



Results of Three Pilot Studies Quantifying the Effects of Selected Health Co-morbidities on ACC Injury Treatment Utilisation and Costs

Results of studies involving:

- 1. Brief review of the literature**
- 2. Service provision using GP Practice data**
- 3. ACC Claims Utilisation and Costs using linked ACC-MOH data**

ACC Research Project RS 1311

Status: FINAL: 17/12/2010 13:15

Authors

- John Wren, Principal Research Advisor, Governance, Policy and Research, ACC
- Jenny Mason, Senior Business Intelligence Analyst – Injury Prevention, ACC

Suggested Citation

Wren, J. & Mason, J. 2010. Selected health co-morbidity Effects on ACC Injury Treatment Utilisation and Costs? ACC, Governance Policy and Research. Wellington, New Zealand.

Acknowledgements

The authors wish to thank the following people:

- Craig Wright, Senior Advisor (Statistics/Epidemiology), Data Integration Health & Disability Intelligence Unit, Health & Disability Systems Strategy Directorate, Ministry of Health

for providing access to Ministry of Health data and pilot study analysis of health co-morbidity effects on health service provision, and insights into various data and its interpretation, and peer review.
- Lorna Bunt, Manager Business Intelligence (Injury Prevention)

for collaborating in providing data linkage and statistical analytical support with the ACC-MOH data linkage study.
- Dr Jackie Fawcett, previous Principal Research Advisor and Research Manager

who did some of the initial design work and organised the supply of data from MOH to ACC for the data linkage project.
- Sheryl Calvert, ACC

for her editing.

Peer Review

The report has been the beneficiary of verbal and written comments from a range of internal and external peer reviewers including:

- Senior ACC research staff
- University researchers
- ACC Clinical Advisors.

Table of Contents

TABLE OF FIGURES	5
EXECUTIVE SUMMARY	8
PURPOSE	8
HEADLINE RESULTS.....	8
EXCESS INJURY TREATMENT CLAIM COSTS TO ACC ASSOCIATED WITH DIABETES AND CORONARY HEART DISEASE COMPARED TO THOSE WITHOUT THE CO-MORBIDITIES (LINKED ACC-MOH DATA)	8
IMPLICATIONS FOR ACC SCHEME LIABILITY	10
KEY FINDINGS – ACC-MOH LINKED DATA: INJURY TREATMENT UTILISATION AND COST IMPACTS TO ACC FOR SELECTED CO-MORBIDITIES.....	11
KEY FINDINGS – PRIMARY CARE SERVICE UTILISATION AND COST IMPACTS TO ACC.....	11
KEY FINDINGS: LITERATURE.....	12
THIS REPORT - BACKGROUND.....	13
SECTION 1: INTRODUCTION AND REPORT STRUCTURE	14
BACKGROUND.....	14
RESEARCH QUESTIONS	14
REPORT STRUCTURE	15
SECTION 2: SUMMARY OF LITERATURE	16
KEY FINDINGS: LITERATURE ON HEALTH CO-MORBIDITY EFFECTS ON INJURY TREATMENT SERVICE UTILISATION	16
INTRODUCTION AND METHOD.....	17
FINDINGS	17
<i>Health Co-morbidity Effects on General Primary Care and Hospital Treatment Utilisation</i>	17
<i>Workers Compensation</i>	20
<i>Cost-benefit of wor-k based health promotion interventions</i>	20
SECTION 3: RESULTS OF A STUDY USING GP PRACTICE DATA EXAMINING THE EFFECTS OF CO-MORBIDITIES UPON GP AND ACC CONSULTATION RATES RESPECTIVELY	22
INTRODUCTION AND METHODS.....	22
FINDINGS	23
<i>Effect of Health Co-morbidity on ACC Consultation Rates and All Consultations Respectively</i>	23
<i>Discussion</i>	24
KEY FINDINGS –INJURY TREATMENT UTILISATION AND COST IMPACTS TO ACC FOR SELECTED CO-MORBIDITIES	26
SECTION 4: SELECTED HEALTH CO-MORBIDITIES AND ACC INJURY TREATMENT UTILISATION AND COMPENSATION COSTS: RESULTS OF A TRIAL OF LINKED ACC-MOH DATA	26
INTRODUCTION	27
METHODS.....	27
WHY DIABETES AND CHD?.....	28
FINDINGS	29
<i>Introduction</i>	29
<i>Prevalence of Diabetes and CHD in the ACC Population Compared to National Estimates</i>	30
Diabetes.....	30
Coronary Heart Disease.....	30
DOES THE PRESENCE OF DIABETES OR CHD RESULT IN EXTRA CLAIMS UTILISATION?	31
<i>All Claims</i>	31
Diabetes.....	31
Coronary Heart Disease.....	31
<i>Entitlement Claims</i>	35
Diabetes.....	35
Coronary Heart Disease.....	37

CLAIMS COSTS AND DURATION FIRST 6 & 12 MONTHS (INCL. PUBLIC HEALTH ACUTE SERVICES PHAS))	39
<i>Diabetes All Claim Costs</i>	39
<i>Diabetes Entitlement claims –mean cost and duration at 6 and 12 months (incl. PHAS)</i>	41
<i>Additional analysis: Diabetes</i>	44
Diabetes and Injury Diagnosis Group.....	44
<i>Diabetes and Type Injury Event: Falls, Burns, Extremities</i>	46
Falls.....	46
Burns	46
Extremities	47
<i>CHD All Claim Costs</i>	49
<i>CHD Entitlement claims –Mean Cost and Duration at 6 and 12 months (incl. PHAS)</i>	50
<i>Additional analysis: CHD</i>	53
CHD and Injury Diagnosis Group and Injury Site.....	53
CHD and Type Injury Event: Falls.....	55
SUMMARY & CONCLUSIONS	58
LITERATURE.....	58
ACC-MOH LINKED DATA.....	59
IMPLICATIONS FOR ACC AND THE HEALTH SYSTEM.....	59
REFERENCES	61
APPENDIX 1: META-EVALUATION OF WORKSITE HEALTH PROMOTION ECONOMIC RETURN STUDIES	64

List of Tables

Table 1: Summary - Extra Costs, Claims Utilisation and Duration Associated with Coronary Heart Disease.....	9
Table 2: Summary - Extra Costs, Claims Utilisation and Duration Associated with Diabetes .	9
Table 3: Injury Treatment Utilisation, Health Co-morbidity Rate Ratios Injured / Non-injured	18
Table 4: Mean Number Consultation Rates by Demographic Group and Existence of Co-morbidity	24
Table 5: Mean Number (and 95% Confidence Intervals) of GP ACC Consultations by Patients With No Co-Morbidity Compared to Patients With Co-morbidity,.....	25
Table 6: Percentage of the population with diabetes, comparison of MOH estimates with ACC data set.....	30
Table 7: Percentage of population with CHD, Comparison of National Estimates with ACC Data set.....	31
Table 8: Claims Rate – All Claims ‘Has Diabetes’ Compared to ‘No Diabetes’	32
Table 9: Claims Rate - All Claims ‘Has Coronary Heart Disease’ Compared to ‘No CHD’, July/ June 2008/09 Financial Year.....	33
Table 10: Number of Entitlement Claims, Per 1000 People with record (with ACC NHI) With and Without Diabetes, by Sex and Age Group, 2008/09 Financial Year.....	37
Table 11: Number of Entitlement Claims, Per 1000 People With and Without CHD, by Sex and Age Group, 2008/09 Financial Year	38
Table 12: Mean Cost (incl PHAS) and mean duration of All Claims Diabetes related, First 6 months, July/June 2008/09 Financial year	40
Table 13: Mean Cost (incl PHAS) and Duration of Diabetes related Entitlement Claims, @ 6 and 12months, July/June 2008/09 Financial year	42
Table 14: Mean Cost (incl PHAS) and Mean Duration of All Claims CHD related, @ 6 and 12 months, July/June 2008/09 Financial year	50
Table 15: Mean Cost (incl PHAS) and Mean Duration of CHD related Entitlement Claims, @ 6 and 12 months, July/June 2008/09 Financial year	51

Table of Figures

Figure 1: MOH - ACC data linkage process and claim history preparation.....	27
Figure 2: Comparison All Claim Rates, per 1000 people by Age and Sex with Record of Diabetes to those Without Diabetes, July / June 2008/09 Financial Year	34
Figure 3: No CHD related All Claims per 1000 People by Age and Sex, July/June 2008/09 Financial Year	35

Figure 4: No Diabetes related Entitlement Claims Per 1000 People, By Age and Sex, 95% Confidence Intervals, 2008/09 Financial Year	36
Figure 5: No CHD related Entitlement Claims per 1000 People by Sex and Age, 95% Confidence Intervals, July/June 2008/09 financial year	38
Figure 6: Mean Cost (Incl. PHAS) of Diabetes related All Claims first 6 Months by Age and Sex, July/June 2008/09 Financial Year	41
Figure 7: Mean Cost Diabetes related Entitlement Claims (incl. PHAS) in first 6 months by Age and Sex, July/June 2008/09 Financial Year.....	43
Figure 8: Mean Cost Diabetes related Entitlement Claims (incl. PHAS) in first 12 months by Age and Sex, July/June 2008/09 Financial Year.....	43
Figure 9: Mean Cost (incl. PHAS) of Diabetes related Entitlement Claims in first 6 Months of claim by Diagnosis, 2008/09 July/June Financial Year	44
Figure 10: Mean Cost (incl. PHAS) of Diabetes related Entitlement Claims by Diagnosis in first 12 Months of claim, 2008/09 July/June Financial Year	45
Figure 11: Mean duration of Entitlement Payments, first 12 months 2008/09 Financial Year, Diabetes / No Diabetes, Diagnosis.....	45
Figure 12: Mean duration of Diabetes Falls related Entitlement Payments, first 12 months 2008/09 Financial Year	46
Figure 13: No Diabetes related Extremity Entitlement Claims Per 1000 people, July/June 2008/09 Financial Year	47
Figure 14: Mean Cost (Incl. PHAS) Diabetes Extremity Entitlement Claim first 6 Months, 2008/09 Financial Year	48
Figure 15: Mean Cost (Incl. PHAS) Diabetes Extremity Entitlement Claims first 12 Months	48
Figure 16: Mean Duration Diabetes Extremity Entitlement Claims	49
Figure 17: Mean Cost (Incl. PHAS) CHD related Entitlement Claims, first 6 Months, July/June 2008/09 Financial Year	52
Figure 18: Mean Cost (Incl. PHAS) CHD related Entitlement Claims, first 12 Months, July/June 2008/09 Financial Year	52
Figure 19: Duration CHD Entitlement Claims, Mean Paydays, July/June 2008/09 Financial year	53
Figure 20: No CHD Entitlement Claims per 1000 People by Injury Diagnosis, 2008/09 Financial Year	54
Figure 21: Mean Cost of CHD Entitlement Claims by Injury Diagnosis Group, 2008/09 Financial Year	54
Figure 22: CHD Falls-Related Entitlement Claims per 1000 people, 2008/09 Financial Year	55
Figure 23: Mean CHD Falls-Related Entitlement Costs (Incl. PHAS), first 6 months, 2008/09 Financial Year	56

Figure 24: Mean CHD Falls-Related Entitlement Costs (Incl. PHAS), first 12 months,
2008/09 Financial Year, Sex and Age..... 56

Figure 25: Mean Duration of CHD Falls-Related Entitlement Claims, 2008/09 Financial
Year, Sex and Age..... 57

Executive Summary

Purpose

Research has completed a suite of pilot studies aimed at identifying and describing the evidence for health co-morbidity effects upon ACC injury treatment claims utilisation and claims costs over a 12 month period.

Health co-morbidity is defined as the existence of a chronic disease that has a gradual onset or period of development. Chronic diseases may result in poorer health status and reduction in health life expectancy for those affected by them.

This is the first report to produce quantified estimates indicating the size of the burden to ACC associated with health co-morbidities on injury treatment utilisation, claims costs and duration. The report presents the key results of the work undertaken by external and internal researchers. The paper has been subject to external and internal peer review including clinical advisors and university researchers.

Headline Results

Evidence for the existence of health co-morbidity effects on increased injury treatment utilisation and costs is well supported in the literature.

Extra ACC injury treatment and rehabilitation costs of approximately \$100 million in a 12 month period have been associated with the presence of diabetes and coronary heart disease.

There are marked differences between life-cycle age groups and gender in extra claim utilisation and cost where a co-morbidity is present.

Analysis of GP consultations clearly shows that the presence of one or more of a wide range of health co-morbidities is associated with extra GP ACC injury related consultations compared to those without a health co-morbidity. In the 12 month period April 2008 to March 2009, the extra cost to ACC of GP injury treatment consultations where a co-morbidity is present is estimated to have been \$12.6 million in that period.

Extra injury treatment claim costs to ACC associated with Diabetes and Coronary Heart Disease compared to those without the co-morbidities (linked ACC-MOH data)

The following two tables summarise the extra claims utilisation, duration and cost associated with coronary heart disease and diabetes respectively.

Excess costs are calculated by summing the mean extra cost of a claim where the identified co-morbidity is present compared to the mean cost of the claim where the co-morbidity is not present, multiplied by the number of co-morbidity claims.

For All Claims in the 2008/09 financial year:

- Extra costs of at least \$60 million have been associated with the presence of coronary heart disease at the 6 month time point following a claim
- Extra costs of at least \$36 million for the 2008/09 year have been associated with the presence of diabetes at the 6 month time point following a claim
- Extra costs continue to increase to the 12 month time point. The substantive costs are incurred within the 6 month time period.

- Evidence for the existence of health co-morbidity effects on increased injury treatment utilisation and costs is well supported by the literature. There are marked differences between life-cycle age groups and gender.

Table 1: Summary - Extra Costs, Claims Utilisation and Duration Associated with Coronary Heart Disease

Excess associated with Coronary Heart Disease Claims made in July / June 2008/09 Year, for whom ACC has an NHI number					
	Extra Costs (Incl. PHAS)		Percent Extra Claims Utilisation associated with co-morbidity*	Duration: Medical Payments	Duration: Paydays
	6 months	12 months			
All Claims	\$62,670,614	\$66,635,192	20%	Yes, particularly 25-44 age group	n/a
Entitlement Claims	\$27,859,014	\$27,567,687	23%	Yes, those working age - particularly Males approx. 20 - 30 payments	Yes, those working age - particularly Males approx. 30 - 40 payments
* % based upon: Utilisation Ratio Claims per 1000 people CHD / No CHD					

Table 2: Summary - Extra Costs, Claims Utilisation and Duration Associated with Diabetes

Excess associated with Diabetes Claims made in July / June 2008/09 Year, for whom ACC has an NHI number					
	Extra Costs (Incl. PHAS)		Percent Extra Claims Utilisation associated with co-morbidity*	Duration: Medical Payments	Duration: Paydays
	6 months	12 months			
All Claims	\$36,396,050	\$ 40,964,302	16%	None	n/a
Entitlement Claims	\$13,168,872	\$14,189,812	14%	Yes, Males Working Age - approx. 6 - 16 payments increasing with age	Yes Males Working Age - approx. 10 - 18 payments, varies by age
* % based upon: Utilisation Ratio Claims per 1000 people Diabetes / No Diabetes					

Implications for ACC Scheme Liability

The report presents substantive evidence that there is an extra cost to ACC for treating injuries where diabetes and coronary heart disease (CHD) are present as health co-morbidities. The increased costs have been quantified at 6 and 12 month time points for claims occurring in the 2008/09 financial year.

In addition, there is sufficient published international literature, including some New Zealand, which clearly shows a wide range of other health co-morbidities are associated with increased injury claim utilisation and costs at the primary and hospital care levels.

It is expected that additional extra costs associated with other health co-morbidities would be identified should the pilot work be extended to include other co-morbidities.

Given the marked sex and age related effects seen with the two selected health co-morbidities, it is expected that as the New Zealand population gets older Scheme liability will increase over time particularly in the Non-Earners Account, and to lesser degree in the Work and Earners' Accounts.

To address this scheme liability, recommended actions that could be taken include developing:

- policy settings around the apportionment of the cost of a claim to the health system where a health co-morbidity is present, however this is likely to be highly contentious
- claims management processes to better identify and manage claims where a health co-morbidity is present, currently no data is collected by ACC about the presence of a health co-morbidity
- experience rating models that include a function for health co-morbidity effects for population groups differentiated by type of co-morbidity, life-cycle age group, and sex. This work would likely require further research to be undertaken focussing upon developing New Zealand specific risk ratios for the selected health co-morbidities
- workplace based health promotion programmes targeted at improving the general health of the workforce and thereby reducing co-morbidity related workers compensation costs and poor health status in general
- further research to develop a more complete estimate of the cost effects of the full range of health co-morbidities to ACC based upon the methods used in this report, and to develop more complete and better estimates of the relative risk associated with specific health co-morbidities on ACC claims utilisation and costs.

Key findings – ACC-MOH Linked Data: Injury Treatment Utilisation and Cost Impacts to ACC for Selected Co-morbidities

The prevalence of diabetes and coronary heart disease in the ACC population is similar to that reported in national estimates for all age groups up to 80 years of age.

There is clear evidence that the selected co-morbidities (diabetes and coronary heart disease) increases the risk of making an ACC claim (claim utilisation), increases the mean cost of All Claims and Entitlement claims respectively, and results in increased duration of some claims. The effects are statistically significant in some cases.

Irrespective of statistical significance, small levels of increased costs associated with the co-morbidity adds up to significant costs to the Scheme, in the 2008/09 time period examined.

- Excess All Claims costs of least \$60 million for the 2008/09 financial year have been attributed to the presence of coronary heart disease at the 6 month time point following a claim.
- Excess All Claims costs of least \$36 million for the 2008/09 year have been attributed to the presence of diabetes at the 6 month time point following a claim.
- Costs, for both co-morbidities continue to increase to the 12 month time point for All Claims and Entitlement Claims respectively, but not significantly.
- Increased costs of All Claims are likely to be related to increased complexity of treating claims due to the presence of the co-morbidity.
- Increased cost of Entitlement claims is likely to be associated with increased rehabilitation required due to the presence of the co-morbidity.
- The effects of the selected co-morbidities are significantly related to older population age-groups. This has implications for increased Scheme liability as the population gets older.

Key findings – Primary Care Service Utilisation and Cost Impacts to ACC

A study using GP practice data (CBG Health Research Ltd, 2009) has shown that in the 12 month period April 2008 to March 2009:

- The extra burden to ACC of consultations for patients with a recorded health co-morbidity is estimated to be 340,000 consultations nationally, which at an average cost of \$37.12 per consultation for the period, equates to a cost of \$12,620,800 (excl GST) in that period.
- Approximately 32% of the GP patient population has at least one health co-morbidity (Anxiety, Asthma, Bipolar Affective disorder, Coronary Obstructive Pulmonary Disease, Congestive Heart Failure, Depression, Diabetes Mellitus, Infectious gastroenteritis, Influenza-like Illness (ILI), Ischaemic Heart Disease, Schizophrenia, Substance Abuse) recorded on their patient file.
- Irrespective of age, sex, and ethnicity ACC patients who have a recorded chronic disease have approximately twice as many ACC consultations for injury treatment than ACC patients who don't have a chronic condition. This level of extra service utilisation was also found in the GP client population who weren't ACC clients.
- ACC Consultations represented 8.1% of all GP consultations.

Key Findings: Literature

Health co-morbidity effects

The international literature, and the limited amount of New Zealand research, is unequivocal that the existence of a broad range of health co-morbidities is associated with increased injury risk, health service utilisation and higher medical treatment costs.

The presence of one or more health co-morbidities in a patient complicates treatment, prolongs hospitalisation and rehabilitation, and confounds analysis when examining the importance of other risk factors such as age, ethnicity and social deprivation.

Patients with mental health and behavioural disorders and those with previous injuries respectively, have higher treatment rates - at least double - compared to those without a co-morbidity, and compared to other co-morbidities.

A causal link appears to exist between the existence of mental health conditions, risk-taking behaviours, alcohol misuse and psychological characteristics such as impulsivity, sensation seeking and risk-perception and increased risk of injury and injury treatment utilisation.

Patients with higher numbers of co-morbidities utilise services more than patients with lower co-morbidities.

Two Ministry of Health pilot studies found that the probability of hospital admission for falls-related injuries significantly increased where substance abuse, anxiety and dementia, and vision impairment were present. The probabilities increased with age, and particularly so for those over 55 years.

Workers Compensation

Higher workers' weekly compensation costs are associated with high individual health risk status (typically includes a range of health risk and behaviour indicators), with higher health risk scores associated with higher costs and:

- there is considerable confidence that the excess risk from health co-morbidities accounts for at least 25% to 30% of medical costs per year across a wide variety of companies, regardless of industry or demographics;
- the biggest cost factors are the cost of extra treatment utilisation, and medical costs associated with the complications of a co-morbidity;
- there is a substantive body of literature indicating that comprehensive workplace-based health promotion programmes promoting health life styles are cost-effective (typical cost-benefit ratio 1:6.3) in reducing economic losses including Workers Compensation costs associated with workers with a risky life style, health co-morbidity or injury experience.

Other findings

Severe acute injury events can lead to chronic health conditions, which in turn can result in increased risk of injury.

Estimates of the attributable burden of injury based upon samples of the injured population may overestimate the burden of injury in the whole population, if they do not adjust for co-morbidity effects in the injured population.

Background: This Report

This report consolidates information from a suite of research initiatives that have been undertaken examining the degree to which health co-morbidities affect ACC injury claims utilisation, and treatment and rehabilitation costs.

The report is intended to address the following questions:

- Does the publicly available international literature support the hypothesis that the existence of a health co-morbidity is associated with an increased injury treatment service utilisation and Weekly Compensation costs?
- Is there New Zealand evidence of such a relationship, and
- if so, what is the size effect on ACC and the wider New Zealand health system?

The following work has been undertaken over the last 18 months to address the questions:

- a brief review of the academic literature on the link between health co-morbidities and risk of injury and extra injury treatment provision;
- a short descriptive epidemiological study using Ministry of Health National Minimum Dataset information to explore whether the existence of a health co-morbidity is associated with higher health system injury treatment costs;
- a large descriptive epidemiological study using HealthStat data, drawn from a large random sample of General Practices (GPs), to explore whether the existence of a health co-morbidity was associated with extra ACC Consultations and, if so to determine the size effect of this;
- a trial study linking ACC and MOH data to examine the effects of selected health co-morbidities upon ACC claims utilisation and costs.

This work demonstrates the utility and on-going necessity, of using linked ACC-MOH data to inform ACC research, policy development, service design and operational decision-making.

Section 1: Introduction and Report Structure

Background

Co-morbidities are diseases or disorders that co-exist with the disease or illness of interest (Hall, 2006; Sarfati, Hill, Purdie, Dennett, & Blakely, 2010). Clinicians have been long aware of the importance of co-morbidity in modifying patient treatment. The presence of health co-morbidity conditions can prolong and complicate treatment, affect the quality of life, and increase the risk of early mortality (Sarfati, Hill, Purdie et al., 2010). Higher rates of injury and costs of workers compensation treatment and rehabilitation for people with high general health risks and co-morbidities are now well described in the international literature. The importance of effects though, has only recently been recognised in health policy and research (Sarfati, Hill, Purdie et al., 2010). Measuring co-morbidity has potentially significant implications for ACC and Ministry of Health service planning, funding, and policy.

ACC is not able to look directly at the impact of health co-morbidity on injury treatment utilisation and costs in its own data because information about the presence of health co-morbidity conditions is not collected in the claims management system. However recent research has demonstrated how routinely-collected Ministry of Health (MOH) administrative data can be used to inform co-morbidity research for health policy and service design (Sarfati, Hill, Purdie et al., 2010; Wright, 2009; Wright & Davies, 2009). The implication of this new research is that by linking ACC and MOH administrative data, ACC may, for the first time, be able to begin to quantify the effect health co-morbidity has upon injury treatment utilisation and costs to the Scheme.

Research Questions

Over the last 18 months ACC Research has undertaken a suite of activities aimed at exploring the effect health co-morbidities may have upon ACC injury treatment utilisation and costs. Specifically:

- Does the publicly available academic literature support the hypothesis that the existence of a health co-morbidity is associated with increased workers compensation injury treatment service utilisation and costs?
- Is there New Zealand evidence of such a relationship, and
- if so, what is the size effect on ACC injury treatment utilisation and costs, claims duration and weekly compensation costs?

The following research activities have been undertaken to address the questions:

1. A brief international literature review of published literature;
2. A study commissioned exploring at primary care level, the relationship between health co-morbidity and ACC injury treatment provided in GP practices (CBG Health Research Ltd, 2009);
3. A study linking ACC and selected MOH administrative data to explore the health co-morbidity effects of diabetes and cardio-vascular heart disease upon ACC injury treatment utilisation and costs for the Scheme as a whole;
4. Two brief case-studies by the Ministry of Health, Health and Disability Intelligence Unit exploring whether:

- a. deteriorating health status affects falls injury severity and mortality (*Wright & Davies, 2009*)
- b. the existence of mental health disorder affects the cost of hospital injury treatment for motor vehicle traffic crashes in the 15-34 year age group, and falls injuries in females aged 75+ years (*Wright, 2009*).

Report Structure

The report is structured into the following sections:

1. Introduction
2. A brief descriptive review of the literature about the effects of a health co-morbidity upon risk of injury, treatment utilisation, and Weekly Compensation costs respectively.
3. Results of a study using GP practice data examining the effects of the existence of a health co-morbidity upon GP and ACC consultation rates respectively.
4. Results of a ACC / MOH data linkage project exploring the effects of selected co-morbidities upon ACC treatment utilisation rates and claim costs.
5. Summary and Conclusions

Section 2: Summary of Literature

Key Findings: Literature on Health Co-morbidity Effects on Injury Treatment Service Utilisation

Health co-morbidity is defined as the existence of a chronic disease or disorder that has a gradual onset, and which co-exists with the disease or illness of interest. Chronic diseases may result in poorer health status and reduction in health life expectancy for those affected by them.

- The literature reviewed, including the limited amount of New Zealand research, is unequivocal that the existence of a broad range of health co-morbidities is associated with increased injury risk, health service utilisation and higher medical treatment costs.
- The presence of one or more health co-morbidities in a patient complicates treatment, prolongs hospitalisation and rehabilitation, and confounds analysis when examining the importance of other risk factors such as age, ethnicity and social deprivation.
- Patients with mental health and behavioural disorders and those with previous injuries respectively, particularly result in rates of utilisation which are at least double compared to those without co-morbidity, and compared to other co-morbidities.
 - A causal link appears to exist between the existence of mental health conditions, risk-taking behaviours, alcohol misuse and psychological characteristics such as impulsivity, sensation-seeking and risk-perception and increased risk of injury and injury treatment utilisation.
- Patients with higher numbers of co-morbidities utilise services more than patients with lower co-morbidities.
- Two MOH pilot studies found that the probability of hospital admission for falls-related injuries significantly increased where substance abuse, anxiety and dementia, and vision impairment were present respectively. The probabilities increased with age, particularly for those in the over 55 year age group.

Workers Compensation

- Higher Workers' Weekly Compensation costs are associated with high individual health risk status (typically includes a range of health risk and behaviour indicators), with higher health risk scores associated with higher costs and:
 - there is considerable confidence that the excess risk from health co-morbidities accounts for at least 25% to 30% of medical costs per year across a wide variety of companies, regardless of industry or demographics.
- The biggest cost factors are the cost of extra treatment utilisation, and medical costs associated with the complications of a co-morbidity.
- There is a substantive body of literature indicating that comprehensive workplace-based health promotion programmes promoting health life styles are cost-effective (typical cost-benefit ratio 1:6.3) in reducing economic losses including Workers Compensation costs associated with workers with a risky life style, health co-morbidity or injury experience.

Other findings

- Severe acute injury events can lead to chronic health conditions, which in turn can result in increased risk of injury.
- Estimates of the attributable burden of injury based upon samples of the injured population may over-estimate the burden of injury in the whole population, if they do not adjust for co-morbidity effects in the injured population.

Introduction and Method

A literature review has been undertaken to identify relevant research-based findings about the effects of health co-morbidities upon injury treatment utilisation and weekly compensation and health care costs.

The literature summarised in this section has been identified by electronic searching of leading injury prevention journals using the key words: co-morbidity, injury, effects and workers compensation, and the “snowball” technique, where reading one article lead to identifying other articles of interest through the reference lists. Using these two techniques 36 articles have been identified and selected as relevant to the topic, and reviewed.

The ‘snowball’ technique identified that the substantive body of literature on the subject resides in the occupational health and safety, and trauma treatment literature respectively, not the injury prevention literature. An unexpected finding was the identification of a substantive body of approximately 500 articles in the health promotion literature examining the cost-effectiveness of work-based health promotion programmes, which target health co-morbidities as a mechanism to reduce medical insurance and workers compensation costs in large companies. Two authoritative meta-analyses of this literature have been attached in Appendix 1 (*Chapman, 2003, 2005; Pelletier, 2001*).

Since the 1980s, staff of the Health Management Research Center at the University of Michigan have been the source of much of the literature describing the links between health co-morbidities in the working population, medical treatment and workers compensations costs (*Burton, Chen, Conti, Schultz, & Edington, 2003; Burton, Chen, Schultz, & Edington, 1998; Edington, 2001; Lynch, Edington, & Johnson, 1996; Musich, Hook, Baaner, & Edington, 2006; Musich, Hook, Barnett, & Edington, 2003; Musich, Napier, & Edington, 2001; Schultz, Chen, & Edington, 2009; Schultz & Edington, 2007; Wright, Adams, Beard, Burton, Hirschland, McDonald et al., 2004; Wright, Beard, & Edington, 2002; Yen, Edington, & Witting, 1994; Yen, Schultz, Schnueringer, & Edington, 2006*). A significant reason for the success of the unit has been access to a large longitudinal dataset, which has been established through the support of a range of large US corporate companies and the Australian Health Management Group (*Edington, 2001*). Sarfati et al (2010) have authored, and identified a few other New Zealand research papers on co-morbidity effects in this country.

Findings

Health Co-morbidity Effects on General Primary Care and Hospital Treatment Utilisation

The effect of a pre-existing health co-morbidity on increased health service utilisation has been well-documented in recent World Health Organisation (WHO) reports (*Cameron, Purdie, Kliwer, McClure, & Wajda, 2007; Cameron, Kliwer, Purdie, & McClure, 2006; Cameron, Prudie, Kliwer, & McClure, 2005*). The findings of these reports were based upon analysis of a population-based matched cohort of injured and non-injured people between 18 and 65 years of age who had been treated for injury between 1988-1991 in Manitoba, Canada.

The authors of these reports have concluded that:

- injured people are different from the non-injured population in terms of pre-existing morbidity;
- the existence of a wide range of health co-morbidities results in significant additional risk of injury-related primary care and hospital treatment utilisation that includes increased use of services including length of stay in hospital;

- patients with mental health and behavioural disorders and those with previous injuries respectively, result in rates of utilisation which are at least double compared to those without a co-morbidity, and compared to other co-morbidities;
- patients with higher numbers of co-morbidities utilise injury services more than patients with lower co-morbidities;
- existing population attributable estimates of injury that extrapolate from samples of the injured population may over-estimate the size of the injury problem (Cameron, Prudie, Kliewer et al., 2005).

The following table highlights the increased primary health care and hospital service utilisation rates associated with the existence of a health co-morbidity compared to those without, which have been reported by Cameron et al (2005). The size of the rate ratio indicates the level of increased risk associated with the general type of health co-morbidity. All rate ratios reported below have 95% confidence intervals that do not cross 1, which means the ratios are statistically significantly different.

The following table shows that people with a prior history of mental health disorders or a previous injury event have been shown to have rates of hospital and GP service utilisation 9.31 and 3.5 times higher respectively compared to those without that type of co-morbidity (Cameron, Prudie, Kliewer et al., 2005).

Table 3: Injury Treatment Utilisation, Health Co-morbidity Rate Ratios Injured / Non-injured

Health co-morbidity (ICD-9-CM Chapter)	Rate Ratios* Injured/ Non-Injured	
	*Adjusted for age, sex and place of residence *	
	Hospital Admissions Claims per 1000 person years	Physician Claims per 100 person years
Mental Health disorders	9.31	3.50
Injury and poisonings	3.68	2.72
Blood diseases	3.36	1.53
Endocrine and metabolic	2.79	1.38
Musculoskeletal disorders	2.61	1.76
Nervous system diseases	2.35	1.42
Respiratory diseases	1.98	1.38
Circulatory diseases	1.70	1.21
Congenital anomalies		1.41
Skin diseases	1.54	1.33
Digestive diseases	1.52	1.62
Infectious diseases	1.50	1.31
Genitourinary diseases	1.46	1.37
Neoplasms		1.27
Source: Adapted from Cameron et al, 2005. Tables 4 and 5 respectively.		

Similarly those with a prior history of an injury or poisoning have hospital admission claim rates 3.68 times higher than those without that co-morbidity.

Other studies of a range of other health co-morbidities report excess health service utilisation and costs of approximately double, compared to the population with no health co-morbidity (Edington, 2001; Musich, Hook, Barnett et al., 2003; Yen, Edington, & Witting, 1991; Yen, Schultz, Schmueringer et al., 2006)

In a recent briefing report for the Australian Institute of Health and Welfare, Cripps & Harrison (2008) have concluded “there appears to an aetiological link between mental health conditions and injury, particularly in relation to risk-taking behaviours, alcohol misuse, and psychological traits such as impulsivity, sensation-seeking, and risk-perception.”

New Zealand Research

Published New Zealand research on the effects of co-morbidity in New Zealand is limited (Davis, Lay-Yee, Fitzjohn, & al., 2002; Hill, Sarfati, Blakely, & al., 2010; Sarfati, Hill, Blakely, & al., 2009; Sarfati, Hill, Purdie et al., 2010). Sarfati et al (2010) in their new study report that:

- Davis et al (2002) found in their study of three Auckland hospitals “that over a third of patients admitted had at least one co-morbid condition, and that co-morbidity was associated with length of stay, mortality and the occurrence of adverse events.
- Stevens et al (2008) found amongst a cohort of lung cancer patients that co-morbidity was “very common” and was “adversely associated with survival.”
- Ministry of Health administrative data “provides a reasonably useful source of accessible information on co-morbidity for risk adjustment particularly in multivariable models.”

In addition to this work, recent unpublished Ministry of Health pilot study research for ACC using administrative data has recently examined the effects of selected co-morbidities on injury hospital treatment (Wright, 2009; Wright & Davies, 2009). This work, available as a Microsoft PowerPoint, found that in the 2007/08 financial year:

- 15-34 year old patients admitted for a motor vehicle traffic crash injuries and who also had a pre-existing mental health disorder, cost, on average, an extra \$683 each compared to those without a mental health disorder (Wright, 2009);
- women aged over 75 years admitted for a falls injury event and who had a pre-existing mental health disorder, cost, on average, an extra \$796 each compared to those without a prior mental health disorder (Wright, 2009);
- analysis of falls-related mortality found that there was a significantly higher probability of death following admission for a falls injury where the following co-morbidities were present:
 - Septicaemia (p= 46%)
 - Acute myocardial infarction (p= 31%)
 - Stroke (p= 22%)

- Heart failure (p=20%)
- Increased falls-related mortality was not associated with coronary heart disease or diabetes (Wright & Davies, 2009).
- probability of hospital admission for a falls injury significantly increases where the following co-morbidities were present 12 months prior to the injury event:
 - substance abuse, at least 5% up to 55 years of age then rapidly increases to 25% up to 64 years, and as high 55% over 80 years;
 - dementia, at least 10% for those over 35 years, increasing to approximately 20% by age 60 years, and then rapidly to 30% by mid-70s, and up to 45% plus for older age groups;
 - anxiety and vision impairment respectively, approximately 4% up to age 65, then rapidly to 10% at 70 years, then higher after that particularly for anxiety disorder (Wright & Davies, 2009).

Un-related to injury, Hill et al (2010) found that after adjusting for co-morbidity effects differences in colon cancer survival rates between Māori with non-Māori were significantly reduced. The implication is, that the presence of health co-morbidity affected the probability of survival for colon cancer.

Workers Compensation

The epidemiologic work of the Health Management Research Centre has consistently documented a positive association between increased health service utilisation (including pharmaceutical services) and workers compensation costs among working people in a variety of settings and a variety of health co-morbidities (Edington, 2001; Forrester, Weaver, Brown, Phillips, & Hilyer, 1996; Goetzel, Anderson, Whitmer, & al., 1998; Mills, Kessler, Cooper, & Sullivan, 2007; Milzman, Boulanger, Rodriguez, Soderstrom, Mitchell, & Magnant, 1992; Morris, MacKenzie, Damiano, & Bass, 1990; Morris, MacKenzie, & Edelstein, 1990; Musich, Hook, Barnett et al., 2003; Musich, Napier, & Edington, 2001; Ostbye, Dement, & Krause, 2007; Pronk, Goodman, O'Conner, & Martinson, 1999; Rochon, Katz, Morrow, McGlinchey-Berroth, Ahlquist, Sarkarati et al., 1996; Schultz, Chen, & Edington, 2009; Truls, Dement, & Krause, 2007; Wardle, 1999; Wright, Adams, Beard et al., 2004; Wright, Beard, & Edington, 2002; Yen, Edington, & Witting, 1991, 1994; Yen, Schultz, Schnueringer et al., 2006).

In addition to increased injury risks, higher medical treatment costs, workers compensation costs, and poor work performance (presenteeism) have also consistently been associated with specific lifestyle risk factors such as tobacco use (current and previous), obesity, stress, and lack of regular physical activity (Cripps & Harrison, 2008; Mills, Kessler, Cooper et al., 2007).

Cost-benefit of work based health promotion interventions

A substantive body of over 500 published health promotion articles has been identified that focuses on the effectiveness of worksite-based programmes to deliver general lifestyle health promotion and injury prevention to employees (Chapman, 2003, 2005; Mills, Kessler, Cooper