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Inpatient Discharges Demographic Profiles. What Do They Tell Us?

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Abstract

This article describes the inpatient discharges age profile split by gender and New Zealand deprivation over 3 financial years from July 2005 till June 2008 and its longitudinal variation over 10 years from January 1998 till December 2008 based on the National Minimum Data Set (NMDS). The main findings are as follow:

- *Inpatient discharges exhibit different age profiles for male and female patients*
- *Patients' socio-economic status affects discharge rates across all ages, but at differing rates*
- *The number of discharges for the highest socio-economic status group is about half that of the lowest socio-economic group*
- *The discharge to population ratio was mostly stable for all age groups, increasing slightly for inpatients aged over 75.*
- *There is an intercept age relating to male and female discharge ratio. The female discharge ratio is higher than the male ratio throughout the child-bearing ages, but the male ratio crosses the female ratio at around age 50-54 years and remains higher than the female ratio thereafter.*

These findings show that patient socio-demographic factors are essential for assessing future demand for health services.

1. Introduction

This paper aims to provide the results of some descriptive research into the impact of inpatient socio-demographic status on hospital discharges and longitudinal changes over 10 years (Jan1998 – Dec2008) based on a comprehensive analysis of the National Minimum Data Set (NMDS) collection.

NMDS holds information on hospital discharges for inpatients and day patients and is found among the suite of data collections held by the New Zealand Health Information Service (NZHIS), which is now absorbed into the Ministry of Health's Information Directorate. The information from this data collection can be obtained back to the 1980s.

While ethnicity is also an important part of a person's socio-economic status, this data is less reliable and so it has not been included in this study.

There is a sufficiently strong relationship between demographic factors such as age, gender, and socio-economic status to justify these in such significant health sector models as the population-based funding formula and workforce forecasts. The former funds district health boards, while the latter is illustrated by Antony Raymont [1] which was also used in the surgical workforce forecasting model [2]. He showed a strong relationship between surgical patient socio-economic status and surgical discharges ratio in 1995 calendar year and 1999/2000 financial year.

The authors of this paper used patients' demographic profiles in order to model future demand and therefore the future supply requirements for a number of medical and surgical specialties [3]. Analysis of this type occurs in several different areas of health sector planning, including funding.

In Europe a study of health expenditures showed a strong correlation to age and gender [4, 5]. A comparison of socio - economic inequalities in health in 22 European countries was analysed in [6] where they studied the variation of mortality and self-health assessment with socio-economic status.

The current situation in New Zealand is also faced by many other countries, namely a rapidly ageing population. A comprehensive study of the ageing population and its projection up to 2051 was completed by The New Zealand Treasury in 2003 [7], and its expected effects on national expenditure were estimated in [8].

An increased interest in the optimisation and efficiency of the health service in New Zealand requires understanding of the current health service utilisation by different socio-demographic groups and comprehensive quantitative analysis of national data collections such as NMDS will improve the understanding of health service needs.

2. Methodology

This study was based on relational analysis of the National Minimum Data Set (NMDS) and the medium population projections developed by Statistics New Zealand for the Ministry of Health (MOH) based on the 2001 census. Both data sets contain age and gender, but socio-economic status presented by domicile code in NMDS and by New Zealand Deprivation (NZDep) index in the population projection. Fortunately MOH provides a mapping table to map domicile codes collected in NMDS to the deprivation index. This makes it possible to use NZDep as a measure of patient and population socio-economic status against age and gender to inform a patient's socio-demographic profile.

NZDep has 10 levels from 1 to 10 (with approximately but not exactly, 10% of the population in each level) where 1 was set for the lowest deprivation or highest socio-economic status and 10 was set for the highest deprivation level [9]. NZDEP was calculated at Statistics New Zealand meshblocks level with population of at least 100 people. Where this is not possible the nearest meshblocks were included to calculate NZDep.

Although discharges are coded in NMDS to reflect relative resource use (case-weighted), all discharges have been counted as one for this analysis. Brief analysis of the weighted data did not appear to produce a significantly different result, but this is outside the scope of this paper as numerous changes have occurred to the way weightings have been applied over the years and would have to be allowed for.

The data were in actual age when only patient discharges were analysed and so were then stratified into nineteen age groups, being 0 (new born), 00-04, 05-09 and so on up to 80-84 with finally all those aged 85+ being grouped into one for analysis of patients to population ratio. These data could also be further subdivided by gender and/or deprivation index as required.

Two types of analysis were performed:

- 10 years NMDS data (Jan 1998 – Dec 2008) to identify and analyse any long term trends
- 3 years NMDS data (Jul 2005 – Jun 2008) to analyse the relation between patient's discharges and their socio-economic status.

Discharges were grouped by age band (as above) and gender in the 10 years analysis and in addition by deprivation index in the 3 years analysis.

As the population projections are also broken down by age band, gender and deprivation index, then total discharges for each sub-grouping could be calculated against the relevant population as a ratio and compared.

Three and ten year datasets were analysed as a whole without sampling on a smaller datasets and instead of doing tests of significance, average values and their standard deviations were calculated.

3. Results

Figure 1 shows the age profiles of inpatient discharges when averaged over 10 years of data. As expected, the male and female age profiles for inpatient discharges are different. The female age profile has two clearly visible spikes. The first spike is at age 30 and is assumed to be strongly related to maternity events and the second one is at age 78. The male age profile rises steadily from aged 25 onwards to peak at age 74. The female age profile crosses the male on three occasions, at the ages of 13, 50 and 77. Standard deviation bars show that there were no significant variations in patients' age profiles over the analysed 10 year dataset. The average standard deviation over all ages was 20.3% of male discharges and 13% of female discharges.

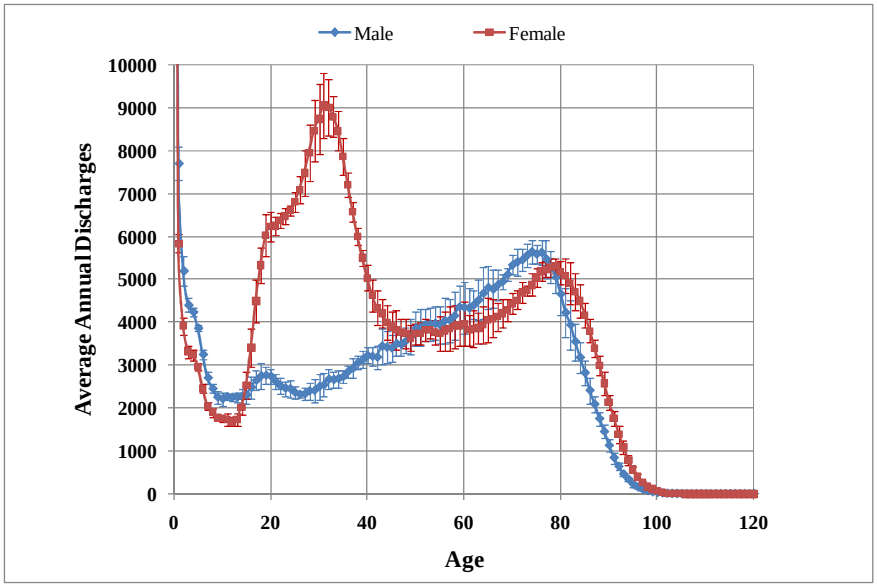

Figure 1 – Inpatients discharges average over 10 year age profiles with standard deviation boundaries.

The inpatients socio-economic status was measured using New Zealand Deprivation index (NZDep). All inpatients events between July 2005 and June 2008 were split by the NZDep in addition to age and gender splits. Figure 2 shows a graphical presentation of this split. In the main, the demand for hospital inpatient stays increases with NZDep. Both male and female discharges curves are nearly parallel with higher discharges of female inpatients across all deprivation levels. There are three clearly visible exceptions to the nearly linear growth which are:

- Number of discharges for NZDep 1 and 2 are approximately equal
- There is a slight reduction in the rate of increase in discharges for NZDep 7 compared to the expected growth
- There is a significant reduction in the number of discharges for NZDep 10.

Whilst there is a reasonable explanation for the first exception related to the very small differences in definition for NZDep levels 1 and 2, it may be difficult to find an explanation for the other two exceptions.

Combining together the effects of age, gender and socio-economic status (using quintile NZDep) five age profiles were produced for each of the male and female inpatient discharges as shown in Figures 3 and 4. The effect of the socio-economic status is not consistent across all ages. The gradient in the inpatient discharges growth is not equal between NZDeps as would be assumed based on the analysis of the Figure 2. There is a big reduction in the number of discharges especially for males but also for female inpatients age 60+ in the lowest socio-economic status.

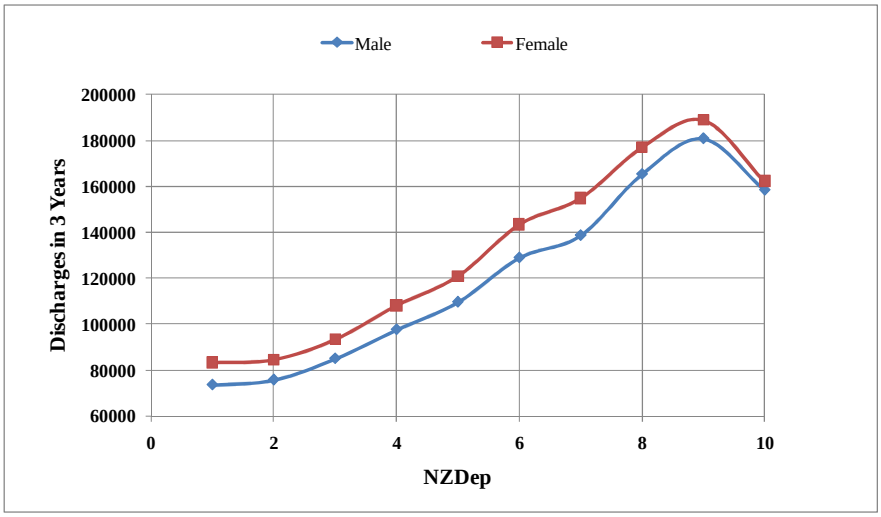

Figure 2 – Effect of the patient's socio-economic status on the inpatient discharges.

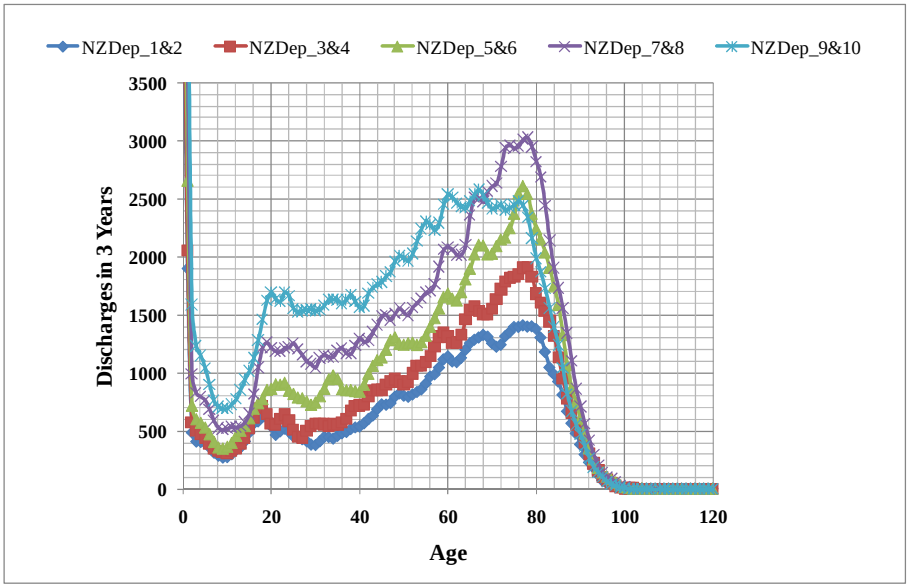

Figure 3 – Male inpatient discharges age profiles for different deprivation.

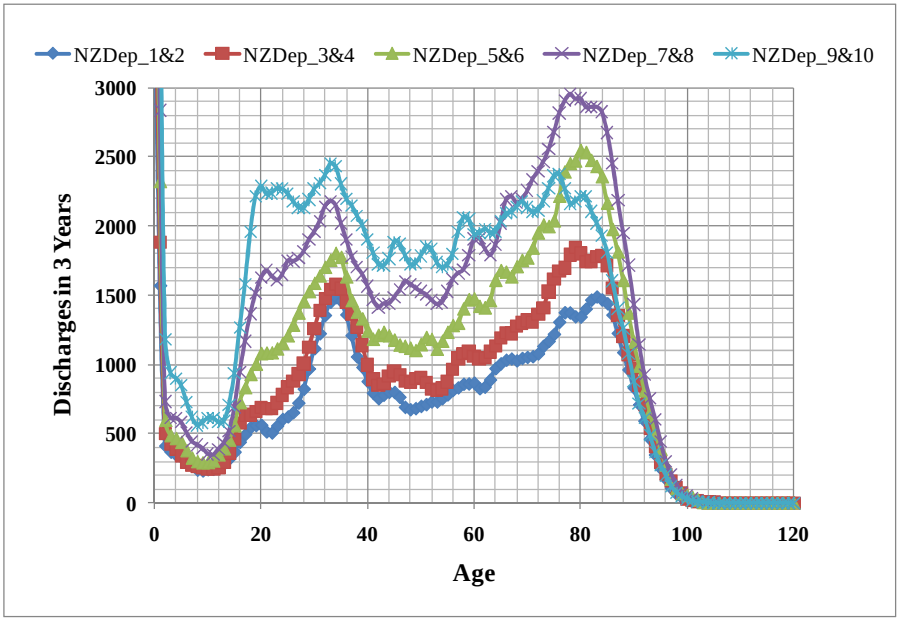

Figure 4 – Female inpatient discharges age profiles for different deprivation.

Having 10 years inpatient data it is wise to investigate the longitudinal effect in the inpatient discharges. The socio-economic status was not considered as it might have a significant variation over 10 years. The discharge to population ratio was used for analysis. Figure 5 shows the average discharge to population ratio calculated for each individual year. The ratio of 100% and more is related to new births where multiple discharges and re-admittances are common. The calculated standard deviation is negligible for mostly all age groups. It is only recognisable on the graph in Figure 5 for age groups 00, 80-84 and 85+. This is a good sign in that utilisation patterns by age and gender for public hospital services have been essentially stable for a decade.

In addition to the discharge to population ratio described above we calculated the discharge ratio to the population in 1998 or in the first year of the analysed data collection. The comparison of the 10-year average annual discharge ratio (as above) to the discharge ratio to the population in 1998 would show any absolute increments in discharges in different age groups. This comparison is shown in Figure 6. The different scales for the male and female discharge ratio were used in order to more clearly display the male and female curves and to emphasise the effect of the absolute increment in discharges. The graphs show that there is no absolute growth in discharges for age groups between 0 and 45. There are small increments in the growth of discharges for age groups between 45 and 70 which is larger for female than for male inpatients. After 70, the absolute growth becomes significantly higher than the annual discharge ratio,

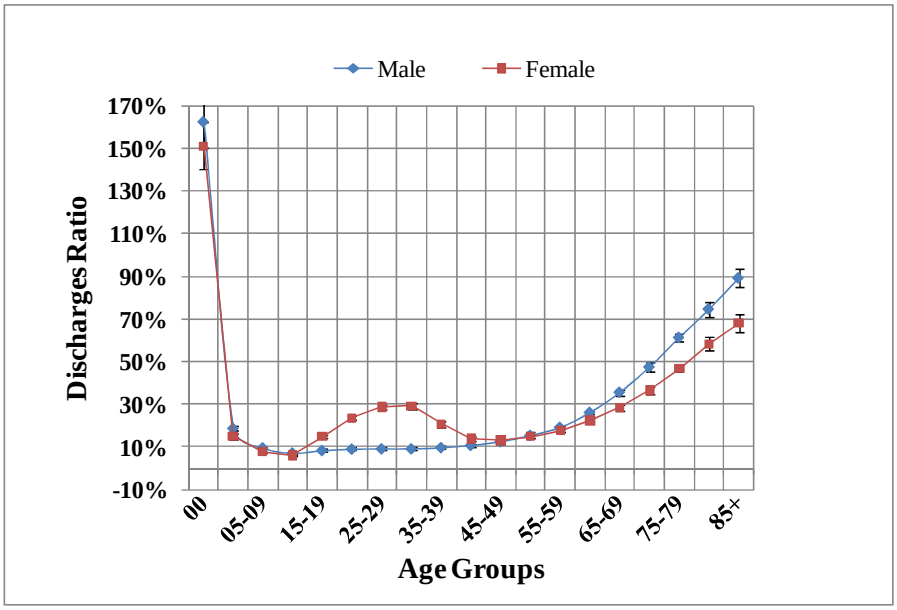

Figure 5 – Inpatients average discharges ratio over 10 years with standard deviation boundaries.

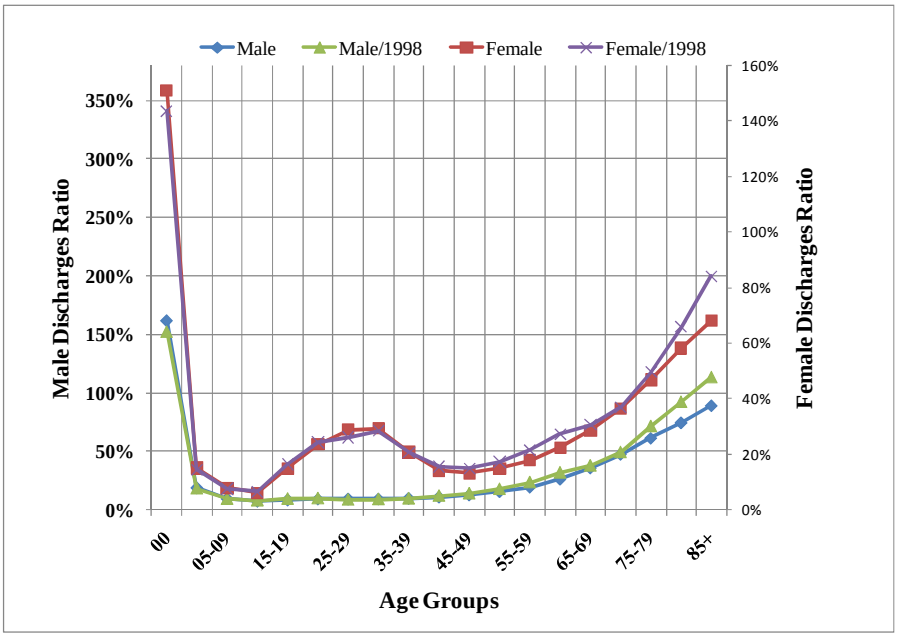

Figure 6 – Inpatients average discharges ratio to the population in 1998.

indicating the effects of the ageing population. It is highly likely that a simple ratio based on total population only, (such as specialist to total population ratio) would not identify this sort of change or take it into account.

4. Discussion

As expected, inpatients' age profiles have significant dependences on gender and socio-economic status. The dependences between those three components (Age, Gender and NZDep) are substantial in value and nonlinear in nature. Taking the average over all ages, the number of patients' discharges from the most deprived population is about twice as high as the number of patient discharges from the least deprived population however, the impact of deprivation index on inpatients' discharges is different for different age groups. While analysis of surgical events showed an almost perfect inverse between number of discharges and socio-economic status [1] our study showed two small anomalies in the discharges to deprivation curve (Figure 2) and a strong reduction in the number of discharges in the lowest socio-economic status.

It may be hypothesised that the reduction in discharges for those aged 60+ in the lowest socio-economic group could be due to lower life expectancy as a result of their socio-economic status. This may well be supported by NZDep 7&8 discharges as they show a significant spike above the other NZDep levels for discharges of those aged around 75 to 85, indicating survival, but poorer general health status.

There are different utilisation patterns between genders, between different socio-economic groups and across age bands. The cross-over in utilisation between genders at age 50 is supported by European research [4] while the other two at aged 13 and 77 were not identified. Possibly maternity/gynaecology utilisation causes crossing at age 13 and 50, and the differing life expectancies for males and females are responsible for the crossing at age 77.

The discharge to population ratio has been mostly stable for all age groups over the last decade, increasing slightly for inpatients aged over 75 which could be reflecting a number of possible causes: the improving ability to successfully treat older and older people, the fact that people are living longer so have time to develop more illnesses or even policy decisions such as the Electives Initiative which is focussed on cataracts and hip and knee joint work which is likely to impact more on this age group.

It is difficult to make an adequate comparison of the effect of the patient socio-economic status in different countries as the measure of the deprivation is different in different countries. In the study [6] socio-economic status was measured based on education, occupation and income while in New Zealand there are nine independent parameters to identify deprivation level.

The discharges to population ratios were calculated from actual inpatient data and population projections. At the national level this approach is appropriate, but care should be taken if the same approach is being considered for analysis at a regional level. Such analysis depends on the accuracy of the data held in the NMDS and the Statistics New Zealand population projections.

The analysis of the inpatient discharges split by age, gender, and deprivation is a good tool to assess the future needs in the health service as it captures demographic changes. It provides an opportunity to identify trends in the past and project them into the future. It is obviously important to take note not only of any absolute increase in population numbers, but also any structural changes that are occurring, such as the rapid ageing of the population, as different subsets of the population have clearly different health consumption rates.

When a population is growing in a non-uniform way, as is currently the case with rapidly ageing populations, the older techniques of specialist to population ratios are not able to pick up on the subtle underlying changes and will therefore become less and less valid.

Workforce planning is a significant focus for New Zealand and of its new government. Patient demographics on health service throughput data allows likely future workforce demand to be captured in a way that accounts for the nation's evolving demographic structure. Health sector information systems that facilitate the availability of patient demographics with output data for all health services, not just those provided by public hospitals, will provide significant value in service planning, and in particular workforce planning.

5. Acknowledgments

A big THANK YOU to all the HWIP team for useful discussions and proactive suggestions.

6. References

[1] Raymont A. Variation in Surgical Uptake by area, socio-economic status and ethnicity 1995 and 1999/2000 - Evaluation of the Clinical Priority Assessment Criteria Programme; 2002.

[2] Raymont A, Simpson J. Projections of surgical need in New Zealand: estimates of the need for surgery and surgeons to 2026. NZMJ. 2008;121(1275):11-18.

[3] Rains M, Minko N, Bridgford P. HWIP Medical workforce forecasting Reports. [cited; Available from: http://www.dhbnz.org.nz/Site/Future_Workforce/HWIP/forecasting/

[4] Riedel M, Hofmarcher M. Austrian health expenditures exhibit an age profile. Vienna Yearbook of Population Research 2003:197-213.

[5] Felder S. Population Ageing and Health Care Expenditure: Is Long Term Care Different? 5th Geneva Association Health & Ageing Conference 2008.

[6] Mackenbach J, Stirbu I, Roskam A-J. Socioeconomic inequalities in health in 22 European countries. N Engl J Med. 2008;358:2468-81.

[7] Bryant J. The Ageing of the New Zealand Population, 1881-2051 (Working Paper 03/27). Wellington: Treasury; 2003.

[8] Bryant J, Teasdale A, Tobias M, Cheung J, McHugh M. Population Ageing and Government Health Expenditures, 1951 – 2051 (Working Paper 04/14). Wellington: Treasury; 2004.

[9] Salmond C, Crampton P. NZDep2001 Index of Deprivation. Wellington: Department of Public Health, Wellington School of Medicine and Health Sciences; 2002.