The prevalence and care of mental disorders in Counties Manukau District Health Board from linked health data

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Simon Thornley
Dean Papa
Gary Jackson
Sue Hallwright
Counties Manukau District Health Board

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Executive summary

Health datasets were linked to identify those people in CMDHB and other Northern DHBs that received care for a mental illness in 2007 from one or more of:

- a mental health hospital admission
- a general hospital admission involving a mental health diagnosis
- a visit to a general practitioner for which specific medication was prescribed for treating a mental health condition
- a mental health service that submits data to the MHINC database.

Each person was only counted once, no matter how many times they appeared in each set, or how many sets they appeared in. For this report we termed this the 2007 CMDHB "Mental Health Population". While not covering the totality of mental illness in the population, when compared to the 2006 NZ Mental Health Survey (Te Rau Hinengaro) a reasonable concordance was shown for some relevant measures (Chapter 3).

A wide variety of analyses were performed. Key results include:

- In 2007, 7.1% of the CMDHB adult population was classified with treated or known mental disorder according to our criteria.
- Older age groups are over represented in the CMDHB Mental Health Population (including a peak in those aged over 75 years due to an increased frequency of dementia). European, Other and Maaori show the highest prevalence of mental disorders
- Around 2.2% of the adult population accessed secondary care mental health services in 2007. This is consistent with the estimated 70% of Blueprint position for mental health services in CMDHB; the national service target is 3%.
- The majority (72%) of this Mental Health Population had received an antidepressant prescribed by their general practitioner without having received secondary care during that year. This highlights the proportion of mental health disorders treated 'exclusively' by primary care.
- From our estimated 2007 CMDHB Mental Health Population those most likely to be admitted to hospital for parasuicide had a diagnosis of anxiety, personality disorder or substance misuse, when adjusted for other demographic variables.
- Those that had a previous or current diagnosis of depression but were not taking an antidepressant medication in 2007 had the highest odds of attending secondary care mental health services in that year (odds ratio 51.6; 95% CI 38.4 to 69.2) when adjusted for other demographic variables.
- Substance misuse had the strongest link with premature death (odds ratio 3.8; 95% CI 2.8 to 5.1) in 2007 when adjusted for other demographic variables.
- Residents in CMDHB have low use of subsidised nicotine replacement therapy (0.5% annually). Although comparative access for the CMDHB Mental Health Population is good, potential exists for increased uptake of NRT in CMDHB, particularly in Pacific groups.
- The age specific prevalence of dementia in CMDHB in 2007 was less than one percent in those aged less than 75 years, increases to 4% in those aged 75 to 84, and is 10% in those over 85 years.

- General practitioners were more likely to prescribe amitriptyline and nortriptyline for patients that had not seen secondary services during the year than those who had. In contrast, those who had attended secondary care were more likely to have received citalopram, a novel selective serotonin reuptake inhibitor.
- The calculated costs per capita for Mental Health Population individuals for laboratory and pharmaceutical services, and non-mental health hospital admissions were roughly two to three times those not diagnosed with mental illness.
- CMDHB spends less per age-adjusted Mental Health Population individual than other Northern DHBs.
- Those with a recorded diagnosis of a mental disorder or prescription of a medication for a mental health condition have about twice the odds of ambulatory sensitive hospitalisations, adjusted for demographic variables, than those without such a diagnosis.
- People with mental illness are no more likely to have diabetes than others after adjustment for demographic variables. However those that take antipsychotic medication are more likely than those that do not to have diabetes (odds ratio 1.6; 95% CI 1.4 to 1.8).
- If they have diabetes mental health patients are as likely as others to be monitored with an HB_{A1c}. However, they are marginally less likely to receive ACE – inhibitor or angiotensin-2 blockers to prevent progression of diabetes, adjusted for demographic variables.

This study has defined a new methodology for estimating the descriptive epidemiology of mental health disorders using linked anonymised health data. Although not formally validated it provides a view of mental health care not previously available for CMDHB, and provides insights into service use by different groups, relationships between services, and linkages between mental health and physical health.

As the datasets develop, further work is anticipated around validation and to examine trends over time. The range and variety of analyses presented here we hope will stimulate discussion and comment. We would particularly welcome thoughts on improvements in the methodology and ideas for further analytical work – please feedback to Gary Jackson: gjackson@cmdhb.org.nz.

Chapter 1. Introduction

According to the World Health Organization, mental illness accounts for 15 percent of the total burden of disease in the developed world, with Usten attributing 4.4% of total DALYS, and 12% of years lived with disability worldwide in 2000 to these conditions.[1] Depression is predicted to become the second leading cause of disability in the world by 2020.

Locally The New Zealand Mental Health Survey (2006) was the first major national prevalence survey of mental disorders.[2] All New Zealanders aged over 16 years were to be included in the sampling frame. The survey was limited by not screening for psychotic and cognitive disorders (e.g. dementia) and exclusion of those living in institutions. Life time prevalence of mental disorder was 46.6%, and in the last 12 months, 20.7% were labelled with a mental disorder.

The prevalence of psychiatric disorders varied by gender and ethnicity in this survey. In the last 12 months, females had a higher prevalence of anxiety disorder (2.0% cf. 1.3%), major depression (7.1% cf. 4.2%) and eating disorders (0.6% cf. 0.3%) compared to males. Conversely, males had higher rates of substance use disorders (5.0% cf. 2.2%) over the last 12 months. Maaori and Pacific ethnic groups had higher levels of mental disorder than 'Other' (12 month prevalence of any mental disorder was 29.5% for Maaori, 24.4% for Pacific people and 19.3% for 'Others'). The sample included 12,992, with 2,595 Maaori and 2,374 Pacific, with a response rate of 73.3%.

The survey also identified those with mental illness often do not seek help from the health sector, and Pacific people are least likely to do so. Of respondents that reported a mental disorder within the last 12 months - only 36% visited the health sector for assessment or treatment of such a disorder. This varied by severity (58% for serious disorders, 36% for moderate disorders and 18% for mild disorders). Reasons given for delays in seeking help were - wanting to handle the problem themselves, the problem spontaneously resolved, thinking the problem would get better by itself and cost. Of Pacific people who met the criteria for a DSM-IV disorder in the last 12 months, only 26% had seen a mental health professional over the same period compared with 33% of Maaori and 41% of 'Others', corrected for age and gender.

The government's response to the burden of mental health in New Zealand is to "*decrease the prevalence of mental illness and mental health problems in the community*" and "*increase the health status of and reduce the impact of mental disorders on consumers, their families, caregivers and the general community*".[3]

Counties Manukau District Health Board (CMDHB) population has a varied ethnic mix, comprising 17% Maaori, 21% Pacific, 15% Asian and 47% European/Other. With the high representation of Pacific populations - traditional low users of mental health services - we aim to estimate the prevalence of medicated/identified mental

[1] T. B. Üstün, J. L. Ayuso-Mateos, S. Chatterji, C. Mathers, and C. J. L. Murray. Global burden of depressive disorders in the year 2000 The British Journal of Psychiatry 2004 184: 386-392.
[2] MA Oakley Browne, JE Wells, KM Scott (eds). 2006. Te Rau Hinengaro: The New Zealand Mental Health Survey. Wellington: Ministry of Health.
[3] Ministry of Health. DHB Toolkit. Mental Health: To improve the mental health status of people with severe mental illness. 2003. Wellington, Ministry of Health.

illness in the community, assess their level of access to both mental health services and care for non-mental health conditions. The data that we have access to allows comparison between Counties Manukau and Auckland, Northland, and Waitemata DHBs.

Previous uses of routinely collected data for psychiatric epidemiology

To our knowledge, this study is the first attempt to characterise a mental health population by linking different sources of health data. Previous examples of such use include time series analysis of prescribing regulatory warnings on the use of antipsychotics in dementia populations (Canada)[4], and for studying influences, such as drug company advertising, on psychotropic drug prescription (UK).[5] One study used health records from psychiatric outpatient clinics and hospital admissions to estimate the prevalence of schizophrenia in south west Scotland.[6]

What causes mental disorders?

Readers of this report are likely to speculate about the patterns of mental disorders described. This section seeks to give a brief introduction to the causes of mental disorders in the published literature.

Mental disorders have been linked to stressors in the social environment – both community-wide and personal, and to exposures to toxic substances in the environment. The Three Mile Island, Chernobyl disasters and 9/11 attacks were examples of events that have been linked to an increased rate of psychopathology – either as a result of the acute event itself or its aftermath. Post Traumatic Stress Disorder is one type of anxiety disorder attributed to the experience of such events. Personal stressors, such as unemployment and bereavement, have been linked to psychiatric illness, particularly in patients lacking social supports (e.g. women who lacked a confiding relationship with their partners, were not employed outside the home, had three or more children under six years of age, or had endured the loss of their own parents in childhood).[7] For specific conditions such as bipolar affective disorder, genetic factors may contribute although the evidence is not definitive. Insults to the brain, such as perinatal hypoxic brain injury or head injury or those associated with substance abuse have also been linked to mental disorders. Environmental insults, such as heavy metals (e.g. occupational exposure to lead), or solvents may also contribute to psychiatric disease.

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[4] Valiyeva E, Hermann N, Rochon PA et al. Effect of regulatory warnings on antipsychotic prescription rates among elderly patients with dementia: a population-based time-series analysis. CMAJ 2008;179(5):438-46

[5] Baber E, Ballinger BR, Fenton GW. Influences on psychotropic drug prescription in a psychiatric service. Psychiatric Bulletin (1996) 20:206-9

[6] Allardyce J, Morrison G, Van Os J, et al. Schizophrenia is not disappearing from south-west Scotland. The British Journal of Psychiatry (2000) 177: 38-41

[7] Brown G. Harris T. Social Origins of Depression: A Study of Psychiatric-Disorder in Women. New York: The Free Press; 1978.

Aims

We seek to describe the demographic characteristics of the known or medicated CMDHB mental health population, explore factors associated with service use and particular diagnostic categories, and compare this population to others in the Northern Region. Other questions that do not involve the linking of health data have also been added.

Questions

1. What is the prevalence of mental health disorders from health service utilisation (MHINC), pharmaceutical claims and hospitalisation data compared to:
    a. the prevalence and severity of mental health disorders described in the national mental health survey (Te Rau Hinengaro[8])?
    b. What is the descriptive epidemiology of the CMDHB mental health population (by ethnicity, age, gender, deprivation).
    c. Age-standardised comparison of CMDHB mental health users compared with the rest of the Northern region DHBs. What are the proportions of these DHB mental health populations seen in primary care and secondary care? What proportion of the high needs population e.g. those taking anti-psychotic medication are
2. What proportion of the CMDHB population with mental disorders has access to secondary care mental health services? How does this compare to Ministry of Health access targets? What proportion of those receiving anti-psychotic medication are receiving secondary care in CMDHB?
3. What is the incidence of medical diagnoses (e.g. diabetes) amongst mental health users and how does it compare to the non-mental health population? Is it similar to that expected from national surveys?[9] What spectrum of psychiatric disease is likely to be captured by such an analysis?
4. What is the epidemiology (ethnicity, age, gender, deprivation) of those who use mental health pharmaceuticals in CMDHB and how does it compare to the rest of the Northern population?
5. Do mental health clients get similar access to non–mental health pharmaceuticals for chronic conditions such as diabetes/smoking cessation?
6. What is the total cost of care to CMDHB for those with and without mental illness?
7. What is the time trend pattern of incidence of completed suicide and/or parasuicide in the CMDHB region over the last fifteen years?
8. What are the patterns of prescribing of antidepressant and antipsychotic medication by provider (GP vs specialist) in CMDHB? What are the relative frequencies of using specific drugs?
9. What is the epidemiology of dementia in CMDHB? What proportion is receiving antipsychotic medication? What is the extent of polypharmacy amongst this population?

[8] MA Oakley Browne, JE Wells, KM Scott (eds). 2006. Te Rau Hinengaro: The New Zealand Mental Health Survey. Wellington: Ministry of Health.

Methods

We estimated the prevalence of treated or known mental health disorders in the Northern region (Northland, Auckland, Waitemata, and Counties Manukau DHBs) by identifying individuals who received treatment for such an illness (as a diagnostic category from services provided at secondary care – inpatient or outpatient service; or from Pharmaceutical claims data indicating that they were receiving a medication exclusively indicated for treatment of mental disorders) (Figure 1). We refer to this group as the *CMDHB Mental Health Population* in this report. A person's residential address was coded as a census area unit and such codes that indicated residence in CMDHB boundaries were used to identify this population. The denominator was taken from the 2006 New Zealand Census, with extrapolations used to estimate the population in 2007. The aim was to estimate a population with known or treated mental illness in the Northern region during 2007, then estimate one year prevalence of known or treated mental health disorders over that year. This prevalence was later compared to expected mental health population size for CMDHB, based on ethnicity extrapolations from the national New Zealand Mental Health Survey.

We designed the study to simulate a cross-sectional survey undertaken on the 31st of December 2007. Therefore, we included anyone in the 2007 mental health population that had a mental health event (prescription of psychiatric drug, hospital discharge diagnosis or secondary care diagnostic health record) during that year. Current use of service implied by appearance in any of these datasets in 2007 was considered necessary to identify an individual with active mental disorder considering the natural history of such conditions which do, on occasion, spontaneously resolve. Any individual who died and appeared in mortality data during that year was excluded, as they would not have taken part in our hypothetical survey (Figure 1). They were included, however, in later cross-sectional analyses linking demographic and mental health variables with mortality.

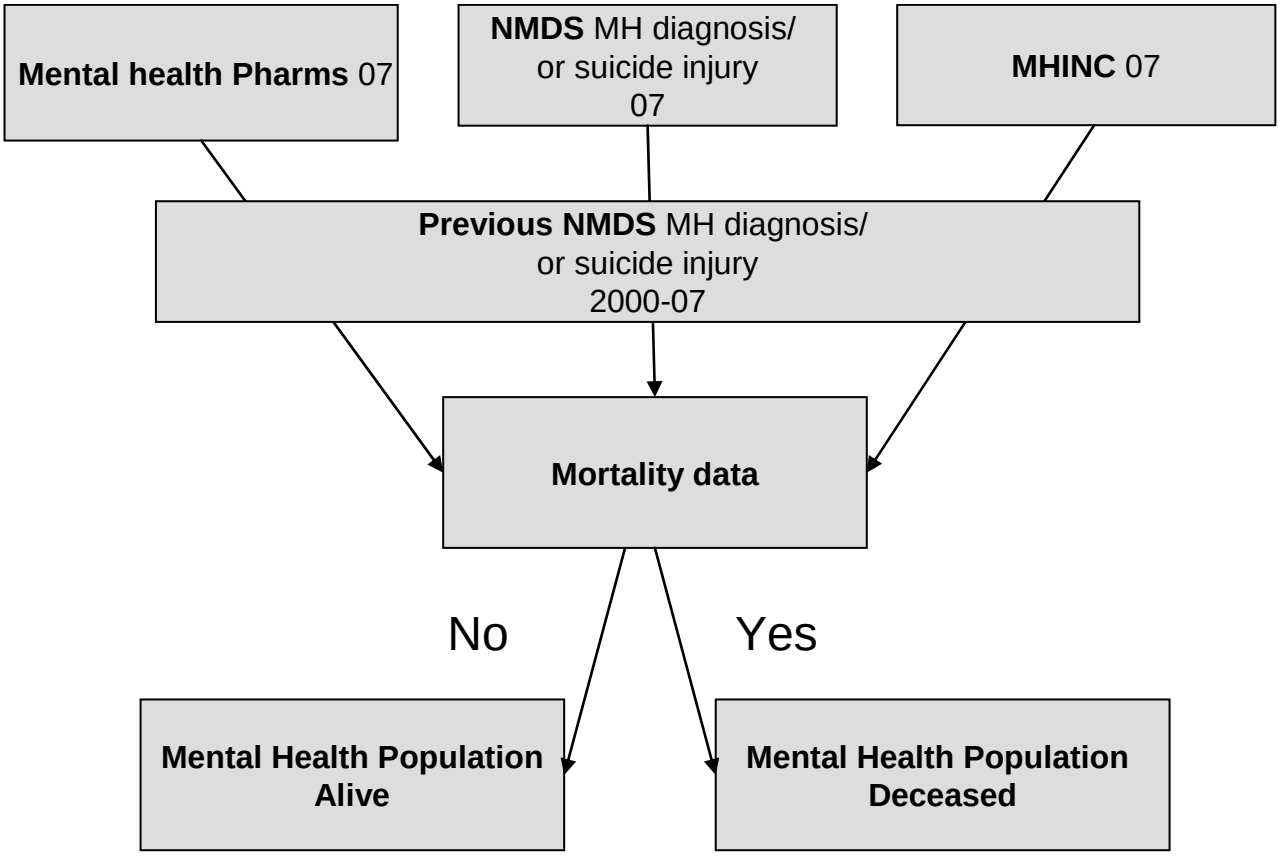


Figure 1. Flow chart of steps used to construct the CMDHB mental health population

We further limited the population by age group. Those under 15 years were excluded to avoid analysis of developmental conditions (younger ages) and the more specialised services that cater for such patients which deserves a more detailed examination. Our aim was to assess uptake and need of adult mental health services. Need was estimated by comparing service use with estimates based on national surveys. For cross-sectional analyses linking health outcomes to mental health and other demographic characteristics we further restricted the population to those aged less than 65. This was done to identify links with 'premature' health related events, and to avoid definitional issues that arise from conditions such as cognitive decline and dementia.

All analyses were carried out using the freely available software package "R 2.7.2".[10] Logistic regression analyses were carried out using the glm function. Both "R" and Microsoft Excel were used to produce graphs and manipulate data.

[10] R Development Core Team, *R: A language and environment for statistical computing*. 2007, R Foundation for Statistical Computing: Vienna.

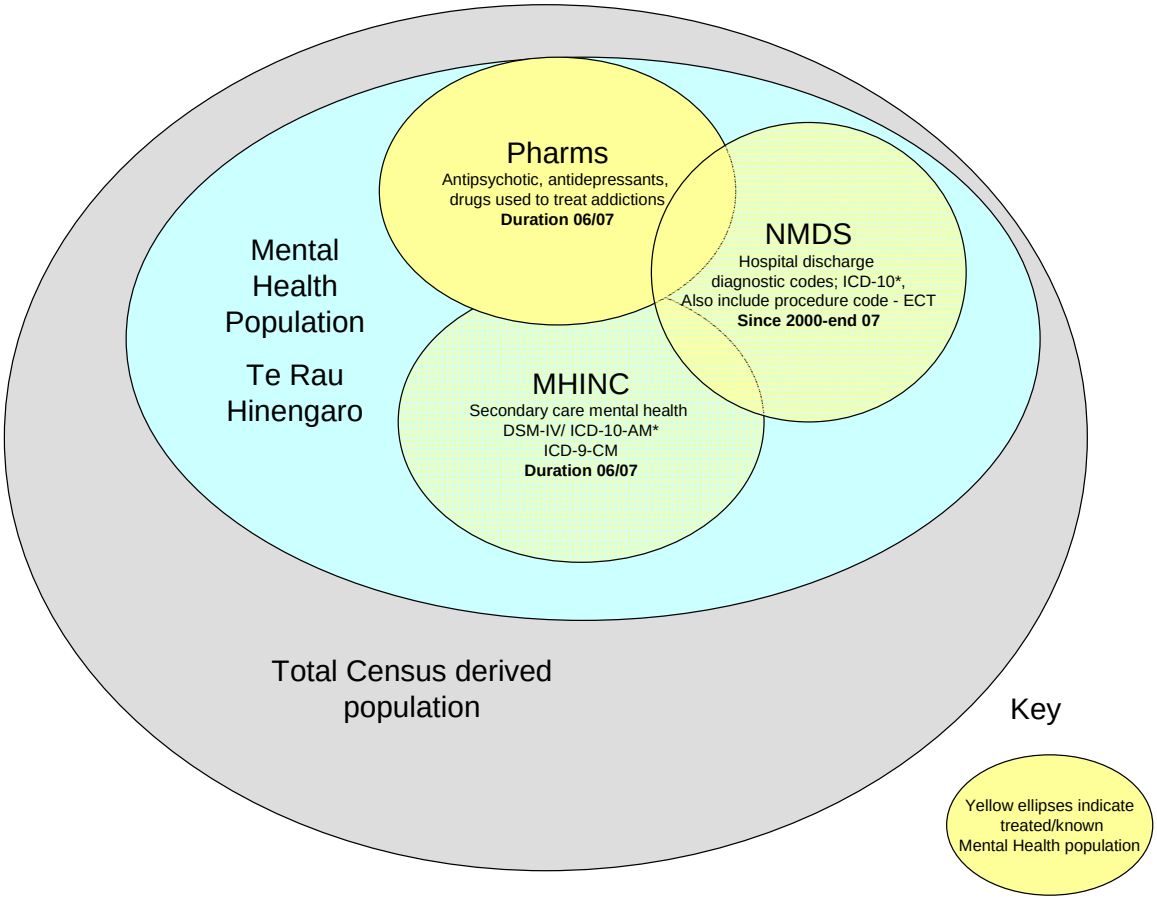


Figure 2. Schematic of data sources used to calculate prevalence of psychiatric disorders in CMDHB and Northern Region

The estimated Northern population with known or treated mental health disorders was synthesised by linking a number of data sets linked by encrypted National Health Index identifier (NHI). This encryption protected the identity of individual records. NHI key codes (also known as HCU codes) for all individuals in the reconstructed population were encrypted by the Analytical Services team at NZHIS which maintains the anonymity of individuals within routinely collected data. Only aggregated results are reported in this document and no contact with individuals was undertaken. Ethical approval for this analysis was therefore not sought.

These datasets are illustrated in Figure 2 and include:

- **(A) PHARMS dataset** – Individuals who were dispensed a medicine from the NZ Pharmaceutical Schedule and a reimbursement claim along with an NHI number recorded for the claim (roughly 94% of pharmaceutical claims had NHI numbers recorded) are recorded in this dataset. Those with mental health disorders were identified by selecting a medication used to treat mental illness such as an antidepressant, antipsychotic, or drug used for the treatment of addiction (naltrexone, methadone and disulfiram) (Appendix 2). We included any prescription for a drug which may be prescribed for a psychiatric disorder to include a large group from primary care, although we recognise that some patients may be prescribed such drugs for other indications (e.g. nortriptyline for smoking cessation; haloperidol as an anti-emetic in palliative care scenarios, amitriptyline for chronic pain). Importantly, this data excludes use

of non-subsidised medicines and those which were obtained from a hospital pharmacy.
- **Note**: Benzodiazepines have not been included as they are frequently used to treat seizures and sleep disorders as well as anxiety disorders.

Medications thought to represent treatment were divided into three categories:
(1) Antidepressants;
(2) Anti-psychotics (including mania);
(3) Treatments for drug dependence (including naltrexone, methadone or disulfiram)
Cholinesterase inhibitors used to treat dementias (such as rivastigmine) were not included as only government subsidised medicines were included in the PHARMS database, and such drugs are not currently government subsidised. A list of included medicines is contained in Appendix 2.

- (B) **NMDS (National Minimum Data Set) -** Those that appeared in the NMDS since the year 2000 to the end of 2007 with a hospital admission and coded mental health diagnosis code, suicidal behaviour injury code, or electro convulsive therapy procedure code were included as indicators of a mental health disorder. Those that appeared only between 2000 and 2007 had to be 'validated' by appearance in another data set – MHINC or PHARMs, to demonstrate evidence of continued treatment of disorder. The diagnostic categories for mental illness were designed to allow comparison with the New Zealand Mental Health Survey (2006) (table 2). NMDS data was taken from 2000, when the classification system was changed to ICD-10 for classifying diagnoses.

- **(C) MHINC** – this dataset is administered by the New Zealand Health Information Service (NZHIS). Although this dataset was initiated in 2000, reporting of diagnosis category (and utility for our purposes) was only made mandatory from the 1st of July 2004. Categories for diagnosis included DSM-IV, ICD – 9-CM or ICD-10-AM. MHINC ethnicity data is recorded up until Statistics New Zealand level 2. This dataset excludes ~90% of NGOs that deliver mental health services in CMDHB, and was limited to those seen in 2007, however, historic diagnoses were again used to classify patients if available from previous years. The MHINC database is limited by lack of NGO reporting, variation in diagnostic accuracy (many submit no diagnosis), and regional variation in consistency between DHBs.

We divided DSM-IV and ICD diagnoses into similar psychiatric diagnostic categories which allowed comparison with the New Zealand Mental Health Survey (2006) (Appendix 3).

We used drug use to further classify individuals into diagnostic categories (Table 1).

Ethnicity

Ethnicity as a concept is used to encapsulate cultural characteristics of an individual. It is self defined and has notions of group identification which are fluid and socially constructed. Whilst this variable can help plan services for such groups and identify 'high needs' populations it is important not to engage in victim blaming (seeing ethnic groups as deviants) and not consider deeper social and institutional processes that are

likely to influence the causal pathway of disease development and progress such as experience of racism.[11]

Ethnicity was derived from that collected and coded against NHI using Ministry of Health protocols.[12] This report presents ethnic group prioritised by ethnicity, whereby individuals are categorised into only one ethnic group, according to a prioritised schedule. This allows for instances where individuals need to be allocated to only one ethnic group in analysis of socio-demographic data. Where this need exists it is important to identify groups of policy importance and ensure that groups of small size are not lost amongst the dominant NZ European ethnic group. Consistent with Ministry of Health recommendations, ethnicity is prioritised in the following order: Maaori, Pacific, Asian, Other.

Table 1. Rules applied for allocating diagnostic categories for people with mental disorders

Rule	*Mental Health Disorder Classification*
Any antidepressant use	Depression category
Any medication for drug dependence	Substance abuse category
Any use of lithium carbonate	Manic category
Any use of anti-psychotics	Psychotic disorders category
Any appearance in manic disorders category*	Remove from depression category

*Rule applied according to DSM-IV hierarchy of diagnoses.

Summary

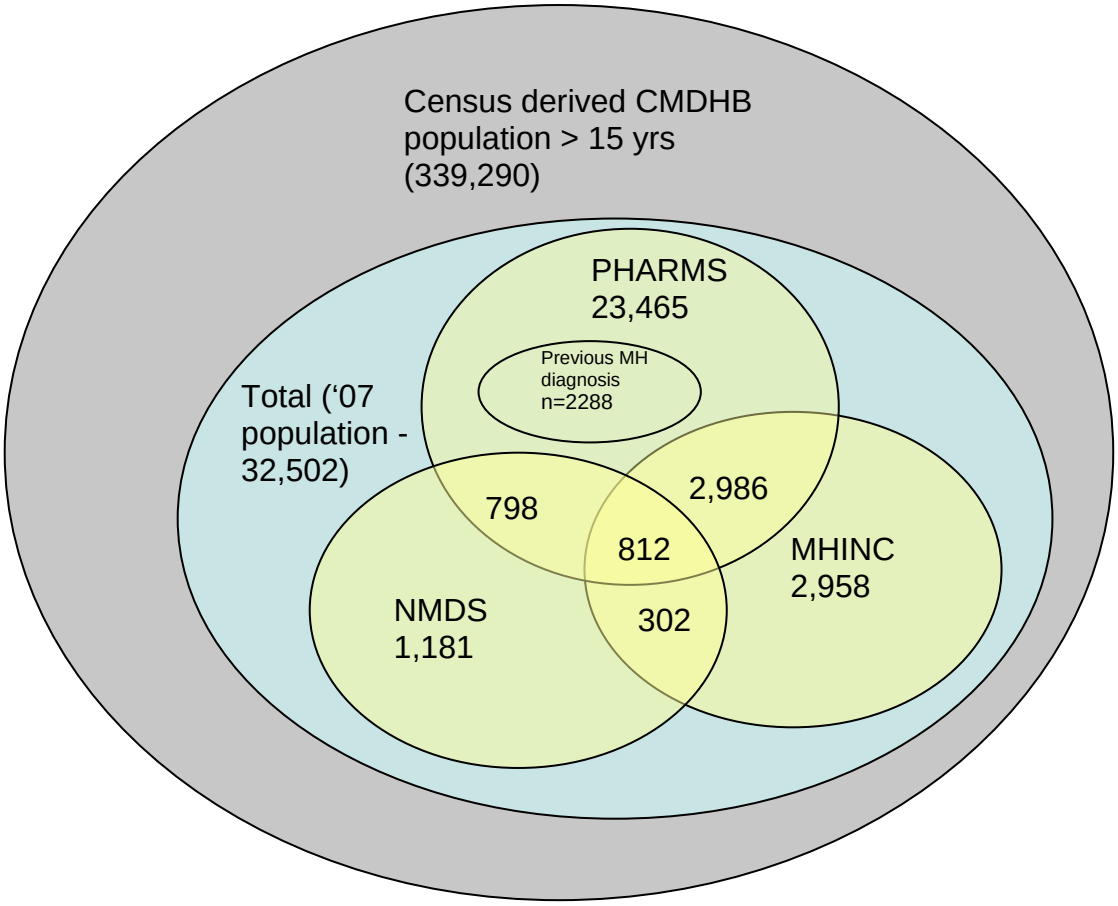
Health datasets were used to identify those people in CMDHB and other Northern DHBs that received care for a mental illness from either a hospital admission, a visit to a general practitioner for which a medication was prescribed for treating a mental health condition, or they attended a mental health service outpatient clinic that submits data to the MHINC database.

Thus, those not necessarily included in this population include those:
(1) that received prescriptions from hospital pharmacies
(2) that did not have an NHI recorded against their pharmaceutical claim (<5% of scripts)
(3) that attended an emergency department with a psychiatric related diagnosis and were not admitted to hospital or had a stay less than three hours
(4) that attend one of the approximately 90% of NGOs who do not routinely submit diagnoses to MHINC for analysis
(5) that were treated non-pharmacologically in primary care (e.g. behavioural therapy or counselling)
(6) that sought no treatment, or did not have their mental illness recognised/recorded.

[11] Sheldon TA, Parker H. Race and ethnicity in health research. Journal of Public Health Medicine. 1992. Vol 14(2):104-110.
[12] Ministry of Health. Ethnicity data protocols for the health and disability sector. Wellington: Ministry of Health, 2004.

Chapter 2. Descriptive results

The 2007 CMDHB "Mental Health Population" was estimated at 32,502. This is 7.1% of the CMDHB population aged ≥ 15 years. (If current evidence of treatment for a mental disorder was not used to select records, the population was increased by 2/3rds [n=55,062]). The contributions of the data sources to the 2007 CMDHB Mental Health Population is highlighted in a Venn diagram (Figure 4).



NMDS- National Minimum data set; MHINC- mental health services dataset; PHARMS, pharmaceutical dataset.

Figure 3. 2007 CMDHB Mental Health Population

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Some who were included in this population from the pharmaceutical database (alone) had mental health diagnoses carried forward from previous years, so that a total of 11,325 (34.8%) of this population had a mental health diagnosis at some time recorded. The remainder had a diagnosis inferred from the type of drug recorded in the PHARMS dataset.

Of those who had such a diagnosis, the range is displayed in Table 2.

Table 2. CMDHB Mental Health Population diagnostic categories

diagnosis	*Male*	*Female*	*total* (%)*
Anxiety	758	1530	2288 (7.0)
Depression	909	1835	2744 (8.4)
Depression†	7582	16342	23926 (73.6)
Mania	553	388	941 (2.9)
Mania†	676	479	1155 (3.8)
Substance use	1616	895	2511 (7.7)
Substance use†	1632	909	2541 (7.8)
Eating	71	13	84 (0.3)
Psychosis	862	1250	2112 (6.5)
Psychosis†	2001	1858	3860 (11.9)
Personality	326	261	587 (1.8)
Dementia	645	436	1081 (3.3)
Suicide	903	472	1375 (4.2)
Total other	4792	4994	9786‡ (30.1)
Total (any ICD-10 or DSM IV diagnosis)	6915	4410	11325 (34.8)

*Denominator – 32,502; more than one diagnostic category may have been assigned.
† Includes drug use as indicator of diagnostic category if no other diagnostic code is available in NMDS or MHINC data (since 2000). Depression includes any antidepressant. For bipolar disorder, includes lithium carbonate. For substance use, includes methadone, naltrexone and disulfiram use. For psychotic disorder, includes any antipsychotics including lithium carbonate.
‡ Includes three labelled with unknown gender

The "Other" category was a combination of MHINC and NMDS diagnoses that did not fit the categories of interest. The majority did not have other mental diagnoses (8604/9786; 88%). Over half (*n*=7462) of such diagnoses were "Unknown and unspecified causes of morbidity" or "Diagnosis of condition deferred on Axis I".

A large number of individuals did not appear in the NMDS or MHINC in 2007 and were included through their use of mental health pharmaceuticals prescribed in primary care (Table 3).

Table 3. Proportion of psychiatric drug class use for those not using secondary care in 2007

Drug category	***n***	*%*
Antidepressants	22438	95.6
Antipsychotics	2273	9.6
Disulfiram	42	0.2
Naltrexone	29	0.1
Methadone	191	0.8
Total	23465*	100.0*

*Patients may be prescribed more than one medicine in this category.
Note that this table differs from those in the table above as users of secondary care (so individuals recorded in MHINC or NMDS were excluded).

The vast majority of this subset used antidepressant medication, with almost 10% included due to antipsychotic use. None of those who used antidepressants were concomitantly using antipsychotics. In contrast, 70% of those in the methadone group were also taking an antidepressant.

Table 4. CMDHB Mental Health Population (aged 15 years and over), 2007

	Gender (*n*)					
Age-group	**Male**	**Female**	**Unknown**	**Total**	**% CMDHB Mental Health Population**	**% CMDHB population strata***
15-24	2057	1772	0	3829	11.8	9.8
25-34	2736	1847	0	4583	14.1	12.8
35-44	3895	2416	1	6312	19.4	13.4
45-54	3870	2258	0	6128	18.9	14.4
55-64	3177	1747	2	4926	15.2	15.4
65-74	1978	1153	0	3131	9.6	16.3
75+	2435	1158	0	3593	11.1	23.9
Missing	0	0	0	0	0.0	0.0
Ethnicity						
Maaori	2504	1834	0	4542	13.3	8.8
Pacific	1508	1416	0	2963	9.0	4.5
Chinese	486	206	0	706	2.1	3.4
Indian	748	474	0	1226	3.8	5.7
Other Asian	438	227	0	670	2.0	5.8
European	12871	6743	0	20203	60.3	13.1
Other	1593	1451	3	3086	9.4	13.8
Missing	0	0	0	0	0.0	0
NZdep						
1 and 2 least deprived	3802	2072	0	5874	18.1	7.2
3 and 4	1702	890	0	2592	8.0	8.7
5 and 6	2474	1391	2	3867	11.9	6.8
7 and 8	3575	2064	1	5640	17.4	17.3
9 and 10 most deprived	6673	4907	0	11580	35.6	4.8
Missing	1027	1922	0	3032	9.1	Not reported
Total	12351	20148	3	32502	100	7.1%

*Denominator –total usually resident 2007 CMDHB population within demographic strata of left hand column

Table 4 highlights that older age groups are over represented in the CMDHB Mental Health Population. The peak in those aged over 75 years may be due to an increased frequency of dementia. European, Other and Maaori have the highest prevalence of mental disorders when stratified by ethnicity. Chinese have the lowest prevalence, with only 3.4% of this population included. The NZdep status of those using mental health services is over-represented in the least deprived (1 and 2) and most deprived (7 to 10) categories.

The age structure of the CMDHB Mental Health Population varied by ethnicity with 'Other' (non-Pacific, non-Maaori – cf. Table 1), having a proportionately older population than either Pacific or Maaori (Figure 4). This mirrors the changes seen in the age structure for the total CMDHB population for these ethnic groups.

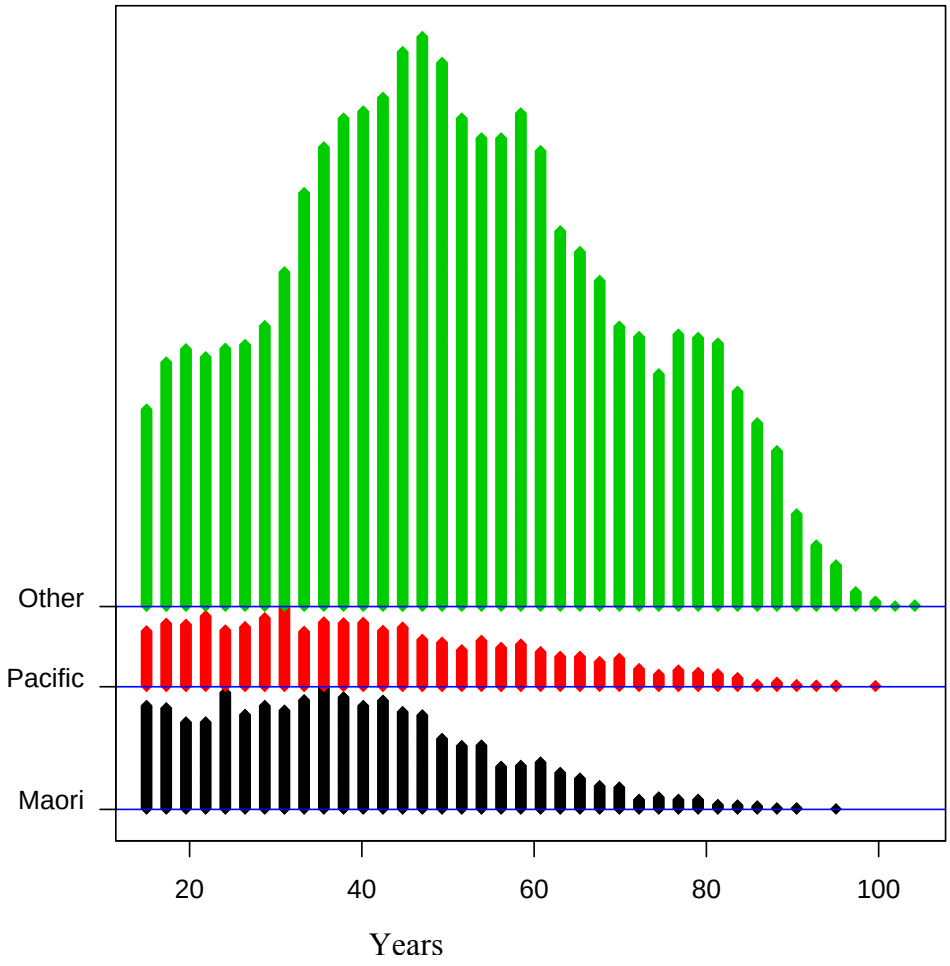


Figure 4. Histogram of age distribution by ethnicity for CMDHB Mental Health Population

Of the 2007 Mental Health Population, 13,188 had a mental health diagnosis either from outpatient or inpatient care during that year or from previous records. The correlation between diagnostic categories was further examined (Table 5). From this table, many in the 'Other' category (n=1114) feature prominently in the suicide category. The diagnoses coded for this group are most frequently 'Unknown and unspecified causes of morbidity' (n=907), 'Observed or suspected mental and behavioural disorder (n=88)', and 'Problematic relationship with spouse or partner' (n=45).

Those coded with mental disorders often had more than one diagnosis. Correlations that were most strong between categories were depression and anxiety (φ=0.26), other and depression (φ=0.25), parasuicide and personality disorder (φ=0.27), substance abuse and parasuicide (φ=0.20), and substance use and psychotic disorders (φ=0.25). This compares with Te Rau Hinengaro in which mood and anxiety disorders were highly correlated, along with substance use and anxiety; and mood disorders and substance use.

Table 5. Phi correlation coefficients for diagnostic groups in CMDHB Mental Health Population (2007)

group	Anx	*Dep*	*Dep**	*Man*	*Man**	*Sub*	*Sub**	*Eat*	*Psy*	*Psy**	*Per*	*Dem*	*Sui*	*Oth*
Anx	1.00													
Dep	0.26	1.00												
Dep*	-0.08	0.18	1.00											
Man	0.07	-0.05	-0.23	1.00										
Man*	0.07	-0.04	-0.21	0.90	1.00									
Sub	0.09	0.10	-0.28	0.14	0.12	1.00								
Sub*	0.09	0.10	-0.28	0.14	0.12	0.99	1.00							
Eat	0.05	0.07	-0.02	0.00	0.00	0.02	0.02	1.00						
Psy	0.05	0.03	-0.33	0.22	0.19	0.25	0.25	0.02	1.00					
Psy*	0.05	0.06	-0.29	0.21	0.29	0.17	0.17	0.01	0.72	1.00				
Per	0.15	0.13	-0.09	0.22	0.21	0.21	0.20	0.06	0.21	0.17	1.00			
Dem	0.03	0.05	-0.19	0.01	0.00	0.00	0.00	-0.01	0.01	0.08	0.01	1.00		
Sui	0.20	0.31	-0.06	0.13	0.12	0.20	0.20	0.06	0.11	0.09	0.27	-0.02	1.00	
Oth	0.18	0.25	-0.57	0.13	0.11	0.21	0.21	0.06	0.20	0.17	0.14	0.12	0.21	1.00

Anx-Anxiety; Dep-Depression; Man-Mania; Sub-Substance use; Eat-Eating disorder; Psy-Psychotic disorder; Per-Personality disorder; Dem-Dementia; Sui – Suicide; Oth-Other.
*** Includes drugs as diagnosis indicator for above categories.**
Notes: Shaded cells are referred to in the text.

Summary points

- In 2007, 7.1% of the CMDHB adult population was classified with treated or known mental disorder according to our criteria.
- The majority (72%) of this Mental Health Population had received an antidepressant prescribed by their general practitioner without having received secondary care as a result of an outpatient visit or hospital admission during that year. This highlights the proportion of mental health disorders treated 'exclusively' by primary care.
- Of those who we classified as having a known or treated mental disorder, 28% (9,037/32,502) had visited secondary care facilities during the last year, either for psychiatric outpatient care or as a result of a medical, surgical or psychiatric hospital admission.
- Diagnostic category correlation were high for depression and anxiety; and personality disorder and parasuicide.

Chapter 3. National comparisons

A series of analyses were undertaken to compare the figures derived from the study to national prevalence figures, and to utilisation figures from neighbouring DHBs. Secondary care mental health service access was also assessed against national targets.

Te Rau Hinengaro

We compared the 2007 Counties Manukau DHB Mental Health Population with the NZ Mental Health Survey (Te Rau Hinengaro, 2006) to estimate study validity. Only a narrow range of indicators could be compared due to the different diagnostic categories available from the two data sources, and the different ways of collecting data.

We found a surprising similarity between prevalence of some mental health indicators, to that obtained from the national survey (**Table 6**). Comparisons were made by ethnicity and NZdep because geographic data (CMDHB residence data) was unavailable from the national survey.

For one indicator - annual prevalence of a visit to a mental health professional – our estimate was very similar to the national survey for Maaori and 'Other' ethnicities (9.3% cf. 8.8% for Maaori and 12.6% cf. 10.9%). Pacific results were lower in this analysis (4.2% in CMDHB cf. 7.8% in Te Rau Hinengaro). Suicide prevalence estimates were similar for Maaori and 'Other', but less for the Pacific population (1.2% in Te Rau Hinengaro cf. 0.2% from our estimate). Similar rates of suicide were seen when stratified by deprivation (NZDep).

For those accessing secondary mental health services or admitted to the general hospital following a suicide attempt, the prevalence and distribution of diagnoses was very different from that in the whole population as identified by Te Rau Hinengaro. When including medication as a surrogate for diagnosis, the prevalence of mood disorder and major depressive disorder increased significantly. After such an adjustment was made, "Other" had higher rates of depressive disorder in our analysis compared to the national survey, with the number of "Other" people in Counties Manukau DHB on antidepressants exceeding national survey estimates of prevalence of major depression by 9,230.

Table 6. CMDHB Mental Health Population compared with Te Rau Hinengaro (selected indicators only) by ethnicity and deprivation

	Te Rau Hinengaro	*CMDHB estimate*		
12 month prevalence	**% (95% CI)**	**Without medication % (95% CI)**	**Including PHARMS * categories % (95% CI)**	**CMDHB estimated difference (count) ‡**
Mental health care visit†				
Ethnicity				
Maaori	9.3 (7.9 to 10.7)	NA	8.8 (8.6 to 9.1)	230
Pacific	7.8 (6.1 to 9.5)	NA	4.5 (4.3 to 4.7)	2135
Other	12.6 (11.5 to 13.7)	NA	10.9 (10.7 to 11.2)	3838
Mood disorder*				
Maaori	11.6 (10.1 to 13.2)	1.3 (1.2 to 1.4)	5.5 (5.3 to 5.7)	2990
Pacific	8.3 (6.6 to 10.0)	0.5 (0.4 to 0.6)	2.6 (2.5 to 2.8)	3685
Other	7.5 (6.8 to 8.2)	1.2 (1.1 to 1.3)	9.7 (9.5 to 10.0)	-5112
Major depressive disorder				
Maaori	6.9 (5.7 to 8.1)	0.4 (0.3 to 0.5)	5.1 (4.9 to 5.3)	871
Pacific	4.4 (3.0 to 5.8)	0.1 (0.1 to 0.2)	2.5 (2.3 to 2.6)	1253
Other	5.6 (5.0 to 6.2)	0.2 (0.1 to 0.2)	9.6 (9.3 to 9.9)	-9230
Bipolar disorder				
Maaori	4.6 (3.6 to 5.6)	0.5 (0.4 to 0.5)	0.6 (0.5 to 0.7)	1968
Pacific	3.7 (2.7 to 4.7)	0.1 (0.1 to 0.2)	0.2 (0.2 to 0.2)	2276
Other	1.8 (1.4 to 2.1)	0.2 (0.2 to 0.3)	0.4 (0.3 to 0.4)	3339
Anxiety disorder				
Maaori	19.4 (17.1 to 21.7)	0.7 (0.6 to 0.8)	NA	9189
Pacific	16.3 (13.8 to 18.9)	0.3 (0.3 to 0.3)	NA	10377
Other	14.1 (13.0 to 15.1)	0.8 (0.7 to 0.8)	NA	30787
Substance use				
Maaori	9.1 (7.6 to 10.6)	1.8 (1.7 to 1.9)	1.8 (1.7 to 2.0)	3569
Pacific	4.9 (3.6 to 6.1)	0.6 (0.6 to 0.7)	0.6 (0.6 to 0.7)	2768
Other	2.7 (2.3 to 3.2)	0.5 (0.5 to 0.6)	0.5 (0.5 to 0.6)	4987
Suicide attempt				
Ethnicity				
Maaori	1.1	0.7	NA	NA
Pacific	1.2	0.2	NA	NA
Other	0.3	0.4	NA	NA
NZDEP				
9 & 10 (most)	0.6	0.4	NA	NA
7 & 8	0.8	0.4	NA	NA
5 & 6	0.3	0.3	NA	NA
3 & 4	0.2	0.1	NA	NA
1 & 2 (least)	0.2	0.2	NA	NA

*Mood disorder includes any antidepressant and lithium. For major depressive disorder – includes antidepressants only. For bipolar disorder, includes lithium carbonate.
NA – not applicable
† Includes any health care professional, as well as doctors.
‡ Estimated from difference between Te Rau Hinengaro prevalence and CMDHB (including PHARMS) estimate

Suicide attempts from our (CMDHB) estimates were lower for Maaori and Pacific when compared with the national survey. A number of reasons are likely to explain the observed differences. Firstly, for suicide attempt, CMDHB estimates were collected from hospital admission and MHINC (secondary care) only, so that

emergency department consultations which did not result in hospital admission were not included. Also suicide attempts when the person did not seek health care will not be included.

The mental health visit comparisons were very similar, despite large differences in method of data collection between the two studies. Our analysis included hospital admissions, pharmaceutical claims (presumably involving a GP consult for the mental disorder) and a proportion of secondary care utilisation. The Te Rau Hinengaro population had a much broader classification including any of the following health care providers: doctors, psychologists, nurses, religious counsellors, and traditional and alternative healers.

The large discrepancy observed between the CMDHB Mental Health Population and national survey prevalence of anxiety disorders is expected in that medication is rarely used for the treatment of such disorders. We thus have no way of identifying those who do not access specialist services in our study.

Comparison between DHBs

The prevalence of several mental disorders was then compared between Northern DHBs by ethnicity to compare access to services (**Figure 5**). We found that Northland had a higher prevalence of mental health visits and diagnosis of either mood or depressive disorders. This may reflect a greater tendency by GPs or hospital doctors to prescribe such medications, or a greater degree of socioeconomic stress incurred by such a population. For diagnoses more reliant on diagnostic code, rather than medication (e.g. anxiety disorder), prevalence of disorder was similar between DHBs.

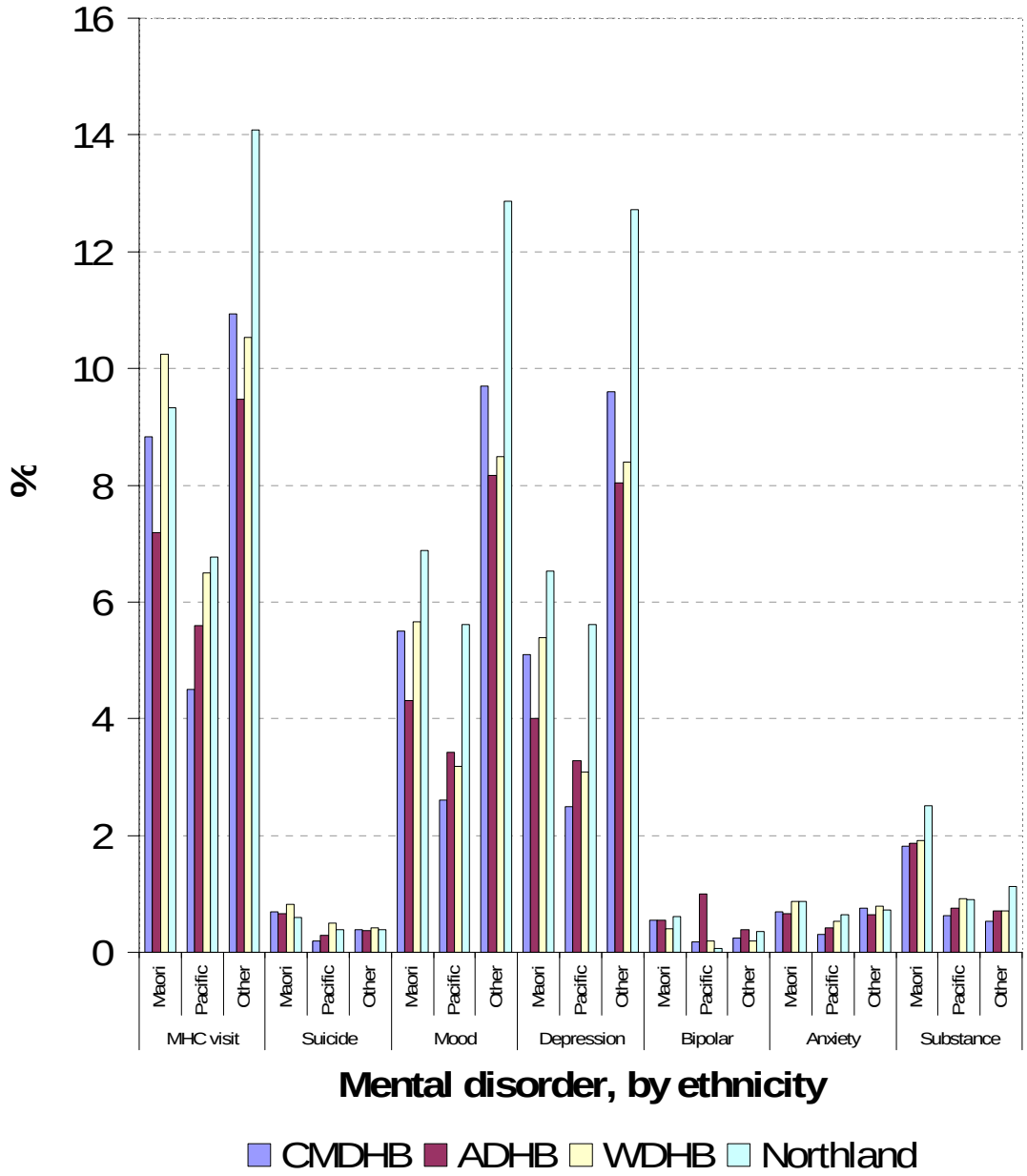


Figure 5. Estimated prevalence of various mental disorders by ethnicity for Northern DHBs (2007)

What proportion of the CMDHB population has access to secondary care?

Over the 2007 period, of the 32,502 adult (aged ≥15 years) population found in CMDHB routinely collected data, 7,058 (21.7%) had secondary mental health services use recorded (Table 7). Of this group, 1114 (3.4%) of patients that had mental health secondary care also had a hospital admission in which a mental health diagnosis was recorded during 2007. An additional 1979 (6.1%) that were not seen in such services in 2007 had a general admission to hospital for which a mental health diagnostic category was recorded.

Table 7. Secondary care mental health record in 2007, by gender

Secondary care mental health record?	*Female*	*%*	*Male*	*%*
Yes	3365	16.7	3693	29.9
No	16783	83.3	8658	70.1
Total	20148	100	12351	100

Ministry of Health targets specify that 3% of the DHB population should have access to secondary care for mental health disorders. Using the 2006 usually resident CMDHB population as the denominator aged ≥ 15 years, 7,058/320,979 or 2.2% had access to secondary mental health care. If we also include those that have had a general hospital admission with a mental health diagnosis noted, the proportion increases to 2.6%.

Such targets from the Ministry of Health are projected for higher than current DHB funding levels. Funding levels in 2007 were at approximately 70% of 'Blueprint'[13] levels so the observed level of access for 2007 was roughly consistent with funded service levels.

Although females make up a large proportion of the adult Mental Health Population (62%; 20,148/32,502), we found that they were less likely to attend mental health secondary care services, with 16.7% of women attending such services in 2007, compared with 30% of males (Table 7). The counterpoint lies in the over-representation of females in those prescribed antidepressants – more than double (16,342 vs 7582).

What proportion of those receiving anti-psychotic medication are receiving secondary care from CMDHB?

Of the 32,502 CMDHB Mental Health Population, 5,028 (15%) were receiving antipsychotic medication in 2007. Of this group, 2274 (45%) were also recorded in the MHINC database in that year. An additional 517 that received antipsychotic medication that hadn't appeared in MHINC, had a mental health diagnosis recorded from a hospital admission in '07. These results suggest that at most 1737 individuals or 35% of those treated with anti-psychotic medication have never been seen by secondary care mental health services within the year. From Table 8, a greater proportion of those taking anti-depressants and accessing secondary care for mental health are in younger than older age groups.

We do not have any standardised data on what would be an appropriate percentage of such patients receiving antipsychotics to be receiving secondary care, although mental health clinical advisors consider that young patients (aged 15 to 40) treated with anti-psychotics should ideally be supervised by specialist services with a visit at least once a year, in contrast to being fully reliant on primary care services for support.

[13] The Mental Health Commission. Blueprint of Mental Health Services in New Zealand: How Things Need to Be. 1998. Mental Health Commission. Wellington.

Table 8. Age structure of those who receive antipsychotics by record in mental health dataset for 2007

	In MHINC '07?			
Age category	No	%	Yes	%
15 to 24	245	8.9	286	12.6
25 to 34	387	14.1	507	22.3
35 to 44	538	19.5	557	24.5
45 to 54	478	17.4	387	17.0
55 to 64	311	11.3	190	8.4
65 to 74	301	10.9	118	5.2
75 plus	494	17.9	229	10.1
Total	2754	100	2274	100

Summary points

- This analysis produced broadly similar results to the NZ Mental Health survey in such indicators as rate of mental health visits for European and Maaori. However Pacific had about approximately half the rate as compared to the national average (4.5% vs. 7.8%). The reason for this is not clear, but suggests that access for Pacific persons with mental disorders in comparison to Maaori is lower than national averages.
- This analysis underestimates the frequency of most mental health disorders, when using hospital or clinic based codes for diagnosis. However, when using medication use as a surrogate for diagnosis, prevalence of depressive disorders appears higher than survey based estimates. Thus, much of mental health care is carried out in the primary care setting: relying on secondary care sources such as MHINC can be misleading. This finding may also indicate that access to other treatment, such as psychological techniques are limited.
- We estimated that 2.2% of the CMDHB adult population access secondary mental health care annually (contracted NGOs excluded). This is below the Ministry of Health target of 3%.
- A large proportion (44%) of patients receiving anti-psychotic medication in 2007, had not been recorded in CMDHB mental health secondary care in that year.

Chapter 4. Associations with important mental health outcomes

From the 2007 CMDHB Mental Health Population we investigated relationships between demographic, diagnosis and drug variables and important outcomes using logistic regression. Effects of exposures (e.g. mental health diagnoses or demographic variables) on outcomes (e.g. parasuicide) are described by odds ratios. This is defined as the ratio of the odds of an event occurring in a first group to the odds of it occurring in a second (reference) group. An odds ratio greater than 1 indicates that the condition or event is more likely in the first group. And an odds ratio less than 1 indicates that the condition or event is less likely in the first group. The reference group is either stated in the table (e.g. European for ethnicity), or is assumed to be those without the exposure (e.g. for depression the reference group is those with no diagnosis of depression). Important outcomes selected were parasuicide (necessitating > three hours admission in hospital), psychosis, and access to secondary care for mental health disorders. Parasuicide and psychosis may be seen as manifestations of severe mental health disorders and secondary care access was chosen as an outcome to highlight any disparity by demographic population characteristics.

We analysed relationships between variables using a cross-sectional method. All demographic variables were force fit into the models with diagnostic variables (defined in Appendix 3) tested for significance, and removed if not significantly related to the outcome ($P>0.05$). Medication use was again used as an indicator of diagnosis if not available from NMDS or MHINC. The age of the population was further restricted to those aged less than 65 years so that the psychogeriatric population was excluded. Two additional variables were created for this analysis and included in models if a statistically significant β coefficient was found. These were a 'non-medicated' depressed or psychotic population – diagnosed previously with depression or psychosis, but not taking corresponding medication in 2007 due to any of the following:

- they receive hospital dispensed medications (i.e. their medication use is not recorded in the PHARMS database;
- their treating doctor chooses psychological based therapy (e.g. we expect that drug related psychoses would not be treated with antipsychotic medicines)
- their diagnosis is no longer current (both depression and psychosis may be temporary, or even when more enduring may wax and wane).
- they are non-compliant with medication.

We also used diabetes and cardiovascular disease indicator variables in models – these are described in more detail, along with their derivations, in Chapter 10.

Use of secondary mental health care

Table 9. Associations of secondary mental health use amongst CMDHB 2007 Mental Health Population

Category	*OR* (95% CI)*
Age category	
15 to 24	1 (referent)
25 to 34	0.89 (0.78 to 1.03)
35 to 44	0.65 (0.57 to 0.75)
45 to 54	0.48 (0.41 to 0.56)
55 to 64	0.28 (0.24 to 0.34)
Ethnicity	
European	1 (referent)
Maaori	1.28 (1.12 to 1.45)
Pacific	1.00 (0.86 to 1.16)
Chinese	1.15 (0.80 to 1.65)
Indian	0.69 (0.54 to 0.89)
Other Asian	0.88 (0.64 to 1.21)
Other	0.74 (0.61 to 0.90)
Gender	
Male	1 (referent)
Female	0.88 (0.80 to 0.97)
Diagnostic group	
Anxiety	2.17 (1.82 to 2.57)
Depression (medication)	0.01 (0.01 to 0.01)
Mania (medication)	0.69 (0.57 to 0.83)
Substance abuse (medication)	0.31 (0.27 to 0.35)
Psychosis (medication)	0.35 (0.31 to 0.39)
Eating disorder	4.57 (2.27 to 9.22)
Personality disorder	5.94 (4.74 to 7.44)
'Non-medicated' groups	
Depression	51.6 (38.4 to 69.2)
Psychosis	7.14 (4.19 to 12.17)
NZDep	
1 and 2 (least deprived)	1 (referent)
3 and 4	1.14 (0.93 to 1.40)
5 and 6	1.09 (0.91 to 1.30)
7 and 8	0.90 (0.77 to 1.06)
9 and 10 most deprived	1.02 (0.89 to 1.18)
Physical Disorders	
Cardiovascular disease	0.93 (0.76 to 1.12)
Diabetes	1.18 (1.00 to 1.40)

*Multivariate; adjusted for all variables included in table

This analysis considers the excess or reduced risk of demographic and diagnosis characteristics of the CMDHB Mental Health Population accessing secondary care in 2007. Demographic patterns show higher use of secondary care in younger age groups, with older groups more likely to receive primary care only for their mental illness (Table 9). Maaori were more likely than other groups to be counted in the secondary care setting. This suggests that treatment of psychiatric disorders in

primary care for Maaori are low, if they are accessing secondary care at a rate expected by their population profile. In this analysis we included two variables that may indicate non-medical treatment for a disorder – depression and psychosis.

The high odds of use of DHB secondary mental health care in those who have ever (2000-2007) had a formal diagnosis of depression or psychosis is apparent, but have never or are not currently (in 2007) filled a script for anti-depressant medication. At face value this suggests that more medication may be better and reduce need for secondary care. Such findings must be interpreted cautiously, in that such patients must have had either contact with outpatient or inpatient services to obtain a diagnosis and be included in this analysis. However anxiety or eating disorders require similar contact for diagnoses and the odds ratios associated with these are much less than the "non-medicated" groups. The comparisons associated with psychiatric disorders must be viewed cautiously as some disorders have imputed diagnosis for medication use and others do not, so such groups are not directly comparable. Some diagnoses may have been sourced from earlier data sets and not be current, hence some measurement error in allocation of exposure may be present. This would be expected to reduce the observed effect between diagnosis and use of mental health care. Again, differences in psychosis and antidepressant groups may be due to prescribing patterns.

We hypothesise that those patients in the 'non-medicated' antidepressant group may be more likely to have had their antidepressant stopped, whilst those in the antidepressant group – largely those seen exclusively in primary care – may not have their medication stopped as a result of appreciating the natural history and time limited course of depressive episodes. National guidelines on the treatment of depression state that treatment for first episodes of major depression should be no longer than a year, with three years treatment indicated for recurrent major depression.[14] Further work to investigate this phenomenon is recommended.

This analysis demonstrates an important negative – that socioeconomic status does not appear to limit access to secondary care. Odds ratios are very similar – close to unity (no difference) for all levels of deprivation. However, if access was truly equitable, we might expect that secondary care use would be higher in most deprived deciles, as these have higher prevalence of severe mental health disorders.[15]

The error rate of this predicted model was extremely good – a value of <0.001% was calculated.

Associations with parasuicide amongst Mental Health Population

We found that those with personality disorder had the greatest association with parasuicide, with anxiety having a similar strength of relationship. Multiple suicide attempts, however, may be included in the diagnostic criteria for diagnosing some personality disorders. Predictable patterns of parasuicide were observed by age,

[14] Royal Australian and New Zealand College of Psychiatrists Clinical Practice Guidelines Team for Depression. Australian and New Zealand clinical practice guidelines for the treatment of depression. Australian and New Zealand Journal of Psychiatry 2004; 38:389–407

[15] MA Oakley Browne, JE Wells, KM Scott (eds). 2006. Te Rau Hinengaro: The New Zealand Mental Health Survey. Wellington: Ministry of Health.

gender and socioeconomic deprivation, with higher rates at younger ages and for females.

Table 10. Associations with parasuicide requiring admission to hospital (CMDHB 2007 Mental Health Population)

Category	*Odds ratio (95% CI)**
Age category	
15 to 24	1(referent)
25 to 34	0.63 (0.52 to 0.75)
35 to 44	0.45 (0.37 to 0.54)
45 to 54	0.35 (0.29 to 0.43)
55 to 64	0.19 (0.14 to 0.25)
Ethnicity	
European	1(referent)
Maaori	1.00 (0.84 to 1.19)
Pacific	0.71 (0.56 to 0.90)
Chinese	0.89 (0.54 to 1.47)
Indian	1.27 (0.94 to 1.72)
Other Asian	1.04 (0.68 to 1.61)
Other	0.46 (0.32 to 0.66)
Gender	
Male	1 (referent)
Female	1.60 (1.39 to 1.85)
Diagnostic group	
Anxiety	5.67 (4.85 to 6.62)
Depression (medication)	1.39 (1.19 to 1.64)
Mania (medication)	1.82 (1.43 to 2.32)
Substance abuse (medication)	3.68 (3.12 to 4.35)
Eating	2.12 (1.14 to 3.95)
Psychosis	1.39 (1.17 to 1.67)
Personality disorder	5.94 (4.74 to 7.44)
Non-medicated groups	
Depression	4.17 (3.12 to 5.57)
Psychosis	0.95 (0.54 to 1.67)
NZDep	
1 and 2 (least deprived)	1 (referent)
3 and 4	0.94 (0.70 to 1.26)
5 and 6	1.12 (0.88 to 1.43)
7 and 8	1.37 (1.11 to 1.70)
9 and 10 (most deprived)	1.11 (0.91 to 1.35)
Physical disorders	
Cardiovascular disease	0.83 (0.62 to 1.10)
Diabetes	1.22 (0.96 to 1.55)

*Multivariate; adjusted for all confounders included in table

Younger age groups (15-24 years) are more likely to be admitted to hospital with parasuicide, and the risk decreases with advancing age. Females are also more likely than males to be injured due to parasuicide.

All diagnostic categories are associated with an increased risk of parasuicide, but the highest risk groups in descending order are: personality disorders (OR 5.94), anxiety disorders (OR 5.67), "non-medicated" depressive disorders (OR 4.17) and substance abuse (OR 3.68).

The error rate associated with this logistic regression model (predicted probability from model for individual's risk profile is >0.5 and suicide status is "yes", and predicted probability from model is <0.5 and suicide status is "no" is 6%. This indicates excellent model fit to the data.

Psychosis

In this analysis we used the total CMDHB population (≥15 to 64 years) as the denominator, so to assess the risk of such a diagnosis from the general population.

Table 11. Associations with psychosis diagnosis or use of antipsychotic medication amongst CMDHB 2007 population aged 15 to 64

Category	*OR* (95% CI)*
Age	
15 to 24	1 (referent)
25 to 34	0.70 (0.54 to 0.91)
35 to 44	0.68 (0.53 to 0.88)
45 to 54	0.70 (0.54 to 0.91)
55 to 64	0.47 (0.33 to 0.66)
Ethnicity	
European	1 (referent)
Maaori	1.14 (0.88 to 1.48)
Pacific	0.96 (0.71 to 1.30)
Chinese	0.66 (0.36 to 1.22)
Indian	0.67 (0.42 to 1.07)
Other Asian	1.15 (0.71 to 1.87)
Other	0.80 (0.60 to 1.07)
Gender	
Male	1 (referent)
Female	1.01 (0.84 to 1.21)
Diagnostic group	
Anxiety	3.55 (2.69 to 4.69)
Depression (medication)	10.95 (8.99 to 13.33)
Mania (medication)	2.21 (1.40 to 3.50)
Substance abuse	2.31 (1.69 to 3.14)
Personality disorder	2.02 (1.28 to 3.18)
NZDep	
1 and 2 (least deprived)	1 (referent)
3 and 4	1.20 (0.87 to 1.67)
5 and 6	0.99 (0.73 to 1.34)
7 and 8	0.81 (0.61 to 1.09)
9 and 10 (most deprived)	0.75 (0.58 to 0.96)
Other diagnosis	
Cardiovascular disease	1.10 (0.75 to 1.61)
Diabetes	1.08 (0.75 to 1.54)

*Multivariate; adjusted for all other variables included in table

We found that risks of psychosis were much higher for those with a diagnosis of depression than any other factor (OR 10.95; 95% CI 8.99 to 13.33). This multivariate

estimate differs from the negative correlation found in the univariate negative correlation coefficient found in table 5 which examined correlations between diagnostic categories in individuals. This analysis, in contrast, examined the independent effects of a number of different demographic and diagnostic categories on psychiatric outcome. This suggests that when other demographic variables are accounted for, the independent effect of depression is high of predicting a psychosis outcome. Due to the cross-sectional nature of the analyses we can not distinguish cause from effect and the causal link may be in the other direction with psychotic disorders linked to depression. Diagnosis of psychosis was raised in all other diagnostic categories, with those experiencing anxiety disorders having the next highest risk. Risk of psychosis was highest in those aged 15-24 years, declining in risk with increasing age. Differences by ethnicity were not marked, however, Chinese and Indians had reduced ratios of psychosis compared to European, although this effect was not statistically significant. The low risk observed amongst Indians may be due to reduced access to psychiatric services.

Table 12. Associations with premature death (2007) amongst total CMDHB population aged over 15 years and less than 65

Category	*OR* (95% CI)*
Age category	
15 to 24	1(referent)
25 to 34	1.19 (0.78 to 1.82)
35 to 44	2.62 (1.83 to 3.77)
45 to 54	5.97 (4.22 to 8.43)
55 to 64	14.67 (10.43 to 20.65)
Ethnicity	
European	1(referent)
Maaori	2.75 (2.19 to 3.45)
Pacific	1.56 (1.22 to 2.00)
Chinese	0.83 (0.46 to 1.50)
Indian	0.67 (0.41 to 1.10)
Other Asian	0.69 (0.35 to 1.35)
Other	0.52 (0.38 to 0.73)
Gender	
Male	1(referent)
Female	0.54 (0.46 to 0.64)
Diagnostic group	
Anxiety	2.49 (1.70 to 3.65)
Depression (medication)	2.28 (1.86 to 2.79)
Mania (medication)	2.05 (1.17 to 3.62)
Substance abuse	3.78 (2.81 to 5.07)
Psychotic (not medication)	1.70 (1.06 to 2.71)
NZDep	
1 and 2 (least deprived)	1(referent)
3 and 4	1.19 (0.79 to 1.79)
5 and 6	1.08 (0.75 to 1.55)
7 and 8	1.38 (1.02 to 1.88)
9 and 10 (most deprived)	1.53 (1.16 to 2.01)
Other diagnosis	
Cardiovascular disease	0.94 (0.72 to 1.23)
Diabetes	0.88 (0.68 to 1.15)

*Multivariate; adjusted for all other variables included in table

In, 2007, 313,517 individuals were recorded as residing in CMDHB, between the ages of 15 and 64. During that year, 624 individuals died. The effect of demographic and mental health diagnoses were linked to this outcome. We did not have information on important confounders such as smoking status. This analysis highlights the high risk of premature mortality associated with a range of mental health disorders, but particularly substance misuse (OR 3.78; 95% CI 2.81 to 5.07). The population attributable fraction for substance abuse was 1.2% for premature death. In contrast, an exposure with a weaker association, but higher prevalence (depression) had a population attributable fraction of 5.5% for the same outcome.

The association between age group and risk of death is consistent with the known rule of thumb that risk of dying doubles about every eight years. We were surprised by the null finding of no association between diabetes and CVD diagnoses and premature death. This may be, in part, due to this group, identified by treatment and engagement

with the health system being at low risk, compared to those not so identified. Part of this risk is likely to be also embodied in age category effects.

Nicotine replacement therapy

We linked pharmaceutical claim for at least one prescription for nicotine replacement therapy (NRT) to demographic and diagnosis variables for CMDHB in 2007 (age restricted from 15-65). In 2007, 1,475 of 312,628 people (0.5%) in this group filled at least one script for nicotine replacement therapy. This number doesn't account for quit attempts made either 'cold-turkey', or with non-NRT smoking cessation medications such as nortriptyline or varenicline or NRT bought over the counter in either Pharmacies or supermarkets, or distributed from hospital pharmacies.

The odds of individuals in the CMDHB Mental Health Population claiming for NRT is 3.4 times greater than non-mental health patients, after controlling for demographic and diagnosis variables. Tobias et al. estimate that the prevalence of cigarette smoking amongst the population with any mental disorder is 32.3% (95% CI 29.7 to 34.8), nearly 1.5 times that of the total population.[16] Levels of smoking are likely to be higher in those with a diagnosis of psychosis. Together, this data indicates the CMDHB Mental Health Population has very good access to such treatment.

Of particular interest is the ethnic disparities observed. Maaori are 1.4 times more likely to receive such treatment than European, despite nearly twice the prevalence of smoking recorded in this population. Pacific have the most dramatic disparity in access to these medicines (compared with smoking prevalence), with roughly half the likelihood of making a claim for NRT compared to NZ European, yet they have almost one third higher prevalence of smoking. This suggests that Pacific experience the greatest ethnic disparity in access to publicly funded nicotine treatment of all ethnicities in CMDHB.

This data also indicates that a small proportion of the population are accessing NRT in CMDHB. If about 22% of the CMDHB adult population smokes and the New Zealand tobacco use survey indicates that between 70 and 80% of smokers want to quit, the number of people annually in CMDHB that may benefit from NRT are (312,628*22%*75%) about 51,000. Thus, the potential to implement programmes to escalate uptake of NRT is evident.

The assumptions of this model were checked by calculating the error rate of the model –a value of 0.5% was calculated. This indicates very good global model fit to the data.

16. M Tobias, R Templeton and S Collings How much do mental disorders contribute to New Zealand's tobacco epidemic? doi:10.1136/tc.2008.026005,*Tob. Control* 2008;17;347-350.

Table 13. Associations with at least one claim for nicotine replacement therapy, CMDHB population aged 15-64, 2007

Category	*Odds ratio (95% CI)*
Age category	
15 to 24	1 (referent)
25 to 34	2.20 (1.80 to 2.70)
35 to 44	3.00 (2.40 to 3.70)
45 to 54	3.20 (2.60 to 3.90)
55 to 64	3.50 (2.80 to 4.40)
Ethnicity	
European	1 (referent)
Maaori	1.40 (1.20 to 1.60)
Pacific	0.42 (0.35 to 0.50)
Chinese	0.09 (0.04 to 0.21)
Indian	0.19 (0.13 to 0.29)
Other Asian	0.29 (0.18 to 0.48)
Other	0.50 (0.41 to 0.60)
Gender	
Male	1 (referent)
Female	1.10 (1.00 to 1.20)
NZDep	
1 and 2 (least deprived)	1 (referent)
3 and 4	1.70 (1.30 to 2.40)
5 and 6	2.00 (1.40 to 2.70)
7 and 8	3.50 (2.50 to 4.80)
9 and 10 (most deprived)	3.10 (2.30 to 4.20)
Mental Health	3.40 (3.00 to 3.70)
Diabetes	1.80 (1.60 to 2.20)

Table 14. Crude prevalence of regular smoking among adults (aged ≥ 15 years) in CMDHB, by ethnicity in 2006

	Males	Females	Total	NZ Total
Maaori	42.5%	50.3%	46.8%	42.2%
Pacific	34.3%	26.7%	30.3%	30.3%
NZ European	20.8%	19.3%	20.0%	19.4%
Asian	16.3%	3.4%	9.6%	11.1%
MELAA	22.0%	8.9%	15.5%	15.1%
Other ethnicity	16.6%	15.4%	16.0%	16.6%
Total	24.0%	20.4%	22.1%	20.7%

Data source: Ministry of Health (2008)
MELAA – Middle Eastern, Latin American and African ethnicity.

Cross-sectional studies are unable to distinguish cause from effect and we are, therefore, unable to draw any conclusions of causal inference from this data, however, a number of patterns emerge. Of the CMDHB Mental Health Population, Pacific groups are distinguished by lower levels of parasuicide than other ethnic groups and lower levels of use of secondary care. This may be due to a number of factors including patients' perceptions of providers' ability to help (cultural competency) or structural factors such as access. "Other" ethnic groups are also at lower odds of accessing secondary care for mental health disorders.

Summary points

- From our estimated 2007 CMDHB Mental Health Population, those most likely to be admitted to hospital for parasuicide had a diagnosis of anxiety, personality disorder or substance misuse, when adjusted for other demographic variables.
- Those that had a previous diagnosis of depression, but were not taking an antidepressant medication in 2007 had the highest odds of attending mental health secondary care in that year (odds ratio 51.56; 95% CI 38.4 to 69.2) when adjusted for other demographic variables.
- Risk of psychosis was highest in those with a previous diagnosis of depression or who were currently treated with an antidepressant, after adjusting for other demographic and diagnostic variables.
- Substance misuse had the strongest link with premature death (Odds ratio 3.78 95% CI 2.81 to 5.07) in 2007 when adjusted for other demographic variables.
- Residents in CMDHB have low use of subsidised nicotine replacement therapy (0.5% annually). Although comparative access for the CMDHB Mental Health Population is very good, potential exists for implementing programmes to increase uptake of NRT in CMDHB, particularly in Pacific groups.

Chapter 5. Dementia

We used linked data to describe the patterns of dementia in CMDHB in 2007. Record of a diagnosis of dementia in the NMDS or MHINC data bases were necessary for inclusion in the study. This analysis would therefore leave out those with dementia who have been diagnosed in either General Practice or medical outpatients without a visit to hospital or mental health services. We do not know of a suitable publicly funded medicine to use as a surrogate for diagnosis of dementia. New anti-cholinesterase inhibitors are not publicly funded at the date of writing.

Of those found in the CMDHB Mental Health Population in 2007, 1081 had a diagnosis of dementia.

The subtype of these diseases is outlined in Table 15.

Table 15. Dementia in CMDHB, by subtype (2007)

Dementia type	*n*	*%*
Alzheimer	330	31
Vascular	291	27
Parkinson's disease	41	4
Other medical conditions*	3	0
Unspecified	416	38
Total	1081	100

*HIV, Huntington's disease

The age composition of this dementia population is shown below (**Figure 6**).

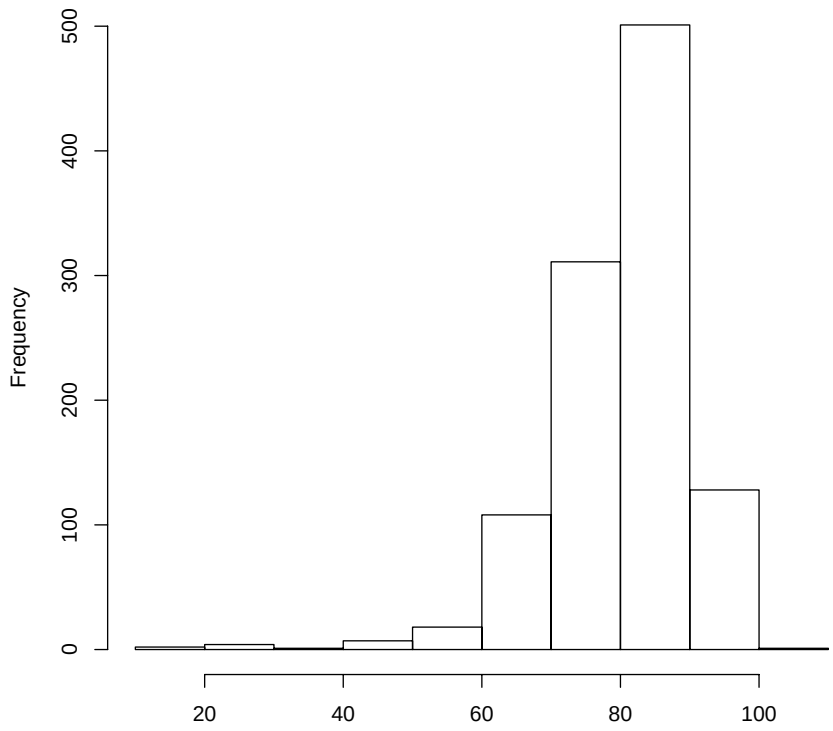


Figure 6. Age distribution of CMDHB dementia population

The ethnic composition of this group is shown below (**Figure 7**).

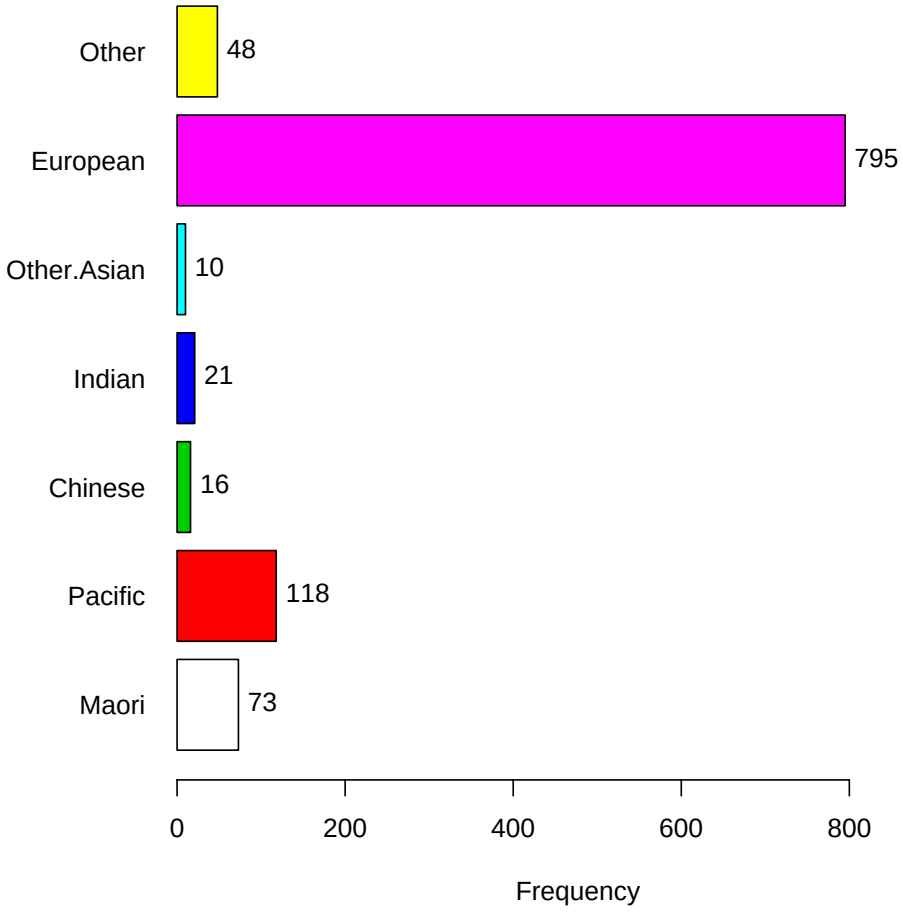


Figure 7. Ethnic distribution of dementia in CMDHB, 2007

The age-specific prevalence of dementia in CMDHB is shown below (**Table 16**). The proportion of the population with dementia rises sharply after the age of 80 – nearly 9% of the population over the age of 85 were seen by health services with a diagnosis of dementia in 2007.

Table 16. Age specific prevalence of dementia in CMDHB (2007)

Age cat	*Frequency*	*CMDHB Population**	*Age specific prevalence (%)*
15 to 24	4	71,770	0.006
25 to 34	3	60,940	0.005
35 to 44	3	70,620	0.004
45 to 54	10	59,400	0.02
55 to 64	43	42,420	0.10
65 to 74	187	24,520	0.76
75 to 85	484	13,070	3.70
85 plus	353	4,020	8.78

*2007 estimated resident population, Statistics New Zealand June 2008.

Using the PHARMS database we showed that 498 (46.1%) of this dementia population had been treated with antipsychotic medication, whilst only 85 of them had a recorded diagnosis of psychotic symptoms in a health record. Of the antipsychotic

drugs used to treat this population, the most frequently used were risperidone (*n*=262), quetiapine (*n*=161), haloperidol (*n*=56) and olanzapine (*n*=36).

What is the incidence of polypharmacy amongst the CMDHB dementia population?

What is polypharmacy? What issues are of concern to those treated for mental health disorders?

Polypharmacy refers to concurrent use of multiple medications in a single patient. Traditionally, polypharmacy has a negative connotation, implying an inappropriate or irrational use of multiple medications, and is thought to be an important and common cause of iatrogenic morbidity and mortality in the elderly. The use of multiple medications can sometimes be an effective clinical intervention, however. The degree of risk and benefit associated with polypharmacy varies depending on the medications used and the characteristics of the patient.

1) Same-class polypharmacy: The use of more than one medication from the same medication class (e.g. two selective serotonin reuptake inhibitors, such as fluoxetine plus paroxetine).

2) Multi-class polypharmacy: The use of full therapeutic doses of more than one medication from different medication classes for the same symptom cluster (e.g. the use of lithium along with an atypical antipsychotic, such as fluoxetine plus olanzapine for treatment of mania).

3) Adjunctive polypharmacy: The use of one medication to treat the side effects or secondary symptoms of another medication from a different medication class (e.g. the use of trazadone along with buproprion for insomnia).

4) Augmentation: The use of one medication at a lower than normal dose along with another medication from a different medication class at its full therapeutic dose, for the same symptom cluster (e.g. the addition of a low dose of haloperidol in a patient with a partial response to risperidone) or the addition of a medication that would not be used alone for the same symptom cluster (e.g. the addition of lithium in a person with major depression who is currently taking an antidepressant).

5) Total polypharmacy: The total count of medications used in a patient, or total drug load. Consideration of total polypharmacy should include prescription medications, over-thecounter medications, alternative medical therapies, and elicit pharmacological agents.

In general, more than one medication from any of the following medication classes should not be used in a single patient:

o Typical antipsychotics (haloperidol, fluphenazine, etc.),
o Selective serotonin reuptake inhibitors (paroxetine, fluoxetine, etc.),
o Tricyclic antidepressants (amitryptiline, imipramine, etc.),
o Monoamine oxidase inhibitors (phenelzine, tranylcypromine),
o Stimulants (methylphenidate, amphetamine), or
o Benzodiazepines (diazepam, alprazolam, etc.).

In addition, more than two antipsychotic medications, typical or atypical, should not be used simultaneously.

To investigate these issues we first looked at number of medications prescribed per patient with dementia during the 2007 calendar year. These analyses represent the aggregated number of different drugs and classes per year. We are not able to distinguish whether patients were using such medications simultaneously or not. The results are summarised in Figure 8.

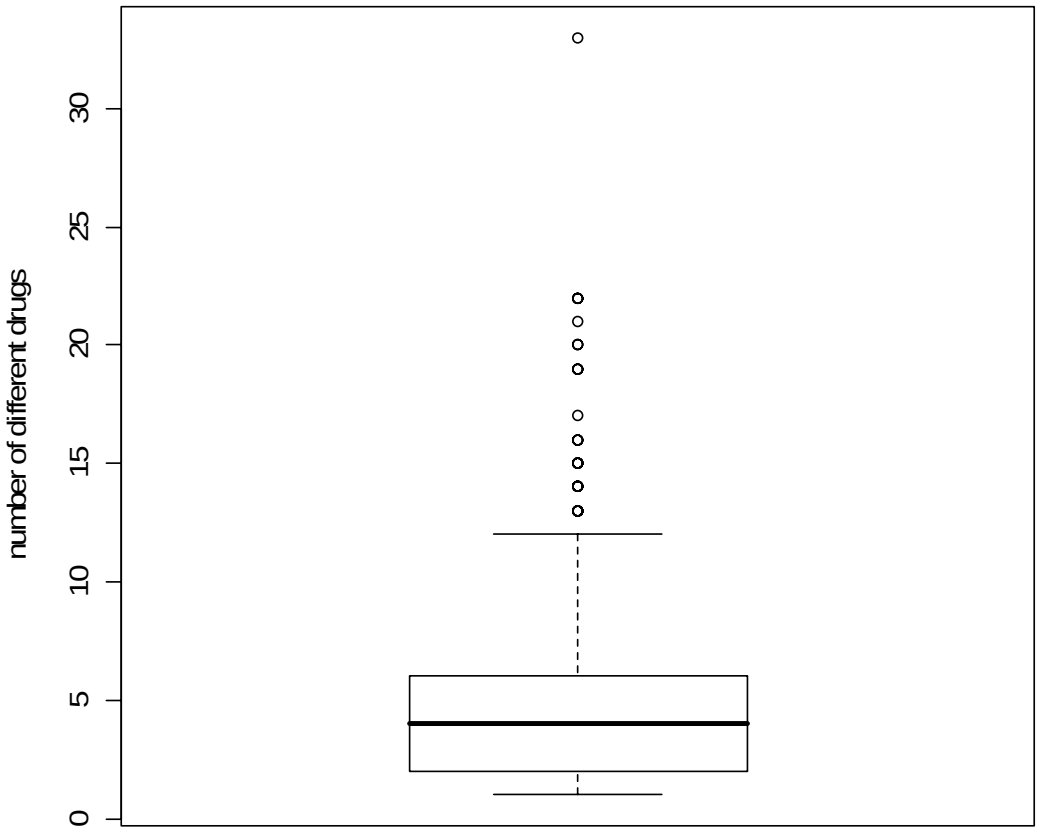


Figure 8. Box plot of total polypharmacy for CMDHB population with a diagnosis of dementia, 2007

The horizontal line shows the median (*n*=4) and the top and bottom of the box, the 25th and 75th percentile. The vertical lines correspond to whiskers which are 1.5 times the interquartile range or roughly the 95% confidence interval. Outliers, more than 1.5 times above or below the interquartile range are plotted individually. The frequency histogram is shown below (Figure 9).

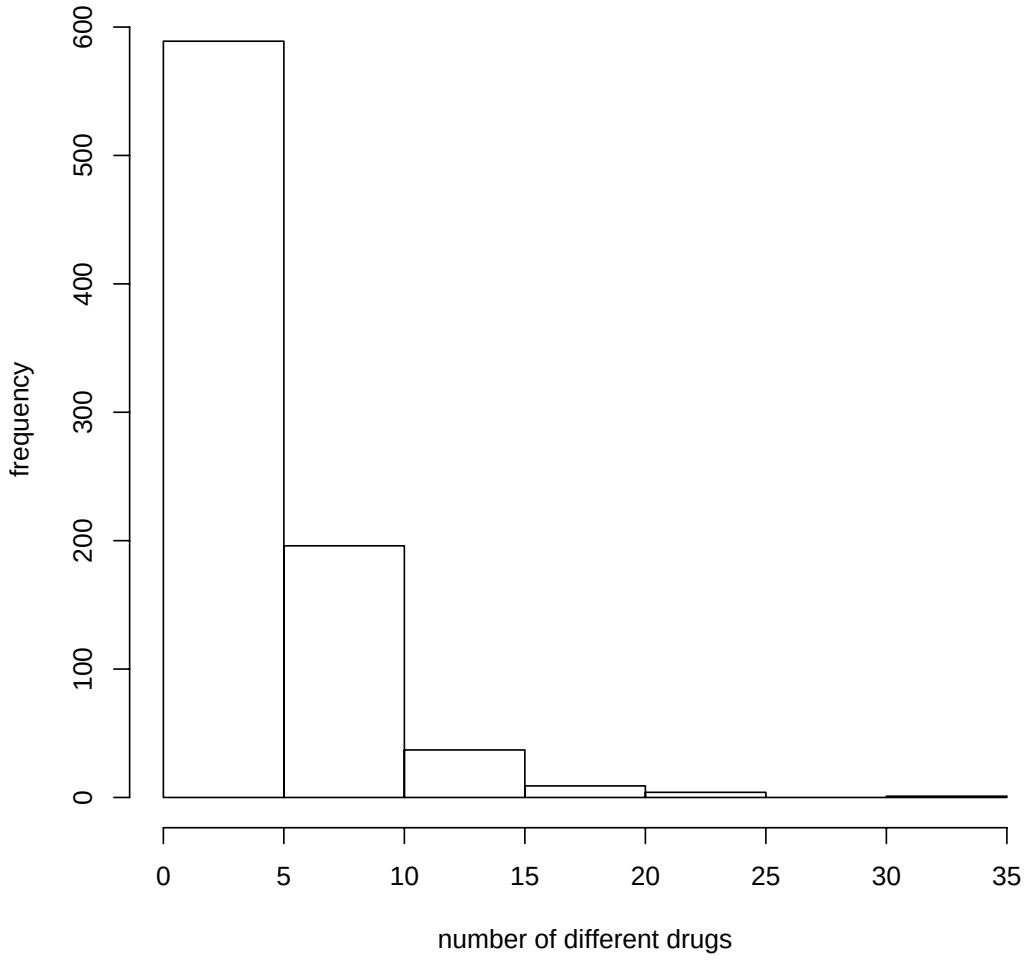


Figure 9. Frequency of total polypharmacy for CMDHB dementia population, 2007

The number of different drug classes per individual was large, as illustrated by the following box and whisker plot (Figure 10).

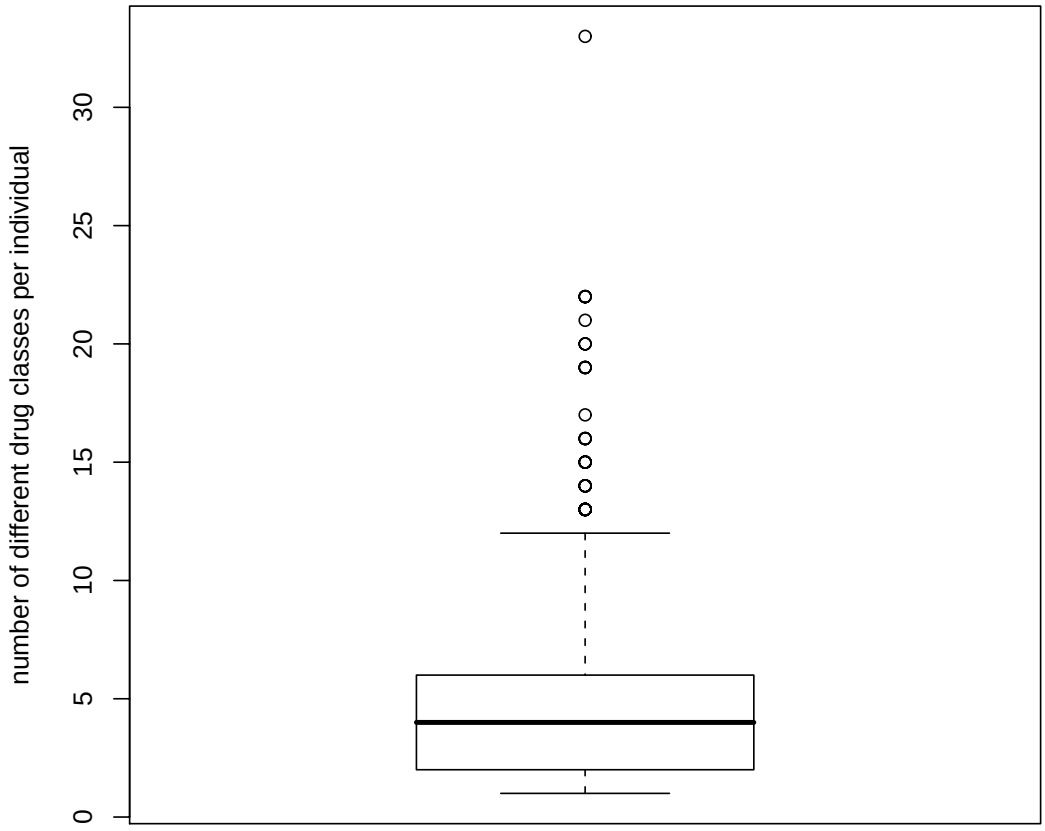


Figure 10. Box plot of total number of drug classes for CMDHB population with dementia diagnosis, 2007

The most frequent classes of drugs prescribed in 2007 were antibacterials (n=556), antidepressants (n=269), NSAIDS (n=199) and topical corticosteroids (n=188).

Of interest, 45 prescriptions of lipid modifying agents were listed, along with 93 for sedatives or hypnotics.

The issue of multi-class polypharmacy was investigated using prescriptions filled in 2007 for those prescribed antidepressants. 4/893 individuals had two anti-depressant class medications prescribed on the same date. One of these instances involved treatment with two tricyclic medicines, the other three included the use of tricyclic and SSRI anti-depressants. No patients had the same date script with two or more antipsychotics of the same class (all were treated with an anti-psychotic and lithium carbonate).

Summary points

- The age specific prevalence of dementia is less than one percent in those aged less than 75 years, increases to nearly 4% in those aged 75 to 84, and then is close to 9% in those over 85 years.
- About half of patients diagnosed with dementia in 2007 were receiving psychotropic medication. Most common agents used were risperidone and quetiapine.

Chapter 6. Prescribing practices

We compared the frequency of prescribing specific antipsychotic and antidepressant medications by provider (primary care or secondary). The population was restricted to those <65 years and ≥15 years. We then divided the population as to whether they had received any form of secondary care by identifying whether those having pharmaceuticals dispensed appeared only in the PHARMS database, or whether they also appeared in the MHINC or NMDS collections. This allowed the population to be divided into those who had had contact with secondary care during the year (at least once) and those who did not. This was then used as proxy for those 'under the supervision' of secondary care, compared with those under the care of primary care alone. Again the 2007 population only was analysed. We compared prescribing practices amongst those that received antipsychotic and antidepressant medication. Note that most prescriptions were written in primary care, whether or not they are allocated to the 'secondary care' group here.

Table 17. Comparison of CMDHB Mental Health Population receiving antipsychotic drugs by treatment provider

	Secondary care		*Primary care*	
	n	%	*n*	%
Atypical				
Clozapine	425	12.9	4	0.7
Olanzapine	662	20.2	23	3.8
Pimozide	0	0	1	0.2
Pipothiazine palmitate	4	0.1	0	0
Quetiapine	677	20.6	122	20.2
Risperidone	927	28.2	140	23.2
Ziprasidone	9	0.3	0	0
Zuclopenthixol decanoate	5	0.2	0	0
Typical				
Chlorpromazine.hydrochloride	82	2.5	30	5
Flupenthixol decanoate	7	0.2	2	0.3
Fluphenazine decanoate	6	0.2	0	0
Haloperidol	69	2.1	75	12.4
Haloperidol decanoate	6	0.2	0	0
Lithium carbonate	308	9.4	117	19.4
Methotrimeprazine	31	0.9	43	7.1
Pericyazine	26	0.8	10	1.7
Thioridazine hydrochloride	4	0.1	8	1.3
Trifluoperazine hydrochloride	34	1	29	4.8
Total	3282	100	604	100

Secondary care = at least one visit to a secondary care service in 2007

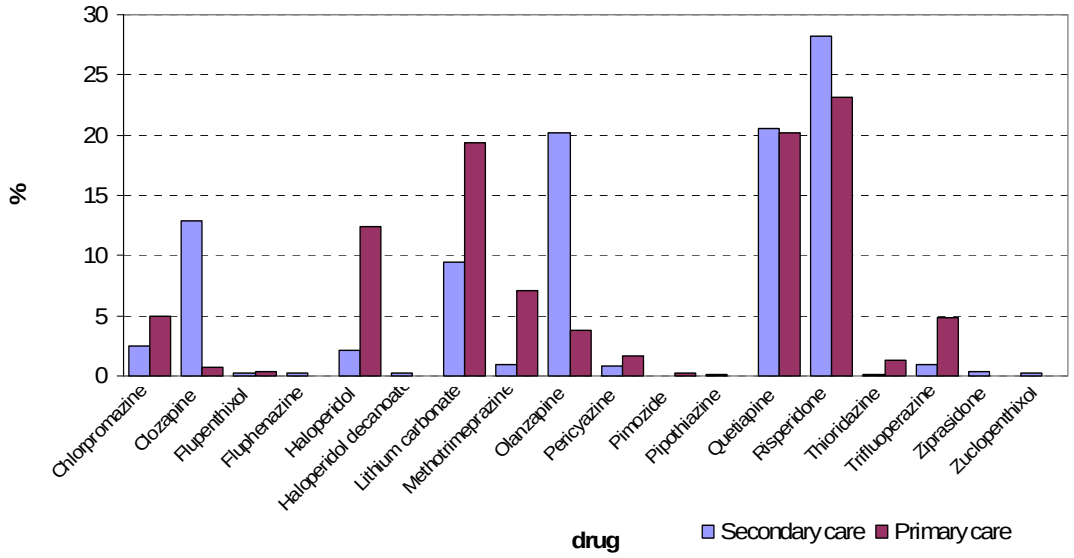


Figure 11. Comparison of use of antipsychotic drug classes by treatment provider, CMDHB Mental Health Population 2007

Table 18. Comparison of CMDHB Mental Health Population receiving anti-depressant drugs by treatment provider (2007)

	Secondary care		*Primary care*	
	n	%	*n*	%
Tricyclic				
Amitriptyline	550	10	3837	25.9
Clomipramine hydrochloride	49	0.9	51	0.3
Desipramine hydrochloride	0	0	0	0
Dothiepin hydrochloride	68	1.2	255	1.7
Doxepin hydrochloride	47	0.9	161	1.1
Imipramine hydrochloride	26	0.5	91	0.6
Maprotiline hydrochloride	1	0	3	0
Mianserin hydrochloride	3	0.1	1	0
Moclobemide	35	0.6	32	0.2
Nortriptyline hydrochloride	375	6.8	1681	11.4
Phenelzine sulphate	2	0	9	0.1
Tranylcypromine sulphate	6	0.1	4	0
Trimipramine maleate	12	0.2	25	0.2
SSRIs				
Citalopram hydrobromide	1405	25.6	2421	16.4
Fluoxetine hydrochloride	1116	20.3	3049	20.6
Paroxetine hydrochloride	1357	24.7	2859	19.3
Other				
Venlafaxine	436	7.9	324	2.2
Total	5488	100	14803	100

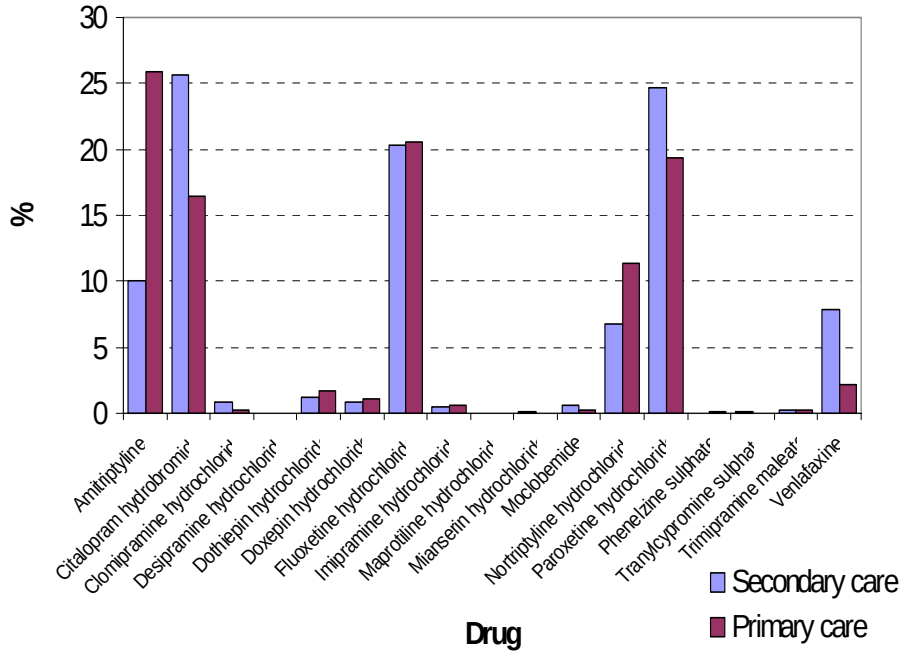


Figure 12. Comparison of drug use by treatment provider, CMDHB Mental Health Population, 2007

Summary Points

- Different patterns of prescribing for antidepressant agents were observed. General practitioners were more likely to prescribe amitriptyline and nortriptyline for patients that had not seen secondary services than those who had. In contrast, those that had attended a secondary care service during the year were more likely to receive citalopram, a novel selective serotonin reuptake inhibitor.
- Antipsychotic agents commonly prescribed by general practitioners in patients not seen in secondary care in that year included older antipsychotics such as haloperidol. Patients seen by secondary care in that year were more likely to have had dispensed atypical anti-psychotics such as clozapine and olanzapine.

Chapter 7. Suicide and parasuicide

Suicide data was taken from NMDS data that documented hospital admissions with injury due to self harm, and completed suicide was taken from mortality data sets. Change from ICD-9 to ICD-10 coding in 2000 may result in minor changes before and after this time point. For individuals to be recorded as having a hospital admission, they must have been treated in the emergency department for at least three hours. Considerable regional variation exists in this threshold for recording.

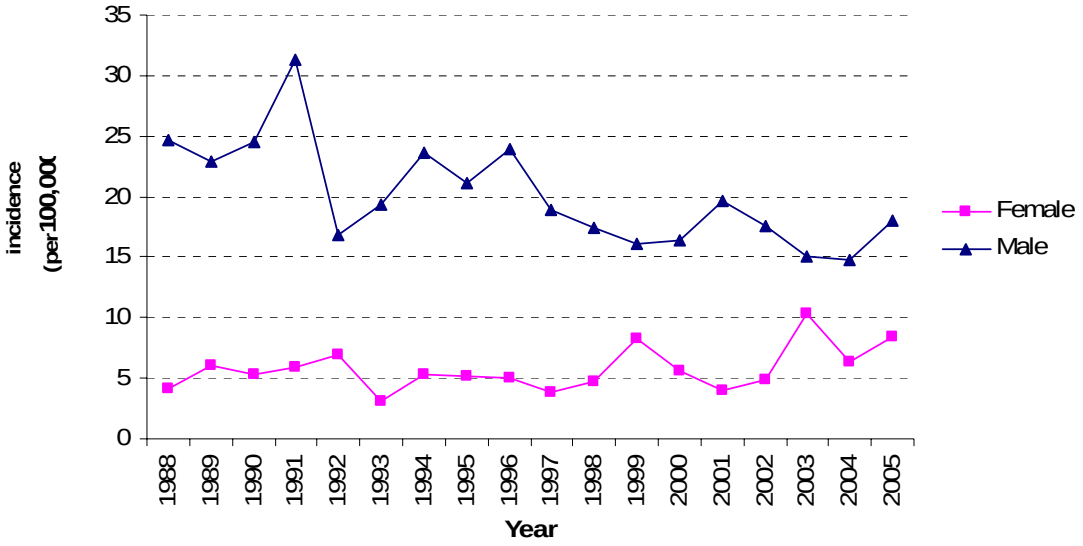


Figure 13. Completed suicide incidence rate/100,000 for CMDHB (1988 – 2005), by gender

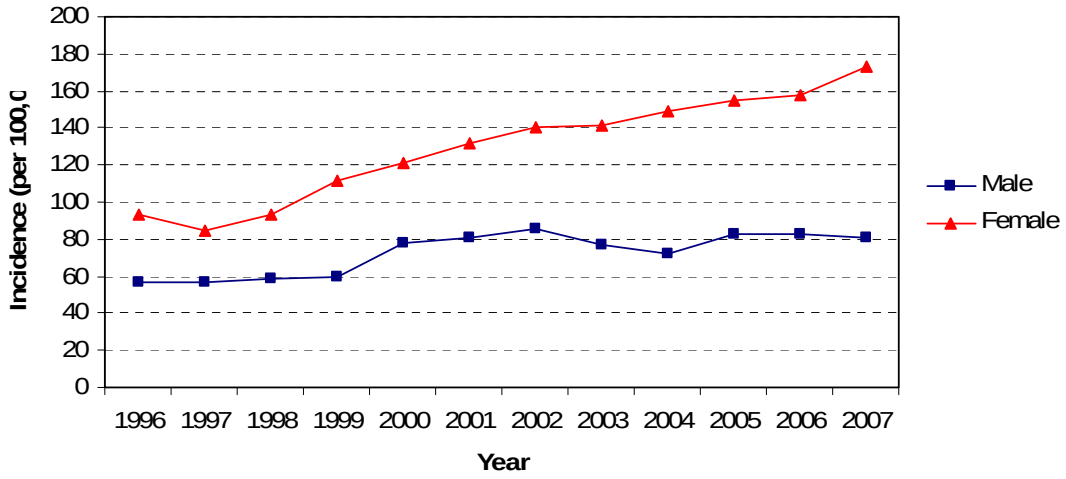


Figure 14. Parasuicide resulting in admission to hospital, incidence rate per 100,000 population by gender (CMDHB)

These figures illustrate, that crude rates of parasuicide resulting in admission to CMDHB have been increasing with time, particularly for females, with an almost doubling of incidence in ten years, whereas the incidence of completed suicide in

males in CMDHB has fallen by about 30% in the last 10 years with a linear trend in the downward direction. Female incidence of completed suicide, in comparison, has been stable over that time with a modest increase in the last four years.

Source: Ministry of Social Development
Figure 15. Rate of completed suicide (moving average over three years), NZ, 1986-2004

The reduction in completed suicide mirrors the rate observed in the rest of the country (Figure 15).

Summary points

- Between 1988 and 2005, the male rate of completed suicide has declined by about one third, whereas the female rate has stayed the same.
- Between 1996 and 2007, female parasuicide rates (resulting in hospital admission) increased by about one third whilst male rates remained the same

Chapter 8. Costs

The additional costs of mental disorders were estimated from PHARMS, Labs and NMDS data for all Northern DHBs. Note that costs of community based secondary mental health care were not included in this analysis – only the additional costs to the health system for medications, laboratory tests and general hospitalisations. Other primary care costs were also not included.

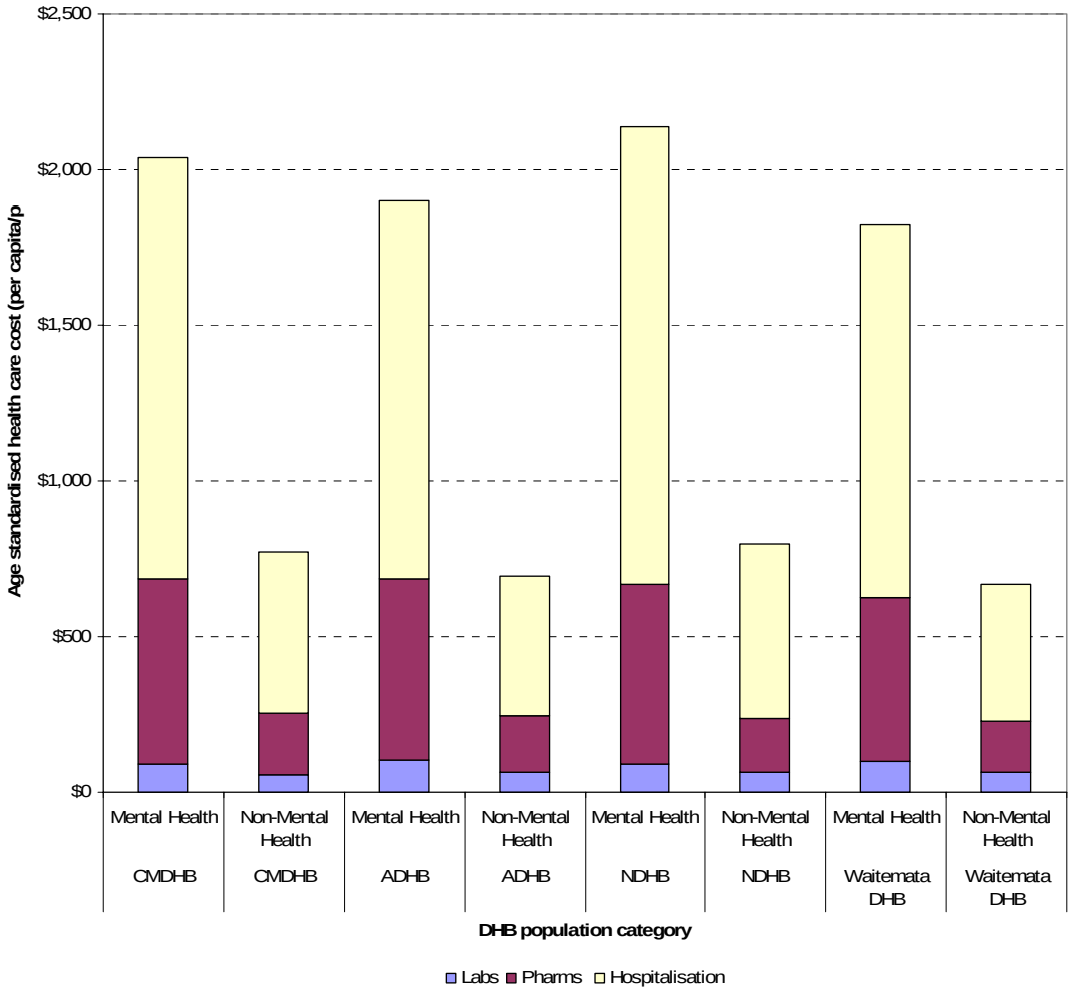
A less strict definition was applied to the Mental Health Population such that anyone with a mental health diagnosis from 2000 on in NMDS, MHINC or PHARMS was included if they were still in the population using healthcare in 2007. For CMDHB, this increased the Mental Health Population to 55,062 from 32,502. Because a more liberal definition of mental health was used, these estimates are likely to be more conservative than those in which a current (annual) diagnosis is sought. Comparisons were made to the non-Mental Health Population for each DHB, based on census estimates. Age–standardisation of mental health and non-mental health populations were made using the age structure of the census derived, age stratified total New Zealand population. Case weights were used to estimate hospitalisation costs by multiplying these by WIES costs of NZ$3740.

The costs of those with mental illness were about double those without such a diagnosis. Waitemata DHB had the lowest per capita mental health costs, with ADHB the second lowest and Counties Manukau having the lowest proportionate increase from non-mental health to Mental Health Populations. Hospitalisation costs accounted for most of the observed differences. Northland and CMDHB have the greatest socioeconomic deprivation and greatest proportion of disadvantaged ethnic groups of the two DHBs, which is likely to explain greater costs of care for their respective Mental Health Populations (cf. ADHB and Waitemata).

Table 19. Cost comparison of age-standardised Mental Health and non-Mental Health Populations (aged ≥15 years) by DHB, for 2007

DHB	*Population*	*n*	*Labs**	*Pharms**	*Hospitalisation**	*Total*	*Ratio*
	Mental Health	55,062	$90	$596	$1,352	$2,038	2.63
CMDHB	Non-Mental Health	291,988	$58	$195	$521	$774	
	Mental Health	55,949	$103	$582	$1,215	$1,899	2.74
ADHB	Non-Mental Health	300,361	$64	$182	$446	$692	
	Mental Health	25,042	$90	$578	$1,470	$2,138	2.69
NDHB	Non-Mental Health	118,670	$65	$173	$558	$796	
	Mental Health	68,400	$100	$523	$1,202	$1,825	2.74
Waitemata	Non-Mental Health	336,040	$66	$161	$439	$666	

†Hospitalisation excludes those to mental health specific services
*Cost/capita/year (NZ$)



*Secondary mental health costs not included.

Figure 16. Comparison of age–standardised mental and non-mental health costs of medical and surgical (non mental health) care, by DHB for 2007*

Costs of mental health admissions were estimated for each of the Northern DHBs. The case weights for mental health admissions were extracted, multiplied by $3740 to calculate a cost, then divided by the age-specific estimated size of the DHB's Mental Health Population, then a weighted average was taken, standardising the population to the age structure of the total estimated Northern Region DHB Mental Health Population. While these services are not actually reimbursed by the caseweight methodology this method provides a way to compare across services.

As can be seen (Figure 17), CMDHB spends relatively less than the other DHBs on admissions, per capita Mental Health Population, than the other DHBs. The Auckland – CMDHB comparison is most dramatic. CMDHB has put particular effort into treating people with mental health disorders in the community, so this pattern may be related to this deliberate strategy in prioritisation of services. Such a pattern is unlikely to reflect community care access difficulties, because this usually results in increased admissions.

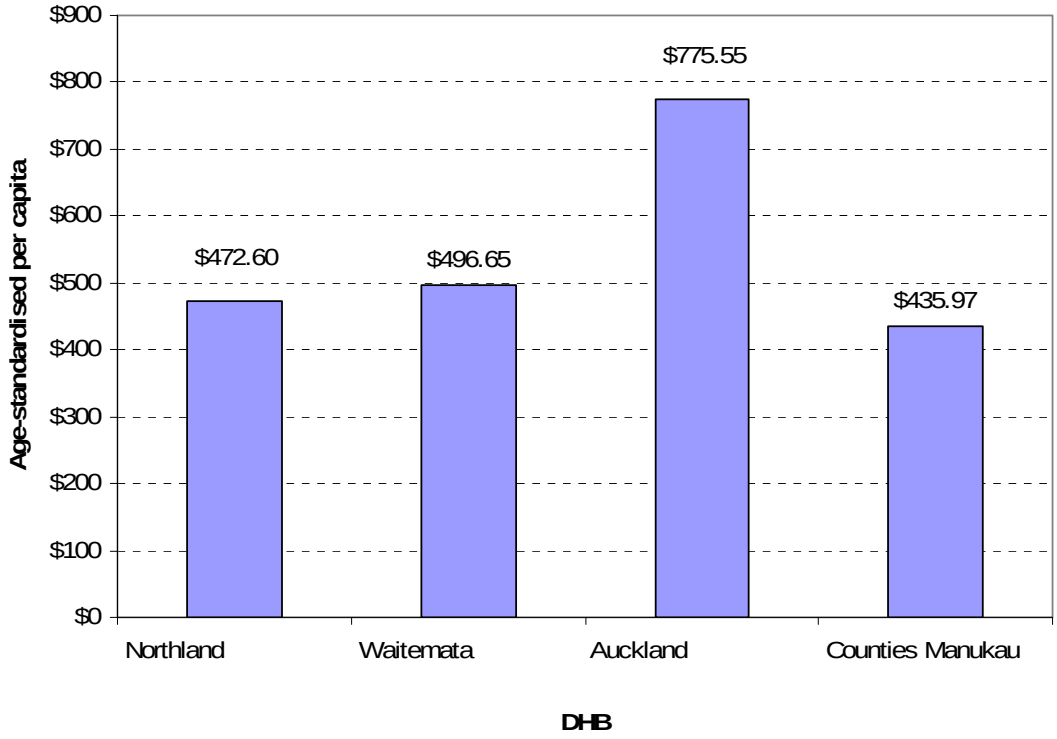


Figure 17. Age-standardised (to Northern DHB Mental Health Population) per capita costs of mental health admissions in 2007

Summary Points

- We used a more inclusive definition of mental illness to estimate health costs. Even with such a definition, the calculated costs per capita for the Mental Health Population individuals were roughly two to three times those not diagnosed with mental illness for laboratory, pharmaceutical and non-mental health hospital admissions.
- Comparison of costs of mental health related admissions between DHBs shows that CMDHB spends less, per age-adjusted Mental Health Population individual than other Northern DHBs.

Chapter 9. Mental health and physical disorders

From our known/medicated CMDHB Mental Health Population, combined with other NMDS derived health outcomes, we estimated whether the presence of a recorded mental health diagnosis is associated with increased risk of adverse health outcomes as diabetes, ambulatory sensitive hospitalisations (ASH), potentially avoidable hospitalisations (PAH) and housing related ambulatory sensitive hospitalisations (HRH). We used a cross-sectional study design, with the total CMDHB population between 15 and 65 years, during 2007 as the population of interest, health related outcome as the dependent variable and "mental health" disorder as the independent variable along with demographic characteristics. PAH are those conditions that are theoretically preventable from primordial or primary public health prevention (**Appendix 4**). ASH are a subset of PAH - those conditions thought to be preventable from high quality primary care (**Appendix 4**). HRH are a subset of those conditions thought to be at least partially preventable from high quality housing (**Appendix 4**).

Binary outcomes were adjusted for known confounders and a mental health diagnosis. For ambulatory sensitive hospitalisations, we also used negative binomial regression to link annual counts of ASH admissions (a rate) to demographic characteristics and a mental health diagnosis. Further, for people with diabetes in CMDHB, we estimated whether the population with mental disorders were as likely as those without to receive indicators of quality of care such as at least one annual $HbA1_c$ test or at least one prescription of an ACE – inhibitor or angiotensin II converting enzyme inhibitor medication. These medicines are known to slow the rate of progression of diabetic nephropathy in diabetic populations with microalbuminuria.

All cross-sectional studies are limited by not being able to distinguish cause and effect, and survivor bias, in that those who have died will not participate in the analysis. In these analyses, for example, we do not know whether some potentially avoidable hospitalisations may induce mental illness rather than the converse.

Associations with diabetes diagnosis

The number of people with diabetes has been estimated in CMDHB from routinely collected data, by the use of an algorithm based on pharmaceutical claims data, NMDS diagnoses for diabetes and laboratory tests (Hb_{A1c}).[17] We used this analysis to designate individuals within the CMDHB area as having or not having diabetes. We then used logistic regression to investigate whether those with mental illness were at higher risk of being diabetic, after controlling for available demographic variables.

Risk of diabetes was higher in those with increased age, male gender and increasing deprivation. Maaori and Pacific were more likely to have diabetes. We found that those in CMDHB with mental disorders were no more likely than their demographically matched counterparts to have a diagnosis of diabetes in 2007 (OR 0.92; 95% CI 0.85 to 1.00). However, when we linked antipsychotic use (ever use in

[17] Smith J, Papa D, Jackson G. Diabetes in CMDHB and northern region: Estimation using routinely collected data. CMDHB. 2007. Available online at: http://www.cmdhb.org.nz/About_CMDHB/Planning/Health-Status/Health-Status.htm#diabetesreport

2007) as a predictor, rather than mental health diagnosis, a significant association was found (odds ratio 2.84; 95% CI 2.55 to 3.17), (**Table 20**). This is an anticipated finding considering the well documented evidence linking antipsychotic use and diabetes.[18] However, this cross-sectional analysis does not allow us to infer whether diabetes causes psychosis, or anti-psychotic use indeed contributes to diabetes as is now accepted.

Table 20. Associations with diabetes diagnosis, CMDHB 2007 population

Category	*Odds Ratio (95% CI)*
Age category	
15 to 24	1 (referent)
25 to 34	4.09 (3.55 to 4.70)
35 to 44	11.84 (10.40 to 13.49)
45 to 54	29.98 (26.38 to 34.08)
55 to 64	68.57 (60.34 to 77.91)
Ethnicity	
European	1 (referent)
Maaori	2.57 (2.42 to 2.73)
Pacific	3.22 (3.06 to 3.40)
Chinese	1.23 (1.11 to 1.37)
Indian	3.70 (3.46 to 3.95)
Other Asian	1.54 (1.38 to 1.71)
Other	1.20 (1.13 to 1.27)
Gender	
Male	1 (referent)
Female	0.91 (0.88 to 0.94)
Diagnostic group	
Antipsychotic use in '07	2.84 (2.55 to 3.17)
NZDep	
1 and 2 (least deprived)	1 (referent)
3 and 4	1.13 (1.05 to 1.21)
5 and 6	1.26 (1.17 to 1.36)
7 and 8	1.58 (1.48 to 1.70)
9 and 10 (most deprived)	1.93 (1.82 to 2.06)

*Multivariate – adjusted for all confounders listed in table

Quality of diabetes care

Amongst the CMDHB population that has diabetes (2007) those with mental disorders were no more or less likely to receive an Hb_{A1c} test (**Table 21**). This indicates that the quality of monitoring of diabetes is no different for those with mental disorders than the rest of the CMDHB population. This may be partly due to Hb_{A1c} being part of the algorithm for labelling individuals with diabetes. This represented 4,000 out of an estimated 27,000 diabetic patients in CMDHB of all ages.

[18] Wirshing D A, Boyd J A, Meng L R,.Ballon J S, Marder S R, &. Wirshing W C. The effect of novel antipsychotics on glucose and lipid levels. J Clin Psychiatry 2002 63:10 856-865.

Table 21. Associations with HbA1c test during 2007, amongst the CMDHB diabetic population

Category	*Odds ratio (95% CI)*
Age category	
15 to 24	1 (referent)
25 to 34	0.44 (0.32 to 0.59)
35 to 44	0.90 (0.68 to 1.20)
45 to 54	1.60 (1.20 to 2.10)
55 to 64	2.20 (1.60 to 2.90)
Ethnicity	
European	1 (referent)
Maaori	1.30 (1.10 to 1.50)
Pacific	1.50 (1.30 to 1.60)
Chinese	1.40 (1.10 to 1.90)
Indian	1.50 (1.30 to 1.80)
Other Asian	1.20 (0.95 to 1.60)
Other	1.20 (1.10 to 1.40)
Gender	
Male	1 (referent)
Female	0.82 (0.76 to 0.89)
NZDep	
1 and 2 (least deprived	1 (referent)
3 and 4	1.20 (0.97 to 1.40)
5 and 6	1.10 (0.93 to 1.40)
7 and 8	1.10 (0.84 to 1.30)
9 and 10 most deprived	1.10 (0.89 to 1.30)
Mental Illness	0.99 (0.90 to 1.10)

*Multivariate – adjusted for all confounders included in table

We examined the population with diabetes in CMDHB using logistic regression to link prescription for (any) ACE – inhibitor (and angiotensin II blocker) with demographic and mental health diagnosis predictors. We hypothesised that mental health patients may not be as likely to receive ACE – inhibitors if they had diabetes, from reduced quality of care from their doctors (primary or secondary care).

Table 22. Associations with claims for any ACE- inhibitor/Angiotensin II blocker prescriptions for CMDHB diabetes population, 2007

Category	*Odds ratio* (95% CI)*
Age category	
15 to 24	1 (referent)
25 to 34	1.30 (0.92 to 1.80)
35 to 44	3.30 (2.40 to 4.50)
45 to 54	6.60 (4.80 to 9.10)
55 to 64	9.00 (6.60 to 12.00)
Ethnicity	
European	1 (referent)
Maaori	1.80 (1.60 to 2.00)
Pacific	1.70 (1.50 to 1.80)
Chinese	0.63 (0.51 to 0.78)
Indian	1.20 (1.00 to 1.30)
Other Asian	1.00 (0.84 to 1.30)
Other	1.10 (0.96 to 1.20)
Gender	
Male	1 (referent)
Female	0.76 (0.71 to 0.81)
NZDep	
1 and 2 (least deprived	1 (referent)
3 and 4	1.20 (1.00 to 1.50)
5 and 6	1.20 (1.00 to 1.50)
7 and 8	1.40 (1.20 to 1.70)
9 and 10 most deprived	1.60 (1.40 to 1.90)
Mental Illness	0.93 (0.85 to 1.00)

*Multivariate – adjusted for all confounders included in table

After adjusting for all other confounders, those in the CMDHB Mental Health Population were marginally less likely to receive ACE – inhibitors if diabetic (odds ratio 0.93; 95% confidence interval 0.85 to 1.00). This may reflect a number of different issues, from practitioner bias or discrimination, to reduced compliance from the mental health population. We also found that Maaori, Pacific, and more deprived populations are more likely be prescribed ACE – inhibitors. The magnitude of the change suggests that these populations have more severe disease in which such treatment is indicated, and or are less likely to be opportunistically screened and have their disease managed at an early stage, when ACE inhibitor therapy is not indicated.

Potentially avoidable hospitalisations

We found that those with mental health disorders have a 2.5 times increased risk of a potentially avoidable hospitalisation than those without such a diagnosis. The size of this association was surprising, being nearly as significant as having a chronic physical illness such as diabetes (OR 3.0). The burden of potentially avoidable hospitalisations is compounded by the increased risk associated with Maaori and Pacific ethnicity and socioeconomic deprivation more common in these populations. Increased risk by advancing age was both expected and observed.

Table 23. Predictors of potentially avoidable hospitalisations, CMDHB 2007

Category	*Odds ratio* (95% CI)*
Age category	
15 to 24	1(referent)
25 to 34	1.00 (0.93 to 1.10)
35 to 44	1.13 (1.00 to 1.20)
45 to 54	1.69 (1.60 to 1.80)
55 to 64	2.43 (2.30 to 2.60)
Ethnicity	
European	1(referent)
Maaori	1.94 (1.80 to 2.10)
Pacific	1.52 (1.40 to 1.60)
Chinese	0.61 (0.51 to 0.72)
Indian	1.20 (1.10 to 1.30)
Other Asian	0.83 (0.71 to 0.97)
Other	0.41 (0.37 to 0.46)
Gender	
Male	1(referent)
Female	0.96 (0.92 to 1.00)
NZDep	
1 and 2 (least deprived	1 (referent)
3 and 4	1.15 (1.00 to 1.30)
5 and 6	1.20 (1.10 to 1.40)
7 and 8	1.35 (1.20 to 1.50)
9 and 10 most deprived	1.67 (1.50 to 1.90)
Mental Illness	2.51 (2.40 to 2.60)
Diabetes	3.00 (2.80 to 3.20)

*Multivariate – adjusted for all confounders included in table

Ambulatory sensitive hospitalisations

We modelled both the binary odds of an ambulatory sensitive hospitalisation (using logistic regression), along with the count of episodes of hospitalisation during 2007 (negative binomial regression). Both analyses showed an increased (multivariate) risk for mental illness (odds ratio 2.32; 95% CI 2.20 to 2.50), although lower than that associated with diabetes (odds ratio 3.36; 95% CI 3.10 to 3.60). Similar to PAH above, the increased proportions of Maaori, Pacific and low socioeconomic status in the mental health population would result in an increased burden from this population.

Table 24. Predictors of ambulatory sensitive hospitalisations

Category	*Odds ratio* (95% CI)*	*Incidence rate ratio* (95% Confidence Interval)*
Age category		
15 to 24	1(referent)	1(referent)
25 to 34	0.94 (0.87 to 1.00)	0.96 (0.88 to 1.04)
35 to 44	1.04 (0.95 to 1.10)	1.05 (0.96 to 1.14)
45 to 54	1.43 (1.30 to 1.60)	1.48 (1.36 to 1.61)
55 to 64	2.03 (1.90 to 2.20)	2.14 (1.96 to 2.34)
Ethnicity		
European	1(referent)	1(referent)
Maaori	2.16 (2.00 to 2.30)	2.21 (2.05 to 2.39)
Pacific	1.68 (1.60 to 1.80)	1.69 (1.57 to 1.82)
Chinese	0.54 (0.44 to 0.66)	0.53 (0.43 to 0.64)
Indian	1.29 (1.20 to 1.40)	1.25 (1.12 to 1.40)
Other Asian	0.81 (0.68 to 0.96)	0.76 (0.63 to 0.91)
Other	0.41 (0.37 to 0.46)	0.39 (0.35 to 0.44)
Gender		
Male	1(referent)	1(referent)
Female	1.02 (0.97 to 1.10)	1.00 (0.95 to 1.06)
NZDep		
1 and 2 (least deprived)	1(referent)	1(referent)
3 and 4	1.11 (0.97 to 1.30)	1.13 (0.98 to 1.29)
5 and 6	1.22 (1.10 to 1.40)	1.21 (1.04 to 1.40)
7 and 8	1.32 (1.10 to 1.50)	1.32 (1.13 to 1.55)
9 and 10 (most deprived)	1.68 (1.50 to 1.90)	1.75 (1.54 to 1.98)
Mental Illness	2.32 (2.20 to 2.50)	2.66 (2.51 to 2.82)
Diabetes	3.36 (3.10 to 3.60)	3.56 (3.30 to 3.84)

*Multivariate – adjusted for all confounders included in table

Similar to ASH and PAH, the risk of a housing related admission is higher in those with mental disorders.

Table 25. Associations with housing related hospitalisations (2007)

Category	*Odds ratio* (95% CI)*
Age category	
15 to 24	1(referent)
25 to 34	0.91 (0.80 to 1.00)
35 to 44	1.00 (0.88 to 1.10)
45 to 54	1.29 (1.10 to 1.50)
55 to 64	1.93 (1.70 to 2.20)
Ethnicity	
European	1(referent)
Maaori	2.75 (2.40 to 3.10)
Pacific	1.95 (1.70 to 2.20)
Chinese	0.46 (0.31 to 0.68)
Indian	0.83 (0.67 to 1.00)
Other Asian	0.62 (0.44 to 0.88)
Other	0.32 (0.26 to 0.40)
Gender	
Male	1(referent)
Female	0.88 (0.81 to 0.96)
NZDep	
1 and 2 (least deprived	1(referent)
3 and 4	1.01 (0.79 to 1.30)
5 and 6	1.16 (0.90 to 1.50)
7 and 8	1.19 (0.90 to 1.60)
9 and 10 (most deprived)	1.81 (1.40 to 2.30)
Mental illness	2.17 (2.00 to 2.40)
Diabetes	2.40 (2.10 to 2.70)

*Multivariate – adjusted for all confounders included in table

Summary points

- Those with a recorded diagnosis of a mental disorder or prescription of a medication for a mental health condition have about twice the odds of ambulatory sensitive hospitalisations, potentially avoidable hospitalisations and housing related ambulatory sensitive admissions, adjusted for demographic variables including deprivation, gender, and ethnicity than those without such a diagnosis.
- People with mental illness are no more likely to have diabetes than others after adjustment for demographic variables. However those that take antipsychotic medication are more likely than those that do not to have diabetes (odds ratio 1.57; 95% CI 1.40 to 1.77). If they have diabetes, mental health patients are as likely as others to be monitored with an HB_{A1c}, however, are marginally less likely to receive ACE – inhibitor or Angiotensin-2 blockers to prevent progression of diabetes.

Chapter 10. Conclusions and implications for future research

This study has defined a new methodology for estimating the descriptive epidemiology of mental health disorders using linked health data. Although not formally validated, some estimates of prevalence of disorder have been found to be similar to national surveys. Further work could be done to validate diagnostic categories by using a population diagnosed using standard criteria population. For example, the primary care 'Chronic Care Management' population enrolled in the depression pathway may be one such reference population. Recent developments, enabling record linkage to primary care data are already underway.

We highlighted the significant role primary care plays in mental health treatment. The majority of users of antidepressants in the CMDHB population were managed by general practitioners, without apparent (at least annual) input from specialist services. The prevalence of people not identified as Maaori or Pacific who had prescriptions filled for antidepressants was greater than the prevalence of people with major depression in the national survey. One possible explanation is that antidepressants were being prescribed for other disorders such as chronic pain. Another possibility is that general practitioners are prescribing antidepressants where they are not indicated, or failing to discontinue antidepressants when they are no longer needed. With longer time trend information from the PHARMS database, incident cases of depression could be analysed to establish duration of pharmacologic treatment. If antidepressants are being prescribed too frequently and for too long, the potential for cost savings to the regional budget for pharmaceutical expenditure may be large. Also, unnecessary drug-drug interactions may be prevented.

A large proportion of those prescribed antipsychotic medication in CMDHB do not appear in secondary care datasets in 2007. This may be due to care being handed over to general practitioners after an initial diagnosis and management in secondary care. Alternatively, resource or referral for ongoing secondary care supervision of treatment may be inadequate. Recent evidence shows that anti-psychotics are associated with significant cardio-metabolic side effects and that judicious use of such medicines, particularly in young people is desirable. Further research to more carefully investigate patterns of anti-psychotic use in primary care, to outline supervision of treatment may be indicated.

Importantly, we found that mental health disorders were associated with a greater burden of physical disease than those without as indicated by increased association with a range of outcomes such as avoidable hospitalisations and premature death. Such a mental health disorder resulted in as large an association as those indicated by physical diagnosis variables such as diabetes and cardiovascular disease. Part of this effect is likely to be due to a higher prevalence of smoking. Nevertheless, these analyses indicate the importance of preventive treatment of physical disorders by those involved in the care of the mentally ill. Health care costs for mental health were two to three times that for non-mental health, even excluding specialist mental health services.

This analysis also highlights the contribution of primary care to the management of those with mental disorders. The limits of secondary management of mental disorders

are evident - both in resource and reach. This work supports the idea that efforts to increase the quality of mental health care provided in the primary care sector is an effective strategy to impact on the majority of the CMDHB population suffering from such disorders.

Reassuringly there was evidence that quality of physical health care for CMDHB Mental Health patients is high. Mental Health patients with diabetes were just as likely as those without mental illness to have monitoring of their diabetes and had reasonably equitable access to ACE inhibitors. Access to nicotine replacement therapy was appropriately high for mental health patients, however, we found that Pacific populations are under represented in claims for such treatment.

Finally, due to the short time period available of linked health datasets (2006-2008) we used cross-sectional analyses to link health outcomes and exposures. As consistent time trend data becomes available, longitudinal analyses, that are able to observe temporal and possibly causal relationships between exposures and mental or physical health outcomes may be possible. The ability to monitor cardiovascular outcomes associated with anti-psychotic use is of particular interest, along with the uptake of effective treatments such as nicotine replacement therapy amongst ethnic minorities.

Appendix 1. Data Sources

Pharms and Labs

Pharmaceutical reimbursement claims data was extracted from Pharmhouse, the national pharmaceutical subsidy data collection held by the New Zealand Health Information Service (HZHIS) and Pharmac. The Pharmhouse data warehouse contains claim and payment data from pharmacists for the dispensing of subsidised prescriptions that have been processed within the HealthPAC General Transaction Processing System (GTPS). Pharmaceutical claims data for this analysis were obtained by the Regional Decision Support Team at NDSA (Northern DHB Support Agency) and passed on to CMDHB (northern region only made available).

NMDS

This is a national collection of discharge information from public and private hospitals. NZHIS has provided CMDHB with NMDS data for the northern region. Analysis of discharge data in this report generally refers to medical and surgical inpatient discharges, rather than from other services such as psychiatric services. We used data from 2000-2007 due to the consistent ICD-10 coding used, although data was available from 1990 onwards.

Mortality

Finally, the NZHIS Mortality Collection is a complete set of national data, in which the underlying cause of death for all deaths registered in New Zealand is classified according to ICD-10-AM criteria [17]. This data was used to remove deceased individuals from the reconstructed populations.

MHINC

This dataset is administered by the New Zealand Health Information Service (NZHIS). Although this dataset was initiated in 2000, reporting of diagnosis category (and utility for our purposes) was only made mandatory from the 1st of July 2004. Categories for diagnosis included DSM-IV, ICD – 9-CM or ICD-10-AM. MHINC ethnicity data is recorded up until Statistics New Zealand level 2. This dataset excludes a >90% of NGOs that deliver mental health services in CMDHB, and was limited to those seen in 2007, however, historic diagnoses were used to classify patients if available from previous years. The MHINC database is limited by lack of NGO reporting, variation in diagnostic accuracy (many submit no diagnosis), and regional variation in consistency between DHBs.

Appendix 2. Medicines by category extracted from PHARMS database

Table 26. Medicines used to indicate individuals being treated for a mental disorder

Class	Antidepressant	Anti-psychotic	Drug dependence
Generic name	AMITRIPTYLINE* CLOMIPRAMINE DOTHIEPIN DOXEPIN IMIPRAMINE MAPROTILINE MIANSERIN TRIMIPRAMINE NORTRIPTYLINE*† PHENELZINE TRANYLCYPROMINE MOCLOBEMIDE CITALOPRAM FLUOXETINE PAROXETINE VENLAFAXINE	Oral CHLORPROMAZINE CLOZAPINE HALOPERIDOL LITHIUM CARBONATE METHOTRIMEPRAZINE OLANZAPINE PERICYAZINE PIMOZIDE QUETIAPINE RISPERIDONE THIORIDAZINE TRIFLUOPERAZINE ZIPRASIDONE Depot preparations FLUPENTHIXOL FLUPHENAZINE HALOPERIDOL DECANOATE PIPOTHIAZINE RISPERIDONE OLANZAPINE	METHADONE* NALTREXONE DISULFIRAM

*These medications have indications other than for the treatment of mental disorders (amitriptyline can be used for the treatment of chronic pain, as is methadone).

†Nortriptyline is a second-line treatment for smoking cessation, as well as an anti-depressant. Use of this product for smoking cessation is usually intermittent with treatment likely to last less than three months. Thus, individuals with claims for Nortriptyline required more than three scripts per calendar year to be included in the Mental Health Population.

Appendix 3. Diagnostic categories

Broad diagnostic categories for individuals with mental disorder, with ICD-10-AM and DSM-IV classifications

Psychiatric disorder	DSM- IV	ICD-10
1. Anxiety disorders	panic disorder (300.01; 300.21) agoraphobia without panic (300.22), specific phobia (300.29), social phobia (300.23), GAD (300.02), PTSD (309.81) obsessive–compulsive disorder (300.3) Somatoform disorders (300.81; 300.81; 300.11; 307.89; 307.80; 300.7; 300.7; 300.81)	F40 Phobic anxiety disorder incl agoraphobia, social phobia, specific phobias F41 Other anxiety disorders F42 Obsessive compulsive disorders F43 Reaction to severe stress, and adjustment disorders [including PTSD] F43 conversion disorders F45 Somatoform disorders
2. Mood (Depression)	major depressive disorder (296.2x [single]; 296.3x[recurrent]), dysthymia (300.4) depressive disorder NOS (311)	F32 Depressive episode F33 Recurrent Depressive episode F34 Persistent Mood disorders F38 Other mood disorders
3. Mood (Mania)	bipolar disorder (296.0x; 296.40; 296.4x; 296.6; 296.5; 296.7; 301.13; 296.80; 296.89)	F30 Manic episode F31 Bipolar affective disorder
4. Substance use disorders	Abuse or dependence of the following substances: alcohol (305.00; 303.90) amphetamine (305.70, 304.40) cocaine (305.60; 304.20) hallucinogen (304.50; 305.30) Inhalant (304.60, 305.90) Opiate (304.00; 305.50) Phencyclidine (304.60; 305.90) Hypnotics (304.10; 305.40) Polysubstance (304.80) Marijuana (304.30; 304.20) Other Alcohol related disorders (291.0; 291.1; 291.2; 291.3; 291.5; 291.8; 291.0) Others (304.90; 305.90; 292.89; 292.81; 292.0; 292.11; 292.12; 292.84; 292.85; 292.89; 292.9; 292.82; 292.83)	Abuse or dependence of the following substances: F10 Alcohol F11 Opioids F12 Marijuana F13 Hypnotics F14 Cocaine F15 Other stimulants (e.g. caffeine) F16 Hallucinogens F18 Solvents F19 Multiple drug use
5. Eating disorders	bulimia anorexia	F50 Eating disorders (anorexia and bulimia)
6. Psychotic	Schizophrenia (paranoid,	F20 Schizophrenia – all types

Psychiatric disorder	DSM- IV	ICD-10
disorders	residual, disorganised, catatonic, undifferentiated) – 295.30; 295.10; 295.20; 295.90; 295.60) Schizophreniform disorder (295.40); Schizoaffective (295.70) Delusional (297.1) Brief psychotic (298.8) Shared psychotic (297.3) Psychotic disorder NOS (298.9)	F21 Schizotypal disorder F22 Persistent delusional disorder F23 Acute and transient psychotic disorders F24 Induced delusional disorder F25 Schizoaffective disorder F26 Other non organic psychotic disorders F29 Other non specified nonorganic psychosis
7. Personality disorders	All (301.0; 301.20; 301.22; 301.7; 301.50; 301.81; 301.82; 301.6; 301.4; 301.9; 301.83)	F60 Specific personality disorders
8. Dementia	Dementia 290	F00-F03 Dementia,
9. Other mental health Disorder	Delirium 293 Amnestic disorders (294) Caffeine-related disorders (292) Nicotine (305.10; 292.0) Factitious disorder (300.19; 300.16) Dissociative disorders (300.6; 300.12-300.15) Sexual and gender identity disorders Sleep disorders Impulse control disorders not otherwise specified Adjustment disorders Malingering Disorders usually first diagnosed in infancy, childhood or adolescence.	F51 Nonorganic sleep disorders F52 Sexual dysfunction F53 Mental and behavioural disorders associated with the puerperium F54 Psychological and behavioural factors associated with disorders or diseases classified elsewhere F55 Harmful use of non-dependence producing substances F63 Habit and impulse disorders F64 Gender identity disorder F65 Sexual preference disorder F66 Psychological and behavioural disorders associated with sexual development and orientation F68/69 Other/unspecified disorders of adult personality and behaviour. F70-79 Mental Retardation F80-89 Disorders of Psychological Development F90-98 Child and adolescent behavioural and emotional disorders harmful use tobacco F172 tobacco dep syndr F173 tobacco withdrawal F179 tobacco use with mental/behavioural disturbance NOS

Psychiatric disorder	DSM- IV	ICD-10
10. Non Mental Health disorders coded in MHINC		
11. Hospital admission Parasuicide *	Not applicable	X60-X84; Y87.0

***Suicide was also included in the data drawn from the NMDS (hospital admissions) and did not include visits to the Emergency Department. Mortality from suicide was unable to be estimated as coded cause of death was unavailable at the time or writing. Completed suicides are estimated by those that had a previous suicide code that died in the year of analysis.**

Appendix 4. Definitions of avoidable hospitalisations

Conditions included in potentially avoidable hospitalisations, ambulatory sensitive hospitalisations (ASH), and housing related hospitalisation (HRH).

Potentially Avoidable Hospitalisations	*ASH*	*HRH*
01 Tuberculosis		Y
02 HIV AIDS		
03 Skin cancers		
04 Oral cancers		
05 Colo-rectal cancer		
06 Lung cancer		
07 Breast cancer		
08 Nutrition		
09 Alcohol related conditions		
10 a Myocardial infarction		
10 b Other ischaemic heart disease		
11 Gastroenteritis	Y	
12 Other infections		
13 a Immunisation preventable - Hib	Y	Y
13 b Immunisation preventable - MMR	Y	Y
13 c Immunisation preventable - Whooping cough	Y	Y
13 d Immunisation preventable - Other	Y	Y
14 Hepatitis and liver cancer		
15 Sexually transmitted diseases	Y	
16 Cervical cancer		
17 Thyroid disease	Y	
18 Diabetes	Y	
19 Dehydration	Y	
20 Epilepsy	Y	
21 ENT infections	Y	
22 Rheumatic fever/heart disease	Y	Y
23 Hypertensive disease	Y	
24 Angina and chest pain	Y	
25 Congestive heart failure	Y	
26 Stroke		
27 a Respiratory infections - Acute bronchiolitis	Y	Y
27 b Respiratory infections - Pneumonia	Y	Y
27 c Respiratory infections - Other	Y	Y
28 CORD	Y	Y
29 Asthma	Y	Y
30 Dental conditions		
31 Peptic ulcer	Y	
32 Ruptured appendix	Y	
33 Obstructed hernia	Y	
34 Kidney/urinary infection	Y	
35 Cellulitis	Y	Y
36 Failure to thrive	Y	
37 Gangrene	Y	
38 Meningococcal infection		Y
39 Legionnaires' disease		