6
Waitemata	5.2	5.3	5.1	4.0	4.0	4.5
Auckland Central	8.4	6.3	6.9	7.7	5.5	5.3
South Auckland	7.7	5.7	6.2	6.4	5.3	5.0
Waikato	8.0	6.7	5.7	6.2	5.0	5.0
Bay of Plenty/Lakes	10.8	8.4	6.1	7.8	7.3	5.3
Hawke's Bay/Tairawhiti	11.2	8.7	6.0	9.1	7.0	4.8
Taranaki/Wanganui/Manawatu	7.4	6.9	5.7	5.8	5.2	4.9
Wellington	7.1	6.2	5.1	5.2	5.1	4.1
Nelson-Marlborough	7.1	4.5	4.9	5.0	4.2	3.9
Central South Island	5.7	4.4	5.1	4.3	4.1	4.5
Southern South Island	6.8	6.4	5.8	5.0	4.4	4.2

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

9.2.2 The Tranche Spanning 15-44 Years of Age

National Trends
For New Zealand as a whole in 1980 females could expect on average to spend 14.2 days in hospital between the ages of 15 and 44 years while for males this was 13.2 days (see Table 9.2). By 2000, the values for males were slightly higher than those for females (6.0 days and 5.8 days respectively). However, over the period 1980 to 2000 this HUE for both males and females had dropped by over half, indicating a major reduction in hospitalisation levels.

Regional Trends and Differentials
Similarly there was a reduction in all the regions. However, regionally there has also been a considerable range in this measure, from 8.1 (**Waitemata**) to 19.1 days (**Bay of Plenty/Lakes**) for males in 1980, although this had reduced by 2000 to 4.5 (**Waitemata)** and 7.9 days (**Northland**). There was a similar shift for females.

- Throughout the period 1980 to 2000 **Waitemata** had amongst the lowest values.
- **Bay of Plenty/Lakes** maintained high levels. Other regions with consistently high levels were **Hawke's Bay/Tairawhiti** and **Northland.**
- The most dramatic decline was seen in **Nelson/Marlborough** which had been among the highest in 1980 but was amongst the lowest in 2000.

Table 9.2: Tranche Hospital Utilisation Expectancy (Days) at 15-44 Years By Gender, New Zealand and Regions, 1980, 1990 and 2000

Region	Males			Females		
	1980	1990	2000	1980	1990	2000
NEW ZEALAND	**13.2**	**8.9**	**6.0**	**14.2**	**8.1**	**5.8**
Northland	17.3	10.1	7.9	19.7	9.3	7.8
Waitemata	8.1	6.5	4.5	8.9	5.6	4.4
Auckland Central	10.5	7.2	5.6	11.7	5.6	4.4
South Auckland	11.9	8.5	7.9	11.4	6.9	6.2
Waikato	13.4	8.5	7.2	15.9	8.3	6.3
Bay of Plenty/Lakes	19.1	11.9	7.6	19.4	10.8	6.8
Hawke's Bay/Tairawhiti	16.7	11.6	7.0	18.3	10.4	5.7
Taranaki/Wanganui/Manawatu	15.1	11.6	6.2	16.2	10.8	7.1
Wellington	11.8	8.0	4.6	12.8	7.4	4.6
Nelson-Marlborough	16.0	10.2	5.2	14.9	7.5	7.2
Central South Island	12.6	8.0	5.5	13.4	7.7	6.2
Southern South Island	15.0	9.5	5.1	17.0	10.3	6.7

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

9.2.3 The Tranche Spanning 45-64 Years of Age

National Trends

As is seen in Table 9.3 for New Zealand as a whole in 1980, men who reached age 45 years were likely to spend 21.8 days in hospital before they turned 65, but this had more than halved to 10.0 days by 2000. A similar decrease was seen for women over the review period, with durations dropping sharply from 1980 levels of 19.5 days to 9.2 days by 2000.

Regional Trends and Differentials

A similar trend of decline for both males and females was seen in all regions, but to varying degrees. The ranges across the regions also reduced considerably; for example, for males it had been 13.6 to 29.4 days in 1980, but by 2000 it was 8.1 to 12.8 days.

- The values for the **Waitemata** region were extremely low throughout the period, although on a par with **Nelson/ Marlborough** and **Wellington** by 2000.
- Areas with generally higher levels throughout the period were **Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti**, **Waikato** (females), and **Taranaki/ Wanganui/Manawatu** (females for all three years).

Table 9.3: Tranche Hospital Utilisation Expectancy (Days) at 45-64 Years By Gender, New Zealand and Regions, 1980, 1990 and 2000

Region	Males			Females		
	1980	1990	2000	1980	1990	2000
NEW ZEALAND	**21.8**	**14.6**	**10.0**	**19.5**	**13.2**	**9.2**
Northland	24.5	15.6	9.9	23.0	13.7	9.9
Waitemata	13.6	9.7	8.1	12.3	9.5	7.2
Auckland Central	17.8	12.2	9.9	15.0	10.0	8.8
South Auckland	20.2	13.2	10.9	16.7	12.5	10.5
Waikato	22.1	15.0	10.1	23.4	13.6	10.4
Bay of Plenty/Lakes	29.4	18.2	12.8	25.2	18.5	11.8
Hawke's Bay/Tairawhiti	26.1	19.0	10.3	22.5	16.8	9.4
Taranaki/Wanganui/Manawatu	24.9	16.9	10.5	23.7	16.1	9.5
Wellington	19.5	15.0	8.3	17.0	11.6	7.5
Nelson-Marlborough	21.8	11.2	8.3	20.0	11.0	6.9
Central South Island	22.4	14.1	10.6	18.9	12.2	10.0
Southern South Island	25.1	16.8	10.1	23.5	15.8	8.8

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

9.2.4 The Tranche Spanning 65-84 Years of Age

National Trends

At 65 t0 84 years, there was a decrease by a third or so in the number of days expected to be spent in hospital in the years between ages 65 and 85, as can be seen in Table 9.4. For New Zealand as a whole, in 1980 males and females having reached 65 would each expect to spend around 45 days in hospital before age 85. By 2000 this had dropped to around 27 days (slightly higher for males) – a reduction of some 18 days in expected bed-days.

Regional Trends and Differentials

The range in hospitalisation expectancies across the regions reduced considerably over the period particularly for males. For example, in 1980 the range was 27.1 to 54.4 days and by 2000 the range was 21.8 to 32.4 days. But of interest is that the pattern of decreases varied between regions with some stabilising, or even increasing, between 1990 and 2000. For others, decreases occurred over both decades.

- In 1980 the three **Auckland** regions had the lowest levels of all the regions, but by 2000 they had ceded place to **Nelson/Marlborough**. The **Auckland** regions have not shown as large a reduction between 1980 and 2000 as those seen for the other regions, with **Auckland Central** actually showing a slight increase. However other studies have found that **Auckland** was underserviced in 1980, increasing to more or less equitable levels by 2000, so this rise may represent an increase in supply to meet demand rather than an increase in demand (health effects) over this period.
- **Hawke's Bay/Tairawhiti, Taranaki/Wanganui/Manawatu, Waikato** and **Bay of Plenty/ Lakes** (males) all had relatively high levels in 1980. In contrast, convergence towards the national level is evident by 2000.

Table 9.4: Tranche Hospital Utilisation Expectancy (Days) at Ages 65-84 Years, By Gender, New Zealand and Regions, 1980, 1990 and 2000

Region	Males			Females		
	1980	1990	2000	1980	1990	2000
NEW ZEALAND	**45.5**	**36.3**	**28.4**	**45.2**	**35.3**	**26.8**
Northland	48.7	36.0	24.6	51.9	36.9	22.2
Waitemata	30.0	27.7	27.7	27.6	26.4	27.4
Auckland Central	27.1	27.5	29.8	25.6	23.8	27.8
South Auckland	33.9	29.6	29.2	31.4	28.5	27.3
Waikato	54.0	35.1	27.7	51.0	33.5	25.1
Bay of Plenty/Lakes	53.6	42.4	31.4	54.2	39.2	28.0
Hawke's Bay/Tairawhiti	50.3	41.0	29.3	52.9	43.2	26.7
Taranaki/Wanganui/Manawatu	54.4	39.8	27.2	55.6	39.5	26.7
Wellington	48.1	36.3	24.0	46.8	35.9	22.4
Nelson-Marlborough	45.9	29.4	21.8	48.8	30.1	21.4
Central South Island	51.3	41.4	32.4	52.8	39.9	31.6
Southern South Island	49.9	42.4	29.4	51.8	43.3	26.2

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

9.3 TRANCHE HOSPITAL UTILISATION EXPECTANCIES BY ETHNICITY

National Trends

Regardless of the definition used for Māori, their tranche HUEs are generally above those of the total population for all age groups, except 1996-2000 when Māori tranche HUEs dropped below those of the Total population as is shown in Table 9.5. This reflects, the decline in HUE(0) and HUE(65) for Māori discussed in the last chapter, dropping below total population HUEs in 1996-2000. However, the effect seen when HUEs are broken into tranches is less extreme. The biggest difference between Māori and total population tranche HUEs is seen for the span between 45 and 64 years of age. There was, however, a decline in levels throughout the period for Māori at every age group, particularly between 1980-84 and 1990-94. Thus the decline in hospital utilisation among Māori reflected the overall reduction seen in the Total population. Over the entire period, 1980-1984 to 1996-2000 tranche HUEs for the majority of age groups for both populations were more than halved, with the largest reductions occurring for the tranche spanning the younger working ages of 25 to 44 years, particularly for Māori.

Table 9.5: Tranche Hospital Utilisation Expectancies (Days) for Māori and Total Population, By Gender and Region, 1980-1984, 1990-1994 and 1996-2000

Tranche Age Groups (years)	Māori			Total		
	1980-84	1990-94	1996-00	1980-84	1990-94	1996-00
Males						
0-14	13	7	5	8	6	6
15-44	23	11	8	13	8	6
45-64	39	24	17	21	13	10
65-84	62	44	27	46	34	28
Females						
0-14	10	5	4	6	5	5
15-44	23	11	7	13	7	6
45-64	36	24	16	19	12	10
65-84	59	41	27	47	32	27

Regional Trends and Differentials

- The regional tranche HUEs in Table 9.6 show that those for **Hawke's Bay/Tairawhiti** for all ages and both genders were consistently and substantially above those for New Zealand level and are exceptionally high at older ages, particularly in the two earlier periods, but by 2000 these had converged with national levels.
- In the two earlier periods **Bay of Plenty/Lakes** region and **Northland**, have higher levels at younger ages, but below the national level at the oldest ages. However this pattern is reversed in the most recent period. This raises questions about access, because these regions have disproportionate numbers of younger, less well-off Māori, and in-flows of better-off Pakeha retirees.
- Regions in the **Lower North Island** are generally also lower at younger ages and higher at older ages for both genders until the most recent period when there is convergence with the national pattern.
- In all periods and all age groups levels for Māori in the **Auckland metropolitan** region are below those for New Zealand as a whole.

Table 9.6: Tranche Hospital Utilisation Expectancy (Days) for Māori, By Age and Gender, New Zealand and Regions, 1980-2000

Region	Males			Females		
	1980-84*	**1990-94****	**1996-00*****	**1980-84***	**1990-94****	**1996-00*****
	0-14 years					
NEW ZEALAND	13	7	5	10	5	4
Northland	17	8	7	12	7	5
Auckland	12	6	5	10	5	4
Waikato	12	7	6	9	5	5
Bay of Plenty/Lakes	15	9	6	11	7	5
Hawke's Bay/Tairawhiti	18	11	7	14	8	6
Taranaki/Wanganui/Manawatu/Wellington	12	6	5	9	4	3
	15-44 years					
NEW ZEALAND	23	11	8	23	11	7
Northland	27	13	11	29	13	9
Auckland	20	9	8	19	9	7
Waikato	20	12	8	21	11	7
Bay of Plenty/Lakes	26	14	10	26	13	9
Hawke's Bay/Tairawhiti	30	15	10	29	13	9
Taranaki/Wanganui/Manawatu/Wellington	21	11	7	23	11	7
	45-64 years					
NEW ZEALAND	39	24	17	36	24	16
Northland	39	24	19	35	26	16
Auckland	30	22	16	29	22	16
Waikato	37	23	17	36	22	17
Bay of Plenty/Lakes	39	25	19	35	26	21
Hawke's Bay/Tairawhiti	52	30	18	48	28	17
Taranaki/Wanganui/Manawatu/Wellington	43	25	16	39	25	15
	65-84 years					
NEW ZEALAND	62	44	27	59	41	27
Northland	56	41	27	60	40	29
Auckland	45	33	27	35	31	25
Waikato	56	41	25	53	35	25
Bay of Plenty/Lakes	55	41	30	49	39	31
Hawke's Bay/Tairawhiti	99	69	33	85	60	31
Taranaki/Wanganui/Manawatu/Wellington	74	47	24	79	43	26

*1981 50% or more Māori population is used as denominator. **1991 socio-cultural Māori population is used as denominator. ***1996-2000 population estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

9.4 REGIONAL DISSIMILARITIES IN THE CONTRIBUTION OF TRANCHE CHANGES TO OVERALL SHIFTS, TOTAL POPULATION

Chapter 8 showed there was a marked convergence in HUEs at various exact ages (birth, 65 years) over the reference period. The tranche analysis above (9.2- 9.3) raises a new question. What was the net effect of variations across all regions; that is, to what extent did overall variance in tranche HUEs produce differences between regions?

9.4.1 The Net Effects of Variance: Dissimilarity

The question noted above is analysed using conventionally computed indices of dissimilarity.[39] In order to give consistent weightings to each tranche, and to increase the number of observations so as to give the analysis more statistical power, the indices were computed for 5 year age groups covering the 18 age spans running from 0-4 years to 85+ years rather than the tranches employed earlier.

The dissimilarity index is based around deviations in any direction regardless of sign, from the New Zealand figure. The sum of the deviations is then divided by two, as is prescribed by the formula. This index shows the strength of deviations.

As a further step, the number of differences above or below New Zealand was computed, giving a theoretical range from minus 9 (in which case all the tranche HUEs for the reference region fell below those for New Zealand; that is, the region was favoured in terms of health), to plus 9 (HUEs systematically above NZ, thus showing a region severely disadvantaged across all ages by comparison with New Zealand). This latter index thus extends the dissimilarity analysis by showing the direction of differences. Most regions cluster at +5/-5deviation units, but there are some extreme values (see Table 9.7).

Over the time period the variation from the New Zealand level has reduced considerably, so that by 2000 there was little variation. There had been marked deviation from the New Zealand levels in either direction in 1980, with **Auckland Central** and **Waitemata** showing the greatest differences. By 1990, variations from New Zealand had reduced, although dissimilarities still remained higher than they were to become by 2000.

- Other regions with moderately high levels of variation (as shown by the dissimilarity index) in 1980 were **Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti**, **Taranaki/Wanganui/Manawatu** and the **Central South Island**.
- Only **Nelson/Marlborough** had a dissimilarity index in 2000 that was larger than it had been in 1980.
- Considering directionality, **Waitemata** showed the most consistent net pattern with all tranches below the New Zealand level for all three years. The other two Auckland regions were below New Zealand in 1980 and 1990, but by 2000 the situation had changed with **South Auckland** well above the New Zealand level and **Auckland Central** around it.
- The only other two regions for which tranches fell consistently and substantially below the New Zealand level were **Wellington** at all three dates, and **Nelson/Marlborough** for 1989 and 2000 (falling from above the New Zealand level).
- The four regions that had net patterns well above those for New Zealand were **Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** for all three years, and **Taranaki/Wanganui/ Manawatu** and **Northland** for 1980 and 1990.

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[39] $ID = \frac{1}{2}\sum_{a} \left| X_{a,r} - X_{a,NZ} \right|$,ID Index of Dissimilarity, X Tranche HUE, a age group, r Region, NZ New Zealand (Shyrock and Siegel 1976).

Table 9.7: Index of Dissimilarity for Tranche Hospital Utilisation Expectancies and Net Pattern Above and Below New Zealand, By Region 1980, 1990 and 2000

	Males			Females		
	1980	1990	2000	1980	1990	2000
	Index of Dissimilarity					
Northland	9	6	5	11	5	6
Waitemata	26	13	3	24	13	2
Auckland Central	27	13	3	26	15	3
South Auckland	8	4	3	9	4	3
Waikato	16	10	3	18	9	2
Bay of Plenty/Lakes	15	9	4	16	8	4
Hawke's Bay/Tairawhiti	13	14	2	12	12	2
Taranaki/Wanganui/Manawatu	13	7	3	14	7	2
Wellington	10	3	5	6	5	6
Nelson/Marlborough	6	13	10	7	6	7
Central South Island	12	10	5	13	7	5
Southern South Island	9	10	2	9	11	4
	Net Pattern (number of observations above/below New Zealand)					
Northland	6	2	1	8	4	3
Waitemata	-9	-9	-9	-9	-9	-6
Auckland Central	-8	-7	2	-8	-8	-4
South Auckland	-5	-6	9	-7	-6	6
Waikato	2	-2	3	8	-3	5
Bay of Plenty/Lakes	8	9	8	8	8	8
Hawke's Bay/Tairawhiti	8	9	6	8	9	3
Taranaki/Wanganui/Manawatu	8	9	0	8	8	4
Wellington	-5	-2	-9	-6	-4	-9
Nelson/Marlborough	4	-6	-8	4	-7	-9
Central South Island	-2	-1	0	-2	-1	4
Southern South Island	2	6	0	5	7	-4

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings

9.5 SYNTHETIC PERIOD VERSUS COHORT HUE

The tranches used so far in this chapter have followed the methodology employed throughout the rest of this report. That is, cross-sectional data were drawn upon, although indices have been computed in two ways that produce a temporal dimension:

1. by turning to time-series analysis, and
2. by constructing synthetic life-tables[40] including synthetic HUEs.

But results produced by such methods are affected by the fact that numerous real cohorts are synthesized into the one rate or table. In contrast, cohort rates and tables follow real generations across their life-spans. This is important because cohorts, like individuals, carry with them into subsequent older ages the experiences to which they have been exposed earlier in their life-cycles (Pool and Cheung 2003, 2005).[41] The problem for the present study is that the observations across time (from 1980 to 2000) are very few in number, so we cannot undertake full cohort analyses. But by adopting the strategy of following cohorts as they pass through tranches, a partial cohort analysis can be undertaken. The rationale is that a tranche approximates a life-cycle stage, and thus by analyzing

[40] Using data for one calendar year, or averaged around one year, a synthetic life-table follows a hypothetical cohort as if were passing through an entire life-cycle span until the last member of the reference cohort fails to survive.
[41] That study follows cohorts from well back into the 19th century until 2001. But cohorts born before the first reliable data are available enter the analysis at various ages above birth. Only for a few generations (approximately those born 1875 to 1905) does one have data covering most of the life of the cohort. For cohorts born since 1905 the tables can cover only a part of their life experience.

real cohort tranches we can follow a generation as it goes through a segment of its life-span for a limited period. We now turn to this analysis.

9.5.1 Tranche Hues: Cohort

The tranche HUEs for the cohorts involved a number of computational steps as follows. Tranche HUEs for 5-year age groups were used and the generation was followed as it moved across several 5-year periods. For example, the cohort born 1913 to 1917 was, on average, aged 67.5 years in 1982, 72.5 years in 1987, 77.5 years in 1992, 82.5 years in 1997 and 87.5 years in 2002. Then an index of dissimilarity was calculated across four times five year age groups, across four time periods for each of the cohorts as they passed through the five age-durations for which we had observations. These indices were then summed to come up with an index for a cohort passing across a tranche that has dimensions similar (but not exactly so) to those for the synthetic tranches.[42]

Table 9.8 employs again the methodology for an index of dissimilarity, described above, to show the variation for different cohorts using the tranche HUE for cohorts as they pass through four 5-year age groups referenced around 1980, 1985, 1990, 1995 and following the same cohort through this period. The results have been broken into four broad cohort groups covering different life stages (cohorts born earlier represent older ages and cohorts born later represent younger ages). Three relate to cohorts born over 20 years (1908-27 to 1948-67) and one only 15 years (cohorts born 1968-82).

Table 9.8: Index of Dissimilarity for Cohort Hues as the Cohorts Pass Through the Period 1980 to 2000, By Region, 1980, 1985, 1990, 1995 and 2000

	All Cohorts Total	Tranches Born: 1908-27	1928-47	1948-67	1968-82
		Males			
Northland	23.2	13.4	3.1	4.6	2.1
Waitemata	39.1	23.4	9.2	4.5	2.1
Auckland Central	23.2	15.3	3.4	2.9	1.6
South Auckland	15.9	10.8	2.7	1.8	0.7
Waikato	10.5	6.0	2.4	1.4	0.7
Bay of Plenty/Lakes	29.5	12.7	8.1	6.0	2.7
Hawke's Bay/Tairawhiti	28.8	13.3	7.4	4.8	3.3
Taranaki/Wanganui/Manawatu	20.1	12.2	3.4	3.3	1.1
Wellington	13.0	7.5	2.8	2.0	0.7
Nelson/Marlborough	29.7	20.6	4.9	3.2	1.0
Central South Island	15.3	10.4	2.2	1.2	1.5
Southern South Island	21.2	14.2	4.5	1.4	1.1
		Females			
Northland	23.6	12.5	6.2	3.5	1.3
Waitemata	34.5	19.6	8.9	4.4	1.6
Auckland Central	26.1	16.5	4.7	3.1	1.8
South Auckland	17.8	10.7	4.0	2.3	0.8
Waikato	12.4	7.7	2.8	1.3	0.6
Bay of Plenty/Lakes	27.4	12.6	9.3	3.7	1.9
Hawke's Bay/Tairawhiti	27.9	15.5	5.5	4.4	2.5
Taranaki/Wanganui/Manawatu	19.4	11.3	4.4	2.8	0.9
Wellington	13.7	8.7	2.9	1.6	0.6
Nelson/Marlborough	21.8	13.9	5.0	1.7	1.2
Central South Island	12.1	7.9	2.0	1.1	1.1
Southern South Island	23.1	14.3	5.8	2.3	0.8

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings

[42] In analysing cohorts it is necessary to use tranches of the same sizes to look at systematic shifts across time, whereas this is less essential for the synthetic analyses.

Although mortality and hospitalisation levels are likely to be highest at older ages (i.e. for cohorts born early in the 20th century) these are the life-cycle stages at which socially determined inequalities should be least (House *et al.* 2005) although the cumulative effects of life-course deprivation, while more difficult to measure will still be showing (Naess *et al.* 2004). The significant variation we are seeing here is likely to be a function of this cumulative effect, along with potentially being an indicator of service shortfall.

- The **Waitemata** region had the greatest variation from the New Zealand level.
- Two regions, **Waikato** and **Wellington,** were notable for the fact that they varied only a small amount from the New Zealand level.
- Other regions with marked variance were **Auckland Central, Bay of Plenty/Lakes, Hawke's Bay/Tairawhiti, Nelson/Marlborough** and the **Southern South Island.**
- For persons in the 1908-27 cohort, the regions which showed the largest variation from that of New Zealand were **Waitemata** and **Nelson/Marlborough**, the two regions that had the lowest HUEs in 1998.
- A couple of regions that showed considerable variation were **Auckland Central** and **Hawke's Bay/Tairawhiti.**
- One other result worth noting for the cohorts is the high variation from the New Zealand level among younger cohorts (1948-67 and 1968-82) in the **Hawke's Bay/Tairawhiti** region.

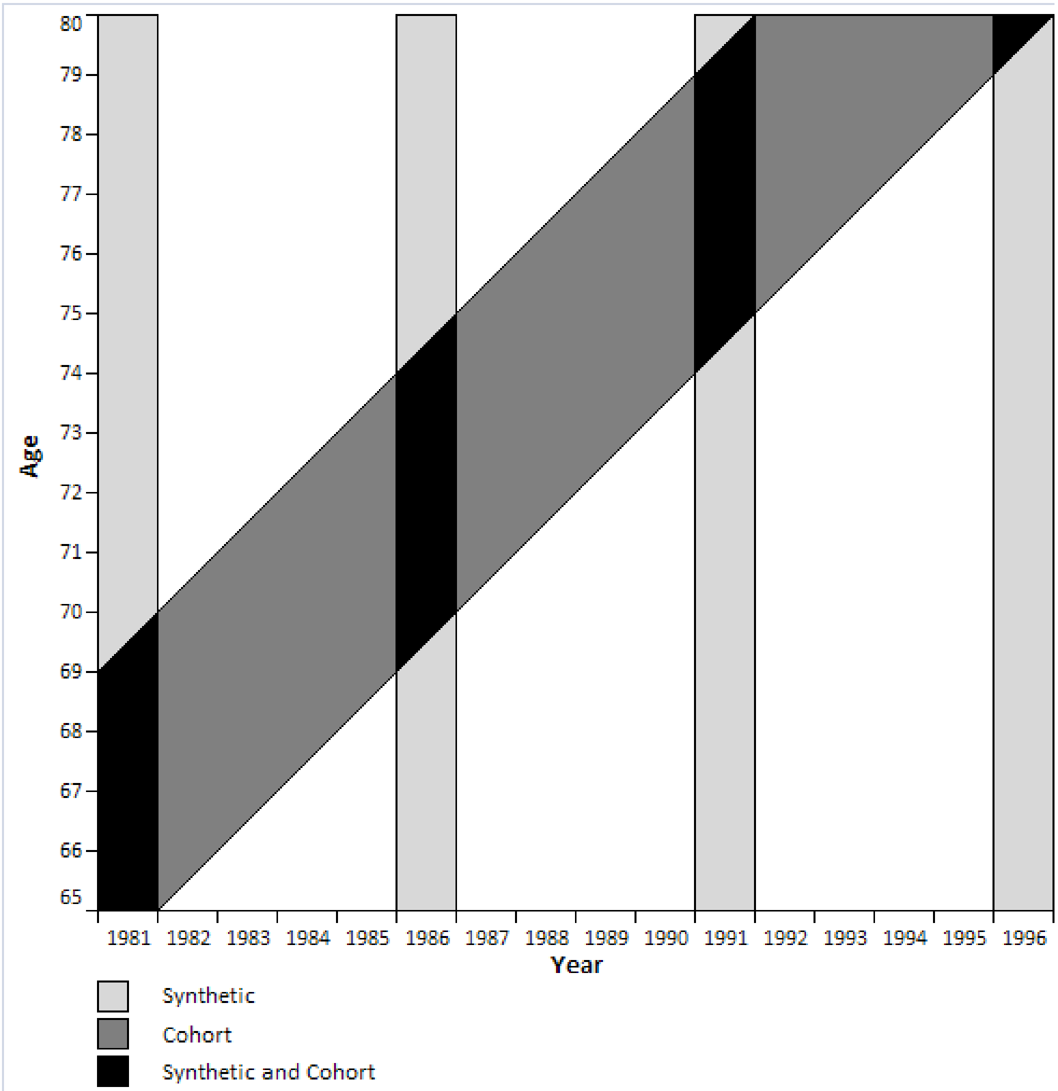
9.5.2 How Synthetic HUEs Reflect Cohort Hospital Utilisation

We have sufficient data to follow any given cohort for 15 years (e.g. from age 65 years to age 79 years inclusive) and to determine actual hospital utilisation over real time in the context of its survival. This is achieved by using an identical calculation to that used for HUEs except that instead of using the age-specific hospital bed-day rates for one time period, the age-specific rates of the cohort over different time periods are inserted into the equation. These values are then used in conjunction with the cohort life-expectancy (LE) in each of the age groups to obtain the HUE for the 15-year period.

By mapping the changes for any true cohort over real time it is possible to determine in a more refined way how change has occurred during the last two decades. To illustrate this we have selected as our example the cohort born between 1912 and 1916 and aged 65-69 years in 1981. This group was chosen as it represents the 'oldest' cohort (HUEs are of higher magnitude at older ages) for which we have sufficient numbers for such a calculation. In Table 9.9 a comparison of the cohort HUEs is made with synthetic HUEs for the 65-69 years age groups in 1981, 1986, 1991 and 1996. The HUEs represented are called tranches because they represent the expected hospital usage between 65 and 79 years rather than usage over the remainder of the lifespan. However, to aid interpretation of Table 9.9, Figure 9.1 first conceptualises the cohort and synthetic measures used.

Figure 9.1 models the overlaps between the cohort and synthetic HUEs data that are presented in table 9.9. The pale grey areas represent ages that are included in the synthetic HUEs but not in the cohort HUE. Dark grey shading indicates areas that are included in the cohort HUE as it moves across time, and increasingly ages as it passes through successive life-cycle stages, but are excluded from the synthetic HUEs for the intermediate periods between our reference dates (1981, 1986, 1991, 1996) but not in the synthetic HUEs. In interpreting synthetic and cohort HUEs it is important to note that, while the selected cohort is included in each synthetic HUE (the black areas), the synthetic HUEs also include other cohorts. In the earlier synthetic HUEs these are older cohorts, and in the later synthetic HUEs these are younger cohorts (refer to the pale grey areas in Figure 9.1; cf 1981 and 1996).

Figure 9.1: Lexis Diagram Modelling the Passage of the 1912-1916 Cohort Between Exact Ages 65 and 80, and the Cohort's Contribution to Synthetic Measures for Years 1981, 1986, 1991 and 1996



The results in Table 9.9 and Figure 9.2 show that, as expected, the cohort tranche HUE falls mid-way between synthetic estimates made at the beginning and the end of the time period. This is because changes in both levels of mortality and hospital bed-days over the period were uni-directional, that is, monotonically decreasing. A further reason why the cohort HUE is expected to be roughly in the middle of the synthetic HUEs for this period is because the synthetic HUEs are essentially taking a snapshots of the hospitalisation experience at different points in time (for the selected cohort as well as cohorts either side), and applying these to the whole 20-year time period. In comparison the cohort HUE tracks these changes in hospital use across the time period, only for the selected cohort.

Table 9.9: Cohort and Synthetic Tranche Hospital Utilisation Expectancies (Days) (65-79 years), New Zealand, 1981-1996

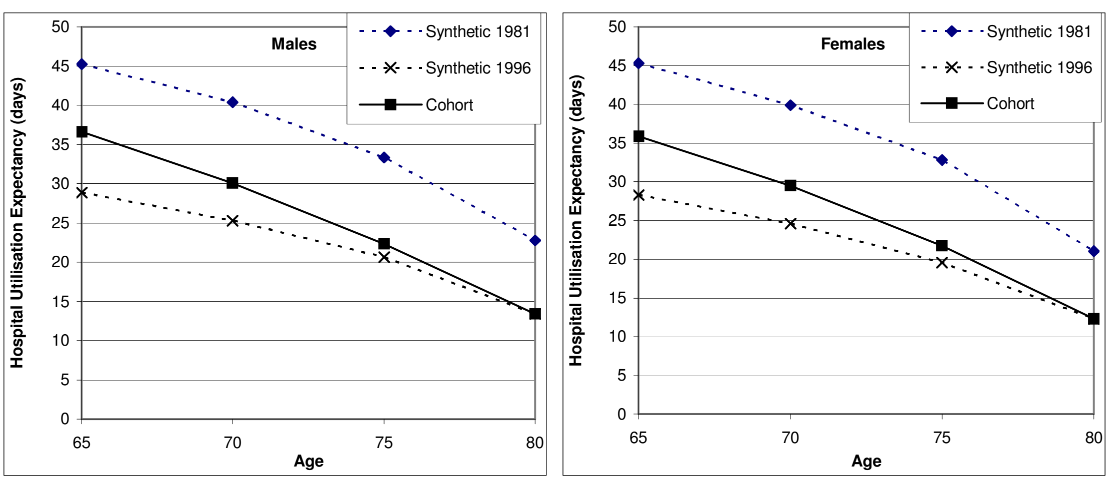
	Male	Female
Cohort born 1912-1916	*36.6*	*35.9*
Synthetic 1981	45.2	45.3
Synthetic 1986	41.8	42.6
Synthetic 1991	33.5	32.6
Synthetic 1996	28.9	28.3

Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings

The cohort HUEs converge by age, towards the synthetic indices because of the high prevalence of hospitalisation at very old ages, a trend compounded by recent significant reductions in bed-days, even at older ages. In contrast, the tranche LE values for the cohort at 65 years and over diverge by age from the synthetic expectancies. The reason there is because recent mortality reductions have been greater at 'younger' than at 'older' ages.

This analysis shows how much synthetic measures are affected by a mix of different cohort patterns. The high 1981 synthetic HUE was largely a result of higher hospital use at that time by the cohorts born prior to our selected cohort (in 1981 the 1912-1916 cohort would be aged 65-69, but the synthetic 1981 cohort also includes people aged 70-79, see Figure 9.1). In contrast, the actual hospital use for our selected cohort was much lower, whereas the lower synthetic HUE for 1996 occurred when younger cohorts had lower hospital use than the selected cohort, thereby depressing synthetic rates.

Figure 9.2: Cohort and Comparable Synthetic HUE, By Age and Gender (65-79 Years), New Zealand, 1981-1996



Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings

We cannot develop this analysis further here, but it does suggest the use of cross-sectional data can distort analyses to some degree and this may provide incorrect forecasts of hospital use. Even within a 15-year tranche there can be a mix of cohorts with different hospital use trends which does not show up in synthetic HUEs. However, this section uses one cohort HUE for a narrow tranche. The next section compares different cohort trends and finds that synthetic and cohort patterns have followed similar broad trajectories.

9.5.3 Intra-cohort HUE Trends

Broad cohort HUE trends are examined in Figure 9.3. These patterns are based on detailed computations that are described below. Figure 9.3 shows the cohort HUEs as they move across a life-cycle stage, observed at different 5-year age groups. Each line represents the HUE (y axis) belonging to a unique cohort as it passed through different ages (x axis). The line on the extreme left relates to people born 1978-82, while that on the extreme right relates to those born 1908-12. The vertical distance between points belonging to different cohorts over the same age groups shows the different tranche HUEs (in days) accumulated by cohorts at different ages as they pass through the period from 1982 to 1997.

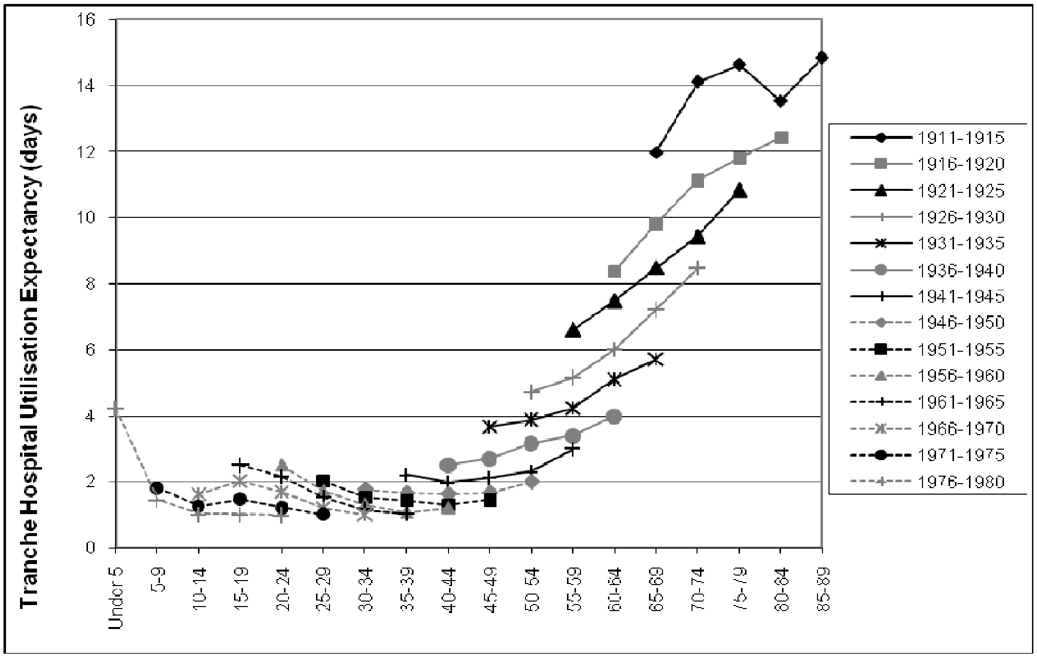
At younger ages cohort HUEs decrease in part because of age-specific bio-social effects, but in part because of declines in hospitalisation in young age groups. But from about 50 years of age, the tranches increase as cohorts become older and enter higher risk age-groups. The shifts in HUEs are greater for males than for females. The declines by age were most substantial for males at childhood ages and after the early adult ages; for females the greatest declines were at childhood ages and the middle years. Estimates for older males were more erratic. The last three cohorts at every age had HUEs that fairly closely paralleled those of earlier cohorts, at times coinciding with them or with earlier ones being even smaller that those later.

An interesting point is that the changes over all age groups are systematic, as is shown by the absence of crossovers. Taking the vertical distances at any particular age-group, that is inter-cohort differences at the same age but for different points in time, the spaces between data-points are relatively equal. When we look at intra-cohort differences the trend is systematically downwards for younger cohorts. But for older cohorts reaching 50 years and over, values increase as these cohorts enter higher risk age-groups.

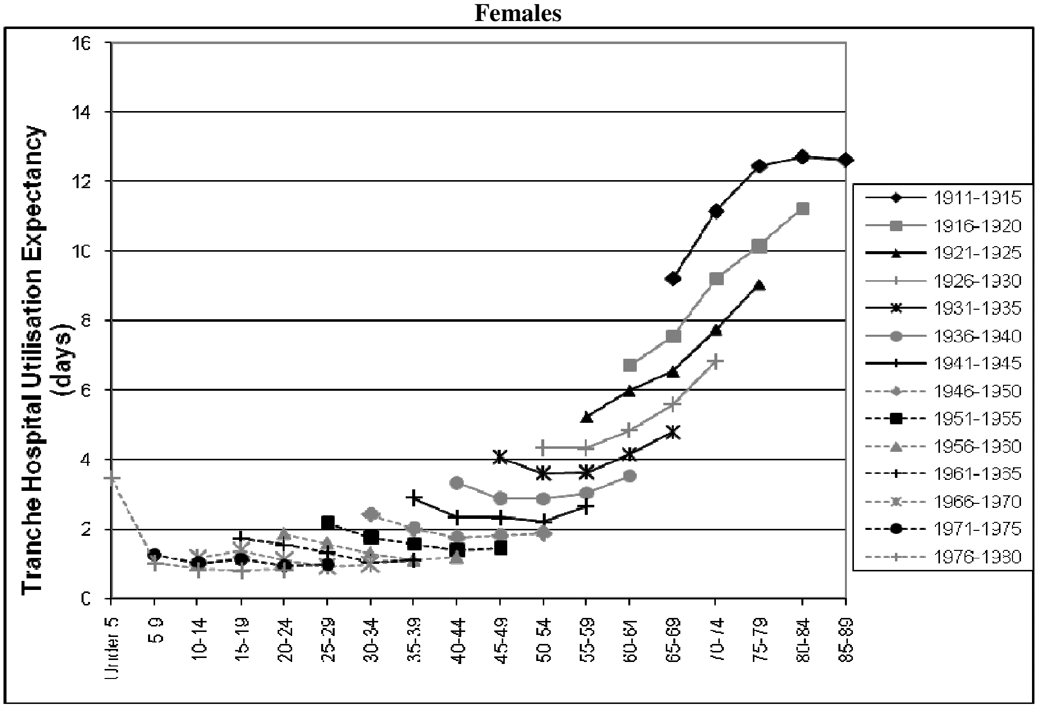
A regional analysis was also undertaken. Although the results are too detailed to show here, some key results are presented. Regions that differed from New Zealand as a whole for cohorts born before 1952 showed a fairly uniform trend. For both males and females **Waitemata** was significantly lower than the New Zealand level. Other regions with all their cohorts below the New Zealand level were **Auckland Central**, **South Auckland** and **Nelson/Marlborough**. At the other end of the scale were a number of regions for which all the cohorts were above the New Zealand level. These were **Bay of Plenty/Lakes**, **Hawke's Bay/Tairawhiti**, **Taranaki/Wanganui/Manawatu** and **Southern South Island**.

Figure 9.3: Cohort Trends in Tranche HUE (Days), By Age Group and Gender, New Zealand

Males



Females



Sources: National Minimum Data Set - Mortality, New Zealand Health Information Service.
National Minimum Data Set - Public Hospital Discharges, New Zealand Health Information Service.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings

9.6 CONCLUSION

This chapter has compared the HUE behaviour of particular tranches and cohorts in order to describe cohort trends. Regional comparisons reveal HUE variations across the country and over time, but with the inter-regional variations decreasing substantially between regions. The findings in this chapter can be summarised very simply: the convergences noted earlier for HUE(0) and HUE(65) have, in fact, occurred across all age-groups and for all cohorts. That said, there are regional differences in timing and velocity, some of which suggest that efficiency-gains may have been at the expense of health-gains. This implies that service delivery has not been even across the country, and thus raises issues of equity. We investigate this theme further in the next chapter.

HUEs can help estimate what the burden and volume of resource use will be in terms of hospital utilisation, taking into account hospital utilisation rates as well as the probability of remaining alive and being admitted to hospital. Their usefulness as tools for health services planning and management lies in this function.

Conventional bed-day rates (as proxies for disability or morbidity) merely document, cross-sectionally, the probability that someone of a particular age will use services. Thus they partially reflect health status, but are also affected by other factors that determine hospitalisation. For example, bed-day rates repeatedly show that a higher proportion of men than women use hospitals. HUEs have the opposite pattern – female HUEs are consistently higher than male HUEs. The expectation that women should spend more days in hospital than men does not, however, reflect poorer health status, but a longer life span during which women are at risk of being hospitalised. Thus, rather than an indicator of health status, HUEs reflect the ***relationship*** between health status (here denoted by survivorship) and hospital utilisation (itself a variable with many determinants and influences).

PART IV:

HOSPITALISATION UTILISATION EXPECTANCIES: INTERPRETING VARIANCE

CHAPTER 10

Disaggregating Supply and Demand: Avoidable Hospitalisations[43]

10.1 INTRODUCTION

Throughout the earlier chapters on the HUE an emerging theme has been one of convergence, of a diminution in regional differences. What we now attempt to do is to determine whether this has been achieved while standards of care have been maintained (i.e. the restructuring did actually produce health gains), or whether convergence has been achieved at the expense of standards (i.e. the restructuring has resulted in efficiency gains, but not in health gains).

The hospital care system has itself changed dramatically over the period, not the least of all for procedures, and particularly the mix of day-patients and in-patient services. We have stressed the point that the Hospital Utilisation Expectancy (HUE) measures both supply-side and demand-side[44] effects on health. Disaggregation of HUEs in different ways can give an insight into these components of hospitalisation. In the following three chapters this has been done in four ways: firstly by looking at Potential Avoidable Hospitalisations, as used widely in New Zealand by the Ministry of Health (1999a); secondly by looking at discharges split between acute and elective; thirdly by analysing HUEs for infectious diseases; and lastly by exploring trends in day-patient discharges. The current chapter deals with the first issue raised, avoidable hospitalisations.

The third point deals with what appears to be a re-emerging demand factor, an apparent reprise in rates that is increasing the burden of disease (Mills, and Tobias 2002). This may throw light on displacement effects produced by health restructuring, particularly as these affect the interface between public health measures (e.g. housing and sanitation), primary care, and the hospital sector.

In the next three chapters we apply the cause-specific bed-days to the overall life-expectancy (i.e. from all causes). There could also be HUEs computed by multiple-decrement techniques using cause-specific life-expectancies. But the problem with using life-table methods to analyse HUEs is that those people who are hospitalised for a specific disease or group of causes do not necessarily die from them. Patient's lives may indeed be shortened because they have suffered from the reference cause but, not necessarily to the extent that everyone exposed to this cause will die from it. To meet this concern, the overall life-expectancy is applied to the group of discharges that are of interest. This has the advantage that, to the extent that a given cause contributes to death, we can identify those causes that are disproportionately associated with premature mortality.

The categorisation employed for the HUEs in this chapter followed a literature review, and resulting in recoding, carried out by us, and across all age-groups. It is imperative to recognise that the distinctions between avoidable and non-avoidable are subjective and thus difficult to make. We must stress, therefore, that the results in this chapter must be seen, at best, as tentative, but, hopefully, they will raise issues that can be explored in greater detail, and more definitively, by public health experts. Our intention was simply to see if we could shed any further light on the vexed questions surrounding supply and demand.

10.2 POTENTIALLY AVOIDABLE HOSPITALISATIONS

A potentially avoidable hospitalisation signals the occurrence of a hospitalisation for a severe health condition that could theoretically have been avoided. In this analysis, however, injury admissions

[43] Dharmalingam *et al.* (2004).

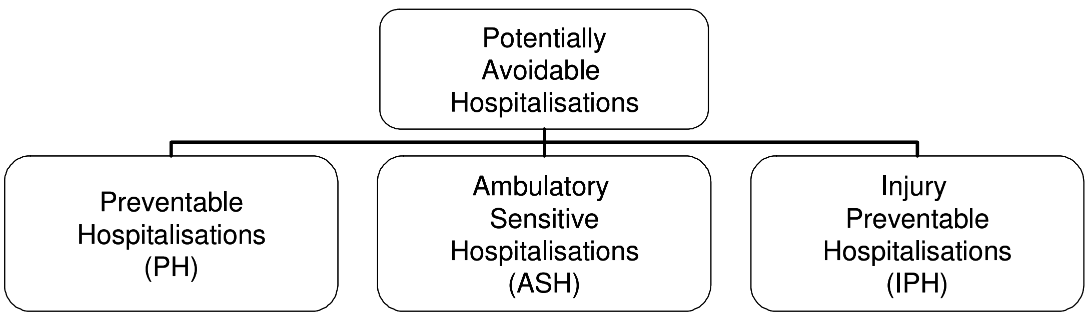
[44]By supply-side, we mean the capacities of the system, from funding, staffing, surgical theatres and other operational/interventional infrastructure, post-intervention follow-up and referral capacities, through to available beds. Demand is based on the incidence and prevalence of morbidity and external causes of hospitalisation.

have been separated from other cause groups of preventable hospitalisations to take account of the different epidemiology of injury and (preventable) disease: injuries have different risk and protective factors and respond to different prevention strategies.

Potentially avoidable hospitalisations fall into three sub-categories as defined by the Ministry of Health (1999a: 326)[45] (see Figure 10.1):

- hospitalisations resulting from diseases preventable through population based health promotion strategies (for example, tobacco excise tax, smoke-free laws) – *preventable hospitalisations (PH)*
- hospitalisations resulting from diseases sensitive to prophylactic or therapeutic interventions deliverable in a primary health care setting (e.g. vaccine preventable diseases, early recognition and excision of melanoma, mammography for early breast cancer, effective glycemic control in diabetics) - *ambulatory sensitive hospitalisations (ASH)*
- hospitalisations avoidable through injury prevention programmes - *injury preventable hospitalisations (IPH)*

Figure 10.1: The Three Categories of Potentially Avoidable Hospitalisations



A literature review was used to categorise all causes of hospitalisation as potentially avoidable or non-avoidable, and to further subdivide the former into the three subcategories of preventable, 'ambulatory sensitive' and injury preventable (Ministry of Health 1999a; Jackson *et al*. 1998). For some causes, there is extensive overlap between two of the subcategories (preventable and ambulatory sensitive), and judgement had to be applied to partition cause-specific hospitalisations between them. The majority of categories attributed to preventable hospitalisation are those identified as causes of primary avoidable mortality; others are derived from the literature review. The ambulatory sensitive codes are largely derived from lists prepared by earlier workers (Begley *et al.* 1994; Billings *et al.* 1996; Jackson and Tobias 2001; Weissman *et al.* 1992). These were extended, where necessary, to reflect recent developments in health care technology and New Zealand patterns of practice.

A potential cause of confusion is the categorisation of admissions as 'discretionary' or 'non-discretionary'. These terms are not synonymous with the concept of avoidability. For example, an admission for appendicitis is non-discretionary and unavoidable, but an admission for a ruptured appendix is non-discretionary yet avoidable.

The analysis divides potentially avoidable hospitalisations into three subcategories as indicated in Figure 10.1a. Data are presented by gender for the years 1980, 1989 and 2000 as these years represent the earliest, middle and latest year for which this analysis can be done. Results in this section are for *potentially avoidable* causes and its components: *preventable*, *ambulatory sensitive* and *injury preventable*. The remaining hospitalisations, which do not fit in the above categories, are called *non-avoidable*.

[45] This draws on work done by Dr Gary Jackson, a co-author of this study.

As will be clear in Table 10.1a the major potentially avoidable cause is the ambulatory sensitive category. It also differs from the other two in one very important regard: it is reliant on access to and use of primary care services and interventions, and occurs where a failure to gain access leads to hospitalisation, presumably as the condition becomes more severe. In short, the link between health care that is antecedent to admission to hospital is direct. In contrast, the link for the other two categories is far less direct: they relate to conditions that might be prevented by health promotion and other programmes (some of which fall well outside the medical domain, (such as improving road designs). Moreover, they may also include disorders for which monitoring has improved over time. They may increasingly be being treated by primary level interventions and surveillance, regardless of whether the underlying causes are behavioural (e.g. a history of smoking), or simply degenerative (age-related rises in blood pressure). In other words a decrease in need for hospitalisation may be more due to primary interventions than to health promotion. Thus in this chapter, apart from an analysis of national level data, we analyse in detail only the ambulatory sensitive category among the potentially avoidable causes.

When looking at regional differences in ambulatory sensitive causes, the difference from the New Zealand average is investigated. This is to give an indication whether the primary sector-hospital sector linkages are keeping up with national trends or not. Thus, the New Zealand rate is treated as a benchmark.

National Patterns

Both 'avoidable' and 'non-avoidable' HUEs decreased over the period, as is shown in Table 10.1a, with the combined 'avoidable' decreasing more than the 'non-avoidable' for males, and about the same for females. All HUE potentially avoidable categories decreased in absolute terms, but the ambulatory sensitive category saw far less marked declines. This is a finding of some importance as it indicates that, while the primary health sector may have been playing a role in reducing hospitalisation, this was less than what might have been desired. In contrast, compared to 1980 figures, the percentage reduction in the HUE was greatest for preventable (63 percent and 57 percent for males and females respectively) and injury preventable (53 percent and 54 percent for males and females respectively) hospitalisations. These categories were however, by far the smallest in absolute terms.

Non-avoidable HUEs made the greatest contribution (about 60 percent) to the total HUE, while ambulatory sensitive HUEs contributed the next highest proportion, while preventable and injury preventable causes were minority components. What is interesting and perhaps a matter of concern is that the ambulatory sensitive HUEs became an increasing proportion of the total, shifting from about a fifth to more than a quarter.

Table 10.1a: Categories of Potentially Avoidable and Non-Avoidable Hospital Utilisation Expectancies at Birth (Days), New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			**Females**		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Preventable	10.9	7.2	4.2	8.5	5.6	3.7
Ambulatory Sensitive	17.5	13.2	13.7	19.3	14.2	13.6
Injury Preventable	4.3	3.1	1.7	3.0	1.9	1.2
(Sub-total Potentially Avoidable)	*(32.7)*	*(23.5)*	*(19.6)*	*(30.9)*	*(21.7)*	*(18.5)*
Non-Avoidable	46.2	34.9	30.9	57.1	41.3	34.1
Total	**79.0**	**58.4**	**50.6**	**87.9**	**62.9**	**52.7**

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Māori Patterns

As has been discussed in Chapters 8 and 9, Māori HUEs went from well above to just below the total in the period 1980-2000, as is shown in Table 10.1b. But the profile of change was different: Māori HUEs for avoidable categories remained above the total population's level, but were below for non-avoidable causes. It must be stressed at this point that the HUE methodology, as a life-table technique, efficiently eliminates age-composition effects. In later chapters we show that at various periods there seemed to be a displacement of cases, so that some people were more likely to receive treatment outside the more formal health systems. This was likely to occur in peripheral regions where Māori were over-represented. If so, then the present results may indicate that hospitalisation efficiency-gains may have been achieved, to a degree, at the expense of health gains. If not, then the data in Table 10.1b would suggest both efficiency and health-gains. A third hypothesis would be that HUEs are sensitive to exposure to risk of hospitalisation while still surviving (exactly the reason for which the method was developed) and that as Pakeha have greater longevity, their exposure to the risk of hospitalisation is longer. We now turn to that hypothesis by looking at HUE(65).

Table10.1b: Categories of Potentially Avoidable and Non-Avoidable Hospital Utilisation Expectancies at Birth (Days), Māori Population, New Zealand, 1980-84, 1990-94 and 1996-2000

	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Preventable	10.5	6.1	2.6	10.0	5.6	2.7
Ambulatory Sensitive	32.8	24.2	15.0	41.0	32.8	17.9
Injury Preventable	7.4	4.8	2.3	3.9	2.6	1.3
(Sub-total Potentially Avoidable)	*(50.7)*	*(35.1)*	*(19.9)*	*(54.9)*	*(41.0)*	*(21.9)*
Non-Avoidable	60.8	41.7	26.5	60.4	44.9	27.3
Total	**111.4**	**76.7**	**46.4**	**115.3**	**86.0**	**49.2**

(1) 1981 50% or more Māori blood population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 population estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Avoidable and Non-Avoidable HUEs at 65 Years, National and Māori Patterns

In Tables 10.2a and b, HUE(65) data are presented for both the total and Māori populations. As has been shown in Chapters 8 and 9, a large and increasing proportion of the HUE occurs after age 65, but more so for the total population than for Māori. This trend is seen again by comparing Tables 10.1a and b with Tables 10.2a and b: more than two-thirds of the total HUE(0) in 1981 and more than 70% in 2000, but only 62% of the Māori HUE(0) occurs at age 65+. Moreover, as was shown in Chapter 5, Māori have substantially lower survivorship at older ages than the total population. Shorter longevity of Māori is clearly a factor affecting the HUE at older ages.

Underlying this finding, however, are some other dynamics of change that might indicate that shorter longevity may also be a function of system shortfalls. For both the Māori and the total population, HUE (65) has decreased radically, especially for non-avoidable causes and particularly for Māori. There have also been rapid decreases for Māori in the potentially avoidable categories. While the ambulatory sensitive grouping has dropped only modestly for the total population, for Māori a decline in excess of 50% of the 1981 level is seen for both sexes. However, this has not been accompanied by markedly improved survivorship. Taken together these two statistics suggest many older Māori, whose needs have not been adequately met by the primary sector, are now also not presenting in the hospital sector.

Table 10.2a: Categories of Potentially Avoidable Hospital Utilisation Expectancies (Days) at 65 Years, New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Preventable	7.6	5.6	3.7	6.6	4.6	3.3
Ambulatory Sensitive	14.1	10.9	11.0	14.5	11.0	10.5
Injury Preventable	0.8	0.5	0.4	1.4	0.6	0.5
(Sub-total Potentially Avoidable)	*(22.5)*	*(17.0)*	*(15.1)*	*(22.5)*	*(16.2)*	*(14.3)*
Non-Avoidable	30.0	23.6	20.8	38.0	28.8	23.7
Total	**52.5**	**40.6**	**35.9**	**60.4**	**45.0**	**38.1**

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Table10.2b: Categories of Potentially Avoidable Hospital Utilisation Expectancies (Days) at 65 Years, Māori Population, New Zealand, 1980-84, 1990-94 and 1996-2000

	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Preventable	7.0	4.5	2.0	7.3	4.2	2.0
Ambulatory Sensitive	23.9	19.4	10.9	27.8	26.2	12.7
Injury Preventable	1.5	1.8	0.4	1.0	0.9	0.3
(Sub-Total Potentially Avoidable	*(32.4)*	*(25.7)*	*(13.3)*	*(36.1)*	*(31.3)*	*(15.1)*
Non-Avoidable	37.3	27.2	15.7	34.9	29.9	15.7
Total	**69.7**	**53.0**	**29.0**	**71.1**	**61.1**	**30.7**

(1) 1981 50% or more Māori population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 population estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

In part, as the work of Pool and Cheung (2003, 2005) on generation mortality shows, older Māori cohorts still carry forward histories of higher levels of morbidity and exposure to risk in general, as demonstrated by cohort survivorship deterioration in the 1990s. The next section examines the tranche HUE(0-64) years to determine the patterns of avoidable and non-avoidable HUEs among younger Māori cohorts, which have not carried forward such adverse histories.

Avoidable and Non-Avoidable HUEs, 0-64 Tranche, National and Māori Patterns

As is clear from comparison of Tables 10.2a and b with Tables 10.3a and b, it is primarily at younger ages that a decline in the potentially avoidable causes has occurred, a finding that is unexceptional in a well-functioning health system in which the primary sector is working efficiently. But for Māori the absolute and relative decreases in potentially avoidable hospitalisations has been so marked (decreasing by two-thirds for Māori under 64 years of age, compared to a decline of about half for the total population over the time period 1980-82 to 1999-2001, see Tables 10.3a and b) that the question arises as to whether there has been displacement from the formal health sector into less formal areas. Preventable causes may be being accommodated less formally, particularly for Māori, this is a subject is reviewed later. In the present chapter we now review whether the shifts in ambulatory sensitive and non-ambulatory sensitive hospitalisations seen nationally have occurred uniformly or vary by region.

Table 10.3a: Categories of Potentially Avoidable and Non-Avoidable Tranche Hospital Utilisation Expectancies (Days) from Birth to 64 Years, New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Preventable	5.3	2.8	1.2	3.0	1.7	0.9
Ambulatory Sensitive	7.2	4.8	4.6	7.3	4.8	4.3
Injury Preventable	3.8	2.7	1.4	1.9	1.4	0.8
(Sub-Total Potentially Avoidable)	*(16.3)*	*(10.2)*	*(7.2)*	*(12.2)*	*(7.9)*	*(6.0)*
Non-Avoidable	24.3	16.6	13.7	25.4	16.5	13.0
Total	**40.6**	**26.8**	**21.0**	**37.6**	**24.3**	**18.9**

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Table 10.3b: Categories of Potentially Avoidable and Non-Avoidable Tranche Hospital Utilisation Expectancies (Days) from Birth to 64 Years, Māori Population, New Zealand, 1980-84, 1990-94 and 1996-2000

	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Preventable	6.4	2.9	1.3	5.0	2.4	1.3
Ambulatory Sensitive	18.9	10.7	8.3	22.0	12.7	8.6
Injury Preventable	6.5	3.5	2.0	3.2	1.9	1.1
(Sub-Total Potentially Avoidable)	*(31.8)*	*(17.1)*	*(11.6)*	*(30.2)*	*(17.0)*	*(11.0)*
Non-Avoidable	39.1	22.8	16.7	36.5	21.9	15.8
Total	**71.0**	**39.9**	**28.3**	**66.6**	**38.9**	**26.7**

(1) 1981 50% or more Māori Blood population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 population estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

10.2.1 Ambulatory Sensitive HUEs

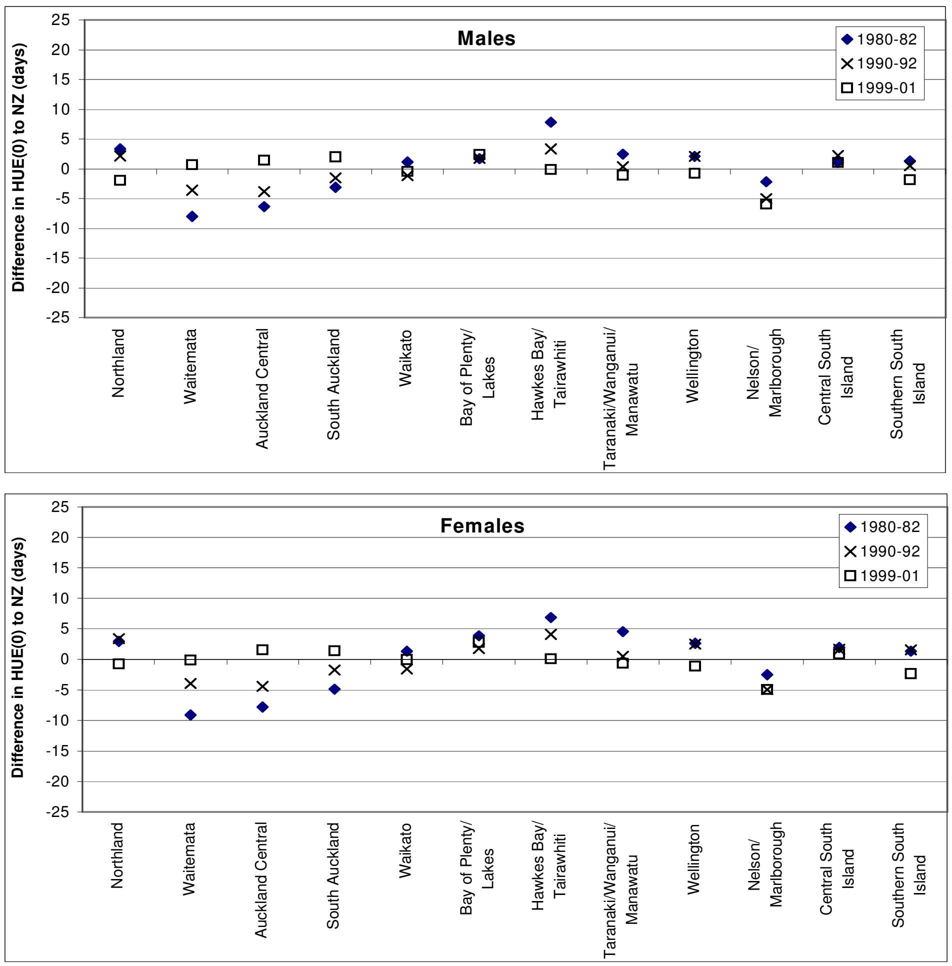
Ambulatory sensitive hospitalisation is a crude indicator of how efficiently cases, which might be controlled and managed by the primary health care system, are kept out of hospital. If these cause-specific HUEs are high, this indicates that the primary health system is not working as well as it should, but if the HUEs are low this indicates that the system is working well, unless there has been displacement out of the system.

In Figure 10.2 the difference from the New Zealand level in the number of days over a lifetime (HUE(0)) which would be spent in hospital for causes which were ambulatory sensitive are shown for each region for three year averages around 1981, 1991 and 2000.

In 1980-82 **Waitemata** and **Auckland Central** were considerably below the New Zealand level, and **Hawke's Bay/Tairawhiti** was considerably above. But by 2000 every region had converged towards and most clustered closely around the national level (<2 bed-days,+/), with some (**Nelson/Marlborough**) doing much better than this.

The same trend of convergence applies to the ambulatory sensitive HUEs at 65 years and for the tranche 0-64 years, as such the results are not shown here (see Appendix Figures 10.1 and 10.2). However, both regional variation and convergence were more pronounced at ages 65+, and less variation was seen at ages 0-64. This convergence implies that efficiency-gains had been affected successfully, and that the burden of care for these conditions had shifted to the primary sector as desired. In the next chapter, however, we will test to see if displacement may have occurred.

Figure 10.2: Ambulatory Sensitive Hospital Utilisation Expectancies (Days) at Birth, Difference from New Zealand Total, By Gender and Region, 1980-82, 1990-92 and 1999-2001



Note: Weighted Average Deviations:[46] Males 1980-82 – 3.2, 1990-92 – 2.1, 1999-01 – 1.4; Females 1980-82 – 4.1, 1990-92 – 2.4, 1999-01 – 1.2.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

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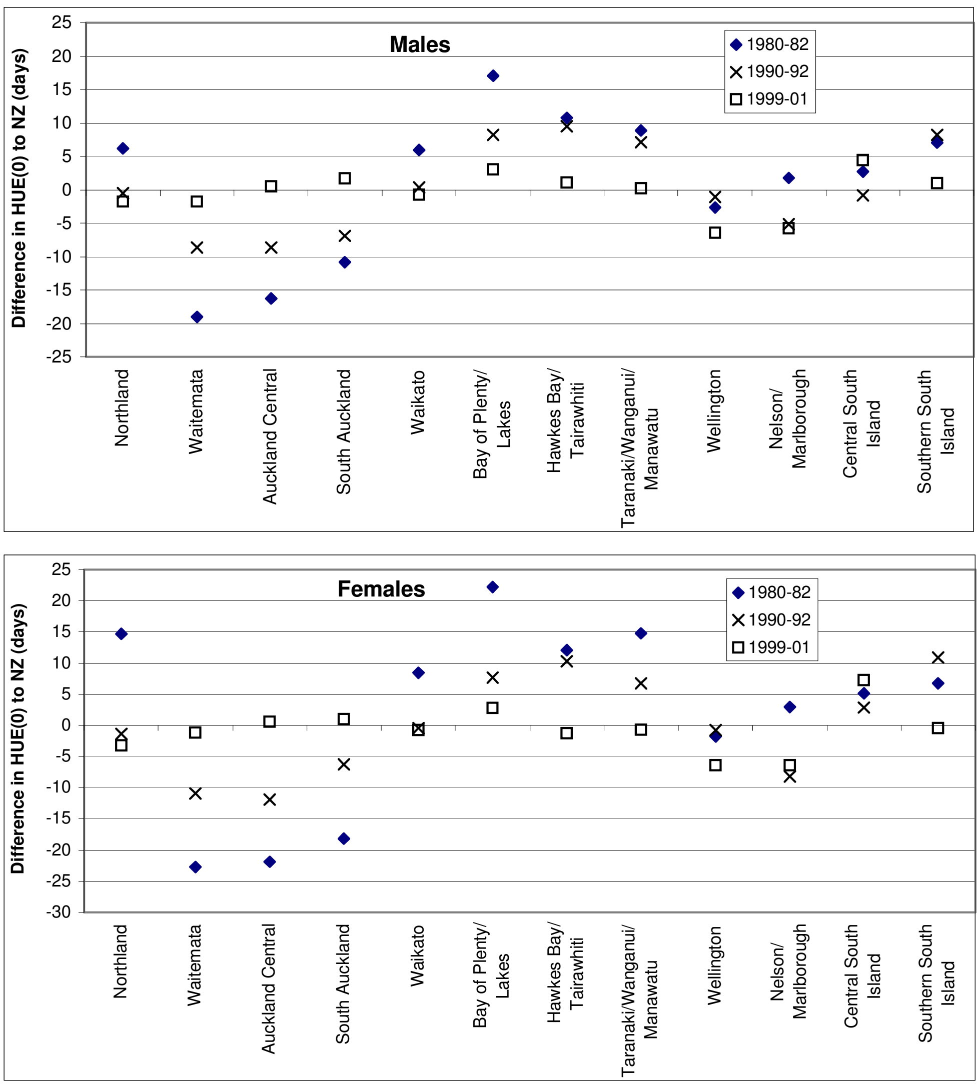
[46] $$\text{Weighted Average Deviation} = \sum_i \frac{|x_i - NZ| \times P_i}{P_{NZ}}$$

Observation x for region i, P – population, NZ – New Zealand

10.2.2 Non-Ambulatory Sensitive HUEs

Interestingly, the trend observed for ambulatory sensitive HUEs was also observed for non-ambulatory sensitive HUEs (see Figure 10.3 and Appendix Figures 10.3 and 10.4). That is, regional variance decreased. Again, similar trends are observed for HUE(0), tranche HUE 0-64 and HUE(65), so only results for HUE(0) are presented here. A major exception to the convergence trend was **Central South Island**, and to a lesser extent **Wellington** and **Nelson/Marlborough**, especially at 65+ years (not for the tranche 0-64 years). This is such a deviant trend that one must assume either that it is the result of classification errors, or of procedures that differed from those in other regions.

Figure 10.3: Non-Ambulatory Sensitive Hospital Utilisation Expectancies (Days) at Birth, Difference from New Zealand Total, By Gender and Region, 1980-82, 1990-92 and 1999-2001



Note: Weighted Average Deviations: Males 1980-82 – 8.9, 1990-92 – 5.2, 1999-2001 – 2.4;
Females 1980-82 – 12.1, 1990-92 – 6.2, 1999-2001 – 2.8.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

10.3 CONCLUSION

This chapter is the first of three that attempt to disaggregate the effects of supply and demand on hospital utilisation by assessing changes in patterns of different types of hospitalisations. This chapter addressed potentially avoidable and non-avoidable hospital admissions, both across the lifespan and at older and younger ages. It dealt not only with supply of hospital services, but also allows us to infer trends in the supply (and demand) of primary care services, as represented by ambulatory sensitive hospitalisations. Steep declines in Māori ambulatory sensitive hospital discharges were observed, without an accompanying improvement in survivorship. Big drops in Ambulatory Sensitive hospitalisations, where not accompanied by improved survivorship, can indicate primary sector shortcomings. An alternative hypothesis is that Māori are increasingly being displaced to less formal treatment for preventable conditions, and not appearing on official hospital statistics. This is further discussed below. The next chapter attempts to further break down the supply and demand components of HUEs by analysing trends in acute and elective hospital discharges.

CHAPTER 11

Disaggregating Supply and Demand: Acute and Elective Discharges and Infectious Diseases

11.1 INTRODUCTION

Another way of attempting to disaggregate supply and demand effects is to separate discharges into those that are more urgent, perhaps resulting from a life-threatening condition, and those for which hospitalisation may depend more on the availability of beds. Acute discharges are emergency, unplanned hospitalisations typically requiring immediate diagnosis and intervention, although sometimes also needing protracted treatment and/or admission as an in-patient. In contrast, elective discharges are planned, tend to be less urgent and are not crisis-related. Acute discharges are unpredictable and have been increasing across the developed world.

This observation does however, require some qualification. In the past acute admissions were typically for communicable diseases. Indeed the infrastructure of the hospital system was developed around ‘fevers’, ‘quarantine-wards’ and similar notions. This was one of the legacies faced by Hospital Boards in New Zealand at the beginning of the reference period covered by this study. A great deal of the restructuring and of the political discourse on the ‘health reforms’ revolved around this issue, especially when small communities faced the closure or down-sizing of their hospitals which had been designed in the 19th century to meet communicable disease emergencies. Today, in contrast, acute admissions are overwhelmingly due to non-communicable causes, and thus require different responses (see essays in Bui Dang Ha Doan1988).

In New Zealand, those in urgent (acute) need of hospital care are hospitalised. However, because of the way public hospital services are funded in New Zealand, an increase in acute discharges is often offset by a corresponding decrease in electives. This is because an increase in acutes will divert funding and staff away from routine (elective) admissions, especially for surgery. Moreover, acute cases are often related to potentially avoidable hospitalisations that could be managed in the primary health care sector. As will be recalled from the last chapter, the balance between the ambulatory sensitive and non-ambulatory sensitive categories changed over the period 1980-2000, with the former increasing proportionately.

The levels of acute hospitalisation may also be influenced by the availability of elective procedures, as people unable to get these become acute cases. Because of this, elective discharges are more subject to influence by funding levels, staff availability and other supply factors. Acute discharges on the other hand, could perhaps be considered a better indicator of health status or demand factors, albeit that this may be confounded by shortfalls in primary care that translate into acute hospitalisations.

This chapter is in two parts. Firstly, acute and elective components of HUEs are investigated, followed by analysis of infectious and non-infectious HUEs. The HUE analysis in this chapter uses discharges disaggregated further into acute and elective, and disaggregated into infectious and non-infectious. The sum of the HUEs for these discharge clusters constitutes the total HUE for medical-surgical discharges. Results are shown for males and females for the three year averages 1980-82, 1990-92 and 1999-01 as these years represent the earliest, middle and latest year for which this analysis was done. For Māori, five year averages were used in the analysis.

11.2 ACUTE AND ELECTIVE HOSPITAL UTILISATION EXPECTANCIES

11.2.1 Correlation Between Acute and Elective HUEs

Table 11.1 uses regional data to provide a statistical overview of the question being analysed here. In this table levels of acutes and electives are correlated across regions. In 1980-82 and 1990-92, HUEs for acute and elective discharges were highly correlated: the higher the level for acute HUEs the higher for electives, and vice-versa. This indicates adequate supply; increases in acute HUEs did not take resources away from elective HUEs. However the strength of the correlation had dropped markedly by 1999-01, and for older males became negative. Thus, levels of acute HUEs are not as highly correlated with elective HUEs in 1999-01. The next section of this chapter teases out the issues raised by the correlations presented in Table 11.1.

Table 11.1: Inter-Regional Correlations Using Spearman's Rank Correlation[47] Between Acute and Elective HUEs, Selected Age Groups and Years, 1980-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
HUE(0)	0.664	0.797	0.294	0.497	0.832	0.140
HUE(65)	0.573	0.769	-0.210	0.413	0.706	0.119
Tranche HUE(0-64)	0.510	0.545	0.182	0.699	0.545	0.266

11.2.2 Percentage of HUE that is Elective at Birth

National Trends

The New Zealand trend shows a decrease in Hospital Utilisation Expectancies in both acute and elective discharges (see Table 11.2a). This trend mainly reflects how the hospital system has changed over time with procedures that used to require longer durations in hospital now being treated as day-stays. National HUEs for acute hospitalisations showed a substantial reduction of about 34 percent over the period. The elective HUEs showed a decrease of 41 percent for males and 49 percentfor females. Over the period 1980 to 2001 elective hospitalisations consistently contributed between about one quarter and one third of the total national HUE. The percent of the total HUE comprising elective discharges was 3 percentage points more for females than males in the earlier periods but had equalised by 2000.

Table 11.2a: Acute and Elective Hospital Utilisation Expectancies (Days) at Birth, New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Acute	54.6	42.6	36.2	58.5	45.6	37.7
Elective	24.4	15.8	14.4	29.5	17.3	15.0
Total	**79.0**	**58.4**	**50.6**	**87.9**	**62.9**	**52.7**
% Elective	30.9	27.0	28.5	33.5	27.6	28.4

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

[47] We consulted with Dr. W. Bolstad, Statistics, University of Waikato, whose generous advice we gratefully acknowledge. As HUEs relate to macro-level data sets, and as we have limited numbers of observations (only 12 regions) it was decided to use Spearman's method rather than those dependent on interval level measurements.

Māori Trends

Māori acute and elective HUE(0) are given in Table 11.2b. The pattern varies quite markedly from that for the Total population. Both acute and elective Māori HUEs were higher than levels for the Total population in 1980-84 and 1990-94, but by 1996-00 Māori elective HUEs had fallen well below those for the Total population and the percentage of elective, especially for females. In contrast the Māori acute HUEs were similar to that for the Total population.

Table 11.2b: Acute and Elective Hospital Utilisation Expectancies (Days) at Birth, New Zealand, Māori Population, 1980-84, 1990-94 and 1996-00

	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Acute	81.7	58.9	35.6	79.7	68.6	38.0
Elective	29.7	17.8	10.8	35.7	17.4	11.2
Total	**111.4**	**76.7**	**46.4**	**115.3**	**86.0**	**49.2**
% Elective	26.7	23.2	23.3	30.9	20.2	22.7

(1) 1981 50% or more Māori Blood population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

11.2.3 Percentage of HUE that is Elective at Ages 65 Years and Over

National Trends

As is seen in Table 11.3a, at 65 years and over the proportion of the HUE that is elective is around that at birth, as is expected (see Table 11.2a). However, the level of the total HUE for this age group that is elective is lower than at birth.

Table 11.3a: Acute and Elective Hospital Utilisation Expectancies (Days) at Age 65 Years and Over, New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Acute	37.1	29.7	26.1	44.5	34.2	28.4
Elective	15.4	10.9	9.8	16.0	10.8	9.7
Total	**52.5**	**40.6**	**35.9**	**60.4**	**45.0**	**38.1**
% Elective	29.3	26.9	27.3	26.4	23.9	25.4

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Māori Trends

The level for the HUE (elective) at 65+ years is also much lower than for all ages (see Tables 11.3b and 11.2b). This is particularly the case for females. As with HUEs at birth, a smaller percentage of HUEs are elective for Māori than for the Total population for this age group. Finally, both acute and elective HUE(65+) for Māori are lower than for the Total population.

Table 11.3b: Acute and Elective Hospital Utilisation Expectancies (Days) at Age 65 Years and Over, New Zealand, Māori Population, 1980-84, 1990-94 and 1996-2000

	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Acute	52.3	40.8	22.8	51.7	52.4	25.3
Elective	17.4	12.1	6.1	19.4	8.6	5.4
Total	**69.7**	**53.0**	**29.0**	**71.1**	**61.1**	**30.7**
% Elective	25.0	22.9	21.2	27.3	14.2	17.7

(1) 1981 50% or more Māori population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

11.2.4 Percentage of HUE that is Elective from Birth to 64 Years

National Trends

For the tranche 0 to 64, elective discharges constitute a high proportion of the HUE, regularly a third or more (see Table 11.4a). However the general trend for both elective and acute HUEs is down, due to the overall decline in HUEs over the period (see Chapter 8).

Table 11.4a: Acute and Elective Tranche Hospital Utilisation Expectancies (Days) from Birth to 64 Years, New Zealand, 1980-82, 1990-92 and 1999-2001

	Males			Females		
	1980-82	**1990-92**	**1999-01**	**1980-82**	**1990-92**	**1999-01**
Acute	27.5	19.6	14.6	21.4	16.2	12.5
Elective	13.1	7.3	6.3	16.2	8.1	6.4
Total	**40.6**	**26.8**	**21.0**	**37.6**	**24.3**	**18.9**
% Elective	32.3	27.1	30.3	43.0	33.3	33.8

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Māori Trends

For Māori at 0-64 years (see Table 11.4b), while the percent of the HUE that is elective is lower, levels of both acute and elective HUEs are higher than for the Total population.

Table 11.4b: Acute and Elective Tranche Hospital Utilisation Expectancies (Days) from Birth to 64 Years, Māori Population, New Zealand, 1980-84, 1990-94 and 1996-2000

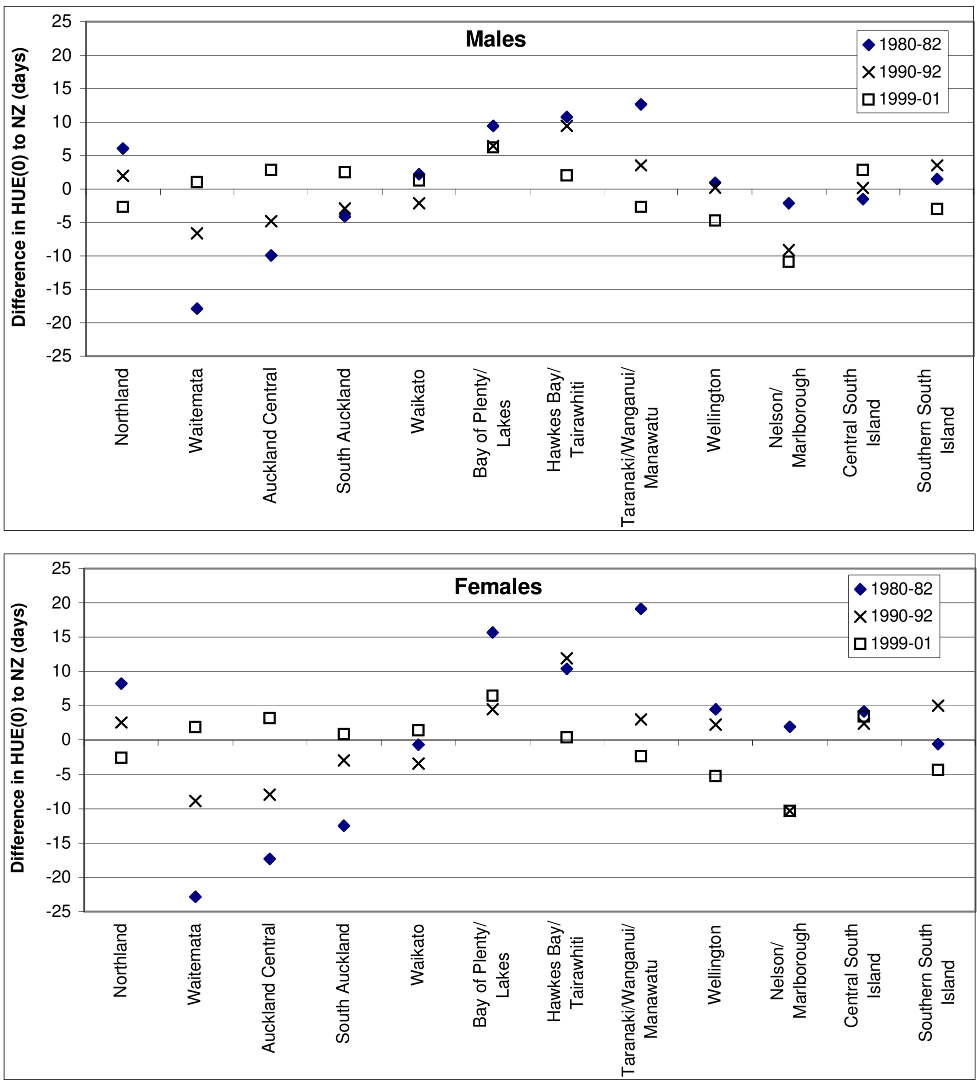
	Males			Females		
	1980-84[1]	**1990-94[2]**	**1996-00[3]**	**1980-84[1]**	**1990-94[2]**	**1996-00[3]**
Acute	51.4	30.5	21.3	44.3	28.2	19.5
Elective	19.6	9.4	7.0	22.4	10.7	7.2
Total	**71.0**	**39.9**	**28.3**	**66.6**	**38.9**	**26.7**
% Elective	27.7	23.6	24.6	33.6	27.6	27.0

(1) 1981 50% or more Māori population is used as denominator.
(2) 1991 socio-cultural Māori population is used as denominator.
(3) 1998 estimated by linear interpolation using the socio-cultural Māori population of 1996 and 2001 censuses.
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

11.2.5 Regional Trends in Acute and Elective HUEs

All regions have experienced a downward trend in HUE(0) for acute discharges, although this has been to different degrees. The difference from the New Zealand level indicates how much the region has changed relative to the New Zealand as a whole (see Figure 11.1). A difference between the acute and elective levels of HUE(0) with respect to New Zealand could indicate where the system is under strain or being oversupplied.

Figure 11.1: Acute Hospital Utilisation Expectancies at Birth: Differences from New Zealand, By Gender and Region, 1980-82, 1990-92 and 1999-2001

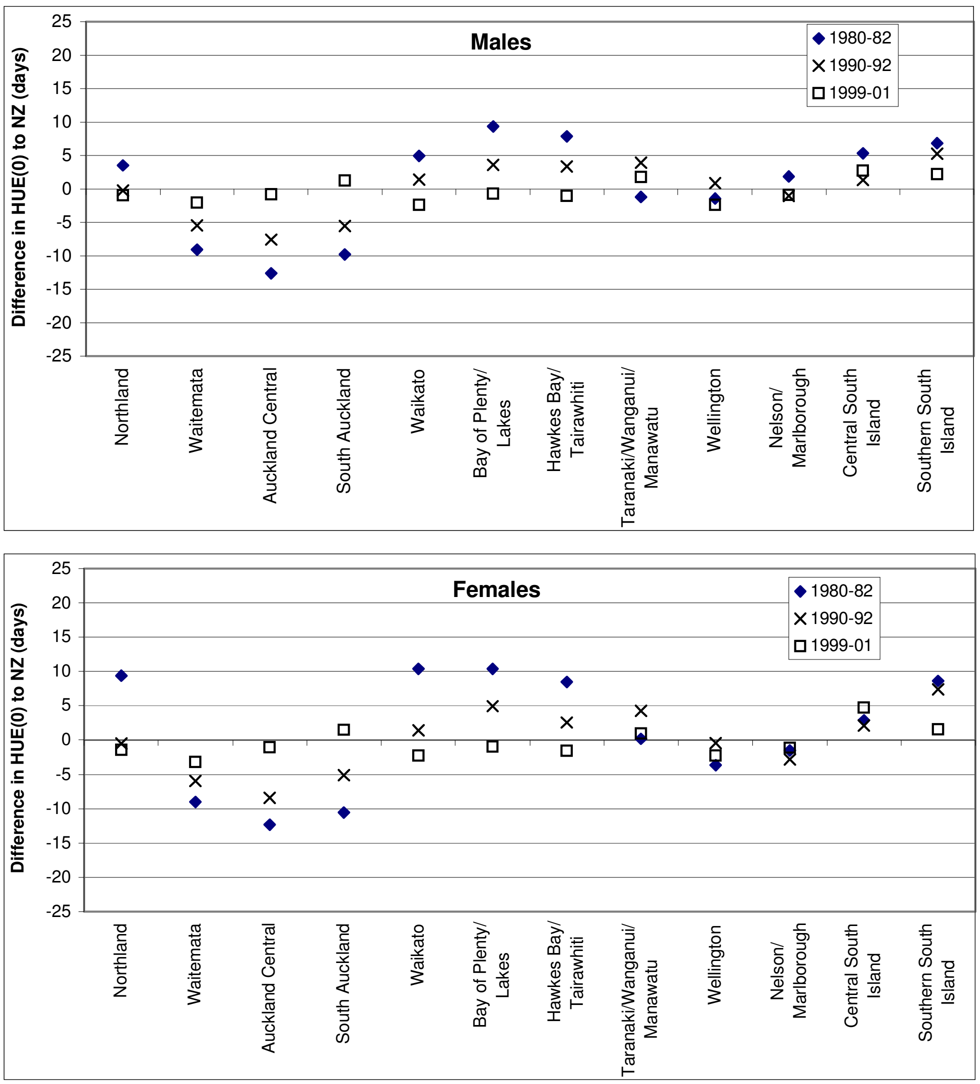


Note: Weighted Average Deviations: Males 1980-82 – 6.3, 1990-92 – 3.6, 1999-2001 – 3.1; Females 1980-82 – 9.8, 1990-92 – 4.3, 1999-2001 – 3.3.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

For acute HUEs there is a pattern of convergence or improvement (i.e. regional levels moved to or fall well below the New Zealand figure), with the exclusion of **Nelson/Marlborough**, and to a lesser extent, **Wellington**. These regions diverged from the New Zealand level over the time period. The only region which was markedly deviant, and also above the level for New Zealand, (more than 5 days above) was **Bay of Plenty/Lakes**. The patterns at 65+ years and for the tranche 0-64 were similar to those for HUE(0) and thus we have not included them here. Regional variations in elective HUEs are now examined in Figure 11.2.

Figure 11.2: Elective Hospital Utilisation Expectancies (Days) at Birth: Difference to New Zealand, By Gender and Region, 1980-82, 1990-92 and 1999-2001



Note: Weighted Average Deviations: Males 1980-82 – 6.1, 1990-92 – 3.4, 1999-2001 – 1.8;
Females 1980-82 – 7.0, 1990-92 – 3.9, 1999-2001 – 2.1.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

Electives follow basically the same trend of convergence as did acutes (see Figure 11.2) with regions moving towards the national level. This indicates a shift in managing the supply-side. But there is concern that not all the convergence can be explained by supply-side factors. For example, **Waikato, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** all dropped substantially. These declines may be due to real health gains or due to efficiency improvements in the health system, not necessarily implying benefits to health.

It is useful to look at Figures 11.1 and 11.2 together. For a number of regions in certain years the acute value was around the New Zealand level, whereas the elective value was well above the New Zealand level: **Waikato** in 1980-82, **Central South Island** in 1990-92 and **Southern South Island** in 1980-82 and 1990-92. This indicates that the hospital systems had enough beds or services to be able to do more elective procedures, given that the populations had average health status.

In contrast, in **Waikato** in 1999-01 and in **Wellington** in 1980-82 the acute value was above that for New Zealand whereas the elective value was below. This could mean either that the health status of the population was poor and people were treated as acute as a result of a failure to access elective procedures, or that, as the elective procedures were not done, they later presented as acute cases as the condition became more severe. Taking this further, in **Bay of Plenty/ Lakes** in 1999-01, in **Northland** 1980-82 for males, and in **Hawke's Bay/Tairawhiti** in 1990-92, **Taranaki/Wanganui/ Manawatu** in 1980-82 and **Nelson/Marlborough** for females in 1980-82 the acute value was above the New Zealand level while the elective value was around the national rate. This could again indicate that these regions have poorer health status, with an increased need for acute admission. It also could mean that there are insufficient elective procedures available to prevent acute admissions.

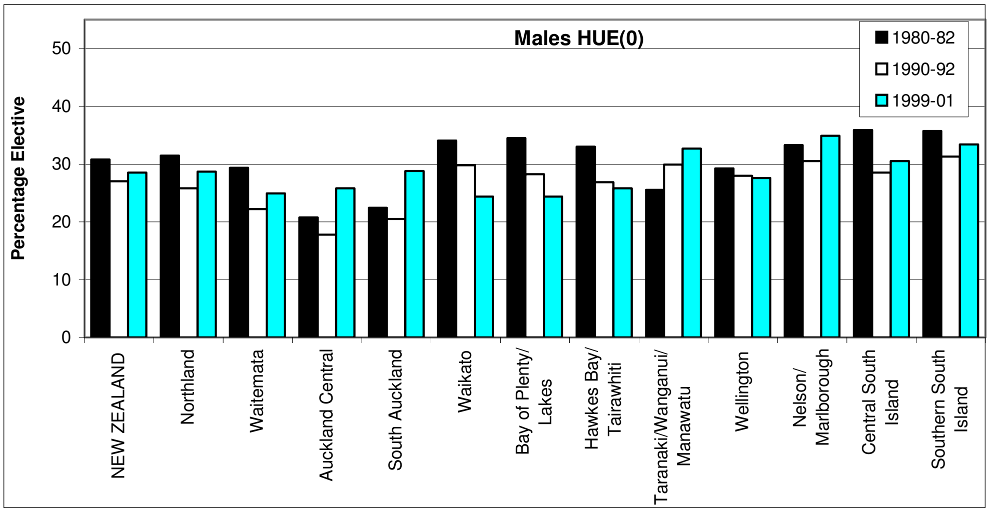
In **Wellington** in 1990-92 and in **Central South Island** for males in 1980-82 the acute value was below the New Zealand level and the elective value was above the New Zealand levels. This suggests that due to good health status, these regions had surplus capacity for acute needs and thus could transfer this to provide sufficient elective procedures to meet demand. In **Wellington** in 1999-01 and **Nelson/Marlborough** in 1990-92 and 1999-01 the acute value was below the New Zealand level and the elective value was around the New Zealand level. This indicates that the health status of the population was good and that there may be sufficient elective procedures available to maintain this position.

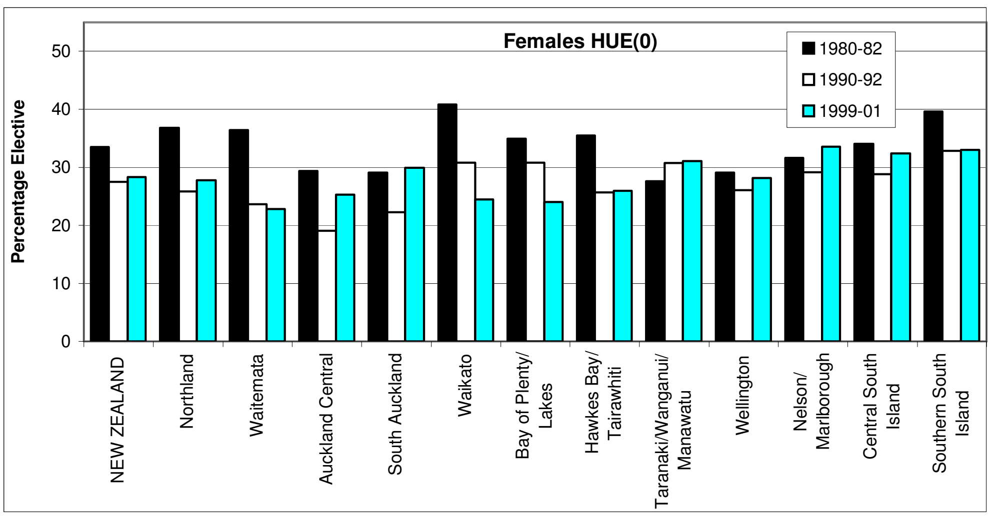
11.2.6 Regional Variation in the Percentage of HUE that is Elective

The contribution of electives to the total HUE (0) varied quite markedly between regions in 1981, as can be seen in Figure 11.3. The proportion generally dropped over time, although in some northern regions there was a slight reprise. More importantly, the percent elective generally remained higher in regions from **Taranaki/Wanganui/Manawatu** south. This may indicate a generous supply of beds.

The patterns at 65+ years and at 0-64 years generally follow those for HUE (0) and are thus not included here. However, at ages 65+, differences are less extreme and the increase in the proportions elective in the South becomes more evident than at all ages. At ages 0-64, higher percentages of the HUE are elective at all ages. As the percentage of HUEs that is acute is simply the inverse of the elective percentage, regional variations in the percentage of HUEs that are acute are not discussed here.

Figure 11.3: Percentage of HUE (0) that Derives from Elective Causes, Regions, 1980-82; 1990-92; and 1999-01





11.3 INFECTIOUS DISEASES[48]

An analysis of the impacts of infectious diseases on the hospital system provides an indication of whether the public health system and health education and immunisation programmes are working effectively. Of interest in this analysis is also the point that infectious disease can be aggravated by poor living conditions (such as poor housing and overcrowding) and inadequate access to primary health systems. There is evidence from recent refined studies that infectious disease is a substantial burden of disease in New Zealand that has actually increased in recent years (Mills and Tobias 2002, Ministry of Health 2001b). With the introduction of penicillin and other antibiotics it was considered that infectious disease was essentially a factor that was part of the past, but in the latter part of the 20th century there seems to have been a re-emergence of these diseases. There are a number of factors that have contributed to this, such as the increased and more rapid movements of people around the world, including large numbers migrating from the poorest countries, where the burden of communicable

[48] This category includes Infectious and Parasitic Diseases (ICD-9 CM 0-139); Inflammatory Diseases of the Central Nervous System including meningitis (ICD-9 CM 320-326); Acute Respiratory Infections including tonsillitis, bronchitis (ICD-9 CM 460-466); and Pneumonia and Influenza (ICD-9 CM 480-497). The primary diagnosis was used. Communicable diseases can be an alternative term for infectious diseases.

diseases is higher, to richer countries, increases in urbanisation where people live closely together, injection of drugs, sexual freedom, the over-use of antibiotics which leads to resistance of drugs, new infections appearing and people choosing not to be immunised thus permitting vaccine-preventable diseases to re-emerge (Eberhart-Phillips 1999).

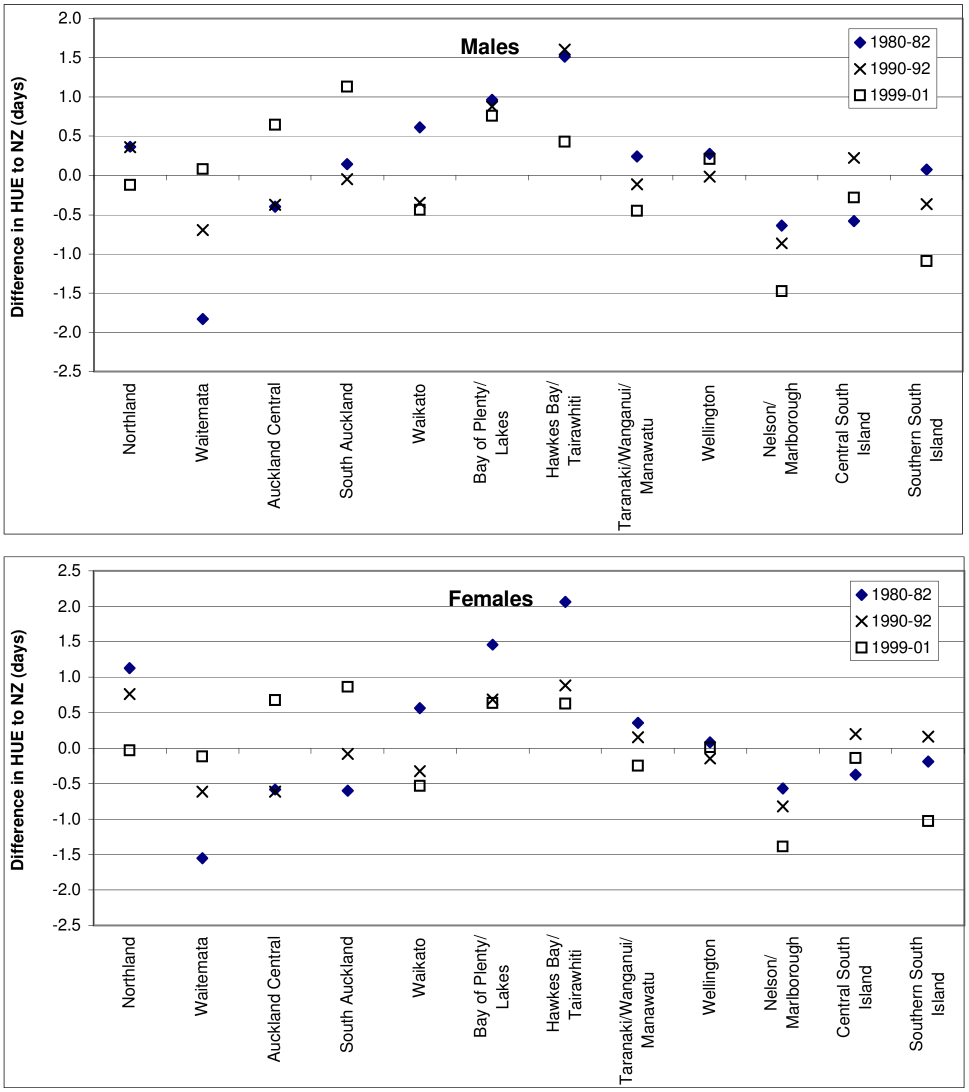
To look at this, and to simplify the analysis three three-year averages were calculated for periods representing the start, middle and end of the period 1980 to 1998. These results show that nationally, the HUE for infectious diseases has not changed significantly over the time period with the male HUE being slightly higher than that for females. For males the infectious disease HUE was 3.7 days in 1980-82, 2.9 days in 1988-90 and 3.3 days in 1996-98 whereas for females it was 3.4, 2.7 and 3.1 days respectively.

As a percent of the total HUE (0), however this group of causes showed an increase from five to seven per cent for males and four to six per cent for females. This change is rather more significant for health services planning than the simple numbers imply. The HUE for infectious diseases suggests that by the late 20th century the health services, especially hospitals, overwhelmingly were dealing with non-communicable causes. This raised concern about health utilisation and hospital infrastructures that had originally been designed to combat 'plagues' and were now having to combat 'chronic disorders' (Bui Dang Ha Doan 1988). Yet if, as Eberhart-Phillips (1999) argues, communicable disorders "are making a comeback", then we may once again have to rethink some aspects of the institutions and infrastructure of the health system.

To add to this the impacts of 'plagues' are not evenly spread. When comparing the regional results to the New Zealand total there are some regions which differ from the national level (see Figure 11.4). **Hawke's Bay/Tairawhiti** HUE's for infectious diseases was very high in the 80s and 90s but converged to nearer the national level in 1999-01; worryingly, a more general trend is of divergence not convergence. **Waitemata, Auckland Central** and **South Auckland** (the three Auckland regions) have shown substantial increases, in the case of **Auckland Central** and **South Auckland** to well above the national level, while most other regions (especially **Hawke's Bay/Tairawhiti**) have shown reductions.

There appear to be three patterns emerging; these are sharp increases from relatively low levels to well above the national level for Auckland regions, sharp decreases from relatively high levels towards the national level for other North Island regions, and moderate declines from below the national level for South Island regions.

Figure 11.4: Infectious Diseases Hospital Utilisation Expectancies (Days) at Birth: Difference to New Zealand, By Gender and Region, 1980-82, 1988-90 and 1999-2001



Note: Weighted Average Deviations Males 1980-82 – 0.6, 1990-92 – 0.4, 1999-2001 – 0.5;
Females 1980-82 – 0.7, 1990-92 – 0.4, 1999-2001 – 0.5.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

11.4 CONCLUSION

This chapter has continued to disentangle the competing effects of supply and demand on HUEs, at both a national and regional level, by analysing acute and elective, and infectious and non-infectious components of HUEs. The next chapter investigates trends in day-patients over time, and the effect of this on utilisation patterns.

A detailed conclusion to the three supply and demand chapters is given at the end of the next chapter.

CHAPTER 12

Disaggregating Supply and Demand: Day-Patients

12.1 INTRODUCTION

As outlined in Chapter 4 there are inadequacies with data on day-patients, and as a result, they have been excluded from the discharges analysed in earlier chapters. It might be noted that this category was relatively uncommon until the late 1980s when, as a part of restructuring day cases became more common. This was probably for reasons relating to both health- and efficiency-gains, and to quality of care, and not simply for cost-cutting. From the mid-1980s data were collated on day-patients and this collection became systematic and complete by the late-1980s.

Obviously, access to day-patient care has an impact on supply and demand, the central concern of this chapter. It may also throw light on the scope of primary care: some patients may present at hospital emergency facilities in lieu of visiting a general practitioner. Among other advantages are that this care is free and patients do not need an appointment.[49] As a result, there have been attempts to encourage people with illnesses to consult GPs rather than go to hospital emergency departments.

It was noted in earlier chapters that a period of rapid change occurred in the late 1980s/early 1990s. This was also a period in which the rates for day-patient discharges increased dramatically, as is shown below. The question thus arises whether the rapid changes in those years were mainly a function *either* of improved or new systems of reporting (i.e. that procedures taking less than one day were now being identified separately and more accurately), *or* of real changes in clinical procedures involving a shift from treatments that demanded a bed-stay overnight (or over a number of nights) to admission and discharge on the same day. Clearly the latter of these would be an efficiency-gain as it eliminated the costly overnight 'hotel' costs. An alternative hypothesis is that these factors explain only some of the changes in this period. A further alternative hypothesis would be that efficiency-gains in other components of the health system produced the unintended and negative effect of increases in use of out- and day-patient facilities because of declines in access to primary health care outside the hospital system.

As was noted in the introduction to this chapter, these changes clearly affect the supply and demand of in-patient services. Thus here an attempt is made to estimate this impact and also to assess the role of day-patient services in efficiency gains. It is not the intention here to see these simply as efficiency-gains as they may have been designed specifically to enhance the chances of recuperation and the quality of life of presenting patients, and thus to entail real health-gains. Unfortunately, however, we cannot evaluate their impact on heath gain as this involves clinical assessments or micro-level analyses of the QALY-sort (Johnstone *et al.* 1998).

12.2 DEFINING DAY-PATIENTS

Chapter 4 (see also Appendix B) described the filtering used to ensure that the hospitalisation data employed in this monograph referred to cases for which some active intervention or procedure was carried out for a definable cause of ill-health or external cause such as injury or poisoning. In those chapters 'day-patients' were filtered out of the set. The reasons were in part substantive – any treatments would have been minor otherwise the patient would have been admitted overnight; in part a response to methodological problems. While there have always been patients treated and sent home on the same day, until 1988 hospitals were not required to report these cases, and even after this became obligatory, the data-set was not complete (this was achieved only in 1992). Moreover, until

[49] The growth of private accident and emergency facilities has also been a change in this period, and may confound the day-patient trends we are analysing here. But the effect will be limited as emergency patients are generally not recorded as day-patients.

1986 when a day stay was reported, it was coded as 'one day'.[50] Beyond this, there was probably some confusion between day- and out-patients while there was a need to distinguish between cases that went through the entire procedure from diagnosis, to treatment to discharge, from those who presented purely for diagnosis, or those who came in for post-operative procedures. This is not always a clear-cut distinction as admission as a day-patient can be for procedures such as biopsies or diagnostic radiology.[51]

There are two other problems. Firstly, the definitions of day- and out-patients changed in the period as the following quotations show: recently an out-patient has been defined as "a person who goes to a health care facility for a consultation, and who leaves the facility within three hours of the start of consultation. An out-patient is not formally admitted to the facility" (Ministry of Health 1998). A day-patient is "a person who is admitted and discharged from hospital on the same day" (Ministry of Health 1998). In this context, it should be noted that a case discharged because of death during the first day has always been counted as an in-patient and thus are included in the general hospitalisation data analysed earlier[52].

Secondly, as a part of the restructuring of the 1980s and 1990s, and where it was clinically desirable, advantage was taken of advances in health technologies permitting patients to be discharged as soon as feasible (Ministry of Health 1999b). Changes occurred whereby cases that would have entailed admission for one or more nights were treated as day-patients. Moreover, in the 1990s "Appropriate treatment as a day-patient [was] to be encouraged and a CHE [Crown Health Enterprise] that [was] doing a high proportion of their cases on a day-care basis [were to] be 'rewarded' by having a shorter average length of stay". A control was instituted by way of a "casemix-adjusted surgical day patient index" to allow for the nature of the different mixes of "status on admission" (Ministry of Health 1998: 288-89), but further clarification about the 'rewards' does not seem to be available. As will be shown below, the flow of day-patients grew to become a significant minority of all discharges.

It was argued in the introduction to this chapter that changes might affect supply and demand of in-patient services. Thus here an attempt is made to estimate this impact and also to assess the role of day-patient services in efficiency-gains. We cannot directly evaluate their impact on health as this involves clinical assessments, but we assume that often these changes did produce gains and were desirable for medical reasons, not just for cost-cutting purposes. Moreover, for most people to be discharged to their own homes probably constitutes an 'improved quality of life'.

As in the rest of this study each admission/discharge is the unit of analysis. Thus, each day-patient encounter is one day's hospitalisation. Each subsequent day-patient admission is another day's stay.

Day-patient procedures and cases are scattered across the entire ICD (Australian) spectrum. Nevertheless, they do cluster to a degree as we can show by taking all examples involving more than

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[50] This is based on a detailed review of cases that showed none for which discharge and admission dates were recorded as the same day.

[51] Groups of day-patients that were filtered out because some hospitals treat them as outpatients are those for chemotherapy, radiotherapy, renal dialysis, gastroscopies, colonoscopies, cystoscopies, blood transfusions and incorrectly coded Starship day-patient stays for 1991-1994 (see Appendix B). This follows the protocols used by the Ministry of Health.

[52] A 'day-patient' is a person who is admitted and discharged on the same day. Day patients do not include those patients who died in hospital or transferred to another hospital; these are recorded as inpatients.
http://www.nzhis.govt.nz/moh.nsf/pagesns/365?Open

Day-patient - A patient admitted for healthcare with a length of stay less than one day, regardless of intent. See also 'Admission' and 'Intended day case'.

Admission - The documentation process, which may include entry to the NHI, by which a person becomes resident in a healthcare facility. For the purposes of the national collections, healthcare users who attend for more than three hours should be admitted. Healthcare users who receive treatment for more than three hours or who have a general anaesthetic are to be admitted. This also applies to health care users of emergency departments. When calculating the three hours, exclude waiting time in a waiting room, exclude triage and use only the duration of treatment. If part of the treatment is observation, then this time contributes to the 3 hours. 'Treatment' is clinical treatment from a nurse or doctor or other health professional.

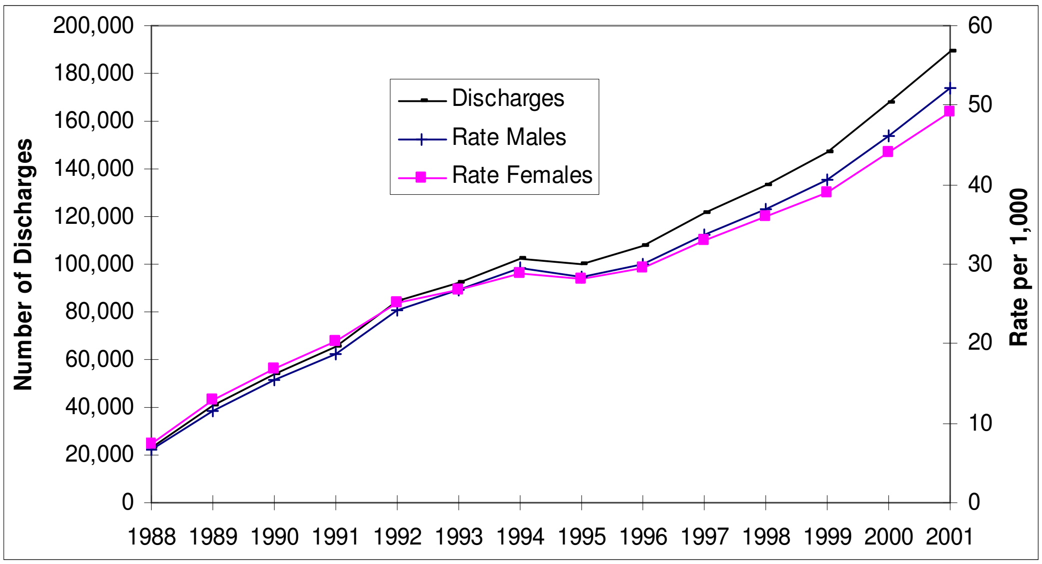
Intended day case - A patient where the intention at admission is that the event will be a day case event.
See http://www.nzhis.govt.nz/moh.nsf/pagesns/241?Open

2000 procedures or cases (out of an average total of 169,096 day-patients, 1999-2001). Thus 46 percent of all day-patient cases are included in only 17 of 98 categories (two-digit procedure codes).[53] Even at the more detailed three-digit level, 22 percent are found in only eight categories, by and large relating to minor medical or dental surgical and diagnostic procedures. Of diagnoses in 1999-2001, on average 29 percent cluster into just 14 ICD 3-digit codes.

12.3 DAY-PATIENT TRENDS

Day-patient numbers rose steadily in the late 1980s, plateaued in the mid-1990s and then rose again. At early stages this may have been in part a function of improved reporting. The changes are shown in Figure 12.1. The rates for each gender also increased roughly sevenfold as can be seen in Figure 12.1.

Figure 12.1: Numbers and Gender Specific Rates (per 1,000) of Day-Patients, New Zealand, 1988-2001



Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1986-2001 Censuses of Population and Dwellings.

[53] **Table: Top Day-Patients Primary Procedure (2 Digit Level), New Zealand, 1999-2001**

	Primary Procedure (2digit level)	Annual Average
86	Operations of skin and subcutaneous tissue	11,962
88	Other diagnostic radiology and related techniques	8,156
99	Other non-operative procedures (eg injections)	8,115
20	Other operations of middle and inner ear	7,613
13	Operations on lens	7,547
23	Removal and restoration of teeth	5,841
45	Incision, excision, and anastomosis of intestine	3,900
80	Incision and excision of joint structure	3,206
21	Operations on nose	2,885
66	Operations on fallopian tubes	2,725
87	Diagnostic radiology	2,586
28	Operations on tonsils and adenoids	2,564
53	Repair of hernia	2,461
67	Operations on cervix	2,398
69	Other operations on uterus and supporting structures	2,337
04	Operations on cranial and peripheral nerves	2,307

Source: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges.

Day-patient rates (age-standardised) vary by region, as is seen in Table 12.1. As the rate increased over the 1990s the inter-regional range decreased, but the direction of differentials did not change markedly except in two cases, **Waitemata** and **South Auckland**. They both shifted from below the New Zealand level to above. **Northland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** remained well above New Zealand, although this difference decreased for **Bay of Plenty/Lakes** but increased for **Hawke's Bay/Tairawhiti**. **Auckland Central** also maintained a rate above New Zealand's but the margin remained relatively similar.

Table 12.1: Day-Patient Age-Standardised Rate per 1,000, Regions, 1992-94 and 1999-2001

Region	1992-94		1999-2001	
	Male	Female	Male	Female
NEW ZEALAND	**26.9**	**26.9**	**46.4**	**44.1**
Northland	43.2	40.8	52.8	47.7
Waitemata	22.8	22.3	52.5	49.1
Auckland Central	30.6	28.9	49.7	45.4
South Auckland	21.1	19.8	56.2	50.6
Waikato	31.7	28.3	43.0	43.1
Bay of Plenty/ Lakes	36.7	38.7	49.0	48.3
Hawke's Bay/ Tairawhiti	31.5	33.0	53.3	49.6
Taranaki/Wanganui/ Manawatu	23.4	25.2	39.9	46.3
Wellington	19.4	20.1	36.8	35.6
Nelson-Marlborough	31.3	34.5	46.0	44.1
Central South Island	26.6	25.5	43.2	42.9
Southern South Island	25.0	29.5	38.4	36.2
Range	*23.8*	*21.0*	*19.4*	*15.0*

Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1986-2001 Censuses of Population and Dwellings.

For New Zealand the percent of all discharges that were day-patients increased from a quarter to a third over the period, a growth that is less than might have been expected given the increases in numbers and rates. Moreover, the inter-regional range in percentages did not increase or decrease systematically over the period, although a modest shift by gender occurred. Again, as Table 12.2 shows, it is the Northern regions plus **Nelson/Marlborough** that have higher levels, but rank positions over time in this are not consistent except for **Nelson/Marlborough** and **Auckland Central**. By 1999-2001, three of the four regions with notably high proportions were the Auckland metropolitan regions.

The day-patient Hospitalisation Utilisation Expectancy (HUE) presented in Table 12.3 puts the situation into a different perspective. The HUE methodology, it will be recalled, combines discharges with the duration of stay for a person surviving (a day-patient is a live discharge).

Table 12.2: Day-Patients as a Percentage of Discharges (In-Patients and Day-Patients), Regions, 1992-94 and 1999-2001

Region	1992-94		1999-2001	
	Male	Female	Male	Female
NEW ZEALAND	**23.8**	**27.7**	**33.4**	**36.3**
Northland	29.8	30.9	32.7	35.0
Waitemata	23.8	29.7	39.7	42.2
Auckland Central	27.2	33.6	36.3	39.0
South Auckland	20.4	24.3	36.6	38.3
Waikato	25.8	26.1	30.0	33.6
Bay of Plenty/Lakes	24.9	29.6	29.5	33.5
Hawke's Bay/Tairawhiti	21.6	26.2	34.0	36.4
Taranaki/Wanganui/Manawatu	20.3	23.9	29.6	33.8
Wellington	20.5	24.6	30.3	33.4
Nelson-Marlborough	29.9	35.7	37.7	40.3
Central South Island	24.9	27.0	33.1	36.0
Southern South Island	21.3	27.7	28.8	33.5
Range	*9.6*	*11.8*	*10.9*	*8.8*

Sources: New Zealand Health Information Service, National Minimum Data Set – Hospital Discharges
Statistics New Zealand, 1986-2001 Censuses of Population and Dwellings.

Table 12.3: Hospital Utilisation Expectancy at Birth HUE(0) for Day-Patients, and as a Percentage of Total HUE(0)[1], Regions, 1992-94 and 1999-2001

Region	HUE(0, day-patients)				(Day-Patients/ total) %			
	1992-94		1999-2001		1992-94		1999-2001	
	Male	Female	Male	Female	Male	Female	Male	Female
New Zealand	**1.0**	**1.1**	**1.9**	**2.0**	**1.8**	**1.8**	**3.7**	**3.6**
Northland	1.6	1.6	2.1	2.1	2.9	2.6	4.3	4.0
Waitemata	0.9	0.8	2.3	2.3	1.9	1.8	4.4	4.2
Auckland Central	1.1	1.1	2.1	2.0	2.4	2.3	3.8	3.5
South Auckland	0.8	0.8	2.3	2.3	1.6	1.4	4.1	3.9
Waikato	1.3	1.2	1.8	2.0	2.3	2.0	3.5	3.6
Bay of Plenty/Lakes	1.4	1.6	2.1	2.2	2.3	2.3	3.5	3.6
Hawke's Bay/Tairawhiti	1.2	1.3	2.1	2.1	1.7	1.7	3.9	3.9
Taranaki/Wanganui/Manawatu	0.9	1.0	1.7	2.0	1.4	1.5	3.5	3.5
Wellington	0.7	0.8	1.5	1.6	1.3	1.3	3.4	3.3
Nelson-Marlborough	1.2	1.4	2.0	1.9	2.6	3.0	4.8	4.5
Central South Island	1.0	1.0	1.8	1.8	1.9	1.6	3.0	2.9
Southern South Island	0.9	1.2	1.6	1.6	1.5	1.7	3.1	3.1
Range	*0.8*	*0.8*	*0.8*	*0.7*	*1.6*	*1.7*	*1.8*	*1.5*

(1) HUE(0, discharges excluding day-patients) + HUE(0,day-patients).
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1991-2001 Censuses of Population and Dwellings.

As Table 12.3 shows, the HUE(0) for day-patients is not only low in level but also low as a percent of the total HUE. Thus the procedural changes involving day-patients had a limited overall impact on hospital resources, especially 'hotel' services, once the intense costs often entailed on admission and discharge have been passed.

Using the methodology employed in Chapter 9, tranche HUE (day-patients) were computed and the percentage contribution by age of day-patients estimated. The results are shown in Table 12.4. Three conclusions can be drawn from this table. Firstly, as in the case of HUE(0) there was an increase over the period and the inter-regional range also increased, although only very slightly and not across all ages. Secondly, day-patients were most likely to be children or at young adult ages. Thirdly, the regional patterns for Tranche HUEs resembled those for the HUE(0) in 1992-94, but by 1999-2001 some other differences appear, depending on the tranche. The **Auckland Metropolitan** regions and **Nelson/Marlborough** tended to have higher day-patient HUEs for most tranches than is true for New Zealand as a whole. **Hawke's Bay/Tairawhiti** also had higher levels at several age-groups, as did **Wellington** for children, and **Waikato, Bay of Plenty/Lakes** and **Taranaki/Wanganui/Manawatu** at the oldest ages.

Table 12.4: Tranche HUEs for Day-Patients as a Percentage of all Discharges[1] By Age, Gender and Regions, 1992-92 and 1999-2001

Region	1992-94				1999-2001			
	0-14	15-44	45-64	65-84	0-14	15-44	45-64	65-84
	Males							
NEW ZEALAND	**4.7**	**3.1**	**1.8**	**1.0**	**7.1**	**6.4**	**4.0**	**2.6**
Northland	6.1	5.1	2.7	1.6	6.2	6.3	4.2	3.4
Waitemata	7.3	2.7	1.6	0.8	7.8	10.0	5.1	3.0
Auckland Central	7.2	3.1	1.8	1.1	6.7	7.9	4.3	2.5
South Auckland	4.0	2.3	1.5	1.1	8.1	6.3	4.2	2.9
Waikato	4.2	3.5	2.4	1.5	5.8	4.5	3.9	2.9
Bay of Plenty/Lakes	3.8	3.4	2.3	1.7	5.6	5.4	3.5	2.8
Hawke's Bay/Tairawhiti	3.5	2.8	1.8	1.0	7.1	6.8	4.4	2.6
Taranaki/Wanganui/Manawatu	3.7	2.5	1.3	0.7	6.1	5.3	3.7	2.7
Wellington	3.9	2.7	1.3	0.6	7.3	5.5	3.6	2.4
Nelson-Marlborough	6.5	4.8	2.9	1.4	7.9	8.1	5.0	3.6
Central South Island	5.1	3.2	2.2	1.0	8.9	6.3	3.5	1.8
Southern South Island	3.6	3.0	1.4	0.8	7.0	4.9	3.3	2.2
Range	*3.8*	*2.9*	*1.6*	*1.1*	*3.3*	*5.5*	*1.9*	*1.8*
	Females							
NEW ZEALAND	**4.4**	**5.1**	**2.1**	**0.8**	**6.6**	**9.0**	**4.4**	**2.3**
Northland	5.5	6.7	3.3	1.2	6.3	8.1	4.7	2.9
Waitemata	6.5	5.7	1.8	0.6	7.0	12.4	5.6	2.8
Auckland Central	7.0	5.9	2.1	0.8	6.4	10.8	4.4	2.3
South Auckland	3.8	4.3	1.4	0.6	8.0	8.5	4.5	2.7
Waikato	3.7	4.5	2.6	1.3	5.7	7.4	4.5	2.5
Bay of Plenty/Lakes	4.0	5.4	2.9	1.4	5.5	7.6	4.2	2.7
Hawke's Bay/Tairawhiti	3.7	4.9	2.1	0.7	5.9	9.2	4.7	2.4
Taranaki/Wanganui/Manawatu	3.3	4.3	1.6	0.5	5.1	8.2	4.3	2.4
Wellington	3.3	4.5	1.6	0.5	6.7	8.2	4.3	2.2
Nelson-Marlborough	6.9	7.6	3.8	1.1	7.6	11.4	5.4	2.8
Central South Island	4.5	4.9	2.1	0.8	7.7	8.7	4.0	1.6
Southern South Island	3.5	5.3	2.3	0.6	6.9	8.0	3.6	1.8
Range	*3.7*	*3.3*	*2.4*	*0.9*	*2.9*	*5.0*	*2.1*	*1.3*

(1) All discharges = day-patient + in-patients

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1991-2001 Censuses of Population and Dwellings.

Table 12.5: Percentage Contribution of Different Age-Groups to the HUE (0, Day-Patients)

Region	1992-1994					1999-2002				
	<15	15-44	45-64	65+	Total	<15	15-44	45-64	65+	Total
Males										
New Zealand	29.3	21.7	21.1	27.8	100	22.4	20.8	20.1	36.7	100
Northland	27.7	29.1	20.7	23.6	100	20.9	23.9	19.8	35.4	100
Waitemata	44.4	16	16.4	23.2	100	18.8	23.3	18.3	39.6	100
Auckland Central	47.2	15.1	15.6	22.2	100	21.9	22.1	20.6	35.4	100
South Auckland	28.8	17.9	20.5	32.8	100	23	21.3	19.1	36.6	100
Waikato	22.6	21.7	21.7	34	100	21.1	17.2	20.5	41.2	100
BOP/Lakes	21.3	23	22.8	32.8	100	19.2	20.8	20.3	39.7	100
Hawkes Bay/Tairawhiti	24.4	26.5	23.2	25.9	100	21.7	23.8	21.7	32.8	100
Taranaki/Wanganui/ Manawatu	26.8	27.6	19.8	25.7	100	21.2	20.3	21.5	37	100
Wellington	29.2	24.3	22.2	24.3	100	26.3	17.1	19.3	37.3	100
Nelson-Marlborough	24.9	27	22.6	25.4	100	18.3	21.5	21.3	38.9	100
Central South Island	27.5	20.3	24	28.2	100	27	20.9	20.6	31.5	100
Southern South Island	26.1	25.5	21.9	26.5	100	24.4	17.1	20.3	38.2	100
Range	*25.8*	*14*	*8.4*	*11.8*		*8.7*	*6.8*	*3.4*	*9.7*	
New Zealand	21.6	33.3	22.5	22.6	100	17	27	21	35	100
Females										
Northland	21.1	34.6	23.7	20.7	100	16.3	28.2	21	34.5	100
Waitemata	34.6	31.1	16.4	17.8	100	14.2	27.6	18.7	39.5	100
Auckland Central	37.9	26.4	17.4	18.2	100	18	26.5	19.6	35.9	100
South Auckland	24.1	33.8	18.6	23.5	100	18.8	24.9	20.6	35.7	100
Waikato	15.9	27.7	24.4	32	100	15.8	24	22.6	37.6	100
Bay of Plenty/Lakes	14.8	31.7	24.5	29	100	15	25.8	20.7	38.5	100
Hawkes Bay/Tairawhiti	21.6	36.9	22.6	19	100	15.7	30.6	22	31.7	100
Taranaki/Wanganui/ Manawatu	17.5	41	22.6	18.9	100	11.8	27.8	21.5	38.9	100
Wellington	18.8	37.9	23.5	19.8	100	19.6	24.7	21.1	34.6	100
Nelson-Marlborough	18.5	36.6	26	19	100	14.7	30.1	21.7	33.5	100
Central South Island	20.1	32.7	21.6	25.6	100	19.3	29.2	21.7	29.8	100
Southern South Island	15.6	38.2	27.6	18.6	100	18.7	26.1	21	34.2	100
Range	23.1	*14.6*	*11.2*	*14.2*		*7.7*	*6.6*	*4.0*	*9.8*	

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1991-2001 Censuses of Population and Dwellings.

Unlike in-patients, day-patients were distributed more evenly across all age-groups, as is seen in Table 12.5. There was, however, a shift over the 1990s towards a greater concentration at ages 65+ years, while the inter-regional ranges decreased significantly, far more than for in-patients. In particular, convergence was marked at childhood, although this was in part due to two very deviant regions in the early 1990s, **Waitemata** and **Auckland Central**. Currently we can suggest no reason for this pattern and in lieu of a better explanation assume that it is related to coding.

To review, some of the regional patterns can be explained by reference to the clustering by diagnosis and procedure, as shown in Table 12.6. There were few differences by diagnosis except for **Taranaki/Wanganui/Manawatu** and **Southern South Island** that were above the New Zealand level. Regions for which clustering in the top 17 procedures exceeded that for New Zealand, tended to be those with concentrations at older ages: **Bay of Plenty/Lakes, Taranaki/Wanganui/Manawatu** and the **South Island regions**. Two very different regions were **Waikato** and **Wellington.** Finally, patients were most likely to be admitted for observation and discharged in the **Auckland metropolitan** and **Central South Island** regions and **Hawke's Bay/Tairawhiti**. The inter-regional range was least for diagnosis and highest for observation and discharge.

As has been shown, older people were heavier users of hospital facilities and it seems that in some areas in which older people were concentrated, some of the in-patient services had been moved into day-patient procedures. In an earlier chapter we looked at the balance between elective and non-elective procedures. The use of day-patient services may be related to this.

Table 12.6: Percentage of Day-Patients, 1999-2001 Whose Discharges Were Within the Top 14 and 17 Categories of Diagnosis for New Zealand as a Whole, or Who Were Subject to No Procedure*

Region	**Diagnosis**	**Procedures**	
	Top 14	**Top 17**	**None**
NEW ZEALAND	29.1	46.6	30.8
Northland	31.4	45.6	30.8
North Auckland	29.2	39.5	43.1
Auckland	28.1	39.7	41.7
South Auckland	28.3	43.3	37.5
Waikato	28.8	49.4	28.3
Bay of Plenty/Lakes	29.1	51.6	21.1
Hawke's Bay/Tairawhiti	27.5	42.8	36.7
Taranaki/Wanganui/Manawatu	34.3	56.1	18.1
Wellington	29.7	50.7	22.2
Nelson-Marlborough	31.7	50.7	16.6
Central South Island	24.7	47.4	31.3
Southern South Island	33.5	50.6	21.1
Range	9.6	16.6	26.5

* 'No procedures' were when patients were observed and then discharged.
Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

Against this, especially in the **Auckland metropolitan area** and **Hawke's Bay/Tairawhiti** day-patient services seemed disproportionately drawn upon for observations with no procedure eventuating. For metropolitan regions this finding is counter-intuitive as these areas have alternative emergency clinics. This may suggest the development of a different demand culture in some regions. Equally well, there may be differences also in referral patterns – admission as an in-patient, referral back to a GP or other primary provider, or treatment as a day-patient.

Following this issue further, diagnoses were analysed for 1999-2001 to check on regional differentials. In Table 12.7 this is summarised by looking at the four most important categories out of 17 for each region. The four top-ranked codes made up between 46.6 percent and 52.0 percent of all categories in each region. Thus the variance in terms of clustering was very limited. The most prevalent diagnoses, moreover, were for causes that could be handled most efficiently as day-patient procedures, for example: cataracts, dental procedures, biopsies, and injuries or poisoning. Cataracts and similar diagnoses topped the list almost everywhere, and were followed typically by admissions for digestive system illnesses and procedures related to neoplasms. Distributions were relatively similar except for four notable exceptions:

- The systematic clustering for genito-urinary conditions in the southern North Island and the South Island regions.
- **Central South Island** had disproportionate numbers in the musculo-skeletal categories.
- The importance of persons presenting with diseases of the respiratory system, and symptoms, signs and ill-defined conditions in **Auckland Central** and **South Auckland**. This may be a further indicator of a 'demand culture' noted earlier.
- Relative to other regions, **Hawke's Bay/Tairawhiti** had high proportions in the supplementary category, which may be a function of limited access to primary and emergency services in that area.

Table 12.7: Regional Clustering by Diagnostic Chapter: Top Four ICD Codes Ranked by Region, 1999-2001

Region	Digestive[1]	Genito-urinary[2]	Musculo-skelatal[3]	Nervous[4]	Respiratory[5]	Injury, Poisoning	Neoplasms[6]	Supplementary	Symptom, signs, ill-defined
Northland	4			1		2	3		
Waitemata				2		1	4		3
Auckland Central				2	4	1			3
S. Auckland	4			1	3	2			
Waikato	3			1			2		4
BoP/Lakes	3			1		4	2		
H.B./Tair.	4			1		2		3	
Tar/Wan/Man	3	4		1		2			
Wellington	2	4		1			3		
Nelson/Marlb	3	4		1			3		
Central S.I.		2	3	1		4			
Southern S.I.	3	4		1			2		
NZ	4			1		2	3		

1) The largest sub-categories were dental and inguinal hernia.
2) The largest single sub-category was menstrual problems.
3) The largest single sub-category was internal derangement of knee.
4) The largest single sub-category was cataracts.
5) The largest sub-categories were tonsils and adenoids, and asthma.
6) The largest sub-categories involved neoplasm's of skin.

Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

12.4 THE IMPACT OF A SHIFT TO DAY-PATIENT CARE ON HOSPITALISATIONS

Clearly, increasing substitution of in-patient care by day-patient was a major change in procedures that took place over the period. This analysis cannot be as definitive as it might be because it is confounded by changes in reporting in the late 1980s and in the completeness of the records prior to 1992. Earlier in this study it was shown that much of the overall change for the period 1980 to 2001 had occurred in the late 1980s. This is a trend that is of seminal importance to the entire monograph that requires explanation because that period in part saw a continuation of former hospital board structures, and then the constitution of Area Health Boards that were to bring together primary and secondary health care systems. These had had a brief period mainly devoted to setting up, during which it might have been expected that real shifts in health- and efficiency-gains would have been fairly minimal, before the 1991 restructuring was instituted. This latter process was structurally a far more radical set of changes, and thus one would have expected efficiency- and health gains to have been more marked in the 1990s than in the late 1980s, until 1982. Yet analyses in earlier chapters suggest that this was not the case.

This leaves the analyst with a number of questions that will be posed here as postulates to be investigated in the remainder of the chapter by studying the impacts of shifts in day-patient procedures in the two critical periods from 1982-84 to 1992-94 and 1992-94 to 1999-2001. It will be recalled from Figure 12.1 that these shifts occurred in two bursts – in the late 1980s and in the late 1990s, each numerically about the same, but the earlier one involving a greater rate of change. The postulates are:

- That the changes in the late 1980s, by comparison with those of the 1990s, were an artefact of improving data collection systems, above all the confounding effect of the more complete reporting of day-patient discharges by 1992.[54]
- That, alternatively, the changes in the late 1980s, by comparison with those of the 1990s, came from the impact of a major shift from in-patient to day-patient procedures. To sustain this postulate the impacts of increasing resort to day-care would have to have been greater in the late 1980s than in the late 1990s.
- That in the late 1980s, by comparison with the 1990s, more substantial system-wide changes, beyond simply a shift to day-care occurred, producing efficiency-gains (and perhaps health gains).

Tables 12.8 to 12.11 address these hypotheses. They permit us, by investigating the effects of changes in discharges and bed-days, for in-patients and day-patients combined and in-patients alone over the period of interest. Table 12.8 looks at cases (discharges) and 12.9 at bed-days for the changes from the early 1980s to the early 1990s; Tables 12.10 and 12.11 for changes from the early to late 1990s.

Indirect standardisation, used for Tables 12.8-12.11, is always difficult to interpret. The aim is to look at changes over two different periods. Here we try to summarise what is in those tables.

Table 12.8 shows that, between the 1980s and early 1990s, across New Zealand as a whole the total number of cases increased, whereas the in-patient component of these decreased. This finding supports the argument that there was a successful shift of cases from in-patient to out-patient: from longer overnight durations of stay to in and out in the one day. There were, however, marked inter-regional differences in this shift-share, with the southern two-thirds of the country seeing greatest decreases in in-patient numbers, indicative of a shift away from an over-supply of beds for those regions.

[54] It must be stressed, again, that these data relate to place of residence, not the facility to which the patient goes/is referred. This point is very important for some peripheral regions, especially Northland. There were other data issues discussed in Chapter Four relating not to total deaths and discharges, but to Māori definitional issues for these two sets of events. For this reason the present analysis relates to the Total population and does not attempt any analysis of ethnic differentials.

Table 12.8: Changes in Case-Loads: Percentage Differences in Expected and Observed Discharges* Between the Early 1980s and 1990s, By Gender and Region

Region	Males		Females	
	In-patient + Day-patient	In-patient	In-patient + Day-patient	In-patient
New Zealand	15.0	-10.5	14.2	-13.2
Northland	9.5	-20.7	4.2	-25.3
Waitemata	40.3	6.3	33.2	-1.5
Auckland	32.1	-1.5	26.6	-7.2
South Auckland	24.5	-5.6	18.3	-10.1
Waikato	24.7	-0.7	20.0	-6.5
Bay of Plenty/Lakes	24.1	-5.3	21.2	-11.7
Hawke's Bay/Tairawhiti	11.7	-10.7	11.9	-13.7
Taranaki/Wanganui/Manawatu	12.4	-8.1	15.6	-8.0
Wellington	2.3	-16.7	1.2	-19.8
Nelson-Marlborough	5.4	-22.6	9.1	-24.6
Central South Island	7.1	-17.5	9.2	-16.1
Southern South Island	5.8	-14.1	10.1	-14.8

* Expected values were computed using indirect age-standardisation applying age-specific rates from 1992-94 to the age distribution for 1982-84 to give an expected number of cases by age. The percentage is the sum of the age-specific expected numbers, minus the total observed (1982-84), divided by the total observed (1982-84). A plus means that the expected > observed and thus that there was an increase in hospitalisations between the 1980s and 1990s; a minus means that the observed > expected, and thus that there had been a decrease.

Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

Table 12.9: Changes in Patterns of Stay in Hospital: Percentage Differences in Expected and Observed Bed-Days* Between the Early 1980s and 1990s, By Gender and Region

Region	Males		Females	
	In-patient + Day-patient	In-patient	In-patient + Day-patient	In-patient
New Zealand	-35.0	-36.5	-35.8	-37.4
Northland	-42.1	-44.2	-44.5	-46.6
Waitemata	-23.7	-25.9	-26.1	-28.3
Auckland	-27.3	-29.3	-27.2	-29.1
South Auckland	-27.9	-29.4	-27.0	-28.7
Waikato	-37.0	-38.8	-39.4	-41.0
Bay of Plenty/Lakes	-38.0	-39.7	-37.1	-39.0
Hawke's Bay/Tairawhiti	-33.7	-35.1	-34.1	-35.6
Taranaki/Wanganui/Manawatu	-35.9	-37.0	-40.2	-41.4
Wellington	-34.6	-35.8	-37.3	-38.5
Nelson-Marlborough	-45.6	-47.4	-48.4	-50.5
Central South Island	-38.0	-39.5	-38.9	-40.2
Southern South Island	-34.1	-35.4	-28.9	-30.5

* Expected values were computed using indirect age-standardisation applying age-specific rates from 1992-94 to the age distribution for 1982-84 to give an expected number of bed-days by age. The percentage is the sum of the age-specific expected numbers, minus the total observed (1982-84), divided by the total observed (1982-84). A minus means that the observed > expected, and thus that there had been a decrease in durations of stay for hospitalisation between the 1980s and 1990s.

Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

Table 12.9 confirms how this change was effected. Bed-days decreased everywhere. This was predominantly due to the shortening of in-patient stays, contingent on the shift to greater resort to out-patient services.

Table 12.10: Changes in Case-Loads: Percentage Differences in Expected and Observed Discharges* Between Early 1990s and 2001, By Gender and Region

Region	Males		Females	
	In-patient + Day-patient	In-patient	In-patient + Day-patient	In-patient
New Zealand	21.5	8.2	24.4	11.6
Northland	10.4	6.6	6.0	1.5
Waitemata	46.0	22.7	51.8	28.1
Auckland	33.9	23.4	43.1	34.1
South Auckland	52.6	25.3	55.4	29.6
Waikato	12.1	4.9	18.6	8.0
Bay of Plenty/Lakes	12.5	6.5	12.1	6.9
Hawke's Bay/Tairawhiti	5.4	-9.9	6.2	-7.4
Taranaki/Wanganui/Manawatu	10.0	-3.0	37.3	23.5
Wellington	17.8	3.1	24.2	10.7
Nelson-Marlborough	13.8	2.0	16.1	9.5
Central South Island	23.0	11.9	29.0	17.1
Southern South Island	3.9	-6.8	1.2	-5.9

* Expected values were computed using indirect age-standardisation applying age-specific rates from 1999-2001 to the age distribution for 1992-94 to give an expected number of cases by age. The percentage is the sum of the age-specific expected numbers, minus the total observed (1992-94), divided by the total observed (1992-94). A plus means that the expected > observed and thus that there was an increase in hospitalisations over the 1990s; a minus means that the observed > expected, and thus that there had been a decrease.

Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

Table 12.11: Changes in Patterns of Stay in Hospital: Percentage Differences in Expected and Observed Bed-Days* Between Early 1990s and 2001, By Gender and Region

Region	Males		Females	
	In-patient + Day-patient	In-patient	In-patient + Day-patient	In-patient
New Zealand	-14.6	-16.6	-14.2	-16.1
Northland	-14.1	-15.3	-17.8	-19.1
Waitemata	0.1	-3.2	4.4	1.1
Auckland	1.7	-0.2	8.4	6.7
South Auckland	2.6	-0.8	-1.7	-5.1
Waikato	-12.3	-13.6	-11.5	-13.2
Bay of Plenty/Lakes	-15.0	-16.2	-16.6	-17.9
Hawke's Bay/Tairawhiti	-29.0	-31.0	-28.3	-30.1
Taranaki/Wanganui/Manawatu	-30.8	-32.6	-3.7	-5.6
Wellington	-26.4	-28.4	-25.7	-27.7
Nelson-Marlborough	-16.0	-18.0	-11.6	-13.3
Central South Island	-10.9	-12.5	-8.3	-9.9
Southern South Island	-27.7	-29.2	-30.6	-31.8

* Expected values were computed using indirect age-standardisation applying age-specific rates from 1999-2001 to the age distribution for 1992-94 to give an expected number of bed-days by age. The percentage is the sum of the age-specific expected numbers, minus the total observed (1992-94), divided by the total observed (1992-94). A plus means that the expected > observed and thus that there was an increase in durations of stay for hospitalisations over the 1990s; a minus means that the observed > expected, and thus that there had been a decrease.

Source: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.

Between the early 1990s and 2001, however, the pattern changed. Total patient numbers increased, as is seen in Table 12.10, but there were also increments in the numbers for in-patients alone. Minor exceptions to this trend were seen in **Hawke's Bay/Tairawhiti**, **Taranaki/Wanganui/Manawatu** and **Southern South Island**, where overall growth in discharges was low and in-patient changes negative. In contrast, in the **Auckland regions** growth in both was rapid.

Table 12.11 indicates these shifts just outlined entailed efficiency gains because almost everywhere in the latter part of the 1990s in-patient bed-days stays decreased, and in most cases this was in excess of that seen for all bed-days (in-patient + out-patient). Auckland's three regions were exceptions to this, but their trend probably reflected a catch-up with southern regions so as to gain more equity.

Tables 12.10 and 12.11 have another aspect that may be less positive. There seems to have been a growth in inter-regional differences. This is not an artefact of structural difference; this was the period of RHAs – as is shown by the differences between Northland and its Auckland metropolitan neighbours, all in the same North Health RHA.

Taken together, these three tables shed quiet a lot of light on the effectiveness of restructuring over the two different periods - late 1980s/early 1990s, and the 1990s. Of particular interest here is that in Table 12.8, for the late 1980s, the trends between all cases and in-patient alone went in opposite directions, but also that the magnitude of the differences between all discharges and in-patient alone were the most marked of any shown in the other tables; in contrast, in table 12.10 for the 1990s, the directions were the same and the magnitude of differences not as marked.

In both Tables 12.9 and 12.11, looking at hospital stays, the directions were the same and the differences not very marked – in short they show that efficiency gains were achieved by a major shift in hospital procedures from in-patient to out-patient. But what is evident in comparing the two tables 12.8 and 12.10 the most radical efficiency gains came in the late 1980s, not in the 1990s when such issues gained a higher public profile. By the early 1990s, a quantum shift had been realised and further changes could only consolidate what had already been achieved. A sub-plot to this was that these changes also involved major shifts northwards in case-loads, a factor mainly due to increasing inter-regional equity in the supply of services.[55] Some of the consolidation in the 1990s was merely the continuation of this movement towards convergence.

This chapter, and especially its last section, has highlighted efficiency gains, and also pointed to equity gains. The next chapter will take this analysis further by trying to analyse whether these changes also entailed effectiveness gains.

12.5 CONCLUSION

The last three chapters have explored ways of disaggregating supply and demand by looking at various groupings of discharges. Firstly, the patterns for avoidable and non-avoidable hospitalisations were analysed. The avoidable category is an indicator of how well demand is being managed through different primary health care strategies. Then we investigated acute and elective hospitalisations to gain an indirect estimate of supply and demand. Acute admission is more likely to relate to demand, and elective is what is left after acute discharges are subtracted and so therefore relates to supply, although the breakdown is not quite as simple as this might suggest. Analysis of another key group of hospital discharges, infectious diseases, give some indication of public health concerns in the regions, and how well the public health system is working in preventing these and thus in limiting the need for hospitalisation. Finally, supply and demand are also affected by whether procedures are in-patient or involve day-patient care.

[55] It must be reiterated that these data relate only to region of residence of the discharge and do not necessarily reflect where the procedure was carried out; thus Auckland data do not reflect the concentration there of specialised services. Similarly, by age-standardisation we have eliminated demographic composition effects.

The most important overall impression that emerges from the last few chapters when these are read in conjunction with earlier ones is of inter-regional convergence over the period, and a general decline over time, for most of the groupings studied. The sole exception was for day-patient discharges which increased as a component of a shift-share in the distribution of clinical procedures from favouring overnight stays to attempting to return patients as quickly as possible to their homes. This is a trend that we have taken to indicate an efficiency-gain, and we accept that often it may involve health gains and improved quality of life. Thus looking across the results here there are clear indications that efficiency-gains were effected, and also that this may have been accompanied by health-gains. However, it must be recalled that, as has been discussed earlier, HUEs do not directly measure health. Rather they are a measure of the complex relationship between population health status, health-seeking behaviour, and health service provision at both primary and secondary levels.

Against this, however, some of the changes seem counter-intuitive and thus may indicate that not all efficiency-gains also produced improved population health. Puzzling for example is the drop in Māori hospitalisations for certain categories, discussed in Chapter 8, from a level well above the New Zealand rate to one well below. While one might have hoped for a convergence towards non-Māori levels it is unlikely that Māori would on average have achieved such good health that they needed to draw on services less than Pakeha – recalling of course that all our results control for age-distribution. Indeed, this trend in hospitalisations appears to contrast markedly with the stagnation of Māori survivorship, whereas it would have been expected that it would increase over the period. Thus the impression is left that efficiency-gains may not always have served Māori well, that too many, as it were, 'fell between the cracks' in the system. That said such a judgement must be mitigated by the fact that by surviving for shorter durations the duration of risk of being hospitalised was less. But this begs the question: why was survivorship less?

A similar problem appears with certain regions. If convergence were a general trend why did Māori HUEs move towards the New Zealand level, yet for all other indicators Māori population health standards in some regions remained below the national figure? Some notion of the dynamics comes from the review of day-patient discharges. Two sorts of regions saw more marked shift-shares from in-patient to day-patient procedures: metropolitan areas and the more disadvantaged regions. Such a change in the former areas where geographical access is less problematic seems entirely reasonable because support systems are readily available for a discharged day-patient who needs re-admission. These would also be the regions where technical innovations would be introduced earlier. Beyond this, the metropolitan regions were those where accident and emergency facilities were first set up and are the most prevalent. But in peripheral regions, where there are also often geographical barriers to access, the question arises whether disproportionate increases in day-patient rates are not indicative of other problems. One could suggest that there might be a displacement effect where, what should be covered in general practice or in after-hour emergency care facilities, is still being met by people presenting as day-patients. That is, the efficiency gains have not also produced "real" health gains. The next chapter attempts to discern whether such a displacement did occur, and whether its impact was felt unevenly across different regions. In other words we look next at whether there is an uneven and perhaps hidden burden of ill-health underlying many of the contradictions that we have raised in this chapter.

CHAPTER 13

Efficiency-Gains, Health-Gains and the Burden of Ill-Health

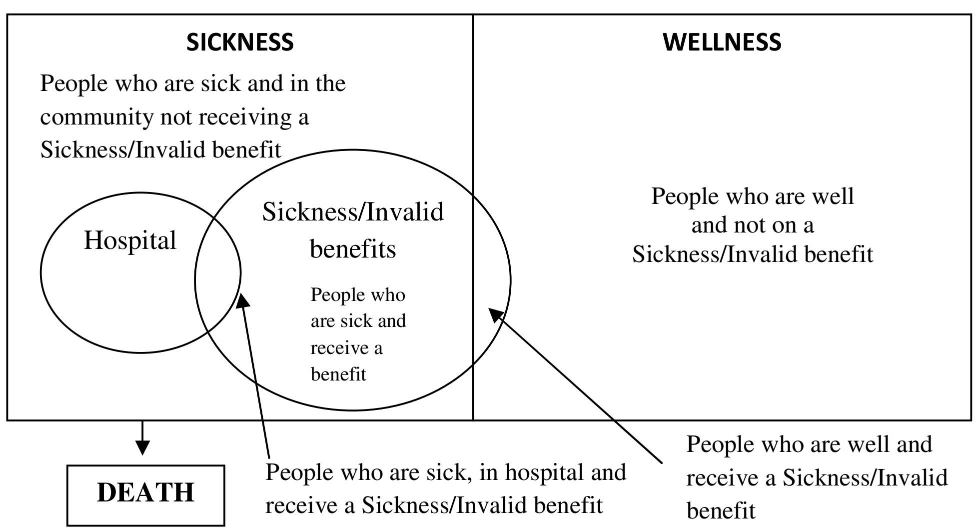
13.1 INTRODUCTION

Hospitalisation is the end of a process. Only death is further down this path, but admission to hospital is merely the 'tip of the iceberg' in terms of the prevalence of ill-health in the population (see Figure 13.1). To be admitted to hospital a person suffering from some condition must be identified, usually by a primary care provider, then be referred to a hospital, or present themselves there.

Our earlier analysis has shown that regional hospitalisation levels converged, which is probably an indication of efficiency-gains produced by the restructuring, yet differences still remain for some mortality based measures. Moreover, there are differences in various cause-specific HUEs that are perplexing if not counter-intuitive. There are also regional and ethnic results that are worrying.

This suggests that health-needs also vary and that convergence might not measure real changes in demand, but rather how need has been managed by the system. There may well be a reservoir or 'burden of ill-health' underlying hospitalisation, but its extent is difficult to determine: here we give a partial answer by investigating Sickness and Invalid Benefit[56] levels. This analyses another dimension of supply and demand by correlating access to the sickness/invalid benefit with Hospital Utilisation Expectancies.

Figure 13.1: Sickness and Wellness State and its Relationship to Hospitalisation and Sickness/Invalid Benefits



This analysis has implications for many aspects of health policy (see Figure 13.1). It could indicate unmet demand for hospitalisation. Alternatively, it could also indicate the proportion of people who 'quit' the 'formal' health system, as measured by hospitalisation, to enter what we have called the 'informal' sector where they have some contact with primary care givers. In one sense they are the health system's equivalent to 'discouraged workers' in the labour market system. Thus this analysis allows us to assess indirectly whether, along with efficiency-gains, there were real health-gains, or whether the 'burden of ill-health' has simply been shifted rather than reduced.

[56] The Sickness and Invalid Benefit are independent, but for our purposes we have taken them as one, as an indication of underlying ill-health in the community. We will use these two terms interchangeably.

One important fact central to the present analysis stands out. To be eligible for a sickness/invalid benefit, the variable we are employing as an indicator for the underlying 'burden of ill-health', the beneficiary will have been subject to a health assessment procedure by a medical practitioner. This measures, as it were, the prevalence of unspecified 'sickness' in the community, only some of which is being accommodated in formal institutional settings.

In the period covered by this monograph, which falls entirely in the years governed by the processes operating prior to the benefit procedural changes introduced in September 2007, the focus was on eligibility, rather than on treatment and cure. The treatment aspect was improved after 2007, but that period is outside the scope of this monograph. Treatments and cures were, of course, often achieved prior to 2007 because of the assiduousness of the medical practitioners or Work and Income staff involved in processing and managing the needs of beneficiaries, and who might recommend/pursue interventions or referrals. But the emphasis was on gate-keeping access to benefits rather than on achieving population-health gains, and there was nothing in the Work and Income system to generate automatic linkages with the health system. The process typically involved a "new case" visiting a general practitioner, who would recommend that they proceed through to be certified to receive a benefit initially, at first for four weeks and then for three months. They were then vetted for eligibility by a medical practitioner appointed by Work and Income. A new certificate was required every three months for sickness benefits, and every two years for invalid benefits. A confounding effect is that beneficiaries often suffered from one or more co-morbidities, often spanning both physical and mental health, but the initiating medical practitioner could include only the primary cause, so that the system did not register or pursue other significant conditions.

It goes almost without saying that the compliance costs and obstacles involved in following these procedures would have been greatest for people living in the more isolated parts of the country, far from the bigger centres, from a range of medical professionals and from a Work and Income office. These were also the areas where Māori were clustered, and these are exactly the regions that show up negatively in Table 13.2. It must be noted that a Disability Allowance did mitigate aspects of this process and facilitate access to health care, but again there appear to have been regional and ethnic differentials in the take-up of these. In contrast, there seems to have been few effects, negative or positive, due to the combining of disability with health, under the Regional Health Authorities, during the 1990s.[57]

The responsibility to navigate through the system might be seen to belong to the patient or that of their immediate carers, typically their family. But as they were, by definition, incapacitated by ill-health or disability this itself was a barrier without adding on all the other factors already noted.
In sum, the system was far from perfect in handling the vulnerable sub-populations who were outside the hospital systems, but whose conditions generated an underlying burden of ill-health in every region, particularly the poorer and more peripheral. Because of their demographic composition (age and ethnicity), these were also the parts of the country where cohort factors were most likely to demand particular care over monitoring and intervention. By way of partial plea in mitigation, because of its population geography - a small population spread across a country that is long and mountainous or hilly, yet concentrated in a few areas - New Zealand does face some particular problems for health care delivery. But the system has clearly not really overcome this problem; in fact our data suggest that it may have become worse, not because the spatial determinants changed, but because policy shifts and their associated management procedures failed to address these issues.

Unfortunately, access to a benefit is not a pure measure of the prevalence in the community of 'sickness'. Above all, the emphasis to date in our monograph has been on physical ill-health, but sickness/invalid benefits also cover mental health, a factor outside the interest of much of this study.

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[57] We wish to acknowledge the valuable assistance of Kay Brereton, Wellington People's Centre, with whom we discussed the issues covered in the last two paragraphs; all errors of fact or interpretation in this commentary are, of course, ours and are not the responsibility of the WPC. This centre has undertaken surveys of access in different parts of the country, and their results show marked differentials, with Māori, Pasifika peoples and rural populations being least able to take up benefits.

Moreover, it is important to recognise that changes in health utilisation might not be the only factors affecting the prevalence of benefit uptake. A number of other factors also contribute. For example, there were some changes in sickness/invalid benefit levels with respect to the unemployment benefit over the period from 1986 to 1996 that can affect rates of inter- benefit movement. Initially in 1986, payments for sickness and invalid benefits were higher than those for unemployment, thereby creating a two tier system making it more advantageous financially to be on the sickness/invalid benefit than on the unemployment one. In 1991 there were *pro rata* cuts to both unemployment and sickness benefits, but not to invalid benefits, creating a three tier system which was still in place in 1996. The different levels of payments may have been an incentive for some people to move from one benefit to another.

Analysis of data suggests a high degree of mobility into the higher paid invalids and sickness benefits of persons who formerly were on the unemployment benefit. For example, "30 percent of all new grants of Sickness Benefit in 1995 were to people previously on Unemployment Benefit" (Preston 1996: 87). But it must also be recognised that low income people are more likely than others to be in poorer health. Beneficiaries are also often people who are not working, as they are dependent on benefits and thus have low income (National Health Committee 1998). Literature reviews of unemployment and health have also shown this relationship (Bethwaite *et al.* 1990, Barnett 1995).

This has also been a time in which the overall level of benefit utilisation has risen across benefit categories (Pool *et al.* 2006b). When the economy is strong, people are able to get employment easily, even some who might otherwise be eligible for the sickness/invalid benefit. When economic conditions worsen and competition for jobs increases, these are the first people to be pushed out of work. Some of this group could also be discouraged workers (Pool *et al.* 2006a).

Finally, many sickness/invalid beneficiaries suffer from psychiatric disorders or intellectual disability. As noted above, much of the present study does not cover these two health categories and thus there is not a perfect fit between the sickness/invalid benefit and hospitalisation, as defined in the rest of this report. That said, many persons with psychiatric and/or intellectual disabilities may also be subject to physical ill-health and thus the disjunction is not as severe as it might seem.

To attempt to synthesise what is in the rest of this chapter, we finish by building scenarios. We assume that an ideal situation would be when each region has rates that are as favourable as or better than those for New Zealand in 2001. This allows us to demonstrate what would have been required were real convergence to have been successfully effected.

For this analysis data for two time points are investigated: at the 1986 and 2001 censuses. In this chapter only the age specific rates of all the people receiving sickness/invalid benefit aged 15-59 years are investigated. This differs from the methodologies used in earlier chapters where benefit use for the overall population at 15-64 years was investigated, with sickness/invalid benefit as part of a hierarchical structure. This produced a measure that was, thus, not a measure of overall prevalence of illness.

The age group was limited to less than 60 years in the present chapter as people had been eligible to draw superannuation at this age in 1986, although by 2001 the age had gone up to 65 years. This allows direct comparisons between the two censuses.

The census question asked whether over the year, a person received one or more benefit. There was a slight difference in the way the question was asked between 1986 and 2001, in 1986 being in terms of social welfare payments in the last 12 months, whereas in 2001 it was in the context of all sources of income over the last 12 months. This could possibly affect the way people responded to the question. That said, the rapid growth in benefit use was clearly not merely a function of question design.

13.2 TRENDS IN LEVELS OF SICKNESS/INVALID BENEFIT RECEIPT

National Patterns

Nationally, all age groups showed a rise in the use of sickness/invalid benefit over the time period, but this was highest for the older age groups (see Table 13.1). The gap between males and females increased at younger ages (15-29 years), but narrowed substantially at older ages (45-59 years).

Table 13.1: Percentage of the Population Receiving Sickness/Invalid Benefit By Selected Age Group and Gender, New Zealand, 1986 and 2001

Age Group	1986		2001		Percentage Point Difference	
(years)	Males	Females	Males	Females	Males	Females
15-29	2.4	2.6	2.9	3.3	0.5	0.7
30-44	2.3	1.5	4.2	3.6	2.0	2.1
45-59	4.1	2.4	5.8	6.5	1.7	4.1

Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

Regional Patterns

The regional pattern for the fifteen year age specific sickness/invalid benefit rates show some interesting patterns (see Table 13.2).

- **Nelson/Marlborough,** and (to a lesser extent) **Central South Island** tended to have high sickness/invalid benefit rates compared to New Zealand for all ages for both 1986 and 2001.
- **Northland** and, to a lesser extent, **Hawke's Bay/Tairawhiti** went from around the level for New Zealand in 1986 to above it in 2001 at all ages, indicating an increased dependency on sickness/invalid benefits.
- **Auckland Central** started off with high sickness/invalid benefit rates compared to New Zealand but converged towards New Zealand levels by 2001, except for the age groups 15-29 years which reduced to below the New Zealand average.
- The region which stands out as systematically having the lowest sickness/invalid benefit rates is **Waitemata**, at all age groups and in both years. **Wellington** also tended below New Zealand at most age groups, and for both years. **Taranaki/Wanganui/Manawatu** was below the New Zealand average in 1986, but was around it by 2001.
- The remaining regions including **Bay of Plenty/Lakes** and **South Auckland** have generally clustered around the national rate for sickness/invalid benefit.
- The largest increases in the percentage receiving sickness/invalid benefit were found in **Northland**. At the other end of the scale, **Waitemata** and **Auckland Central** had the smallest increases.

Table 13.2: Percentage of the Population Receiving Sickness/Invalid Benefit, By Selected Age Group, Gender and Region, New Zealand, 1986 and 2001

Region	15-29years		30-44 years		45-59 years	
	Males	Females	Males	Females	Males	Females
			1986			
New Zealand	**2.4**	**2.6**	**2.3**	**1.5**	**4.1**	**2.4**
Northland	2.4	2.6	2.5	1.1	4.6	2.2
Waitemata	2.0	2.0	1.6	0.9	2.9	1.9
Auckland Central	2.5	2.9	3.3	2.5	6.1	4.3
South Auckland	2.4	2.7	1.9	1.2	3.8	2.3
Waikato	2.8	2.6	2.2	1.5	4.1	2.0
Bay of Plenty/Lakes	2.5	2.7	2.1	1.2	3.8	1.9
Hawke's Bay/Tairawhiti	2.5	2.9	2.2	1.6	4.6	2.4
Taranaki/Wanganui/Manawatu	2.1	2.4	2.1	1.3	3.9	2.0
Wellington	2.1	2.4	2.1	1.4	3.2	2.1
Nelson/Marlborough	3.4	3.7	2.9	2.0	4.9	2.5
Central South Island	2.7	2.8	2.7	1.8	4.8	2.7
Southern South Island	2.5	2.6	2.1	1.3	3.8	2.1
			2001			
New Zealand	**2.9**	**3.3**	**4.2**	**3.6**	**5.8**	**6.5**
Northland	3.8	4.1	6.1	5.0	8.0	8.2
Waitemata	2.2	2.4	3.0	2.5	3.6	4.4
Auckland Central	2.0	2.2	3.4	3.0	6.0	6.1
South Auckland	2.6	3.1	3.5	3.3	5.4	6.9
Waikato	3.0	3.7	4.9	3.9	6.4	6.9
Bay of Plenty/Lakes	3.4	3.9	4.4	3.8	5.7	6.3
Hawke's Bay/Tairawhiti	3.7	4.6	5.0	4.0	6.8	7.2
Taranaki/Wanganui/Manawatu	3.2	4.1	5.2	4.6	6.9	7.8
Wellington	2.6	2.7	3.2	2.8	4.7	5.0
Nelson/Marlborough	3.9	4.5	5.8	5.0	6.1	7.3
Central South Island	3.4	3.8	5.1	4.3	6.6	7.2
Southern South Island	3.2	3.4	4.6	3.9	6.2	7.1

Source: Statistics New Zealand, 1986 and 2001 Censuses of Population and Dwellings.

13.3 SICKNESS/INVALID BENEFITS AND THEIR RELATIONSHIP TO HOSPITALISATION AND MORTALITY

In order to investigate whether or not there has been displacement into the less formal health sector the relationship between, on the one hand, the sickness/invalid benefit age-specific rates and, on the other hand, hospitalisations and survivorship was analysed. Hospitalisation was measured by the tranche HUE for groups at various labour force ages, and the other variable was the probability of dying, which is the inverse of the probability of surviving that was employed earlier. It is important to note that the probability of surviving is also used in the calculation of tranche HUEs, so that tranche HUEs and the probability of dying are co-linear and therefore cannot be directly compared. The tranche HUE is taken here to measure hospital utilisation, the probability of dying to measure health status, and data on the sickness/invalid benefit to measure the underlying 'burden of ill health' in the population.

There were two dimensions in this analysis. The first is how these factors have changed over time in relationship to each other. The time duration in this case was a 15 year span, 1986-2001. The second is how these factors related to regional differences, to deviations from New Zealand patterns as they change over time. For this analysis fifteen year age groups by gender were used between ages 15 and 59 years. These are the ages at which people receive sickness/invalid benefit. The 15-59 year age group is an important group of the population as it provides the workforce to run the economy. If this group does not have good health then the quality of human capital is diminished. At 60 years and beyond in 1986, of course, and at 65+ years in 2001, most beneficiaries were superannuitants.

The changes in the age specific tranche HUEs, and the probability of dying between the ages of 15-59 years for New Zealand are presented in Table 13.3. The tranche HUE followed a general trend whereby the bed-days increase by age, as might be expected, though up to 45 years the differences were not large. Against this, there was a general decline in all the tranche HUEs over time. An interesting point, however, is that in 1985-87, at ages 15-29 and 45-59 years, males had the higher rate, whereas at 30-44 years females had the higher rate.[58]

Table 13.3: Tranche HUE and Probability of Dying By Selected Age Groups and Gender, New Zealand, 1985-87 and 1999-2001

Age Group (years)	1985-87		1999-2001[1]		Percentage Point Difference	
	Males	Females	Males	Females	Males	Females
			Tranche HUE (days)			
15-29	5.6	4.4	2.8	2.4	-2.8	-2.0
30-44	5.0	6.0	3.2	3.0	-1.9	-3.0
45-59	11.3	10.6	6.2	5.8	-5.1	-4.8
			Probability of Dying			
15-29	0.024	0.009	0.018	0.007	-0.006	-0.002
30-44	0.027	0.017	0.023	0.013	-0.004	-0.004
45-59	0.112	0.072	0.074	0.051	-0.038	-0.020

(1) Probability of Dying is a two year average 1999-2000

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

For the probability of dying, rates generally increase with age (also see Table 13.4). Males have higher probabilities of dying than do females. There was a general decline between 1985-7 and 1999-01 with the decrease being larger at older ages. This is part of a long-term general trend in life-expectancy (Pool and Cheung 2003).

We turn now to the relationship between sickness/invalid benefit, and tranche HUE and the probability of dying. The 12 scatter graphs showing the intersects for each region, by 15 year age group and gender; these bi-variate relationships are presented in Appendix Figure 13.1. They show fairly systematically that tranche HUEs and the probability of dying by age both decline over time, but the decrease for the latter is less than for tranche HUEs. In contrast, the rates of sickness/invalid benefits increase over time.

This finding must be treated as indicative rather than to make a definitive point. But it does suggest that accompanying efficiency gains in the hospital sector, as shown by the HUEs, was displacement in the health system into less formal areas. If efficiency and effectiveness gains had been in tandem, then the intersects for the bi-variate relationship between probabilities of dying and being on a benefit would have been in tandem with the intersects of HUEs and benefit use.

[58] It must be stressed that obstetric cases had been filtered out of the data set, and thus this result is not a direct function of normal pregnancy and childbirth. It is more likely, however, that pregnant women would be more carefully monitored than their male peers and thus that any health problems would be identified. In developed countries with low fertility there is an apparent contradiction between higher female morbidity and higher male mortality (Verbrugge 1983).

13.4 CHANGES OVER TIME IN THE RELATIONSHIP BETWEEN SICKNESS/ INVALID BENEFIT RATES, HOSPITALISATIONS AND MORTALITY

We now look at the relationship between sickness/invalid benefit rates, hospitalisations and mortality and how regional differences from New Zealand changed over time. The aim is to determine whether the displacement inferred above produced a growth or decrease in the disparities between regions. For these purposes we turn to a set of indices termed weighted average deviations (WADs). They are based on the mean deviations of regions from the New Zealand level[59].

National Patterns

Table 13.4 presents the WADs for each age and gender category. With one exception, the deviations increase with age for all three measures, which is expected as rates increase by age. There was an increase in the variance between regions for sickness/invalid benefits between 1986 and 2001, whereas the range of tranche HUEs decreased and the probability of dying showed a mix of decreases and increases.[60]

Table 13.4: Weighted Average Deviation[1] of the 12 Regions for Sickness/Invalid Benefits, Tranche HUE and Probabilities of Dying, By Ages and Gender, 1986 and 2001[2]

Age group (years)	1986		2001		Change	
	Males	Females	Males	Females	Males	Females
Sickness/Invalid Benefit (%)						
15-29	0.23	0.21	0.49	0.64	0.27	0.43
30-44	0.36	0.32	0.88	0.67	0.52	0.34
45-59	0.69	0.46	0.86	0.91	0.17	0.46
Tranche HUE (days)						
15-29	0.99	0.74	0.51	0.36	-0.48	-0.38
30-44	0.84	1.05	0.45	0.46	-0.39	-0.59
45-59	1.58	1.77	0.56	0.59	-1.02	-1.18
Probability of Dying						
15-29	0.0027	0.0011	0.0029	0.0016	0.0002	0.0005
30-44	0.0028	0.0031	0.0043	0.0021	0.0016	-0.0010
45-59	0.0081	0.0067	0.0075	0.0063	-0.0006	-0.0004

(1) Sum of the absolute deviations from New Zealand of the regions weighted according to the proportion of the population of the region (see footnote 2, methodology as per Population Monitoring Group 1989, p101).

$$\text{Weighted Average Deviation (WAD)} = \sum_i \frac{|x_i - NZ| \times P_i}{P_{NZ}}$$

Observation x for region i, P – population, NZ – New Zealand

(2) Tranche HUE uses three year averages 1985-87 and 1999-2001, Probability of Dying uses a two year average for 1999-2000.

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

[59] The calculation of WADs requires further explanation. A problem arises with the conventional mean deviation (MD). They would give equal weighting to each region, yet the regions vary significantly in population size. To overcome this problem we have drawn on a methodology employed for a published Population Monitoring Group (1989) report for New Zealand Planning Council. This computes what they called a 'weighted average deviation (WAD)' reweighting the MDs proportionately by size to allow for these differences. The resulting tables and figures can be interpreted in the same manner as one would treat conventional standard deviations.

For our purposes two different sets of computations were carried out. Firstly, for Tables 13.3 and 13.4 the WADs are used to show, at a national level, over time and by age and gender, the degree to which regions are statistically dispersed around the New Zealand mean for each of three variables: sickness/invalid benefit; tranche HUE; and the probability of dying in any given age-span. Secondly, for Figures 13.2-13.6 each region becomes the unit of analysis, and a simple mean is then computed from all of their age and gender weighted deviations to allow us to calculate the number of weighted standard deviations the region has from New Zealand WADs.

[60] These results are important to bear in mind as the size of the deviation is not reflected in the following results, but instead in the overall number of deviations from the New Zealand level. It is also important to remember that the New Zealand level has changed over time, and the results count the number of deviations away from New Zealand. These overall national results were discussed earlier.

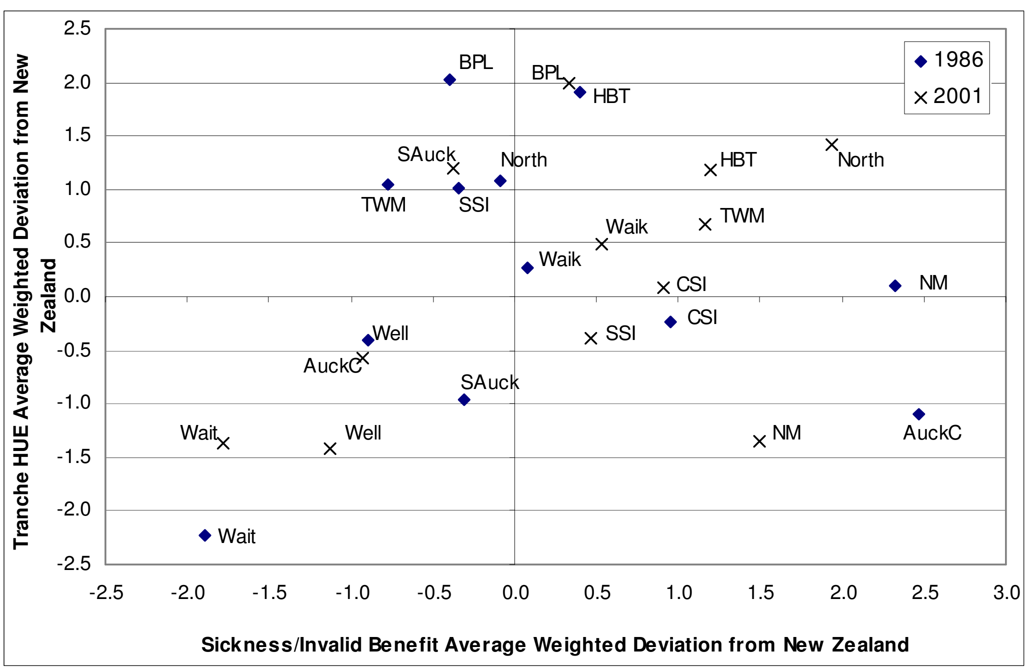
Regional Patterns

For Figures 13.3 and 13.4, which relate to regions, the means of the weighted regional averages from New Zealand WAD for each age and gender category were computed as described earlier. Then, a bi-variate scatter graph of deviations from New Zealand of each of the tranche HUEs and each of the probabilities of dying were plotted against the sickness/invalid deviations. These scatter graphs were completed for 1986 and 2000 in order to show changes over time in bi-variate relationships. Thus, Figures 13.2 and 13.3 show the interaction of weighted standard deviation units. In interpreting Figures 13.2 and 13.3, the intersection of the 0.0 horizontal and vertical lines is the ideal: that is, if this value were achieved there would be no inter-regional variance. It must be stressed that these are relationships between standard deviation units, not absolute values.

For Figure 13.2 (tranche HUEs) in 1986, the scatter was quite wide, suggesting that there was a weak inter-relation between hospitalisation and the burden of ill-health. By 2001, however, it could be argued that the trend was more diagonal, implying that the relationship had strengthened. Because of the small number of observations, correlations and similar statistics should be viewed with a great deal of caution. We did however, compute correlations using Pearson's technique. There was a definite rise from 0.03 to 0.49.

Movement over time towards the lower left-hand panel, or remaining static around 0.0 would demonstrate in Figure 13.2 that relative to New Zealand, efficiency-gains in hospitalisations had also resulted in health gains or in a diminution of underlying sickness levels in the population. **Waitemata** and **Wellington** fit this model, and **Auckland Central** moves from disadvantage into this advantaged category (i.e. from the right-hand to the left-hand panel). **South Auckland** remains in the left-hand panel, but appears to have stabilised its underlying burdens of illness by increasing its tranche HUEs. **Nelson/Marlborough** shifts positively for both measures, but still has high levels of underlying burden of illness.

Figure 13.2: Weighted Average Deviations[1] from New Zealand Average for Tranche HUE(15-59) and Sickness/Invalid Benefit, By Regions, 1986 and 2000[2]



(1) Average Weighted Deviation $= \left[\sum_{a,g} \left(X_{a,g,r} - X_{a,g,NZ} \right) \Big/ WAD_{a,g} \right] / 6$, a – age, g – gender, r – region

(2) Tranche HUE uses three year averages 1985-87 and 1999-2001.

Movement over time towards the lower left-hand panel, or remaining static around 0.0 would demonstrate in Figure 13.2 that relative to New Zealand, efficiency-gains in hospitalisations had also resulted in health gains or in a diminution of underlying sickness levels in the population. **Waitemata** and **Wellington** fit this model, and **Auckland Central** moves from disadvantage into this advantaged category (i.e. from the right-hand to the left-hand panel). **South Auckland** remains in the left-hand panel, but appears to have stabilised its underlying burdens of illness by increasing its tranche HUEs. **Nelson/Marlborough** shifts positively for both measures, but still has high levels of underlying burden of illness.

In contrast, a number of other regions, in fact the majority, seem to have experienced a displacement from hospital utilisation towards sickness/invalid benefit. They include one metropolitan region, **Central South Island** (that includes Christchurch) and all remaining regions. These remaining regions have one thing in common: they are essentially peripheral New Zealand, to use the terminology of dependency theory. Thus, in assessing inter-regional equity in health gain, one must ask whether, with the exception of **Central South Island**, this was achieved primarily in the 'centre' (again using centre-periphery terminology), at the expense of the 'periphery'. This should not be taken too far for most of the regions as their movements involve only limited changes in standard-deviation units. But four regions stand out as undergoing major changes seemingly of a strongly negative sort: **Bay of Plenty/Lakes**, **Hawke's Bay/Tairawhiti, Northland** and **Southern South Island**.

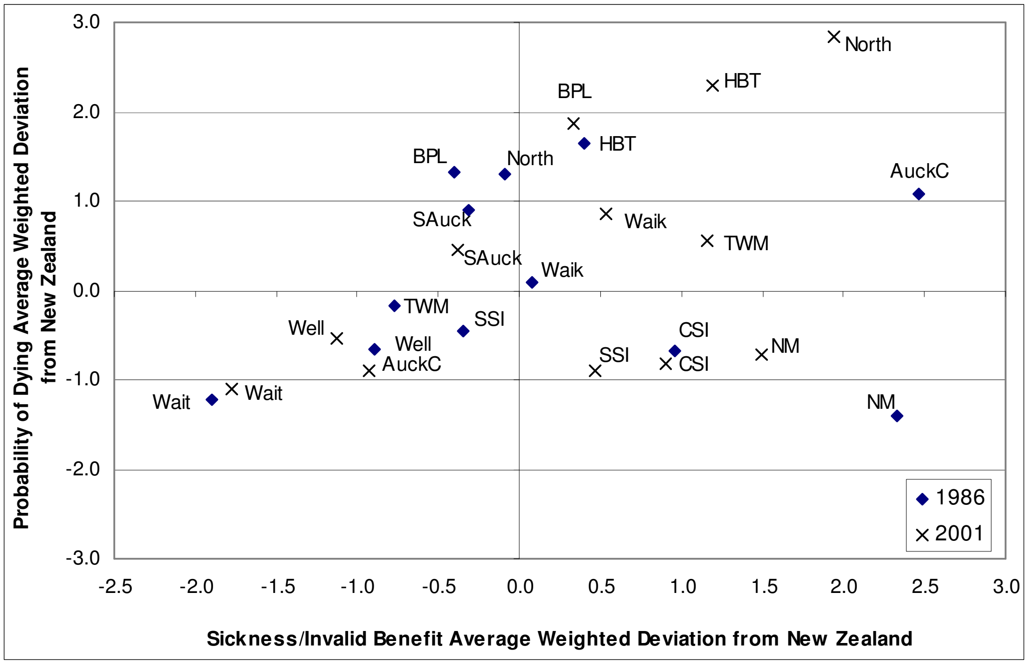
Turning to Figure 13.3 a similar pattern emerges. Once again we must stress that these are shifts relative to New Zealand, not absolute changes. Movement leftwards and downwards is a desirable trend; rightwards and upwards, especially over the horizontal 0.0 line may well indicate growing problems in health system management. Once again, it is the 'centre' that sees improvements (e.g. **South Auckland, Auckland Central**) or the retention of advantage (**Wellington**), whereas the peripheries plus **Central South Island** moved in the other direction, with **Nelson/Marlborough** moving leftwards but upwards towards New Zealand (at 0.0).

Taking these two figures together two themes emerge. Firstly, efficiency-gains were coupled with health-gains in **Northern metropolitan areas**, whereas for peripheral regions and for the **Waikato** region, an area that is a mix of metropolitan and non-metropolitan, efficiency-gains may have been at the expense of health-gains. Secondly, during this period there was also a concerted effort to re-apportion more equitably health expenditures (especially hospitalisation). This resulted in the northern regions, especially **Auckland**, being serviced more equitably and, seemingly, more efficiently. In contrast, **Central South Island** and **Southern South Island** saw declines and a loss, relatively, by comparison with New Zealand as a whole.

That said, above all, these figures document how the real peripheries - **Northland, Bay of Plenty/Lakes** and **Hawke's Bay/Tairawhiti** moved from disadvantage to more extreme disadvantage. This occurred despite the northwards shift in funding. In passing, these results reinforce those shown in Tables 12.8 to 12.11, especially 12.8.

The question must arise whether or not this is a result of broader latent 'political' forces more than planning problems. The 'political' forces relate to the instability and fragmentation of local government (before and after the 1988 reform) and health related structures (Hospital Boards, Area Health Boards, Regional Health Authorities, Crown Health Enterprises, District Health Boards). The mix of these structures and the ways these factors changed over time varies from region to region (Pool *et al.* 2006b), as was described in Chapter 1. This argument would suggest that some areas had more clout in obtaining resources than did others.

Figure 13.3: Weighted Average Deviations[1] from New Zealand Average for Probability of Dying and Sickness/Invalid Benefit, By Regions, 1986 and 2000[2]



(1) Average Weighted Deviation $= \left[\sum_{a,g} \left(X_{a,g,r} - X_{a,g,NZ} \right) \Big/ WAD_{a,g} \right] / 6$, a – age, g – gender, r – region

(2) Probability of Dying uses three year averages 1985-87 and a two year average for 1999-2000.

13.5 SICKNESS/INVALID BENEFIT AND RELATIONSHIP TO ACUTE AND ELECTIVE HOSPITALISATION

A related analysis was carried out for acute and elective hospital discharges taking a form similar to that for the tranche HUE for total hospital discharges, comparing how many weighted average deviations the regional results were from a New Zealand standard. As was shown earlier, acute and elective indices are proxies for supply and demand.

The bi-variate relationship of the deviations for these indicators with the sickness/invalid benefit was explored. This relationship is important because if efficiency-gains occur without concomitant health-gains then the supply-side of hospitalisation will not be met, and the underlying burden of sickness could be expected to manifest itself through increases in sickness/invalid benefit use, at least for the populations at working-ages. Again, this would indicate displacement from the formal health system.

As will be recalled from the earlier discussion, there has been a considerable reduction over time for both the acute and elective HUE tranches. Females went through the largest reduction in the elective category coming from well above those for males to levels that were closer.[61] For the acute HUEs males had the largest reduction, male levels had been well above those for females, and though the gap narrowed, they still remain higher.

The weighted average deviations across the regions by age and gender were reviewed to record changes over time, and to determine whether or not there were differences in these between the acute and elective HUE tranches. The lowest deviations for the acute HUE tranche are seen for the 30-44 years age group, and the highest for 45-59 years (see Table 13.5). For elective discharges the lowest

[61] This is not a function of changes in obstetric demand as these causes had been filtered out of the data set.

deviations were at the youngest working age group, 15-29 years, and increased by age. For all combinations by age and gender, and for both acute and elective HUE tranches, the deviations have reduced over time. Nevertheless, the reduction in the weighted average deviation for the elective HUE tranches were much more marked than for acute discharges. Elective HUE tranche deviations started at a higher level than acutes in 1986 in the 30-44 and 45-59 years age groups, but by 2001 they were lower.

Table 13.5: Acute and Elective Tranche HUE, By Selected Age Groups and Gender, New Zealand, 1985-87 and 1999-2001

Age group (years)	1985-87		1999-2001		Change	
	Males	Females	Males	Females	Males	Females
			Acute Tranche HUE (days)			
15-29	4.2	2.9	2.3	1.9	-2.0	-1.1
30-44	3.5	3.0	2.4	2.1	-1.1	-1.0
45-59	7.5	6.0	4.5	3.9	-3.1	-2.1
			Elective Tranche HUE (days)			
15-29	1.4	1.5	0.6	0.5	-0.8	-0.9
30-44	1.5	3.0	0.8	1.0	-0.8	-2.0
45-59	3.7	4.6	1.7	1.9	-2.0	-2.7

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

For three age groups the deviations for elective tranche HUEs in 2001, are about half those of acutes, or at some ages even lower. This shows that variance, especially for elective HUEs, has reduced over time between the regions, indicating efficiency-gains that could provide evidence that persons at the working ages are getting more equitable access to elective hospitalisation than they had in the past. These reductions are important to note when going into the next stage in the analysis, when the number of standard deviations from New Zealand is investigated which occurs in the context of a marked diminution over the period on the quantum of the deviations.

The analysis that follows in Figure 13.4 shows how the regional acute and elective tranche HUEs differ from those for New Zealand as a whole for 1986 and 2001. The measure used is the same as that in the previous section computed by taking the simple mean of the number of weighted average deviations from New Zealand across all age and gender combinations.

In Figure 13.4 the vertical axis represents standard deviation units from New Zealand of either acute tranche HUEs or elective tranche HUEs. The horizontal axis gives the standard deviation values for sickness/invalid benefits. The graph thus plots the intersection of the acute tranche with sickness/invalid benefits and the elective tranche with sickness/invalid benefit, for each of 1986 and 2001. As in Figures 13.3 and 13.4, the panels to the left and lower are values that are desirable, while those to the right and higher indicate disadvantage. Regions vary significantly not only in terms of levels, but also in terms of the balance between acutes and electives.

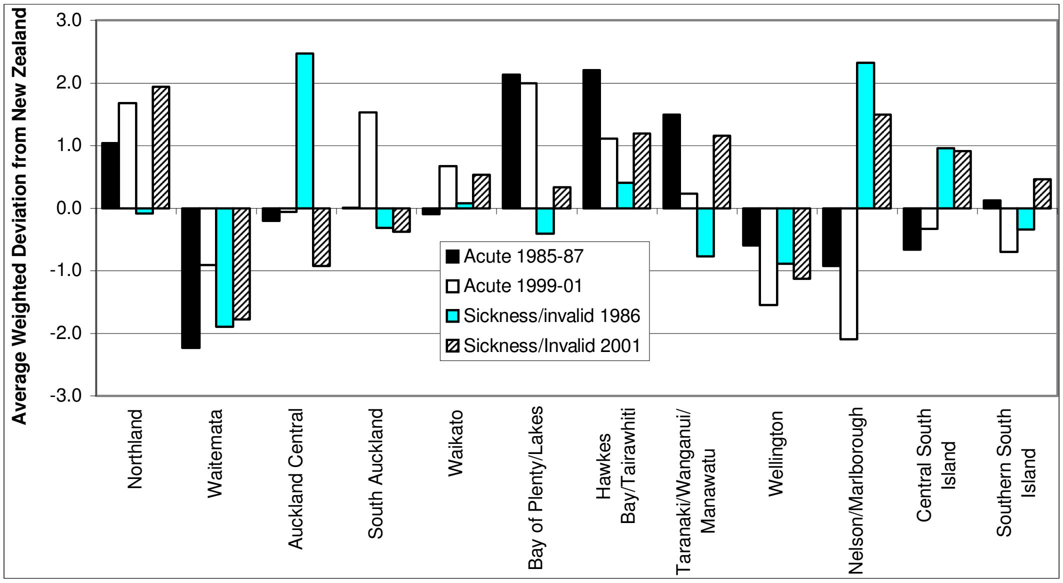
Figure 13.4: Acute/Elective Tranche HUEs, By Sickness/Invalid Benefit, 1986 and 2001

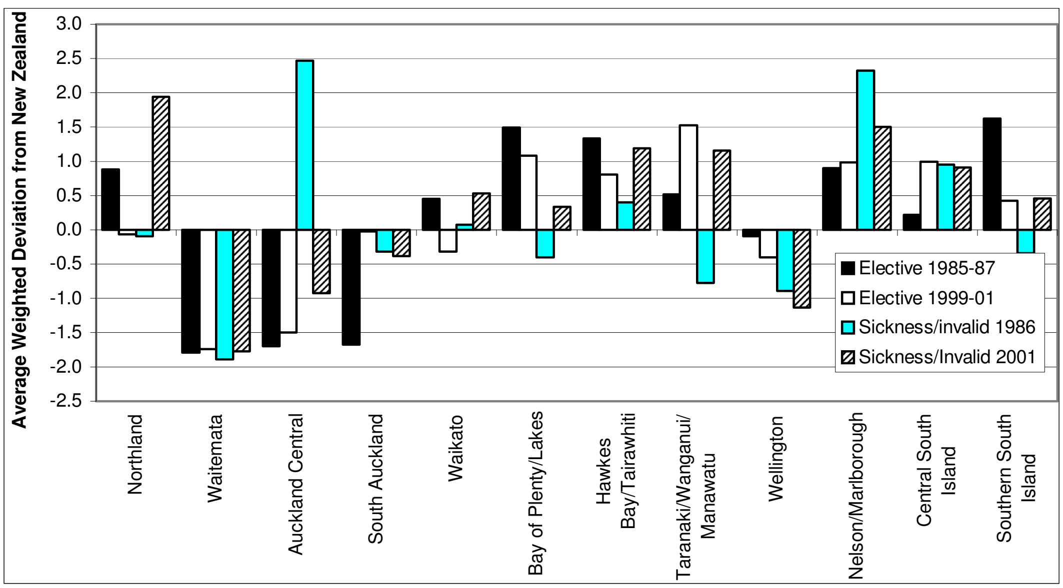
Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

In interpreting Figure 13.4, the analysis starts from the premise that there should be a relationship between trends for acutes and electives. This appears to be the case in general, although the fit is far from perfect especially in 1986. Moreover, by 2001 the relationship between these two variables and sickness/invalid benefit is less scattered and follows closer to a line of best fit, for both the acute-sickness/invalid benefit and the elective-sickness/invalid benefit intersection. This again would suggest that there was some displacement, but contrary to what we expected, this occurred more or less equally from electives and acutes into the less formal sector. Our expectation had been for this to have been more marked for electives. Electives often relate to disabling conditions rather than being life-threatening, and would be expected to be closer to the causes for which a benefit might be accessed. Equally, as these were less urgent, they were therefore the category most likely to be displaced from hospital waiting lists. Along with this, the more defined regression line also suggests that regional differentiation had become more marked over the period.

In Figures 13.5 and 13.6 values at working ages are graphed for deviation from New Zealand of acute tranche HUEs and Sickness/Invalid rates (13.5), and elective tranche HUE and Sickness/Invalid (13.6). This means that three separate factors can be analysed simultaneously to allow two issues to be raised. Firstly, there is the net impact on national health of changes over time as measured by these three variables. Secondly, there are differentials between the regions.

Figures 13.5: Acute Tranche HUE (ages 15-59 years), and Sickness/Invalid Benefit Rates, 1986 and 2001





Average Weighted Deviation $= \left[\sum_{a,g} \left(X_{a,g,r} - X_{a,g,NZ} \right) \Big/ WAD_{a,g} \right] / 6$, a – age, g – gender, r – region

Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

A number of regions showed efficiency- and health-gains for some variables, with net positive effects:

- **Wellington** gained for all three.
- **Waitemata** maintained equilibrium and a favoured position, albeit moving towards the New Zealand level.
- In **Auckland Central, South Auckland** and **Central South Island** increased access to hospitalisation seems to have reduced the underlying burden of ill-health as inferred from

benefit use. **Nelson/Marlborough** partly fits this pattern, but this may have been through resort to electives.
- **Waikato** and **Southern South Island** ended up with modest increases in benefit use, but different mixes of change for acutes and electives, but overall their share changed little.

The experiences of the remaining regions appear overall to have been negative. All of these are peripheral North Island regions.

- For **Northland** a shift towards the New Zealand level in access to electives appears to have been offset in increases in acutes, and in benefit use.
- **Bay of Plenty/Lakes** experienced shifts towards the New Zealand pattern, but still remained highly disadvantaged.
- In the case of **Hawke's Bay/Tairawhiti** a movement towards the national pattern for both acutes and electives has been accompanied by increases in benefit use.

Finally, **Taranaki/Wanganui/Manawatu** is rather complex. The index for acutes decreased; that for electives seems to have offset this to a degree, but benefit use also went up.

13.6 NEW ZEALAND AS THE BENCHMARK

Throughout the study we have provided evidence of convergence. We now hypothesise about what would need to occur for this process to be complete and thus 'successful' in this narrow sense. In the last section of this chapter the notion of efficiency-gains producing convergence is posited by seeing the New Zealand levels as the benchmark for all the regions. The objective is to project the changes necessary in each region for it to have equity with New Zealand.

In this scenario, the 2001 levels for New Zealand would be a minimum benchmark to which regions above this level would need to reach. This is just a case of achieving efficiency gains and reducing levels of hospitalisation in disadvantaged regions, but also decreasing the burden of ill health (as illustrated by sickness and invalid benefits) and the probability of dying. To do this, regions would probably have to experience gains or equity with New Zealand for a range of socio-economic indicators.[62] But if social and economic development levels were not made equitable, then disadvantaged regions might face the need for higher levels of hospitalisation.

Ideally the levels for all regions should move to those of **Waitemata** because it has a low burden of ill health, low probabilities of dying, high socio-economic status and low levels of hospitalisation: **Waitemata** is consistently the best performing region relative to New Zealand, for all the indicators examined in this monograph. But we have instead set New Zealand as the benchmark, recognising of course that were disadvantaged regions to converge towards New Zealand's position in 2001, the New Zealand rates would themselves improve and thus the 'goal-post' would have shifted.

This scenario was calculated for 2001 using five year age-specific rates for New Zealand, and applying these rates to each region to get expected values. The results were aggregated into four broad age groups: 1-14 years, 15-44 years, 45-64 years and 65 years and over, with an overall level for 1 year and over. The discharges and bed-days analysis was excluded for populations under one year as there were problems with comparability between regions especially for acutes and electives.[63] The expected was subtracted from the actual observed value to obtain a difference, and the difference was then expressed as a percentage of the actual observed value. This was done for discharges, total bed-

[62] Again it is worth stressing that our results relate to region of residence, not facility. Thus we measure geographic inequalities.

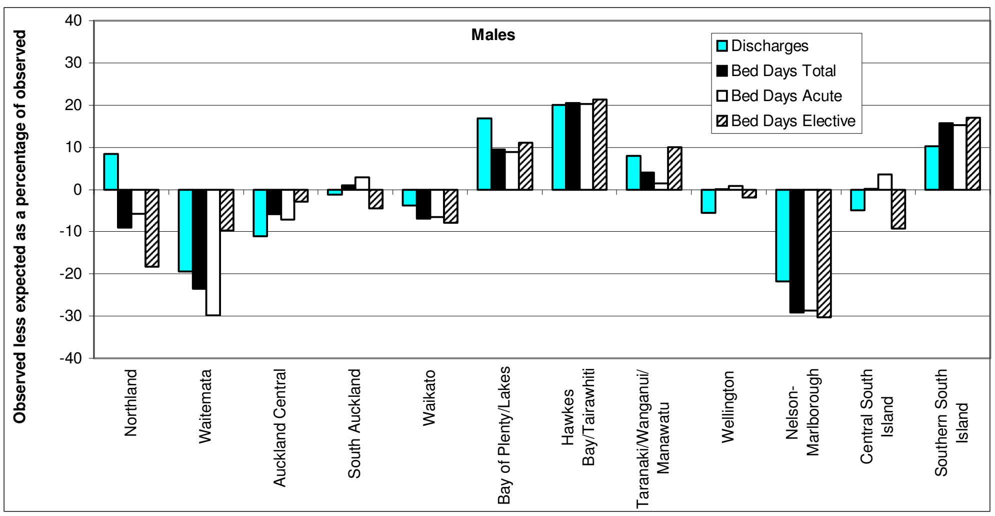
[63] Infants (under one year) are excluded from the analysis as there were inconsistencies in coding of acute and elective discharges between the regions. This can be illustrated in primary diagnosis ICD-9 765 "Disorders relating to short gestation and unspecified low birthweight". The percent elective for New Zealand was 40% whereas Waikato and Nelson/Marlborough were around 5%, and, at the other end, Hawke's Bay/Tairawhiti was 63%.

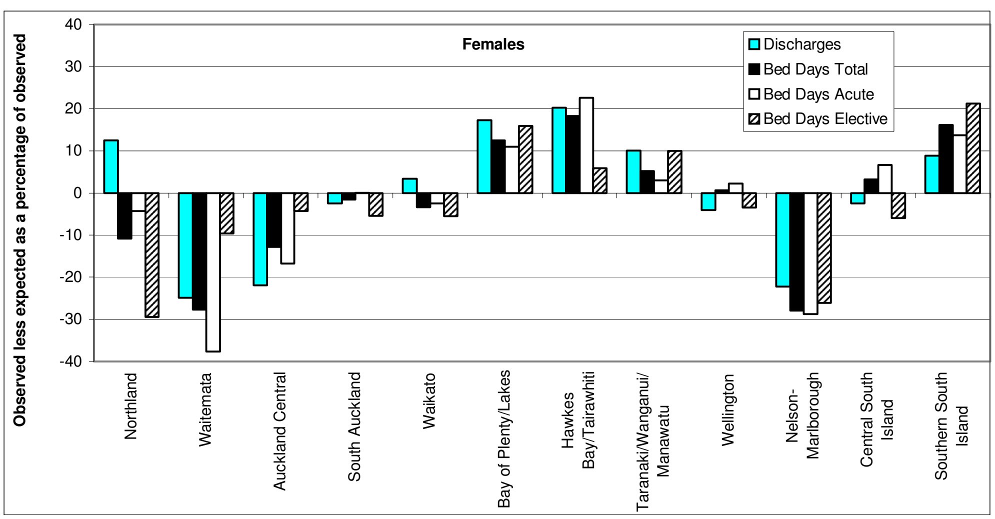
days, and acute and elective bed-days. It gives an indication on what movement of numbers of discharges and bed-days must be made in these regions to reach New Zealand level. It also shows how the mix of discharges and bed-days (acute, elective and total) differ from the New Zealand average.

Taking the overall population one year and over for the four indicators for bed-days and discharges for the regions, graphed in Figure 13.7, there are some definite patterns.

- **Hawke's Bay/Tairawhiti** would need to experience the largest gains to reach New Zealand levels, followed by **Bay of Plenty/Lakes** and **Southern South Island.**
- At the other end of the scale **Waitemata** and **Nelson/Marlborough** were well below New Zealand levels, and thus were already advantaged.
- **Northland** is an interesting situation with discharges being above New Zealand, but bed-days rates being below for all indicators, especially elective bed-days where the difference is quite marked.

Figure 13.7: Changes (%) in Bed-Days and Discharges Needed to Allow Convergence with the New Zealand Level, By Region, Gender, Acute and Elective, Ages 1+, 2001.





Sources: New Zealand Health Information Service, National Minimum Data Set - Mortality.
New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 1981-2001 Censuses of Population and Dwellings.

When the four broad age groups are investigated (data not shown here) there are ages which have different levels compared to New Zealand than the rest. The regions of most interest are those regions above New Zealand.

- Generally **Hawke's Bay/Tairawhiti** and **Bay of Plenty/Lakes** deviate from New Zealand to a similar degree for most age groups, with ages 65 years and over age being closer to New Zealand.
- In **Southern South Island** the age groups 45 years and over are well above New Zealand, whereas the other age groups are closer to New Zealand.
- For acute bed-days **Northland** showed a level above New Zealand for people aged 1-14 years with all the other age groups being well below New Zealand. For discharges all the age groups tended above New Zealand. Total and acute bed-days show a different pattern with those age 45 years and over being well below New Zealand. As discharges tend to be above New Zealand but bed-days below, this indicates that at, 45 years and over, the population has shorter stays in hospital than do people in the corresponding ages in other regions.

13.7 CONCLUSION, CHAPTER 13 AND CHAPTERS 10-12

13.7.1 Chapter 13: Relationship Between Hospital Sector and Benefits

In this chapter we have reviewed sickness/invalid benefit rates for the working ages 15-59 years using data from the 1986 and 2001 censuses, and showed how they relate to various measures of hospitalisation and to the probability of dying. Sickness/invalid benefit was used as an indicator of the underlying burden of ill health in the community. We have moved away from simple trends to attempt to evaluate the impacts of supply and demand effects on the convergence we showed in earlier chapters. This was achieved by disaggregating the HUEs.

As was the case for all cause HUEs, the three categories of potentially avoidable, and acute and elective HUEs for various regions have converged to the New Zealand levels and reduced over time. In marked contrast, the sickness/invalid benefit showed the opposite trend, so that the variations between the regions have become larger for this factor and the rate has also increased.

- The region that did well in terms of all measures of supply and demand is **Waitemata.**
- There is some evidence that **Auckland Central** and **South Auckland** were under- serviced in the late 1980's with low elective rates. **Auckland Central** also had high sickness/invalid benefits levels in 1986 which could indicate that this benefit took up the slack in the hospital system. The situation had improved for these two regions by 2001.
- In contrast, **Hawke's Bay/Tairawhiti** and, to a slightly lesser extent, **Bay of Plenty/Lakes** did not do well in any measure, especially at the working ages.
- **Northland** also did not do well for the probability of dying and, as we show in this chapter, sickness/invalid benefit at working ages in 2001 is substantially higher than that for New Zealand as a whole; however hospitalisation is around the national level. There is also evidence that **Northland** had a lower elective tranche HUE than the national average in 2001 whereas the acute was above the national average. The inference from these diverse factors is that restructuring in **Northland** may have resulted in efficiency-gains, but that these may not have translated into health-gains.

13.7.2 A Summary of Factors of Supply and Demand

This last section of Chapter 13 reviews the range of factors of supply and demand covered in Chapters 10-13. It points to apparent relationships between these diverse factors.

Linking the analysis in this chapter back to Chapter 10, for ambulatory sensitive hospitalisations that are dependent on efficient links between the primary and secondary health sectors, the primary aim for all regions would be to achieve lower levels. The more hospital discharges that can be prevented, the more resources can be diverted to where admission cannot be prevented. Another concern relating to this is that infectious diseases have become a higher percentage of the overall hospitalisation. This could mean that public health systems are not meeting all needs at a primary health care level.

As was discussed in Chapter 11, the issue of the mix of acute and elective hospitalisations is an important equity issue for district health boards, with the increasing demands for acute and elective services placed on hospitals, with the population getting older, and thus with increased numbers in the 65 years and over age group in the coming years. The net effect of this could change the mix of ages of patients receiving acute and elective services, and the level of service people receive. There are issues of equity between the regions in what they get for elective and acute hospital services. That said, it might not be ideal for all regions to get the same levels of acute and elective services, as regions can start from very different population health statuses with very different age and ethnic structures, which together can affect the demand for health services. When people are waiting for elective procedures they could end up on a sickness/invalid benefit.

While the increase in numbers of sickness/invalid beneficiaries is mainly related to the worsening economic conditions, it could also be related to the reduction of hospital utilisation.[64] It could indicate that people are leaving the formal health system and moving to the informal. That is, people who are unable to get the required care from the formal health system could move onto a sickness/invalid benefit while they are waiting to get the required treatment, or be picked up in a primary level screening programme and referral to the secondary or tertiary sectors if this were seen as appropriate. This group adds a financial drain and a waste of human capital for New Zealand.

In the ideal world all regions should move to **Waitemata** levels. However, possibly a more achievable goal is convergence to the New Zealand level for regions with indicators that are worse than the New Zealand level. The regions which have the most ground to make up in terms of hospitalisation compared to New Zealand are **Hawke's Bay/Tairawhiti** followed by **Bay of Plenty/Lakes** and **Southern South Island**. There is also **Northland** which is showing conflicting measures, with discharges tending higher than New Zealand and bed-days being low.

This concludes the hospital utilisation analysis part of the monograph. The next chapter looks to possible future trends and presents an overall conclusion and discussion for the monograph.

[64] It is important to reiterate here that people who get sickness/invalid benefit have to meet specific medical criteria.

PART V:

TOWARDS A SYNTHESIS

CHAPTER 14

Retrospect, Epilogue to 2006, Prospect to 2026

14.1 HOSPITAL SECTOR CHANGES: CONTEXTUAL TRENDS

In this monograph we have looked at macro-level outcomes of hospital health-service delivery over the two decades from c.1980 to c.2000. Our study has assessed the impacts of hospitalisations on the population health of New Zealanders, both nationally and at a regional level (regional patterns are summarised later in the chapter, drawing on Text Appendix C that gives a region by region review of results from our study). In this chapter we extend the empirical analysis to 2006, and then project out to 2026.

The regional patterns are relatively complex. We have identified a major trend towards convergence over time, but also, disturbingly, the continuation of sub-national inequalities and divergence. The net result was a clear set of efficiency gains, but a more confused picture for effectiveness and equity.

Our research question, stated on the opening pages, was disarmingly simple: look at the two measures of 'a nation's health, how long we live and how often we end up in hospital'. This seemed a straightforward exercise, a view reinforced by the fact that we had readily available data (admissions and discharges). What was needed was a robust methodology that would allow us to inter-relate these two factors so that we could map the nation's health, at least as far as this could be evaluated using hospitalisation data in an analysis at a macro-level. We thus assumed that our exploration of this question would be reasonably straightforward, perhaps with some challenges, but mainly, so we thought, they would arise in the technical realm.

The technical problems - to make an integrated analysis of both of these two factors - were overcome early in the project, after we had designed and constructed an index that had its antecedents in life-table methodology. It is analogous to the widely used health expectancies. But, even with such a tool at our disposal, the reality of actually analysing these two factors in combination has proved very different. This is not because of difficulties encountered in mapping trends, which we achieved with relative ease, but because of the many intersecting factors that confound the analysis, thus making interpretation of the map extraordinarily difficult. Not the least of these challenges was to attempt to tease out supply and demand effects, but there were many others. The most notable among them are discussed in this part of the chapter.

14.1.1 The Complexity of the Hospital Sector

The first confounding effects are the methodologies one can bring to bear analysing hospital data. The mapping of hospitalisations at a population level defies simple analysis because one is dealing with an extremely complex institution, in which the main actors confront multi-dimensional problems, both in dealing with individuals, patients, their professional colleagues, as well as the procedures and technologies in this multi-faceted facility in which they work. Reductionist analysis, such as measuring productivity, by relating financial costs to the number of outputs, produce simplistic and misleading notions of the efficiency of the institution.

Moreover, to resort to the direct use of financial data in the measurement of efficiency risks obscuring the real issues of what constitutes hospital efficiency. Each activity, or intervention, or case, will vary enormously depending on a wide variety of factors, not the least of which are purely bio-medical: the health status of the individual, their range of co-morbidities, the diagnostic and therapeutic tools available and so on. To measure efficiency, the focus for fiscal analysts, accountants, managers and health economists, there is a need to use other approaches, as we have done here: in this case the period spent in the institution. It is important to note that bed-days data can be costed, so they have both actuarial and accounting properties. As we will show below, by this measure, we can say categorically that the hospital system has become much more efficient than it was in 1980 and is becoming increasingly efficient. Our study is thus the bearer of a very positive message.

Studying efficiency has a utility in its own right as a part of the monitoring of health systems for reasons of fiscality and accountability. But it belies much of the real productivity of the system. Thus it cannot be seen as a major or, worse, sole indicator of their success and competencies. Efficiency indices are, after all, purely output measures, whereas the ultimate success of the hospital system depends on the outcomes produced by the system – how effective it has been. This is what we have done here by integrating the hospital discharge data – the efficiency component as it were – with survivorship, the effectiveness element. Effectiveness has another dimension to it: whether or not interventions produce a better quality of life, maintain their existing quality or see a diminution. These two factors, whether people are more or less likely to survive, with the same or better quality of life, constitute, of course, the ultimate measure of the success of hospitals, in combination with, the rest of the health system. The recent series of health expectancy tables running from 1996 to 2006 show that older New Zealanders see their health as better and their survivorship is also improving (Tobias *et al*. 2009a). This, the population health accounting dimension, is the most important part of any review of the sector. Overall, it seems that effectiveness has improved, but, that said, not as systematically as efficiency.

Finally, an accounting system must also review equity issues. We have not looked at this at an individual or small group level, but much more at a macro- or population level of aggregation. Here the verdict we have given is mixed; success is some domains, less success in others.

14.1.2 Reforms and Restructuring of the Health Sector

Beyond this, though, map reading has proved complicated because trends for the proximate determinants we were attempting to measure (the organisation of health, especially hospitalisation services) were themselves undergoing radical changes. Some of these were driven by forces that were exogenous to the health sector – for example, political and managerialist ideologies that inspired many of the policy initiatives, but which had an impact on service delivery. Some of the restructuring was based on the neo-liberal thesis, which took a hegemonic position in the public policy discourse over much of the period, that health was a market like everything else, and thus could be governed by competition, profit and other market forces. This is also why measures of accountability, fiscal impacts and efficiency came to play a disproportionately important role in assessing public policy, including, perhaps most importantly, health.

At the same time there were other drivers of change that came, appropriately, from endogenous developments in public health medicine, bio-medical science and health technologies, and also in the way that the procedures for diagnosis and treatment were being executed. Many of these allowed improvements in intervention, but, as a downside, introduced new costs into the system.

Thus, we have had to take into account the fact that the sector was subject to a large amount of both exogenously and endogenously induced reform, much of it probably in ways that improved services. Our difficulty was that the reasons for the massive restructuring over the same period, and the processes that were employed to implement changes, were subject to a great deal of debate. In turn, these controversies often became conflated with, or obscured, more technical analyses of the endogenously driven changes.

"Restructuring" is a bland term for what constituted changes that ran all the way from simple front-line accounting/administrative/management practices, to funding strategies, to re-designing bio-medical and related procedures and tasks, up to introducing and attempting to implement several radically different ways of organising the entire sector – its governance, management and clinical objectives and general strategies, and even the public/private mix for funding and implementation. To this end, much of the more manifest part of restructuring was often achieved, not by reforms that dealt with the fundamentals of health care *per se*, but by rearranging the existing organisations to create new agencies at each restructuring phase. At the same time health sector professionals and the general public had to struggle to digest the bewildering number of acronyms that were generated; for example, AHB, RHA, CHE, THA, RFA, DHB and PHO, to say nothing of other tangential but influential agencies such as the powerful accounting agency CCMAU that, *inter alia*, controlled the lives of the CHEs, and thus had an impact on hospital delivery systems (Gauld 2002). These agencies were then typically discarded unceremoniously[65] in the next round of restructuring, replaced by new ones in a step that would often be achieved through radical moves that produced organisational ruptures with the previous structures. This churning may well have introduced discontinuities in health care delivery, the *raison d'être* for the hospital services, and some of these disjunctions may have been dysfunctional or even negative rather than representing progress.

We have not attempted to describe these process and organisational issues in detail, and certainly have not attempted to evaluate them, because other more qualified researchers have done far more in-depth analyses. But, we could not ignore the fact that the system was in institutional turmoil for much of the period we have had to deal with. Our task became one of investigating whether the factors that we focused on, the actual delivery of health services and, more importantly, their impacts on the population, had been affected or remained unaffected by the turmoil surrounding them. Most recently, economists Gareth Morgan and Geoff Simmons (2009) have reviewed health management, governance and structural changes and come to conclusions that parallel a number of ours, reached using a totally different and independent approach.

For example, one aspect subject to churning is of critical concern for our monograph - the way that the health sector is managed geographically and, more importantly for patients, the health outcomes, especially in peripheral regions (see also Morgan and Simmons 2009: 214). We have focused on regions in an era in which the geographical dimensions of structures in the health system did indeed change very significantly. A side product of this was the enormous difficulty for health planners to build geographically consistent time-series data sets, a fundamental requirement of good forecasting.
This monograph does not argue that reforms in the organisation of health services were unnecessary. A 1974 White Paper had already previewed what were to be major underlying issues for health that the numerous successive population health reforms have struggled with until now: a) how should the sector be organised both geographically, and in terms of the interface between the primary and hospital sectors; and b) how could geographical equity be achieved? In the 1970s, as throughout the earlier 20th century, there had been numerous hospital boards, some extremely small. Funding was based more on how the boards signalled capital and other needs to central government than on some transparent, equitable formula. The combining of boards, advocated by the 1974 report, was highly contentious, but by the 1980s the need for both some form of population-based funding to achieve equity, and even the drawing together of service agencies had become strongly evident. Restructuring was thus necessary, but it was the scale of change, the direction it took and the frequent shifts in policies that have dominated the discourse and even much of the life of the sector over the last two decades of the 20th century and into the 21st century.

Thus, having remained largely unchanged from 1901, when the national system was first established, the health sector in New Zealand has been through a number of revolutions over the short period with which this research deals. It has been said that the British 'National Health Service is a huge, sprawling organisation that has had more reforms in recent years than most of its patients have had headaches' (*Guardian Weekly*, 30 Jan 2009: 14). It could be argued that the New Zealand system, which has often attempted to copy British reforms, has been even more severely buffeted (Gauld 2002).

[65] A feature of the managerially driven reforms was the labelling and sometimes denigration of previous regimes – clinical or administrative. The phrase, for example, 'provider capture' was frequently used to describe the ethos driving clinical staff.

We have not focussed on this issue, yet it has asserted itself; it could not be ignored. Nor, as we noted in an early chapter, can we ignore the fact that each new set of restructuring was typically introduced on the basis of a flimsy evidence-base, yet was normally to have major impacts. Change was revolutionary rather than a series of evolutionary steps, each evaluated carefully and then reformed carefully on the basis of such assessments.

14.1.3 Changes in Population Composition and Geographic Distribution

To add to the complexities arising from restructuring, there were other intersecting exogenous changes to the society itself. Above all, the demographic composition of the society changed radically in this period, a factor of critical significance in studying population health. Earlier chapters looked at many of the regional differences, but these have been in a context of wider, often turbulent, socio-demographic shifts. Nationally, population growth has declined because fertility is low and migration levels have fluctuated wildly, making only a limited contribution in the medium term to change – significantly less than natural increase. Ethnic composition has changed significantly, particularly because of inflows of Asian and Pasifika peoples (Boddington 2003). At the same time, the population has gone through very significant age-structural transitions, largely a function of past fertility trends, and has also been subject to both numerical (growth in numbers aged 65+ years) and structural (growth in percent of the total at 65+) ageing (Pool 2003).

Over a very long period, from about 1900 to 1970, the population geography of New Zealand maintained a sort of equilibrium that fitted well with the functional bases of the economy. However, from the late 1970s disequilibrium set in (Pool 2002). This involved an increasing concentration of the population in metropolitan centres, a growth in ethnic diversity coming both from immigration flows and natural increase, and a major shift-share in the workforce away from manufacturing, but also within the tertiary sector. Most importantly for this monograph, there were associated changes sub-nationally as tracked by a detailed analysis covering demographic, social, workforce, family, income, health and a range of other factors in a study completed by the Population Studies Centre, and parallel to the health analysis discussed in the present monograph (Pool and Baxendine 2006; Pool *et al.* 2004, 2005 a, b, c, d, e, f, g, 2006 a, b, c). These studies show that only two metropolitan regions, plus some small retirement zones and resort areas, showed significant and reasonably consistent population growth. These two metropoli, Auckland and Wellington, were disproportionately the settlement destinations of immigrants, and additionally the loci for concentrations at the young working ages, occasioned in part by the rapid growth of their tertiary sector workforces, especially in the finance, management and related occupations. Average incomes in the metropoli also diverged increasingly from those of other regions to levels well above those of other areas. Both intra- and inter-regional income differentials grew significantly in this period, with the upper-quartile groups in the favoured regions diverging markedly from levels seen elsewhere.

As has been noted elsewhere in this monograph, a number of these regions were themselves composed of sub-regions that were distinctly different in terms of population dynamics and structures. This was certainly true for the two largest metropoli. Moreover, a feature of their demography was the shifts and changes within them: for example, central **Auckland** 'gentrified', displacing less well-off groups to outer suburbs.

Overall, New Zealand trichotomised geographically in this period: two metropolitan regions, **Auckland** and **Wellington** prospered, diverging from the national patterns; a number of other regions such as **Canterbury** and **Waikato** got by, and were close to national patterns; others such as the **southern North Island** outside Wellington got by, but not as favourably; and some, notably the peripheral regions of **Northland**, **Bay of Plenty**, **Gisborne** and **Westland,**[66] three of which have large concentrations of Māori, diverged markedly from New Zealand as a whole, mainly in negative ways.

[66] In our study Westland has been combined with Canterbury into the Central South Island. But as we show in a separate study, Westland is definitely among disadvantaged regions in terms of most health care measures and other socio-economic factors (Pool *et al.* 2006c).

To add to this some regions had a further disadvantage that a significant proportion of their population lived further than 30 or 60 minutes travelling time from major health care facilities, and had lower numbers of medical personnel per 100,000 population (Pool *et al.* 2006c).

It is sobering that several of the regions that had poorer health at the outset of the decades under review, as shown in this monograph, did not seem to benefit as much as some others from the efficiency-gains they had achieved in hospitalisation over this period: in short, efficiency-gains did not produce more effective health interventions equitably across New Zealand, and, in some regions, certainly not for health status as measured by survivorship and by the need to resort to benefits. With this, the burden of disease and ill-health in New Zealand shifted, and with it, the needs that must be met by the health sector. In part, this has been because of the demographic changes (ethnicity, ageing); differential patterns of cohort exposure to the risks of morbidity and its co-variates such as relative poverty; and also to inequalities due to the much wider economic restructuring of which the health reforms were a sub-plot (Blakely *et al.* 2005, 2008; Pool and Cheung 2005; Tobias *et al.* 2009b). The continuation, and in some ways intensification, of inequalities were most manifest at the regional level.

This monograph's research has shown that the mix of all these factors - from the impacts of restructuring, to the organisation of hospital services, to the burden of disease, and, as we have identified in detail in Chapter 13, an underlying burden of ill-health - varied greatly from region to region. **Hawke's Bay/Tairawhiti** (as defined for this study) has a totally different mix from that of **Waitemata** – almost diametrically opposite. What our study shows is that some aspects of servicing have been addressed efficiently over the last two decades, so as to decrease, *grosso modo*, inequalities in outputs. But the devil is in the detail, for this has been accompanied by a complex set of other changes which actually saw some inter-regional inequalities grow in the period under review. This was most evident where there is an interface between the formal hospital system, which is the prime focus of this study, and other components, notably the prevalence of sickness as indicated by the receipt of benefits.

14.1.4 Changes Resultant from the Epidemiologic Transition[67]

A fourth but very major contextual factor, has been the passage of the epidemiologic transition. It affects every corner of the health system, but above all its hospital sector. The good news is that because of this mega-transformation, virtually a global phenomenon, human longevity has increased to historically unprecedented levels. Pakeha women reached 60 years life-expectation in 1900 and are at 82 years today; even more dramatic has been the Māori transition, from the low 20s in the 1890s, to 48 years in 1945, to over 70 years today.

In formulating his epidemiologic transition theory in 1971 Abdel Omran (1982) recognised that different populations would pass through the transition at different starting times and speeds. This is clear in New Zealand where Pakeha were among the most advanced populations in their transitions, while the Māori transition was delayed, after suffering decreases in expectation following contact. It is not possible to identify the earlier transitions of other populations in New Zealand, but Pasifika has probably had similar paths to Māori.

The improvements in longevity had resulted by the late 20th century in two changes. First, the force of mortality had shifted from young ages to older ones. Secondly, there appeared at the older ages to be 'compression' of mortality, by which time the modal age at death had fallen to a narrower and narrower age-band. This shows up for New Zealand and many other western developed countries.

Nevertheless, the permanency and even the validity of this observation is debated. Some reputable scholars see extension of expectancy as a likelihood. But the issue then arises about morbidity: is morbidity also becoming compressed, or if extended will this move in tandem with mortality trends

[67] This section of the chapter draws heavily on Pool 2009.

(dynamic equilibrium), or become extended at the upper end with the onset of ill-health remaining as at present? The most recent analysis of New Zealand health expectancies provides a very mixed verdict on these issues (Tobias *et al.* 2009a). From an accounting standpoint, compression would be the best option, followed by dynamic equilibrium; extension of morbidity implies longer duration for interventions that could well also incur greater costs.

The reason is that the epidemiologic transition has not just been a shift in age patterns of mortality, but also by cause. This has been massive, involving a shift-share from the overwhelming preponderance of communicable disease to the most deaths resulting from non-communicable causes. These major transformations occurred earlier for Pakeha, and more recently, 1945-61, for Māori when a concerted attempt was made by public health officials to reduce gaps. Today a further shift-share is occurring between the non-communicable causes: while heart disease is still the most important category, the cancers are moving up in importance. These transitions are probably more due to the success of public health in diagnosing and treating cardiovascular diseases, and the concomitant increase in cancers less a function of environmental or personal behaviours, and more because they are the residual left when others have diminished in prevalence (documented in detail in Pool 1994).

The net result of the epidemiologic transition is that health services are dealing with a totally different population presenting with very different sets of conditions and requiring physical infrastructures and institutions that are removed from those of just a few decades ago. Even recently hospitals were servicing younger people, often children, presenting with acute infectious diseases. Today, by contrast, the wards are disproportionately given over to older people with degenerative disorders, often with multiple co-morbidities.

To add to confounding factors generated by the epidemiologic transition are cohort effects. Today's elderly are composed of cohorts who have spent much of their earlier life in totally different health and living environments than younger cohorts are experiencing at the moment. They carry with them the good and bad baggage associated with those experiences, the history of which often forms the normal context of an individual's medical diagnosis. Moreover, given that the levels of mortality and of infection were higher in earlier decades they may often represent the hardier survivors of their generation.

Finally, to confound this question more, in a culturally plural society the path for epidemiologic transitions differ from ethnic group to ethnic group. Today differences in survivorship to age 40 years differ only to a limited degree between Māori and Pakeha (the survival rate of male Māori is 90 percent that of Pakeha; for females the ratio is 96 percent). But at age 80 years the differences are vast (the Māori male survival rate is only 35 percent of that of their Pakeha peers; for females it is 32 percent), a function of the continuing higher mortality rates of Māori at late middle and early older ages. The 'hardy survivor' effect shows up for disability: the far smaller proportions of surviving Māori from any cohort at 80-84 years are less likely to suffer the functional limitations reported in health expectancies.

14.2 HEALTH GAINS: TOWARDS A CONCLUSION

The focus of this study has been on population health gains. These were identified by looking at trends and differentials in hospital outcomes within the national population, using regions as the unit of analysis.[68] We analysed health gains looking at three dimensions and the interactions between them:

i. *Efficiency-gains*, as measured by shorter and fewer stays in hospital, where efficiency is gained by reducing over- and under-supply effects. Here this was measured by convergence between regions and towards New Zealand's total pattern and declines in hospital stays.

[68] A region approximates a service area and its population, and thus is a useful reference unit for policy analyses (for regional results see Appendix C).

ii. *Effectiveness-gains,* as measured by shorter and fewer stays AND by higher survivorship. We also looked for signs of *displacement* from the hospital system whereby significant numbers become sickness beneficiaries (e.g. into that part of the primary health sector where there is a lower likelihood of formal monitoring (for health purposes)). A more limited displacement of this sort is one indicator of health gains. Increases in apparent displacement are a measure of *ineffectiveness.*
iii. *Equity-gains,* as measured here by decreases in regional differentials.

We were also able to raise some sub-questions:

i. The linkages between the Primary → Secondary → Tertiary sectors
ii. Relationships between Prevention → Treatment → Death
iii. Displacements into what we termed "less formal parts of the health sector".

The health system, even the hospital sub-sector, is extraordinarily complex, particularly when one is attempting, as we are here, to undertake a macro-level analysis - the unit of reference for the policy maker to whom this study is directed.[69] Moreover, it is impossible to isolate what might be seen as purely bio-medical or clinical factors from their wider contexts that were noted earlier in the chapter, be these social or economic, or regional differences, or historical advantage and disadvantage, or from policy interventions. Furthermore, as implied already, period changes are not just simply due to determinants that are time-bound; the failures or the triumphs of past periods affect what happens in any period under review. Each individual brings with them their past health history, both the aetiologies and the interventions they have sought and had access to; an elective procedure postponed may eventually require acute care, or lessen survivorship probabilities, or require a more costly intervention later. Similarly, each cohort carries with it its past experiences.

This means that population health gains cannot be subject to reductionist analyses; simple quantification can never hope to capture all the qualitative as well as quantitative factors that impact on the system. At the front-line, qualitative assessments about hospital care must be constantly made; *QALYs* and other methodologies may help the practitioner, but in truth they are assumption-driven and thus difficult to interpret (Johnstone *et al.* 1998). Again the quality of any health assessment or intervention does not remain constant over time – the experience and training of health professionals, and the tools at their disposal are constantly changing, affecting every aspect of the throughputs and outputs of the sector, as well as the outcomes for their patients, who make up the population we are reviewing. The macro-level environment is also undergoing constant churning, not the least because of population changes, but additionally, as has been noted, because of radical policy interventions. Because of these confounding factors, the indices that might provide the measures by which to document the health system's accountability using the standard criteria of public policy analyses – productivity and efficiency-gains – may provide simplistic and probably meaningless results. Instead, the ultimate success of the system is whether or not it effectively and equitably produces population health gains, and, as a secondary issue, the extent to which it achieves this goal in the most cost-efficient way. It is necessary to take account of the rich range of factors that are comprised in hospital processes and systems, and to enhance quantitative analyses with qualitative, hedging conclusions with caveats. Our conclusions are thus not definitive but indicative.

With these qualifications aside, we have been able to make some considered conclusions about the population outcomes of the health system over the two decades 1981-2001. Returning to our three-fold classification of gains, we can make three sets of conclusions, some more tentative than others:

[69] Policy is written for populations or sub-populations, not for individuals; of course, health service interventions are typically made at the micro-level, for individuals, families or small groups. Conversely, many central aspects of population-health are achieved through macro-level interventions, and are essential for public health, yet may be outside the direct control of health agencies (avoidable vs non-avoidable causes): e.g. water supplies, sewage, drainage. One could add road engineering, to set better driver safety standards, and attempts to curtail social behaviours such as binge-drinking or eating fast-foods.

1. ***There is little hesitation needed in stating our first conclusion: there were definitely efficiency-gains over the two decades.*** HUEs declined, showing that hospitalisation durations were successfully shortened and yet, for New Zealand as a whole, survivorship levels did not suffer but improved. Moreover, regional HUEs converged systematically towards the national level. On the simple criterion of efficiency, the restructuring seems to have been a success. Thus, overall, the system must take credit for achieving efficiency-gains during the period 1980-2001. Nationally, there were effectiveness-gains as well – the HUEs alone show that, as they take into account survivorship as well as hospitalisations.

2. ***But where there was gain, unfortunately there was also pain, and on two other criteria, effectiveness (at least some aspects, because the results are more mixed in this case) and equity (again at least for some aspects), the detailed mapping illustrates that the path was far less straightforward.*** This shows up particularly when a more in-depth analysis is undertaken, going beyond the overall HUE trends by disaggregating them, and also by looking at displacement from the formal hospital system. Thus regions converged towards the national pattern, typically by catching up, and there was a fairly marked shift of resources northward particularly to the previously under-serviced Auckland region. But this process was not equitable, even for that overall shift northwards, for the wealthier regions saw major improvements, while poorer peripheral regions, mainly in the north, suffered in terms of effectiveness.

This effect shows up in the following two tables drawn from figures in Chapter 13, which graphed the intersects for the weighted average deviations of different measures from levels for New Zealand as a whole. Table 14.1 looks at regions in terms of the way in which efficiency gains, as measured by HUEs[70], were associated by apparent displacement from the formal hospital system into the less formal as measured by take-up of sickness benefits.

Table 14.1: Regions: Relationships Between Efficiency Gains and the Effectiveness of the Hospital System

Regions in which there appear to have been both efficiency and effectiveness gains	
Auckland Central	
Nelson/Marlborough	
South Auckland	
Southern South Island	
Waitemata	
Wellington	
Regions in which efficiency and effectiveness gains appear to be related to displacements into less formal health care	
i) In a limited way	**ii) In a more marked way**
	Northland
Central South Island	Bay of Plenty
Waikato	Hawke's Bay/Tairawhiti
	Taranaki/Wanganui/Manawatu

In the top half of this table, are mainly major North Island metropolitan regions that were also advantaged in terms of most socio-economic measures, above all income. Even **South Auckland**, which had large pockets of disadvantage and a median income below the other parts of **Auckland**, was still better off than most non-metropolitan regions (Pool *et al.* 2005a). These regions also have disproportional access to hospitals that provide both secondary and tertiary services. **Waitemata**,

[70] In this case the tranche HUE at 15-59 years, to correspond with ages at which a benefit other than superannuation might be drawn.

encompassing the **North Shore** and **West of Auckland**, was the best-off region for health factors reviewed here in both 1986 and 2001, and its **North Shore** component was also a leading region for most socio-economic indices at both times. **Nelson-Marlborough** stands out as different. It is the sole region in the top panel having only a secondary hospital to show health gains. But this is to be expected, as it is a retirement area attracting younger, better-off elderly, and also has seen gains over the period for a wide range of socio-economic factors.[71] **South Auckland** was difficult to classify, because the need for benefits remained unchanged, but below the level for New Zealand as a whole. At the same time, its HUEs grew more than for any other region. This was largely a catch-up affected by major capital and other health expenditure in that part of the Auckland metropolitan region. On balance, the region probably gained both in terms of efficiencies and effectiveness.

In the bottom half of the table, the two regions in category ***(i)*****, Waikato** and **Central South Island,** have the remaining tertiary facilities. **Waikato** on the left of the lower panel in table 14.1 is a little different from other centres with tertiary hospital facilities because a far higher proportion of its population live outside the metropolitan zone. HUEs for both regions changed little from the comparator, and this was true for benefit needs for the **Central South Island**, making it very difficult to classify – it could have been, marginally, in the first category in the Table's top panel. But **Waikato** shows clear evidence of displacement to the less formal sector through growth in the need for benefits, making it closer to the peripheral regions than to the metropolitan ones in the first category.

There is no ambiguity about the regions in category ***(ii)*** on the right of the lower panel, which constitute the economically disadvantaged and more isolated areas of New Zealand. Hospital use remained the same or decreased, thus achieving "efficiency gains", but there were major increases in the rates of take-up of invalid/sickness benefits. This indicates a disproportionate displacement in those regions, by comparison with regions in the first category, of some sick persons out of the formal system into the benefits system. "Case" management on a day-to-day basis would have been less systematic, as was discussed in Chapter 13. This is an indication of a failure of the system to ensure equity across New Zealand.

A roughly similar regional division was seen in the graph presented in Chapter 13 showing the intersects between efficiency gains and survivorship, in this case measured by the probability of dying (*q(x)*) at working ages (*(50)q(15)*). Unlike a variable such as being on a sickness benefit, there is no possible ambiguity about *q(x)*: it is an actuarially exact and powerful indicator of the success or failure of the health system, and inequalities in this. All of the regions, **Waikato**, **Northland**, **Bay of Plenty/Lakes**, **Hawke's Bay/Tairawhiti** and **Taranaki/Wanganui/Manawatu** showed negative changes, and, in some cases, these were of a significant magnitude: more people at labour force ages died, and more people also took up benefits. This is the flow on effect of the failure to achieve effectiveness-gains and inter-regional equity in hospitalisations over the period.

Turning from regions, we need to set our conclusions alongside other studies on equity. Some fit exactly alongside our findings and need no further comment here (e.g. Tobias *et al.* 2009b). Their significance lies in the fact they are independent and employed different methodologies from ours.

Issues of equity have also been addressed for infant and childhood health in another paper that looked at trends in hospitalisations and socio-economic pre-conditions. The authors, Grant Johnston and Robert Lynn (2004) based their analysis on discharges by age (1-14 years), and divided them into "avoidable and unavoidable hospitalisations". They used deprivation-index data as their measure of socio-economic status. The hypothesis that they tested was that "the overall growth in children's hospitalisations since the instigation of New Zealand's economic and social reforms in 1984 reflects an increase in morbidity related to socio-economic factors such as poverty, unemployment, household

[71] In many of the Population Studies Centre's regional analyses attention is also drawn to the wide difference between the Western Bay of Plenty, which resembles Nelson-Marlborough, and the Eastern which resembles Hawke's Bay/Tairawhiti. For statistical reasons outlined earlier we could not go into this degree of detail here.

overcrowding and the cost of primary care". They concluded that "the hypothesis is false", or, somewhat less assertively in their abstract, that the results were "not consistent with the hypothesis being tested" (Johnston and Lynn 2004: S2.27 and S2:23).

Their conclusion is supported mainly by a graph on "Avoidable[72] hospitalisation rates for children aged 1-14 years by quintile of deprivation (1996/97 – 2002/03 indexed to 1996/97)". Unfortunately, this index standardises the base (1996/97 = 100, regardless of the starting level for the rates), and thus it is not clear whether the rates *per se* by quintile were converging, which would be a reasonable hypothesis as is evident in our Chapter 9 on tranche rates, and remained different by quintile throughout the period. Their rates for both avoidable and unavoidable hospitalisations for their end year, 2002-03, (Table 2) show[73] that Māori and Pasifika have higher avoidable but lower unavoidable rates; the "most deprived" have rates for both categories, however, that are more than twice (avoidable) or almost twice (unavoidable) those of the least deprived. This is very strong evidence that raises questions about Johnston and Lynn's main conclusion. The rates for the most deprived quintile change little over time in their graph (Figure 3), supporting their major caveat: that they do not have data for earlier periods (1986-96) when economic restructuring made severe impacts on a wide range of socio-economic factors (Pool *et al.* 2004, 2005 a, b, c, d, e, f, g, 2006 a, b, c) – i.e. income and employment, and related social factors. This had both intra- and inter-regional effects, and reached its extreme nadir about 1991. By the late 1990s, and certainly in the early 2000s, living standards were improving again.

Other data in their series suggest at the very least that socio-economic factors played a major role as determinants of childhood hospitalisation. The causes that increased by far the most rapidly from 1988/89 to 2002/03 were all suggestive of deprivation: ENT infections, dental conditions, gastro-enteritis, cellulitis and viral illness (Johnston and Lynn 2004: Tables 3 and 4).

Perhaps other explanations must be sought, as Johnston and Lynn argue (2004: S2.27). We can point, for example, to the general convergence in HUEs, which had the effect of bringing in more and more cases in the Auckland region, in both better off and less well off areas.

3. ***Finally, by way of a conclusion for our monograph, the impacts of restructuring were not spread evenly across the periods covered here***. This shows up in the summary data drawn from across this monograph and presented in Table 14.2. The analysis of these data must be cloaked in caveats. We can cite two immediately. First, the massive restructuring between the late 1980s and early 1990s in sectors other than health could have affected health benefit use as much as health itself, but it is unlikely that it had much impact on the probability of dying at retirement ages, *(20)q(65)* shown here, especially among those aged 70+ years. Secondly, as has become increasingly clear in recent life-tables (since 2000), males are starting to improve their survivorship levels at older ages in a way that has seen them converging towards levels gained by older women. These two important qualifications aside, we must accept that may have been other qualitative factors that we have not taken into consideration (e.g. the turmoil to which the system was subjected across the 1990s and into the early 2000s may well be one such qualitative factor).

We cannot do a "double-blind" test on these results and thus we cannot ascertain the roles of other factors: we are forced to take the data at their face-value, but accept that other intervening factors may have had an impact on them. In looking at impacts we have selected *(20)q(65)* for two reasons: first, our earlier analyses had pointed to disjunctions between electives and acutes arising particularly among older persons; and, secondly, deaths are clustered around these ages. In 2001, the median age at death fell into age-groups 75-79 (males) and 80-84 (females), and modal ages into 80-84 (males)

[72] As we stressed earlier in this monograph, the "Avoidable/Unavoidable" distinction is a very complex and difficult one to make, a caveat not elaborated by Johnston and Lynn (2004), except as a qualification in their conclusion.

[73] Although ours are for ages 0-14, if anything this would dampen any socio-economic differences as neo-natal causes, which constitute an important component, had increasingly shifted away from avoidable towards endogenous causes (i.e. such as those surrounding premature birth or soft cancers, requiring intensive hospitalisation) and not dependent on socio-economic factors.

and 90-94 (females), more or less as we would expect for a western developed country (Robine and Cheung 2008).

Table 14.2: Changes (Absolute) in Health Indices, Nationally, by Quinquennia During the Different Periods of Restructuring, 1981-2001

Index	1981-86	1986-91	1991-96	1996-2001
Efficiency Gains				
HUE(0)				
Male	-7	-10	-8	-3
Female	-7	-14	-11	-3
HUE(65)				
Male	-2	-6	-7	-1
Female	Zero	-11	-8	-2
Impacts on Population Health				
(20)q(65)*				
Male	-.02001	-.04407	-.04137	-.05542
Female	-.01595	-.05024	-.03338	-.04604
Age-stand % of Pop. At 15-59 yrs on a sickness benefit				
	No data	+.6	+.6	+1.0

* Probability of dying between exact ages 65 and 85 years. A minus figure indicates a decline in mortality; an improvement in health.

What is interesting in Table 14.2 is that the most rapid efficiency-gains seem to have been achieved in the late 1980s, in the AHB era, rather than in the next quinquennium when restructuring had a higher policy, political and media profile. By 1991, many of the recommendations of the 1970s white paper, especially relating to efficiency, were well underway, and some (e.g. combining small hospital boards) had been fully achieved. This fits well with the results presented earlier pointing to major organisational shifts towards a greater reliance on out-patient procedures undertaken in the late 1980s, a change that would have enhanced efficiency. Moreover, the spill-over effects onto population health were limited and seem to have been positive.

Thus, with the exception of *HUE (65) (Males)* the most important efficiency gains seem to have been achieved by the early 1990s; from then on the changes seem to be more in the nature of rearrangements, that were documented in detail in earlier chapters. Morgan and Simmons have put this even more succinctly: "There were improvements in efficiency, but it can be argued that these were simply a continuation of a trend started under the AHBs" (2009: 37).

The peculiar trend for males 65+ years could have been due to a wide range of factors that, in the main, are outside the scope of this study. One that is possible is an increase in the rates for older men presenting earlier for different conditions prevalent at these ages (e.g. cardio-vascular; cancers, especially prostate) as a result of media attention and improved monitoring. This fits with the continuing declines in the probability of dying at these ages not just in the mid 1990s, but even more strongly in the late 1990s. This gain aside, in the latter part of the period covered in this monograph, efficiency gains were not as strong as they had been earlier, but equally well the impacts on the population were less in terms of improvements in survivorship for older women, and were accompanied by a marked increase in the uptake of sickness benefits at working ages. We have attributed this in part to displacement from the formal sector because of unintended consequences of efficiency gains.

14.3 EPILOGUE

This study has focussed on the period up until 2001, but the question arises about what has happened since then. This section of the chapter reviews the recent period, but only at the national level.[74] Over the time period 2002-2006, the type of private hospital facility recorded in the dataset changed to include rest homes which markedly affected overall HUE and bed-day trends. For this reason, private hospital events for which no procedure was carried out were excluded from the analysis. As no private hospital events were excluded from the previous analyses, this may result in a slight under-reporting of hospital bed-days and HUEs.

Summary data on HUEs are presented in Table 14.3 for exact ages 0 and 65 years, for 2002 and 2006. Table 14.4 compares this with selected earlier years covered in this study. In interpreting these results, it is important to reiterate that the HUE has two components: hospital use and survivorship. Also, as will be shown below, patterns varied by major ethnic group.

The efficiency gains of earlier years continued. What stands out is that the year 2006 was similar to, and often below, the level for the year 2000, except for males at 65 years.

One interesting result that cannot be explored further here, but that requires serious research, is the marked gender cross-over, at both ages 0 and 65 years seen over the past 20 years. This may be associated with a general trend for males, recently observed in various health and vital data sets in New Zealand (e.g. official life-tables) and elsewhere in developed countries: male improvements in life-expectation in the early 21st century exceeded those of females (we explore this a little further below in this chapter).

Table 14.3: HUEs (Days) at Birth (0) and at Age 65 Years, Males and Females, 2002-2006

	0		65	
	Male	**Female**	**Male**	**Female**
2002	49	50	35	36
2003	49	50	36	36
2004	50	49	36	36
2005	51	50	37	37
2006	50	49	37	36
2002-2006	50	49	36	36
2004/2002	1.0	1.0	1.0	1.0

Table 14.4: HUE(0) and HUE (65 Years) from 1980-2006

Year	1980	1985	1990	1995	2000	2002	2004	2006
HUE(0)								
Males	79	72	62	54	51	49	50	50
Females	88	81	67	56	53	50	49	49
HUE(65)								
Males	52	50	44	37	36	35	36	37
Females	59	59	48	40	38	36	36	36

[74] In 2000 the ICD version used in reporting hospital and mortality events in New Zealand changed from ICD9CM to ICD10AM. A new filter was compiled to match the older filter as closely as possible, but is not a perfect match.

Over the time period 2002-2006 HUEs at birth and at age 65 years remained remarkably steady, fluctuating by a day or two at most. Male HUEs increased slightly, from 49 to 50 days at birth, and from 35 to 37 days at age 65, while female HUEs stayed the same or declined slightly. One interesting result that cannot be explored further here, but that warrants further research, is the gender cross-over, at both ages 0 and 65 years occurring over the last decade or so.[75] Suffice to note here that this represented a partial turnaround of a much longer trend towards higher and higher female longevity. It may indicate a shift in the New Zealand males' traditional reluctance to seek out healthcare (for example a 9.8 percentage point higher annual accessing of primary care by females in 2002/03 falling to 7.6 percentage points in 2006/07 (Ministry of Health 2004:116-7, Ministry of Health 2008: 222-3)).

What is striking about HUE trends over this period is how *little* they change. In examining the time trend from the 1980s to 2006 in Table 14.4 it is apparent that the steady decline in HUEs since the 1980s has stagnated, and HUEs have even increased marginally for males. This may be the first signs of the incomplete compression of morbidity (discussed earlier), leading to an increased demand for hospitalisation overwhelming ongoing efficiency efforts. If estimates of half to two-thirds morbidity compression are correct (Tobias 2009a) then increasing pressure will be coming on our public hospitals.

In addition there was a significant increase in elective surgery over the 2004 to 2006 period, mainly in cataract surgery and hip and knee joint replacements. Cataracts were done mainly as day surgery so will not impact the HUE, but hip and knee replacement surgery will. Whatever the quantitative impact of this, its real import lies in the fact that it was a part of an attempt in that quinquennium to overcome blockages in the health system (see below). These would have been hospitalisations at older ages when medical and surgical procedures were likely to have been longer and more complex, particularly if there were co-morbidities - a common problem in geriatric medicine – and thus longer hospital recuperation periods.

The next question is whether or not there were effectiveness-gains also. Table 14.4 provides the companion data on survivorship, which allows us to look at this. This is done by computing *d(70-79)*, the deaths in the synthetic life-table cohort of an original size of 100,000 members, while passing through age-group 70-79 years. This is a pivotal older age-group, which is today below the modal age at death. It is the age-group in which the median is located for males, but below that at which it occurs for females (2000-02 official complete life-tables). This is also, however, an age at which members are susceptible to both communicable and non-communicable diseases, and accidents, and when medical intervention may make a major difference between life and death. The age-group 70-79 is thus one at which episodes of hospitalisation are likely to occur. In sum, it is an age-group that is sensitive to the very factors being analysed in this Epilogue.

Table 14.5: Life-Table Deaths at 70-79 Years, *d(70-79)*, for the Total Population, 1996-2006

	1996	2001	2006	Differences 1996-2001	2001-2006
Males	28,805	27,042	24,057	-1,763	-2,985
Females	21,296	19,423	17,892	-1,873	-1,531

Source: Official Life-Tables – deaths in age group 70-79 given a starting population of 100,000

These data in Table 14.5 show that survivorship improved and the likelihood of death decreased. Overall, the improvements in health care meant that more people had survived in 2001-06 than had been the case in 1996-2001, even though hospitalisation utilization had decreased: in short the health system had become more effective. There was also a gender crossover, with notable decreases in life-

[75] We reiterate that obstetrical discharges are excluded from the index.

table deaths for males in 2001-06. This was notable because, historically, men had been less likely to present to a doctor or hospital and more likely to do so late when risks of death are higher. Somehow the system was responding better to the needs of this sub-population that had traditionally, in the 20th century at least, been more difficult to serve.

In reviewing the early 2000s, it is possible to put forward several alternative hypotheses that could be investigated in depth by other more appropriately qualified researchers. A first set of postulates relate to health care delivery *per se*. Earlier in this chapter and in Chapter 13, the possibility of displacement into less formal health care outside hospitals over the 1990s was postulated, with some degree of empirical evidence supporting this. A corollary to this would be that formal, more costly procedures requiring hospitalisation were postponed, and that these were finally undertaken in the 2000s. To add to this, any injections of additional money into the system could permit the more ready access of such cases. Yet, as the data on *d(70-79)* show, despite late presentation the system has responded successfully to this challenge. But this would have had a downside because late presentation, it could be suggested, is likely to be related to a longer duration in hospital and greater overall costs to the system.

A second set of factors could relate to changes in the population mix. The elderly are overwhelmingly of Pakeha ethnicity, but minority populations are now growing at those ages. They carry with them a cohort history that is vastly different from the Pakeha one. For example, a Māori born in 1936, and therefore in their 70s in the early 2000s, as a child had much higher exposure than Pakeha to a wide range of epidemics with their attendant mortality and morbidity risks (Pool 1991, 2009). This shows up in higher risks of mortality even at immediately pre-retirement ages. In 2004, a Māori male of 50 years had a probability of 0.8778 of reaching their 60th birthday; for a Pakeha male this was 0.96016.

The impression one gains from our data, and, more importantly from other independent studies, is that there were low-profile but system-wide, deep-seated improvements in the early 2000s, not just in the hospital sector, but in the primary sector as well, and in the integration of these two sectors. This extended into adjunct areas that affect health, such as housing (Bullen *et al*. 2008; Jackson *et al*. under editorial review). There were also improvements in access to services by more deprived sectors of the population as funding went into reducing co-payments for primary care. These must be seen alongside the relative restrictions of the 1990s (Malcolm 1996).

A different point of view, somewhat contrary to these arguments, is the case put forward in a recent paper published by the Business Roundtable (Maniparathy 2008) on "hospital performance in terms of value for money and productivity". In its Foreword, Graham Scott concluded that productivity had dropped in this period. Using classical measures of productivity, with cost as the output factor, Scott noted:

> The real cost per unit of output increased approximately 18% over the five years 2000/01 and 2005/06. When only diagnostic related groups are used to measure output (as a proxy for all output), cost per output increased 11% between 2000/01 as against 18% when all output is used.
>
> Overall productivity of personnel in public hospital decreased 8% over the five years between 2000/01 and 2005/06. This compares with a productivity decrease of approximately 15% for medical personnel and 11% for nursing personnel (productivity figures for all personnel are somewhat distorted by the contracting out of certain services like cleaning, maintenance and information technology).
>
> The overall real average personnel costs for hospital services increased approximately 16% over the five years between 2000/01 and 2005/06 (Maniparathy 2008: viii).

He then goes on to ask some critical questions: whether or not "deterioration in productivity reflects quality improvements"; whether there is a disjunction between "wage increases… and output per employee"; and he also raises a question about the possible impact of the "growth in the number of administrative staff…" (a function of the decision to establish 21 DHBs all with their own management units).[76]

By way of explanation Scott turns to structures and governance, by asking

> What are the real reasons behind the deterioration in productivity and value for money in the hospital sector? The data suggest a break in trend productivity that coincides with the abolition of the purchaser-provider model of health funding. What have been the effects of changes in the governance, funding and management of the system and the use of private providers on productivity? Has the location of the funding function within the DHBs produced the benefits that were claimed would arise and the savings in administrative costs?

The brief for our monograph, on the impacts of hospitalisation on the population, are away from the process and structural issues raised in the Business Roundtable report, yet their study does require some response. We are neither interested in, nor do we have expertise, in the area of public sector governance and management, although if this affects productivity and that in turn has an impact on population health, then it becomes an issue we must address. The analysis earlier in the chapter would, for example, raise questions about the explanation that is presented in the Business Roundtable paper – the abolition of the purchaser-provider model of funding. We would accept Scott's argument that the purchaser-provider model may have had some distinct managerial advantages in terms of re-allocating resources to areas of greater need. That said, earlier in this chapter it was shown that the most rapid efficiency gains – real ones measured in bed-days spent in hospital – actually took place in the late 1980s, before the purchaser-provider model was promulgated.

In any case, concern must be expressed about the tools health economics brings to the study of hospital productivity: there are questions about how effective this form of measurement is even in core domains of economics, and even more debatable in service industries and health. As Scott and Maniparathy accept "the indicators of productivity are reason for concern..." (Maniparathy 2008: iv). Perhaps more problematically, the methodology simply leaves to one side a number of questions affecting health system changes particularly for the aspect that is most important for effectiveness – the ultimate gauge of success – and equity.

What is critical is the actual nature of the transactions that take place at a clinical level, and the way these are changing because of technology, skills, complexities of procedures and the way procedures are undertaken, and the demographic and cause-specific (by category and severity) case-mix of the patients - the factors leading to the sorts of gains in effectiveness that we have already documented. This is not captured by Diagnosis Related Groups (DRG) data as they are too crude, nor do they capture the cohort and other past experiences of patients. To take a case noted earlier in this chapter, there is evidence, albeit imperfect, that, in the late 1990s, many patients may have been squeezed out from hospital care into less formal sectors where systematic health care regimes were harder to enforce. These patients may then have presented some years later, in the early 2000s, with conditions that were more severe and harder to treat, and thus involved longer durations of clinical treatment, and declines in productivity as measured by conventional techniques.

Our conclusion must be that, measured by effectiveness, the system is productive though not meeting some criteria of productivity of an accounting rather than a public health character. We have shown that the efficiency gains were maintained, with improved effectiveness. But this was achieved, one must add, at a time when a range of catch-up strategies had to be implemented because of delayed cases from the 1990s. To add to this radical population-mix changes were also occurring, through ethnic shifts, ageing (of Māori as well as Pakeha), in part a result of past successes in improving survivorship, and the increasing geographic shifts of various sorts.

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[76] Many other observers see this as inefficiency, citing, inter alia, dis-economies of scale for small units (Gauld 2006; Morgan and Simmons 2009).

14.4 PROSPECT

To conclude this study we look briefly into the future, above all to ask about the effects of demographic change on hospital utilisation. Figure 14.1 projects future hospital use on the basis of changing demographic patterns, but assumes that the hospital discharge patterns in 2001 remain constant. That is, it is hypothesised that the projected bed-days are driven entirely by demographic changes, and most importantly by shifts in age-composition, while procedures, durations of stay and technology to which patients are subject will remain constant. Clearly, this is not entirely realistic as the results presented earlier in this chapter suggest for some regions to gain equity there will have to be an increase in service availability. Nevertheless, the projections do highlight the pure effects of demographic change.

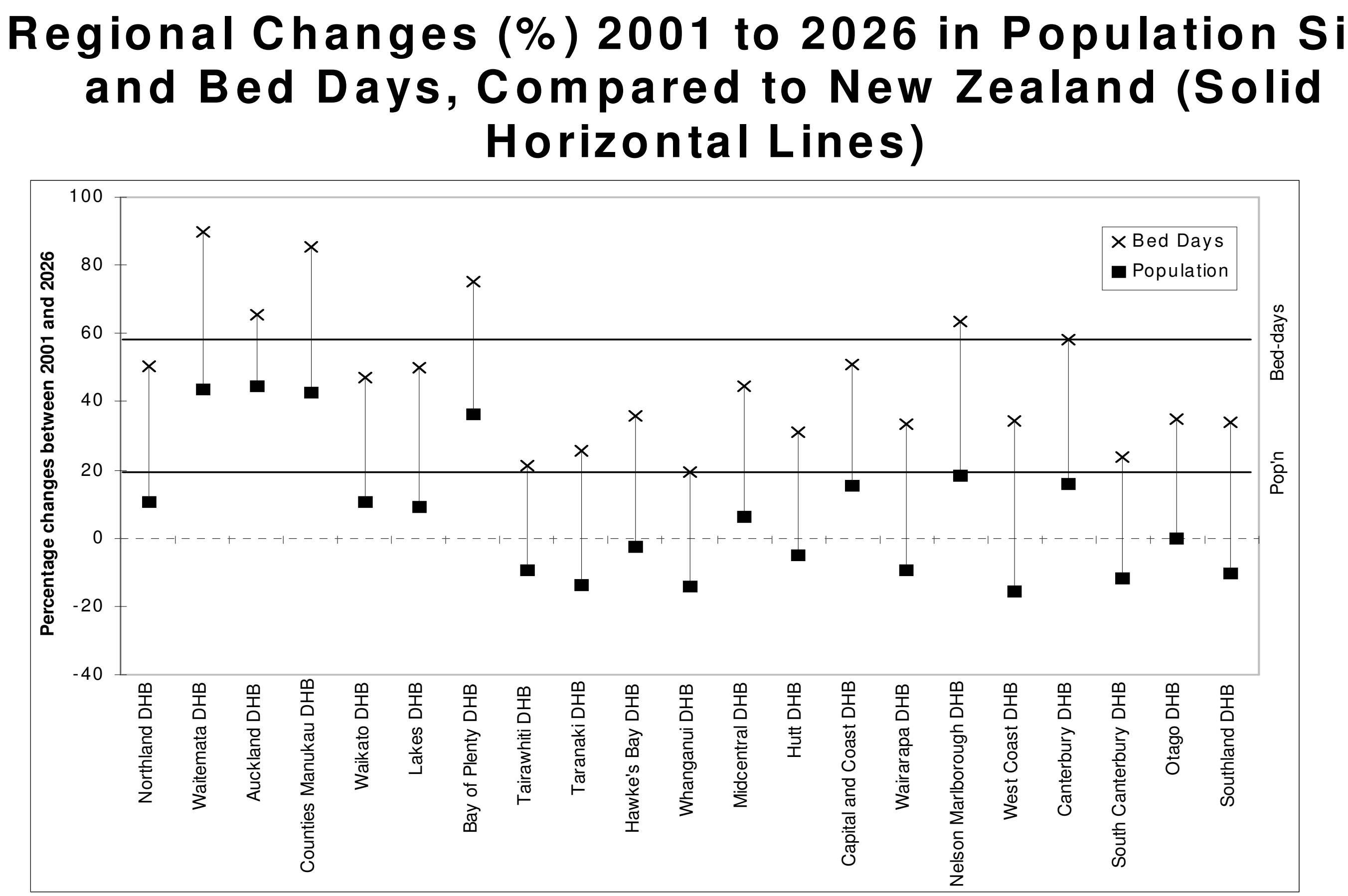
In Figure 14.1 each region is compared with New Zealand represented by the solid horizontal lines. In this case the historical regional experience is drawn upon, but the results are presented for DHBs, as constituted in 2003. The results are very significant.

Firstly, in every DHB bed-days will increase. In some, namely in the **Auckland** regional DHBs, **Bay of Plenty/Lakes**, **Nelson/Marlborough** and perhaps **Canterbury** this increase will be above what will occur for New Zealand as a whole. This is due to demographic forces but growth will not be the main driver. In fact, this is a function of age-specific population changes, the increases today at middle-ages, for a population that will move up to older ages by 2026.

Secondly, because of the age changes, bed-days increase in every region. This is true even for those that have low or even negative growth. Indeed, 10 of the 21 DHBs will have negative population growth overall, yet will see increased demand for beds. This will raise challenges for the population-based funding formula – how to be sensitive to differing population trends.

To summarise, regardless of the region in which each DHB is located, there will be increasing demand for hospital services, driven primarily by age structured changes, reinforced by other factors – migration and natural increase - in a narrow majority of DHBs. As noted already, this projection hides the effects of new procedures and technologies which will sometimes lead to efficiencies, but sometimes to increased demand for previously unavailable services.

Figure 14.1:



Sources: New Zealand Health Information Service, National Minimum Data Set - Public Hospital Discharges.
Statistics New Zealand, 2001based CHE Projections.

14.5 FROM RETROSPECT TO PROSPECT

The overall conclusion to this monograph can be very brief. It has shown that efficiencies have been achieved over the last three decades. At the same time some of the efficiency-gains appear to have been realised at the expense of effectiveness, and/or in terms of inter-regional equity. It has been the smaller peripheral regions that have suffered in this regard.

The challenges for the future are implicit in the data presented in Figure 14.1. But cross-cutting them will be three other challenges:

1. How do we capitalise on the major achievements of the recent past centering on efficiency gains that point to fiscal prudence, yet overcome the problems of effectiveness and equity that they have generated.

2. Overriding this will be the spectre of demographically-driven demands that will be complex, far more complex than would be suggested by a reading of Figure 14.1.

3. Finally, given New Zealand's peculiar population geography that makes all forms of service delivery – in every sector, not just health – extraordinarily difficult, how, in responding to all these issues, do we protect patient care in the smaller more vulnerable regions?

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