NOHSAC
National Occupational Health and Safety Advisory Committee
Komiti Tohutohu Mahi A-Motu Hauora me te Haumaru

THE ECONOMIC AND SOCIAL COSTS OF

OCCUPATIONAL DISEASE AND INJURY

IN NEW ZEALAND

NOHSAC TECHNICAL REPORT 4

ACCESS ECONOMICS
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Glossary of Acronyms

ABS	Australian Bureau of Statistics
ACC	Accident Compensation Corporation
ADMINC	administrative costs (legal, investigation, travel and funeral costs)
AEMC	costs of aids, equipment and home modifications
AWE	average weekly earnings
AWOTE	average weekly ordinary time earnings
BERL	Business and Economic Research Limited
CARERC	costs of carers
CPS	compensation payments in the short run for productivity
CPMED	compensation payments for medical and hospital costs
CPREHAB	compensation payments for rehabilitation costs
CPL	compensation payments in the long run for productivity
DALY	disability-adjusted life year
DOL	Department of Labour
DWL	deadweight loss (associated with transfer payments)
EAI	earnings after incident
EBI	earnings before incident
EEP	employer excess payment
FUNC	funeral costs
GAP_w	gap payments for health services paid for by workers
GDP	gross domestic product
HKC	human capital costs
HSE	Health and Safety Executive (United Kingdom)
ICD-10	International Classification of Disease and Injury, Tenth Revision
ILO	International Labor Organization
INVESTC	investigation costs
IPRU	Injury Research Prevention Unit (Otago University)
LEGALC	legal costs
MEDC	health and rehabilitation costs
MOH	Ministry of Health
MSD	Ministry of Social Development
NOHSAC	National Occupational Health and Safety Advisory Committee
NOHSC	National Occupation Health and Safety Commission (Australia)
NZ	New Zealand
NZHIS	New Zealand Health Information Service

OASCC	Office of the Australian Safety and Compensation Council (Australia)
OECD	Organization for Economic Co-operation and Development
OHS	occupational health and safety
OSH	Occupational Safety and Health Service (Department of Labour)
OTHERC	other costs (carers, aids, equipment and home modifications)
OTP	overtime premium
PDC	production disturbance costs
PHIETC	health and rehabilitation costs not included elsewhere, paid by society
PPP	purchasing power parity
PUBHOSP	public hospital costs for occupational injury and disease
PV	present value (of a future financial flow)
QALY	quality-adjusted life year
SL	sick leave
$REHAB_w$	rehabilitation costs paid for by workers
RETA	average retirement age
RTWA	age of average return to work
STC	staff turnover costs
SUFFC	costs of suffering and premature death
TAXS	taxation transfers in the short run
TAXL	taxation transfers in the long run
TRANSC	transfer costs
TRAVELC	travel costs
UK	United Kingdom
US(A)	United States (of America)
VLY	value of a life year
VOP	value of production
VSL	value of a statistical life
WHO	World Health Organization
WLPI	weeks lost per incident
WPS	welfare payments in the short run
WPL	welfare payments in the long run
YLD	years of healthy life lost due to disability
YLL	years of life lost due to premature mortality

Note: $ means New Zealand dollars unless otherwise indicated.

Executive Summary

This report provides quantitative estimates of the economic and social costs of occupational disease and injury in New Zealand.

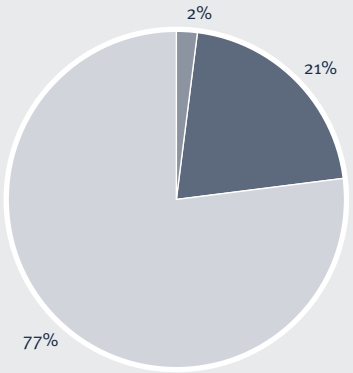
Such a costing is important since there are fundamental flaws in extrapolating information from compensation data to a full costing of occupational incidents or as a basis for policy decisions. Compensation does not cover the full number of workplace incidents and, for those compensated, not all costs are covered. Moreover, the poor coverage is not uniform, so incidents that are more severe, or people with certain diseases that are less well compensated, may suffer unduly if policy decisions are made on the basis of only compensated costs. To achieve socially optimal outcomes, particularly in relation to OHS prevention efforts, it is thus timely to undertake this analysis.

FINDINGS

The investigation found that **only 2% of the full costs of occupational disease and injury in New Zealand ($20.9 billion in 2004–05) are compensated.**

- The full costs include a valuation of suffering and premature death ($16.0 billion).
- These aside, less than 10% of the financial costs of occupational disease and injury in New Zealand ($4.9 billion) are compensated ($480 million in 2004–05).

Costs, by compensation share of total, 2004–05 (%)



Total 2004–05 = $20.9 billion

Compensated financial costs *Uncompensated financial costs* *Suffering (uncompensated)*

COST OF SUFFERING AND PREMATURE DEATH

This cost estimate is based on meta-analysis of willingness to pay estimates from wage-risk and other studies of the value of a statistical life. The large contribution of suffering and early death (three quarters of total costs) is in line with the findings of leading international studies.

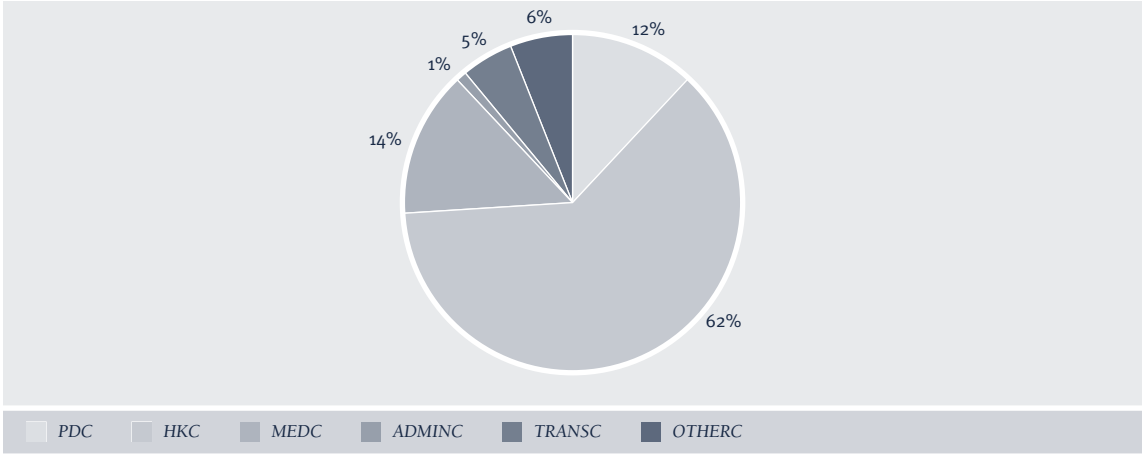
- It is based on the value of a life year in New Zealand of $184,216, derived from the value of a statistical life of $3.9 million and a discount rate of 3.8% over 40 years.
- Since the underlying concepts and their measurement are still potentially controversial, it is suggested that this cost item be separately identified.

FINANCIAL COSTS

The financial cost of occupational injury and disease in New Zealand in 2004–05 of **$4.9 billion (3.4% of GDP)** is categorised into six conceptual groups, consistent with the thrust of the literature. Within each group there may be flows between the "burden-bearers" – employers, workers and society. Calculation of each item depends on the available data, knowing that, for each item, the identity must be satisfied that the total equals the sum of the parts. This provides integrity within the system, as well as cross-checks. The conceptual groups are outlined below.

- **Production disturbance costs – PDC ($573 million)** – comprise the value of production lost between the incident and when a worker either returns to work or is (fully or partially) replaced, as well as the staff turnover costs "brought forward". The employer bears a significant proportion of the PDC burden ($237 million) through overtime premium payments, sick leave, the staff turnover costs and employer excess payments.
- **Human capital costs – HKC ($3.05 billion)** – are the most important single item, reflecting the lost productive capacity of the worker over the longer term – until retirement age. We estimate that $1.88 billion of this cost is borne by workers through lower incomes, while $1.17 billion is borne by society through welfare payments ($393 million), taxation losses ($671 million) and compensation payments (around $104 million).
- **Health and rehabilitation costs – MEDC ($694 million)** – cover the health and 'return to work' expenses of the worker. Of these, most are borne by society through compensation payments ($220 million), public hospital costs ($99 million) and other costs borne by private health insurers, the government and the not-for profit sector ($298 million). The worker bears only $35 million, mainly in "gap" payments, while the employer bears $42 million.
- **Administration costs – ADMINC ($55 million in total)** – include legal costs (negligible), the cost of investigating claims and administration of the compensation system ($32 million), travel costs for workers ($23 million) and the cost of bringing forward funerals (negligible).
- **Transfer costs – TRANC ($238 million)** – are the deadweight cost of administering the welfare system and other government transfers, together with the efficiency losses associated with the need to fund additional welfare payments and replace lost income tax following occupational incidents.
- **Other costs – OTHERC ($293 million)** – comprise the real costs of carers ($223 million) and of aids, equipment and home modifications ($70 million) that may be required by workers who develop disabilities as a result of incidents.

Costs, by type, share of total (%)



WHO BEARS THE COSTS?

Three groups were identified as bearing the costs – employers, workers and society. In allocating costs, we utilised the important distinction between real economic costs (that use real resources) and transfer payments (financial flows) to avoid double-counting.

In 2004–05, employers bore an estimated $287 million (5.9%) of the total financial costs. Workers bore around $2.28 billion (46.4%) and society – primarily through the compensation system and government sector – bore $2.34 billion (47.7%).

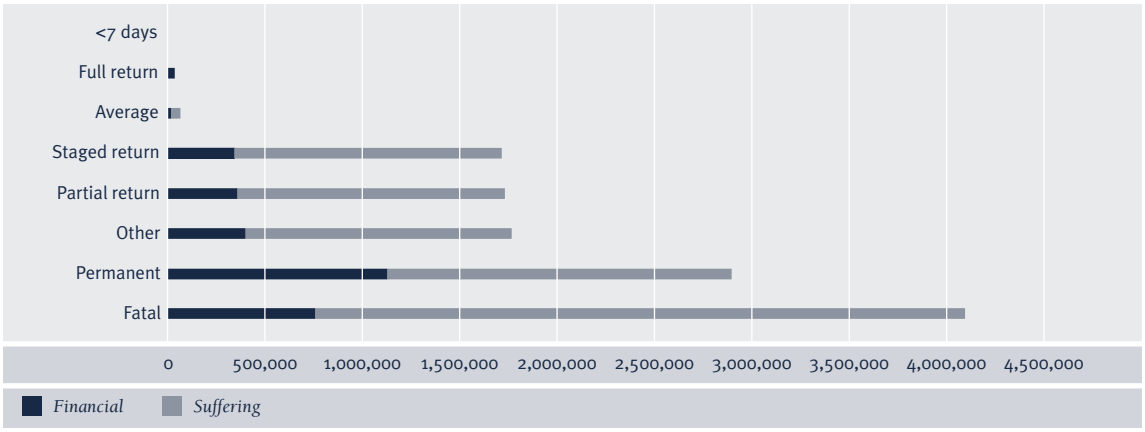
- However, it is important to note that employers also pay the workers' compensation premiums from which society meets in part its lion's share. Were we adopting an "ex ante" measurement approach rather than an "ex post" one, the community share would be lower (around 38%) and the employer share would be higher (around 16%), since $480 million extra would be borne by the employers.
- If the value of suffering and premature death is included and attributed to workers, then their estimated share of the costs of workplace injury and disease is 87.4%, with 11.2% borne by society and 1.4% by employers.

COSTS BY SEVERITY OF THE INCIDENT

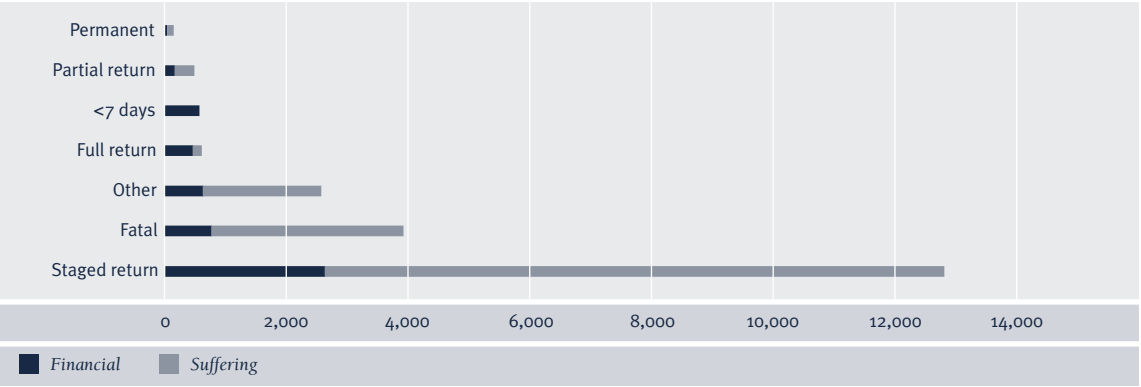
Severity was classified into seven categories as: (1) absence of less than seven days; (2) more than seven days but with a full return to work; (3) staged return; (4) partial return; (5) permanent incapacitation; (6) fatalities; and (7) "other".

- Costs of incidents with a staged return comprise over half of the total financial costs ($2.6 billion).
- The financial cost *per case* is highest for permanent disabilities ($1.1 million), while the total cost per case (including suffering) is highest for fatalities ($3.3 million). Average costs per case were $16,066 and $68,437 respectively.

Cost per case, by severity of the incident, 2004–05 ($)



Total annual cost, by severity of the incident, 2004–05 ($m)

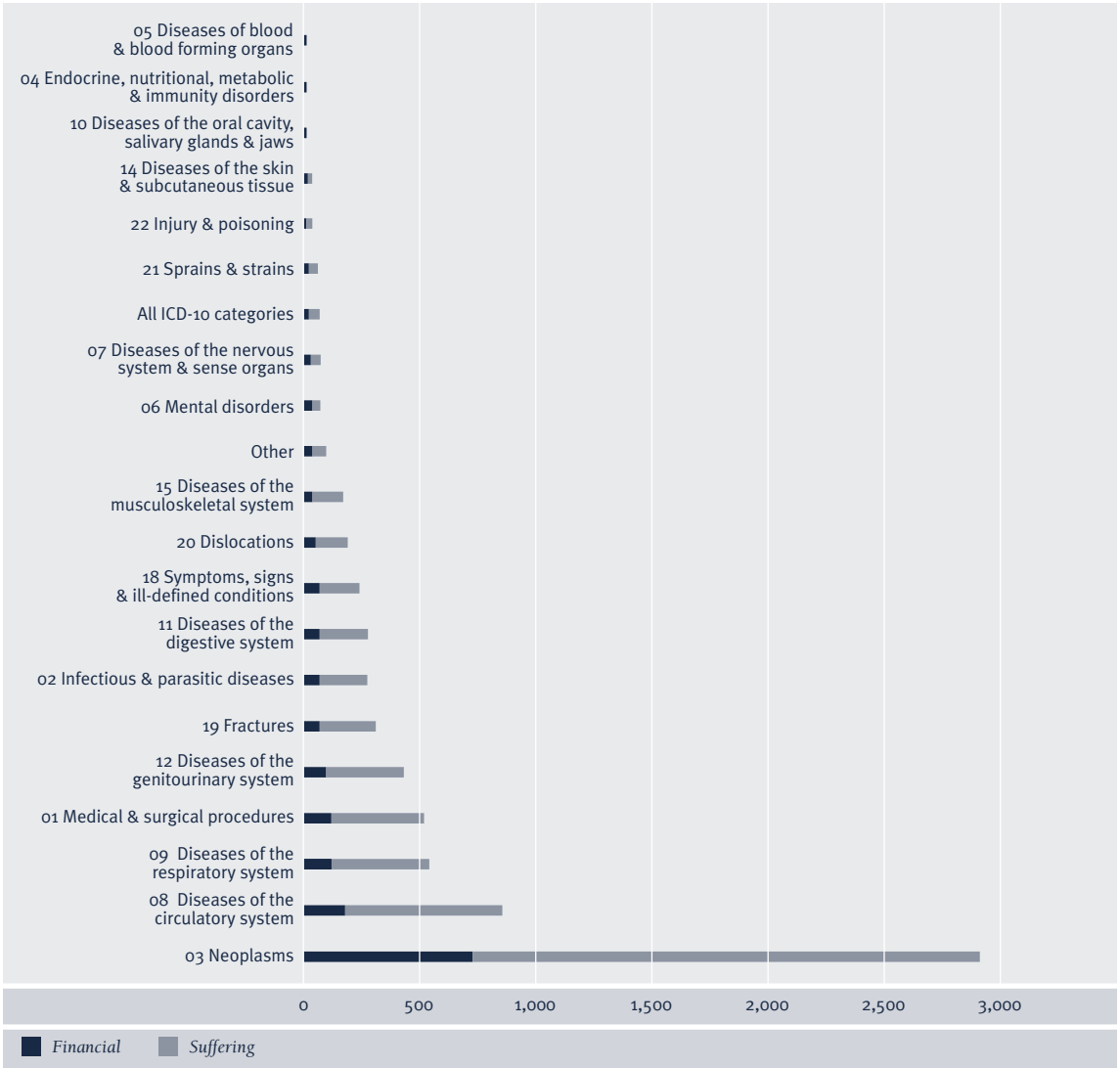


COSTS BY INJURY OR DISEASE TYPE

$15.8 billion (76% of the total annual cost) is due to occupational injuries and $5.1 billion (24%) is due to occupational disease. Of financial costs, $3.8 billion (77%) is due to injuries and $1.1 billion (23%) to disease.

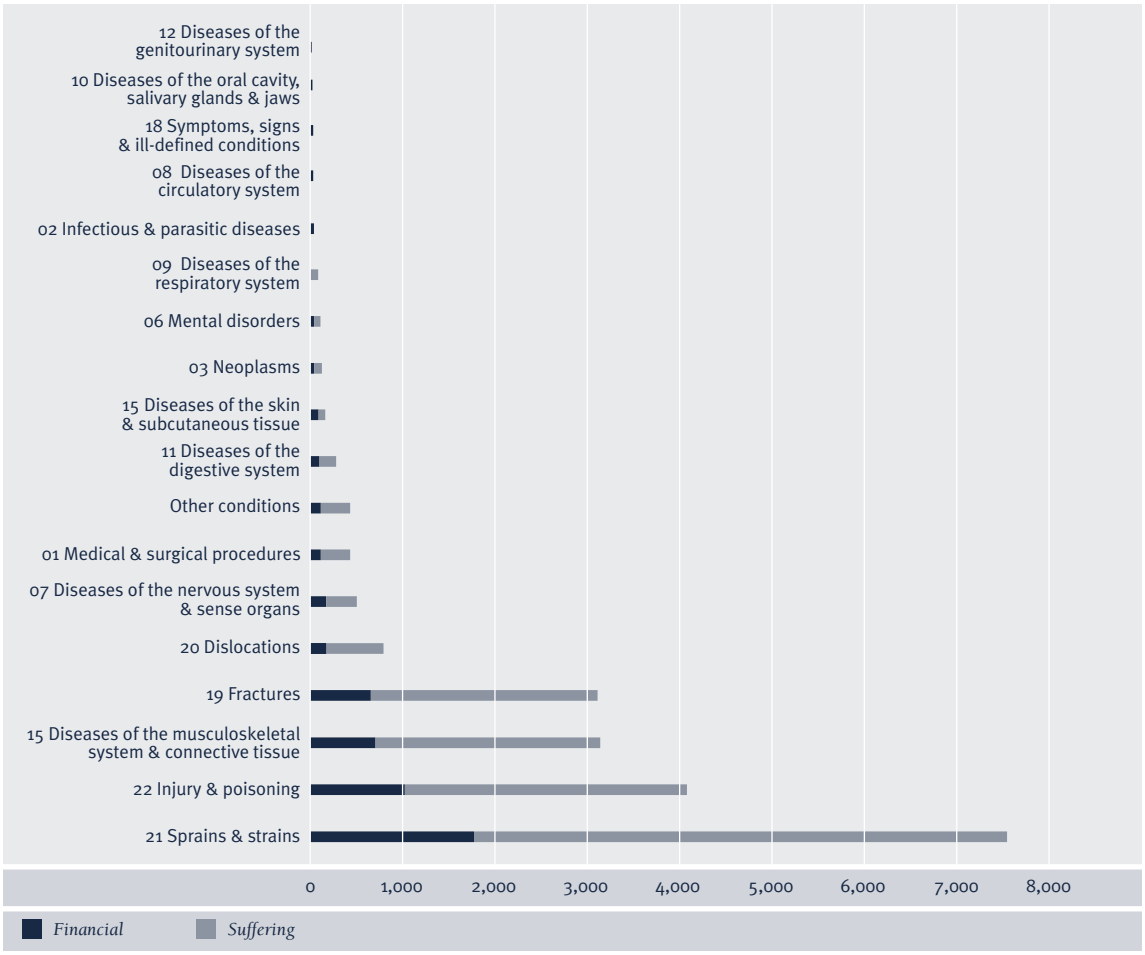
- Human capital costs per case for occupational disease are some six times the next largest cost item, at over $44,500.
- Financial costs per case for cancer are nearly $700,000, with total costs per case (including suffering) of $2.9 million, far higher than any other category.

Cost per case, by ICD-10 category, 2004–05 ($000)



Sprains and strains cost most in total, at $1.8 billion in financial costs and $7.6 billion in total costs (36% of the total costs in 2004–05).

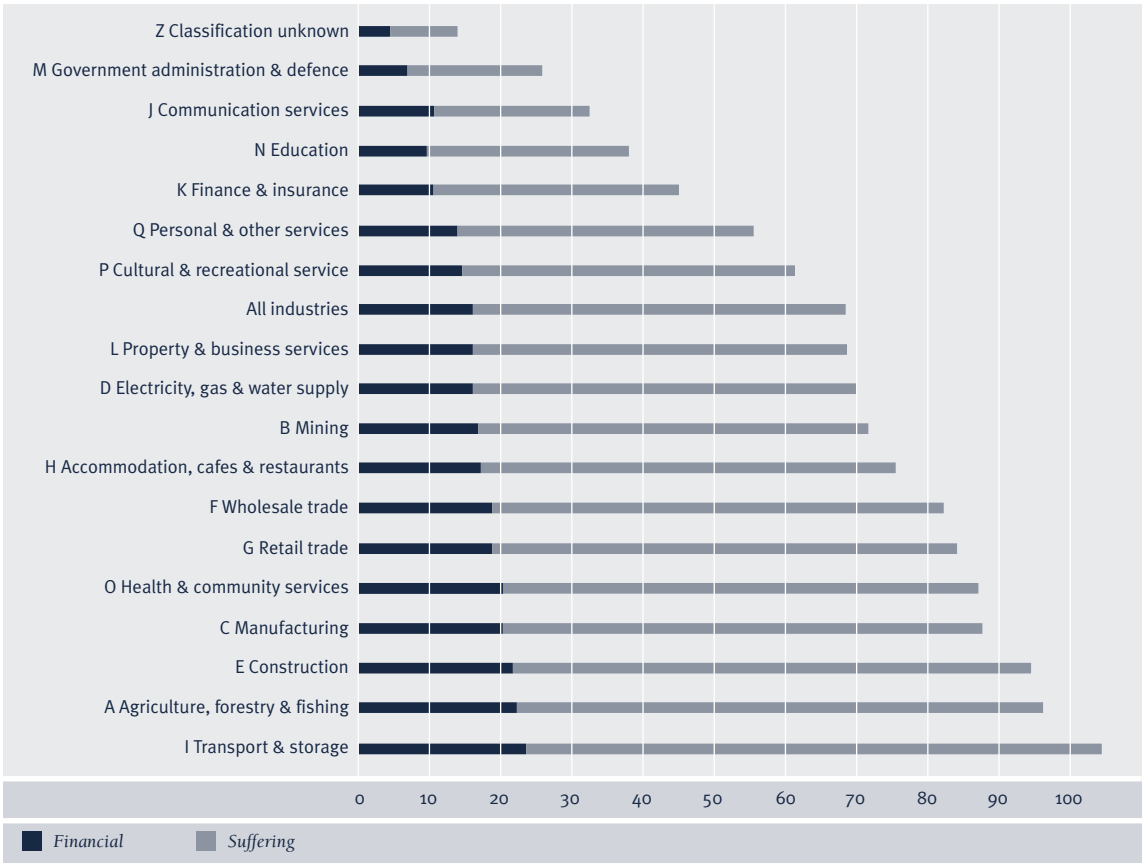
Total annual cost, by ICD-10 category, 2004–05 ($m)



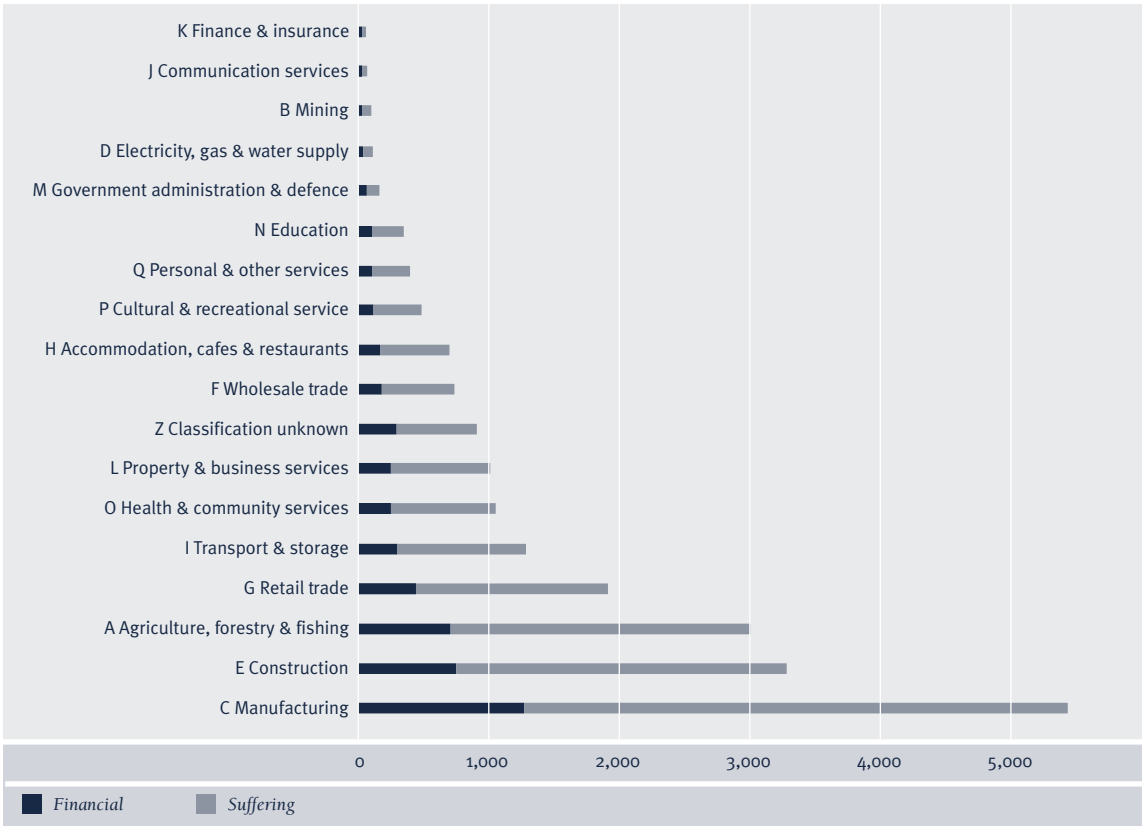
COSTS BY INDUSTRY

Costs in the transport and storage industry (most costly at nearly $24,000 per case) are over three times those in government administration and defence (least costly at under $7,000 per case). Agriculture, forestry and fishing; construction; and manufacturing rank second, third and fourth most costly respectively, in terms of costs per case. Costs are relatively best compensated in the mining industry, but even so, this only extends to cover 4.6% of total costs. As a share of total costs, manufacturing is largest at $1.3 billion in financial costs and $5.4 billion in total costs (one quarter of the total for all industries).

Cost per case, by industry, 2004–05 ($000)



Total annual cost, by industry, 2004–05 ($m)

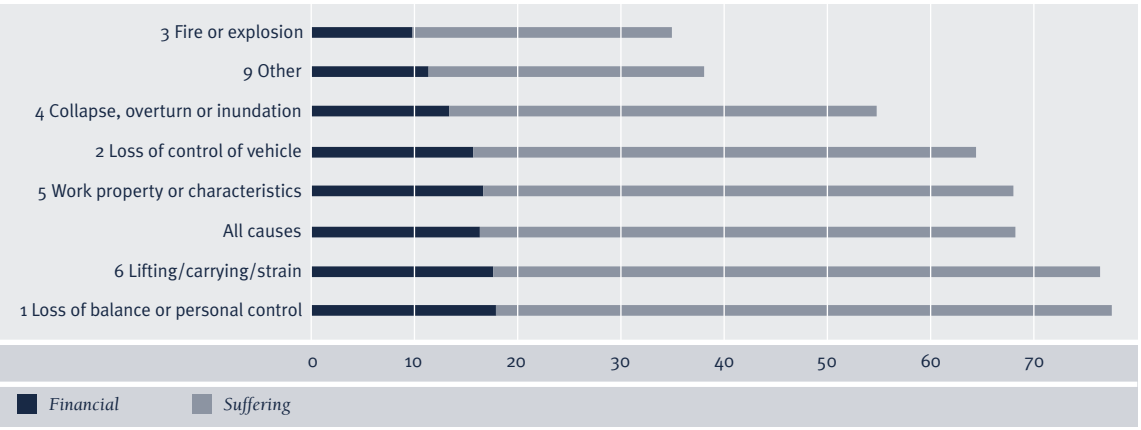


There are less differences within the other sub-strata.

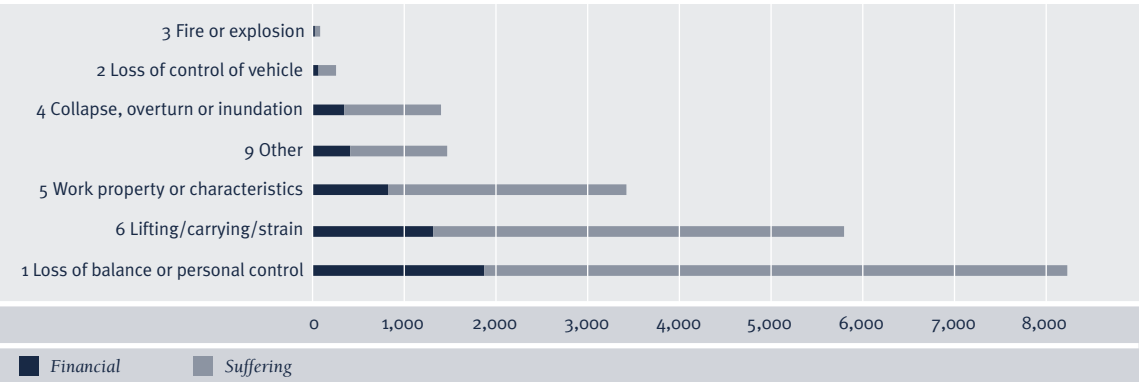
Financial and total costs per case respectively are highest for loss of balance or personal control ($17,775 and $77,878) and lowest for fire or explosion ($9,399 and $34,980). Loss of balance or personal control is also largest overall, with $1.9 billion in financial costs and $8.3 billion in total costs (approaching 40% of the total).

Cause

Cost per case, by cause, 2004–05 ($000)



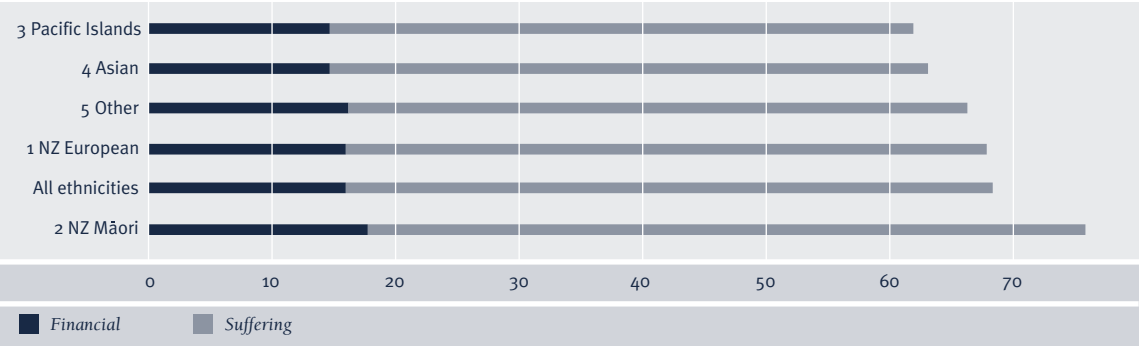
Total annual cost, by cause, 2004–05 ($m)



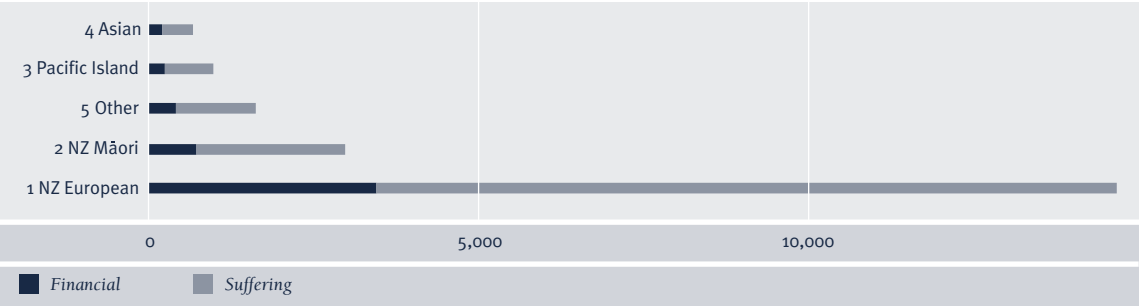
Ethnicity

Financial and total costs per case respectively were highest for NZ Maori people ($17,816 and $76,037) and lowest for Pacific Island people ($14,561 and $62,078). Costs for NZ Europeans were, reflecting their population share, the largest cost component at $3.4 billion in financial costs and $14.7 billion in total costs (70% of the total).

Cost per case, by ethnicity, 2004–05 ($000)



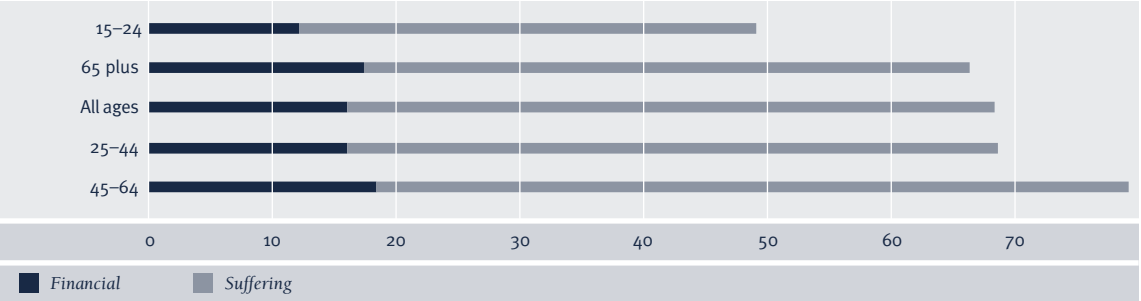
Total annual cost, by ethnicity, 2004–05 ($m)



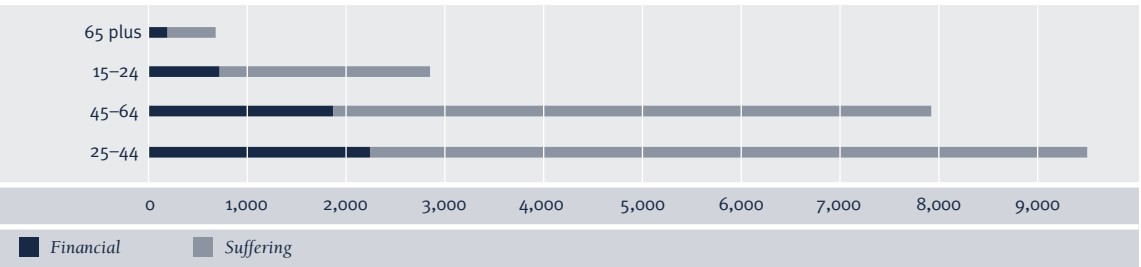
Age

Financial and total costs per case respectively were highest for people aged 45–64 years ($18,403 and $79,288) and lowest for people aged 15–24 years ($11,953 and $49,143). However, costs for workers aged 25–44 years were largest at $2.2 billion in financial costs and $9.5 billion in total costs (over 45% of the total).

Cost per case, by age, 2004–05 ($000)

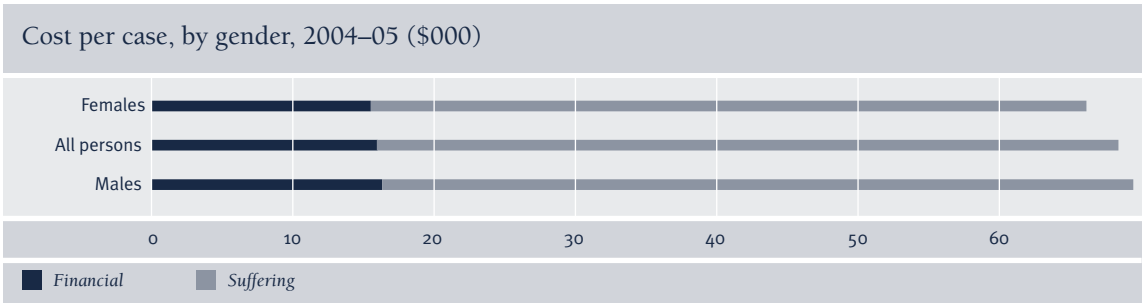


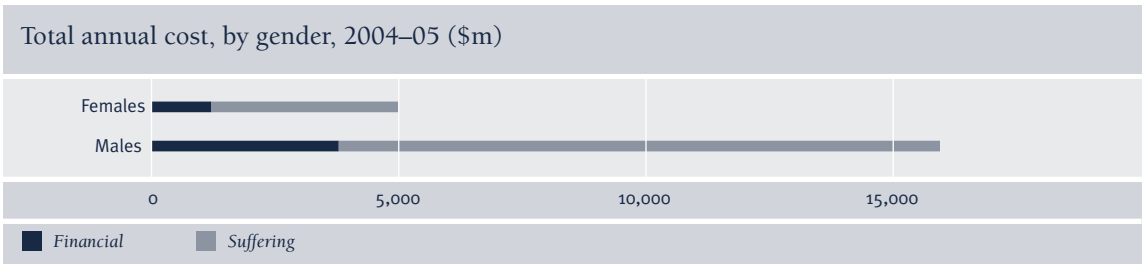
Total annual cost, by age, 2004–05 ($m)



Gender

Financial and total costs per case respectively were higher for males ($16,280 and $69,212) and lower for females ($15,407 and $66,061). Costs for males were $3.7 billion in financial costs and $15.9 billion in total costs (76% of the total).





METHODOLOGY AND DATA

- An "incidence approach" is used to measure new cases of occupational disease and injury from end-March 2004 to end-March 2005 (2004–05).
  - An incidence approach assesses the costs associated with the number of new cases of occupational injury and disease each year, while a prevalence approach assesses the costs associated with the number of people who have any occupational injury or disease in a year, with the incident potentially occurring in the current or past years.
  - The ACC compensation data that underlie aspects of the analysis are far more amenable to an incidence approach, and potential weaknesses in the data (eg, due to delays in reporting) were overcome by using an "ultimate cost" (future expected costs) approach on the basis of the ACC Statistical Case Estimate Model, as well as by comparing with average historical data to smooth the impact of any anomalies.
- We do not utilise the unhelpful distinction between direct and indirect costs, nor do we include conceptually different costs, such as property damage, loss of goodwill or preventive costs, rather using an ex-post human cost per case approach.
- Literature analysis and consultation informed the methodology, matrix classification, analysis and findings.

NUMBER OF INCIDENTS

From the ACC data and key literature (particularly Driscoll et al,[1] the number of cases of occupational disease and injury was estimated for 2004–05 as 305,150 (256,894 to 353,407), a 16% margin each side based on low and high scenarios regarding compensation accessibility).

- Of these, 253,812 (83%) are compensated and 51,338 (17%) uncompensated.
- Some 239,894 (94%) are due to injuries and 13,918 (6%) are due to disease.

While the estimates from Driscoll et al[1] are the best currently available, it should be noted that they appear very conservative, and thus in our view there is considerable risk that the number and proportion of uncompensated cases (particularly for disease) in New Zealand is, in fact, higher than the estimates presented in this report. As such, the associated cost estimates are likely to be conservative.

Access Economics
6 March 2006

SECTION ONE

INTRODUCTION

Access Economics was commissioned by the National Occupational Health and Safety Advisory Committee (NOHSAC) to provide quantitative estimates of the economic and social costs of occupational disease and injury in New Zealand, drawing on information contained with the NOHSAC report *The burden of occupational disease and injury in New Zealand: Technical Report*.[1]

The National Occupational Health and Safety Advisory Committee (NOHSAC) is responsible for providing independent advice to the Minister of Labour on occupational health and safety issues in New Zealand. NOHSAC plays a key role in providing an independent assessment to the Minister on the major occupational health and safety issues for the New Zealand workforce, of advising on the measures that would deliver the greatest benefit for the prevention of occupational injury and disease, and in developing an evidence-based approach to occupational health and safety issues. In addition to the Committee and Minister, this report is intended to inform the Associate Minister of Labour, policy analysts, researchers and health and safety professionals.

The structure of the report was agreed in consultation with NOHSAC and aims to highlight knowledge gaps as well as what is known. Methodological specifications for the project included the following.

- Use of an "incidence approach" to measure new cases of occupational disease and injury in a jointly determined reference year, or a prevalence approach if an incidence approach proved too difficult.
- Examination of a matrix of economic and social costs, taking into account:
  - severity of the disease or injury, distinguishing fatalities, permanent incapacitation and at least three other categories of less severe incidents
  - "direct" and "indirect" costs, including compensated costs, medical and rehabilitation costs, investigation costs and fines, lost productivity from current and future earnings, and other costs of assistance
  - estimates of pain, suffering and early death, using internationally accepted measurement methods.
- Presentation of estimates by:
  - industry
  - gender, ethnicity and age groups
  - severity
  - cause
  - disease and injury type.
- Identification and description of appropriate methodologies, review of relevant literature and consultation with relevant agencies and organisations, including consideration of existing reports and reviews describing the economic and social costs of occupational disease and injury in New Zealand.
- Discussion of limitations of the costing analysis.

Compliance costs for employers are not within the scope of the report.

SECTION TWO

LITERATURE AND

METHODOLOGY

2

This section summarises the literature review that informs the report, as well as outlining broad methodological issues.

2.1 PREVIOUS NEW ZEALAND WORK

2.1.1 2004 TECHNICAL REPORT

The burden of occupational disease and injury in New Zealand: Technical Report[1] was prepared by NOHSAC to provide understanding of the state of occupational injury and disease in New Zealand and an evidence base for decisions by NOHSAC and the Minister regarding future activities and priorities.

Methods

The information in the report was based on published literature and other relevant information from government reports, online sources and other appropriate sources. For each condition, information was presented on exposures, occupations and industries known or suspected to be associated with increased risk. This information was based on New Zealand and international literature, but in most cases the available New Zealand information was not comprehensive. Where international information was used, review articles were relied upon as much as possible, but individual studies were also included where relevant.

All conditions for which there was considered to be reasonable evidence of causation related to work were included, on the basis of two recent review articles, identified literature and conditions of particular relevance to New Zealand.

The report includes quantitative estimates of the annual number of deaths from occupational disease and injury, and the annual number of new cases of work-related disease and injury in New Zealand.

Results

The report found that there are a large number of occupational exposures and activities that carry an increased risk of disease or injury. These include a number of recognised causes of occupational cancer (particularly lung cancer, mesothelioma, prostate cancer, bladder cancer, stomach cancer, colon cancer, pancreatic cancer and hematologic cancers), respiratory disease (particularly asthma, chronic obstructive pulmonary disease and pneumoconioses), diseases of the nervous system (including peripheral neuropathy and chronic solvent-induced toxic encephalopathy), vascular diseases (particularly ischaemic heart disease), musculoskeletal conditions (including upper limb disorders and low back pain), noise-induced hearing loss, vibration disorders, and various causes of fatal and non-fatal injury (particularly in agriculture, forestry and fishing, mining, construction and transport).

The report estimated that each year in New Zealand there are:

- about 700–1,000 deaths from occupational disease, particularly cancer, respiratory disease and ischaemic heart disease
- about 100 deaths from occupational injury
- 17,000–20,000 new cases of work-related disease
- about 200,000 occupational accidents resulting in ACC claims, about half of which result in disability, and about 6% in permanent disability.

The report concluded that work-related disease and injury is responsible for considerable morbidity and mortality in New Zealand, requiring a balanced approach in which both the prevention of work-related disease and the prevention of work-related injury receive appropriate attention and resources from the Occupational Safety and Health Service and other government agencies.

- For mortality, disease represents a considerably greater (ten-fold) burden than does injury; about one-third of the work-related deaths are due to cancer, and substantial proportions are due to respiratory disease and ischaemic heart disease.
- On the other hand, work-related accidents and injuries represent a greater burden of morbidity.

Finally, the report concluded that the development of effective and comprehensive New Zealand systems for the surveillance of work-related disease and injury is a priority, in particular to redress the lack of information on work-related morbidity and mortality in women, Māori and Pacific people, and work-related injuries and disease sustained by bystanders, as well as further research required on costs. (This current report will contribute in relation to the latter research.)

2.1.2 THE 2002 "AFTERMATH" REPORT

A moving 2002 report based on case study research was initiated by the Occupational Safety and Health Service (OSH) of the Department of Labour with the Accident Compensation Corporation, titled *Aftermath: The social and economic consequences of workplace injury and illness*.[2]

The report noted that, while some costs of workplace injury or illness are well documented, the full extent and distribution of such costs and consequences are often not measured or recorded. Employees who are harmed, and their family and friends/colleagues, inevitably bear much of the burden, much of which is "intangible" in an economic sense.

> The experience of being harmed at work can be devastating, with profound emotional consequences for all those involved. People may become isolated, estranged from their community and depressed. Isolation and estrangement can become permanent. The widow in the study expressed the profound and lasting impact of her husband's injury on her: "There was never a point to say goodbye to a marriage and that of all things of the whole lot I feel I have lost. I have lost my marriage... I always feel I live in the shade, I no longer live in the sun." (Ian's wife)[2]

Methods

The study aimed to gain an understanding of the full range of consequences of workplace illness and injury by examining the costs through the experiences of the affected participant, their family, friends, colleagues, employers and supervisors. The methodology centred on four research questions:

1 Identifying the main social consequences and how they can be avoided.
2 Their key characteristics (gender, ethnicity, age, family status, injury or illness type and location).
3 The nature and value of financial costs (loss of income, medical costs).
4 The links between social consequences and economic costs.

The approach used iterative quantitative and qualitative methods, triangulating data from a number of sources, including existing ACC and OSH research, analysis of stakeholder views, and interviews with the affected person, their family, workmates, and, if appropriate, OSH and other health professionals. Fifteen "serious" cases were selected, of which all but one had been the subject of an OSH investigation. Economic costs were categorised as:

- unknown economic costs – costs whose dollar values were not known
- known economic costs – specific dollar costs.

Who bore the costs was derived from both documented and secondary sources. Social consequences were not given a dollar value.

Findings

The research produced seven principal findings from analysis of the case studies:

1 **Minor mistakes cause big consequences** – Workplace injury or illness often resulted from minor oversights, failures or assumptions in systems or practices.[i]
2 **The consequences ripple out** – Injury or illness had huge consequences, not just for the employee but for their family, workplace and community.
3 **Costs were enormous, non-recoverable and ongoing** – Quantifiable and unquantifiable costs continue to compound long after the injury or illness event and are not compensated in many cases.
4 **In spite of common characteristics between cases, consequences varied greatly** – Overlapping personal, social, organisational and environmental variables all affected the consequences of the injury or illness.
5 **Relationship between cause and consequence** – If a company had good health and safety systems integral to the work environment, their support systems for injured or ill employees were also better.
6 **Over-arching cost determinants** – Inter-dependent cost determinants included isolation, suffering, responsibility, blame, power and understanding, which influenced the recovery and coping ability of those affected.
7 **Support** – Better support resulted in better rehabilitation outcomes and an easier return to working and community life.

The findings were also segmented for five areas of society – the participant, their family and friends, the workplace, the medical sector and the government. Key findings relevant to this present study are presented below.

- Injured employees bear about 30% of the total costs.
- The share of costs borne by injured employees rises sharply with severity while the share borne by the employer falls.
- Intangible losses were of health, intimacy, security and lifestyle, while financial losses included ongoing medical costs, direct income loss, transport costs, legal costs and losses related to lifestyle changes.
- Documented costs borne by the 15 participants themselves and their immediate family were $56,952 (not including "potential" income loss considered too difficult to quantify).
- In all the cases, the family suffered emotionally, mentally and financially, with a major impact being the amount of follow-up care provided for the person affected, or assuming their normal responsibilities when they were unable to perform them.
- Major workplace costs were in relation to lost production and morale, extra health and safety compliance work, damage to plant and equipment, loss of business due to public odium, legal costs resulting from fines and prosecutions (including preparing for cases) and staff costs – the later comprised of hiring and training new staff, paying out redundancy and "over-employment" (creating a new job while the worker recovered). Less tangible costs included the loss of a friend and colleague, the immeasurable impact of feeling responsible for an injury or illness or fatality and possible animosity towards the injured or ill employee.

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i The total loss control theory of accidents, first developed by Heinrich in the 1950s, aims to express a rule of distribution of the consequences of a particular type of work accident. Heinrich analysed 1,500 enterprises in 1931 and concluded that the invisible part of accidents was four times the visible part. Thus, behind one visible case of major injury, there were 29 cases of minor injuries and 300 "no injury" accidents. Numerous researchers have subsequently argued for different ratios based on the same triangular model.

- The total documented costs to the fifteen workplaces in the study was $477,830.78 plus six months, two days, and 12 hours of company time (not costed). This did not include undocumented costs, such as lost production, which would add considerably to the total.
- With all the occupational illness cases, there was considerable debate and delay over diagnosis and whether the illness was work-related, because enforcement or compensation was involved. A visible injury was more readily accepted and the work-relationship indisputable.
- Delays led to increased pain, delayed recovery, adverse psychological and emotional reactions, and medical complications because of delays in treatment for participants. Overall, the cases revealed there was a lack of knowledge and resources in relation to occupational health medicine.
- Direct impacts for government covered such actions as enforcement, investigation and payment of compensation/rehabilitation, while indirect impacts included education and prevention programmes, infrastructure and services, and provision of the justice system, such as courts and the collection of fines. There were costs to the economy through the loss of paid and unpaid work, and the government lost taxation revenue.
- ACC's costs were wide-ranging, from the funding of acute health care to rehabilitation, to income replacement and the costs of administration. ACC pays for most public health costs of injured employees through bulk payments to the Ministry of Health. The total cost of entitlement claims for ACC does not represent the total cost of ACC's financial contribution to injury.
- OSH's quantifiable economic costs arose from investigations, assigned according to hours worked based on staff salaries (overheads were not included). Social costs in administering legislation were not included (eg, stress and fatigue occasioned through having to deal with fatalities, serious injuries, catastrophic situations and distressed and injured people).
- Documented costs for the government (excluding ACC), including OSH costs and sickness benefits, were $46,488.89, plus over 390 hours of inspector time. This did not include undocumented government costs.
- The documented costs for ACC and the private insurer for the 15 cases in the study were $585,400.17. The cost of medical treatment or public health acute services received under ACC's bulk funding of the health sector were estimated (not including time or administration costs) – projected future costs for these cases are expected to be $3,985,989.
- The total documented costs for these 15 cases was $1,167,471.84.
- The total projected future costs of the seven cases that were still receiving ACC and private insurance payments was expected to be $3,985,989.
- These estimates do not include the time of OSH inspectors, ACC case managers, workplaces, individuals and their families. It also does not include the loss of income borne by individuals and their families as a result of their injury or illness.

> To understand the total social and economic consequences requires going beyond statistics and recording economic costs. Gaining a human perspective of costs incurred allows us to understand the non-economic "costs" and the complex inter-relationship between economic and non-economic consequences.
>
> Understanding how the social and economic consequences apply increases our understanding of the impacts on people of policy and legislation. But importantly, it also contributes to our understanding of how to minimise the aftermath of occupational injury and illness and plan appropriate preventative measures and support systems. The fifteen case studies illustrated common experiences of employers, working people and their families, but they also showed how certain factors are likely to alter the outcome in a positive or negative way. This study highlights the debilitating effect of not minimising workplace injury and illness; for the injured or ill worker, their friends and family, workplace, and the substantial costs to government and its agencies.[2]

1998 Victoria University Study

An early study from Victoria University, "The direct and indirect costs of work injuries and diseases in New Zealand",[3] estimated costs for the year 1995. A review of the international literature review led to a taxonomy of indirect costs loosely based on that of the Australian Industry Commission's 1995 study,[4] with further sub-categorisation into community, employer and employee costs. Cost estimates were derived primarily from data supplied by the Accident Rehabilitation, Compensation and Insurance Corporation, the Department of Social Welfare and the Department of Labour. Indirect costs did not include lost leisure, low self-esteem, reduced social interaction, care by family members, lost educational investment, travel concessions for disabled workers, increased use of community services nor the replacement and repair of capital and material damaged in a work injury or disease incident. However, the study did include costs omitted from the Industry Commission's study, such as recruitment, selection and training costs and legal penalties.

Direct costs, defined as those paid by the ACC Employers' Account and financed by employer payroll premiums, were estimated to cost $912.7 million. Indirect costs, defined as all other estimated costs that were not direct, were estimated as $314.7 million, a ratio of 1:2.9 relative to direct costs, much lower than other studies. The grand total was thus estimated in 1995 as $1.23 billion, with component elements summarised in Table 2.1.

TABLE 2.1 Costs of work injuries and disease in New Zealand, 1995

DIRECT COST ELEMENT	$000	INDIRECT COST ELEMENT	$000
Injury prevention	**1,968**	*Indirect community costs*	
Rehabilitation benefits		Accident investigations by OSH	6,342
Vocational rehabilitation	4,152	Social welfare benefits	40,263
Social rehabilitation	22,141		**46,605**
Medical treatment	51,281	*Indirect employer costs*	
Hospital treatment	9,081	Lost labour time	25,199
Public health care	36,693	Accident investigations	6,342
Dental treatment	2,011	Legal penalties	1,022
Travel	4,948	Recruitment selection and training	42,033
Miscellaneous benefits	3,183		**74,596**
	133,490	*Indirect employee costs*	
Compensation benefits		Health and medical services	29,013
Weekly compensation	571,054	Partial loss of earnings	149,063
Independence allowance	3,818	Full loss of earnings	15,419
Lump sums	78,989		**193,495**
Death benefits	27,743		
	681,604		
Other payments			
Research grants	1,141		
Collection fees paid to Inland Revenue	15,196		
Interest on borrowing	3,962		
	20,299		
Share of operating costs	**75,335**		
Total direct cost	912,696	Total indirect costs	314,696

Source: Head and Harcourt[3] (50-51).

Methodological weaknesses in the Industry Commission approach are discussed in detail in Access Economics report,[5] which led to the methodological improvements of that report. The Victoria University study itself notes the disparities with international findings and postulates that some of the reasons for the differences may include the following.

- Direct costs in New Zealand include what may be indirect costs in other counties (eg, ACC funding of health and medical treatment), so that the ratio of indirect to direct costs is necessarily smaller. (In most studies, indirect costs are generally some multiple of direct costs.)
- ACC entitlements are believed to be more generous, widely available and easily accessible in New Zealand than overseas, encouraging more people to claim larger benefits.

  In Australia, for example, only 45% of victims file claims for compensation (Worksafe Australia, 1994:ix) whereas the ACC maintains that nearly all injured workers in New Zealand do so. In addition, Australian compensation is in many cases limited to small lump sum payments rather than, as in New Zealand, weekly compensation until retirement.[3]
- In addition, several direct costs may have an additional indirect component, because of insufficient funding by the ACC, eg, the "tiny" independence allowances for pain and suffering or rehabilitation, and medical or travel (eg, ambulance) expenses borne by the employee or their employer that are not claimed, partially reimbursed or rejected.
- The annual indirect costs could be larger than the total cost estimated in the study, because so many costs were omitted or underestimated due to the absence of reliable data. This was particularly true for the cost of recruitment, selection and training, for lost labour time and for full and partial losses of earnings.

2000–2001 research

In 2001, the Department of Labour and the Accident Compensation Corporation (ACC) undertook research into the effectiveness of health and safety legislation through case studies. This followed earlier (2000) New Zealand research that focused on the potential costs to the business sector arising from complying with the Health and Safety in Employment Act 1992 (HSE Act). It found that these costs were hard to identify and quantify. Other research by the Ministry of Economic Development examined the effect of the costs of compliance on employers. Although these costs were seen as part of business, there were concerns about their nature and extent, particularly for small-to medium-size enterprises, and their impact on competitiveness, innovation and investment. However, this research has provided only indirect insight into the social consequences of injury and illness in the workplace, focusing more on compliance.

Costs of Injury Project

The Costs of Injury Project, initiated by the Ministry of Research, Science, and Technology in 2002–2004, involved two phases. The first phase in 2002 reviewed alternative cost methodologies, undertaken by Business and Economic Research Limited (BERL) in 2002 and also reviewed agencies' costs of injury information needs, undertaken by the Department of Labour, as well as a Costs of Injury Symposium in 2002.

The key message that emerged from the Symposium was that a clear direction needed to be set for the project over the next 5–10 years.

The second phase of the project, therefore, involved the development of a Costs of Injury Strategy. A Costs of Injury Framework was identified as an achievable output for the strategy. To assist with refining this framework, a stock-take was commissioned in 2003 from BERL, and an investigation of a method to estimate the cost of inpatient care was commissioned in 2003 from the Injury Research Prevention Unit (IPRU) at Otago University. The second phase of the costs of injury project culminated in the preparation of a report jointly undertaken and supported by the Department of Labour, Accident Compensation Corporation (ACC), NZHIS, Land Transport Safety Authority (LTSA), the Ministry of Transport, and Statistics New Zealand.[6] This report is summarised next.

2004 Measuring the costs of injury in New Zealand[6]

The DOL report was premised on the fact that information on the costs of injury is necessary to assist with managing the incidence and severity of injuries in New Zealand, and that the costs of injury provide an important and readily interpretable insight into the relative impact of injuries on New Zealanders to inform decision-making such as:

- deciding whether to invest in injury prevention, rehabilitation and compensation initiatives and, if so, how much
- setting and evaluating outcomes and priorities for allocating resources between different injuries
- deciding who should bear the costs of injury.

A Costs of Injury Framework was used to explore the current state of information, based on cost categories and perspectives. Cost categories included resource costs (costs relating to treatment and rehabilitation and loss of output or productivity) and human costs. Cost perspectives refer to who bears the costs in the first instance, and include individuals and their families, employers, government and society. A series of key statistics and indicators were identified from key policy questions in the report to support each cost category-perspective combination in the framework.

This report explored information on consequential costs of injury only (ie, not preventive costs and not disease). The report found that current information for measuring the resource costs of injury to government is noticeably better than for individuals, employers and society. In contrast, current information for measuring the human costs to individuals is noticeably better than for employers and government, but is not complete or consistent across injury sectors, although there is scope to enhance this with the aid of data-integration or economic modelling. For example, a monetary value of a statistical life (VSL) is used in some sectors (eg, transport), while qualitative costs have been identified for workplace injuries. (This current report will help in this respect.)

FIGURE 2.1 Summary of state of (and potential to improve) information on costs of injury

	COST PERSPECTIVES:			
COST CATEGORIES	INDIVIDUALS AND FAMILY	EMPLOYERS	GOVERNMENT	SOCIETY
TREATMENT AND REHABILITATION COSTS	Poor (Medium)	Poor (Low)	Good (Medium)	Poor (Medium)
OUTPUT AND PRODUCTIVITY COSTS	**Poor (High)**	Poor (Medium)	Good (Low)	Poor (Medium)
HUMAN COSTS	Moderate (Medium)	Poor (Low)	Poor (Low)	Moderate* (Medium)
TOTAL COSTS	Poor (Medium)	Poor (Low)	**Poor (High)**	Poor (Medium)

** Aggregate measure is used*

Source: Department of Labour.[6]

Figure 2.1 summarises the findings on the current state of information in respect of each of the different combinations of cost categories and perspectives and (in brackets) the potential for improving that information. This potential was rated low, medium or high to reflect the expected cost and effort of improving information and quality of and need for improved information. Areas of real potential to improve information are bolded. The shaded areas represent areas that were considered not worth exploring, either because the expected cost and effort of improving information is considered too great, or because the information is unlikely or does not need to be improved to a significant extent.

Care needs to be taken with measuring total costs (eg, total costs to society) because of issues with aggregation across different cost categories and perspectives.

A range of further work was identified to produce the cost information identified. This work includes new or improved data collection, data integration, economic modelling, proper research of the pros and cons of internationally-recognised measurement approaches, and consideration of the applicability of overseas cost estimates.

Complex issues surrounding cost measurement affect the ability to produce some of the key statistics, including technical feasibility, privacy and data security, benefit-cost optimisation and the possible need for additional base data or analytical models. The expectation is that Statistics New Zealand, in their new role as Information Manager, will be responsible for managing this cost data as part of the injury database they are developing of integrated ACC and NZHIS data.

The primary source of cost information is administrative data from the ACC. Some useful cost statistics could readily be produced by ACC, including:

- individuals' loss of pre-injury earnings from injuries that are compensated by ACC (also a proxy for total loss of pre-injury earnings)
- treatment and rehabilitation costs of injuries to ACC and other government agencies (both actual and lifetime costs).

Administrative data from the New Zealand Health Information Service (NZHIS), Inland Revenue Department (IRD), and the Ministry of Social Development (MSD) also provide substantial insights into costs associated with treatment and rehabilitation and loss of output and productivity.

Linking ACC data with these other data sources offers the most potential for measuring these costs—particularly at a confidentialised unit record level, which is necessary to generate average information across a range of injury and population groups. The main areas of potential are improved information about hospital inpatient costs, comparison of pre- and post-injury incomes and potential incomes to individuals, and indicators of severity/incapacity of injury, including improved "volume" estimates of loss of life and life expectancy. Statistics New Zealand has recently confirmed that ACC and NZHIS data can be integrated to a suitable level of quality and confidentiality.

By way of contrast, the survey-based estimate of the New Zealand value of a statistical life (VSL) for transport injuries is the only current source of information on human costs.

Qualitative information on human costs exists for workplace injuries from recent case study research by the Department of Labour and ACC, including individual, family and employer costs.

A range of cost statistics could be produced from linking ACC with other administrative data. In addition to the statistics produced from ACC data, or from linked ACC and NZHIS data, the following statistics and indicators could also be produced from available administrative data, but would require a significant investment in resources and expertise, and the collaborative effort of many individuals and agencies:

- Individuals' actual loss of pre-injury earnings from injuries.
- Individuals' loss of potential earnings from injuries.
- Individuals' pre-injury and potential earnings from injuries that are compensated by MSD.
- Employers' actual loss of revenue and/or profit from injuries.
- Lifetime treatment and rehabilitation costs to government agencies from injuries.
- Individuals' level of permanent impairment from injuries.
- Total costs of injuries to government.
- Total costs of injuries to society (an amalgamated estimate from available administrative data and the New Zealand VSL).

The report identified that significant information gaps would still remain. These gaps are in respect of the costs of outpatient and emergency services to government, most treatment and rehabilitation costs to individuals, friction costs to employers and human costs to individuals. In the main, survey information offers the best potential to address these gaps. Future developments in hospital outpatient and emergency department administrative databases are also a possibility.

There is also a significant information gap in terms of human costs to society outside the transport sector. A thorough review of different methodologies for measuring these costs is required before an approach can be selected.

Other cost indicators could be produced to address these gaps. The following indicators require substantial work, which may overlap with work agencies are already undertaking (not necessarily in relation to injuries). Development of these indicators may best be undertaken by an independent working group or task force and it is recommended that they are scoped properly by interested agencies and additional funding sought:

- Human costs of injuries to society for non-transport sectors including, but not limited to, investigation of the following:
  - Willingness to pay-based VSL, either using contingent valuation (eg, the New Zealand VSL) or revealed preference theory (eg, wage-risk analysis).
  - Potential to monetise health outcome measures such as quality- or disability-adjusted life years (QALYs and DALYs) or life years lost to injury (LLIs).
- Treatment and rehabilitation costs to individuals from injuries.
- Friction costs to employers from injuries.
- Total costs of workplace injuries to employers.

The following indicator is unlikely to be reliably or efficiently measured, therefore a “go slow” approach is recommended:

- Human costs of injuries to society for non-transport sectors:
  - Development of proxies such as the rate of divorce and change in accommodation or area of living.
  - Description of individuals’ experiences of injuries, and their family and friends’ associated experiences (eg, as part of future case-studies).
  - Investigation of happiness measures.

A “modular” approach was recommended for populating the Costs of Injury Framework. This means that a mix of administrative and survey data and analytical approaches would be used to produce the injury cost statistics. A modular approach also requires that there be a process in place to ensure common understanding and agreement as to where independently developed measures map to the framework.

This approach is considered preferable to developing a single methodology for measuring costs for two main reasons. First, a solid information base exists and there is considerable scope to use this information better. Second, agencies have diverse information needs and a single methodology for measuring costs is unlikely to adequately cater for this diversity.

The main advantage of this approach is that it is pragmatic. Different agencies could take responsibility for producing different parts of the framework, according to their comparative advantage with injury cost information, existing work commitments and specific areas of interest.

The main disadvantage is that a single comprehensive database of injury costs would not be produced and that, without active and effective coordination, the approach could become ad hoc, rather than modular.

2.2 MAJOR INTERNATIONAL WORK

A number of authors since the 1950s have studied the costs of work injuries and diseases – most focusing on particular industries, although others have attempted economy-wide analysis. The difficulties of estimating indirect costs are well documented, and, in general, methodologies are so diverse that the results are not strictly comparable. That said, the World Health Organization (WHO) and International Labor Organization (ILO) surmise that international estimates of the costs to gross domestic product (GDP) of injury and illness at work lie between three and five percent.[7]

2.2.1 UNITED STATES

A landmark study undertaken by Rice et al[8] entailed a report to the US Congress on the cost of injury in the United States. It was the first extensive costing to be undertaken on all injuries for all US citizens. The work, however, did not distinguish between work and non-work related incidents. Over a decade later, Leigh et al produced a report titled *Costs of occupational injuries and illnesses*.[9] This, plus an earlier study by Miller (1997), "Estimating the costs of injury to US employers",[10] are two of the most comprehensive and cited studies carried out in recent years in the US covering work-related injuries and illnesses. Although some of the methods are similar to the Rice et al study, it is these two later studies that are discussed here.

Leigh et al (2000)[9]

The Leigh et al work is particularly relevant. The study was an attempt to estimate the total costs of occupational injuries and illnesses using national data. It claims to be the first to use this data to present estimates of the incidence, prevalence and costs of workplace-related injuries, illnesses and deaths in the US for 1992. It was estimated that the total direct and indirect costs associated with injuries and illnesses in the US was US$155.5 billion. This equates to nearly 3% of US GDP. In estimating costs, the human capital method was employed; the authors state that the costs of pain and suffering could add at least another US$350 billion to the total. Dorman[11] of the ILO considers the Leigh study to be conservative in its cost estimates, and indicates that total costs could easily have been 25–50% higher. Table 2.2 details the costs of injury and illness as estimated by Leigh et al.

Some points of interest include the following.

- 91% of all injuries/illnesses are non-fatal injuries; 8% are illnesses and 1% deaths.
- Injuries generate 85% of total costs, and diseases 15%.
- Direct costs are roughly one third of the total and indirect, two thirds.

TABLE 2.2 Costs of injury and illness in the US, 1992

	COSTS (US$ BILLION)			PERCENTAGES		
	DIRECT	INDIRECT	TOTAL	DIRECT	INDIRECT	TOTAL
Injuries	38.4	94.3	132.8	29%	71%	100%
Deaths	0.2	3.7	3.9	5%	95%	100%
Non fatal	38.2	90.6	128.9	30%	70%	100%
Illnesses	13.4	9.4	22.8	59%	41%	100%
Deaths	8.8	6.3	15.1	58%	42%	100%
Morbidity	4.6	3.1	7.7	60%	40%	100%
Total	51.8	103.7	155.5	33%	67%	100%
Deaths	9	10	19	47%	53%	100%
Non fatal/morbidity	42.8	93.7	136.6	31%	69%	100%

Note: Totals may not add due to rounding.

Source: Leigh et al.[9]

In terms of their methodology, Leigh et al firstly determined the number of injuries and illnesses in particular categories, and then multiplied these by their average costs. One of the major difficulties in this process was the determination of the number of occupational diseases arising due to occupational factors. Six disease categories were assessed: cancer, cardiovascular and cerebrovascular disease, chronic respiratory disease, pneumoconioses, nervous system disorders and renal disorders. Total cases for each of these categories were then multiplied by a factor that explains the proportion of diseases and deaths to which occupational exposures have contributed. These "attributable fractions" were taken from research and studies undertaken in the US (see Table 2.3). With the exception of pneumoconioses, which were assigned 100% as an occupational causation factor, all other categories were assigned a factor of less than 10%.

TABLE 2.3 Occupational attributable fractions of conditions

CONDITION	PERCENT
Cancer	6–10
Coronary heart disease	5–10
Cerebrovascular disease	5–10
Chronic obstructive pulmonary disease	10
Renal disorders	1–3
Nervous system disorders	1–3

Source: Leigh et al.[9]

In terms of assigning costs to the number of injury and illnesses, Leigh et al classify direct costs as those where a monetary payment was made, such as medical expenses for hospitals, physicians, drugs and health insurance administration costs. Indirect costs were defined as all other costs including loss of wages, costs of fringe benefits, loss of home production (such as childcare), employee retraining and workplace disruption costs. Direct cost estimates were generally sourced from compensation related data, while indirect costs were based on a variety of sources, including those contained in other literature. Indirect costs for fatalities were discounted to present values.

A mix of prevalence and incidence is used in the US study. The incidence approach is used for non-fatal diseases and conditions (as it is for non-fatal injuries). The prevalence approach is used for counting and measuring direct costs for the six disease categories identified. For indirect costs, the incidence approach is used, as data are available for both fatalities and non-fatal illnesses. The mix of approaches is consistent with other literature cited by Leigh et al, such as Markowitz et al[12] and Fahs et al.[13]

The Leigh et al study is important due to its comprehensive nature, and many aspects of how the study was undertaken will be drawn upon and explained further in other sections of this report. Leigh has also undertaken similar studies for other states within the US using the same costing approach (Leigh et al[14, 15]).

Miller (1997)[10]

Miller (1997) is the other major piece of work coming out of the US. While many earlier studies assessed the societal costs of occupational injuries, Miller's focus was on assessing costs to the employer. Miller estimated that both on the job and off the job injuries cost employers around US$200 billion each year – or roughly US$1,700 per employee. Of this, occupational injuries cost employers three-quarters of the total – roughly US$155 billion, or US$1,400 per injury.

Miller separates out the costs of injury to employers into the following categories:

- Medical payments – this covers employer-sponsored health insurance plans which help pay for medical care for the injured worker and, potentially, their dependents.

- Tax payments – taxes help pay injury costs for public sector employees (such as police, fire brigade, etc), as well as for other assisted groups.
- Wage replacement – this covers employer-funded workers' compensations schemes that cover wage loss for work-related injury, sick leave and other long-term disability insurance provided by the company.
- Other administrative and legal costs – this covers compensation programme administration, claims processing, injury investigation and reporting.
- Motor-vehicle and other third-party liability insurance.
- Workplace disruption and lost productivity.
- Wage premiums for risk taking – this covers the need to pay higher wages to attract employees into the more risky jobs.
- Property damage – Miller estimates employer property damage costs for motor vehicles crashes. However he indicates that, "property damage results from mishaps that may not produce injuries. Property-damage costs are not injury costs".

Miller estimates workplace injury costs with a top-down approach using national expenditure data. Where such costs were not available, other assumptions are made. Specific approaches to these employer cost categories are discussed further in later sections.

2.2.2 UNITED KINGDOM

In the United Kingdom (UK) a number of assessments of the cost of accidents and diseases have been carried out. The most recent and comprehensive is that undertaken in 1999 by Davies and Teasdale.[16] The study sets out to "estimate the costs to individuals, employers and society of workplace injuries and non-injury accidents and of work-related ill health for Britain". The following estimates were calculated:

- The total cost of all workplace injuries and work-related ill health in 1995–96 was estimated to be in the range of UK£2.9–4.2 billion. This excludes non-injury accidents and pain and suffering estimates.
- The total cost, including non-injury accidents, was calculated to be UK£4.4–8.6 billion, in 1995–96.
- Including pain, grief and suffering increases the total costs to the British society to UK£9.9–14.1 billion. This is equivalent to 1.4% and 2% of the British GDP.
- Including the net present value of costs in future years increases the total cost to the economy to UK£9–12.6 billion, and total costs to society to UK£14.5–18.1 billion. This equates to around 1.3%–1.8% of GDP, and 2.1%–2.6% of GDP respectively.

It should be highlighted that the UK study assesses both injury incidents as well as non-injury incidents. As such, property damage costs are included in their calculations, which differs markedly from other studies. Costs are calculated as losses incurred in 1995–96, but they also "attempt to estimate... the losses in subsequent years caused by working conditions in 1995–96". This does not include all future illness/injury related-costs. For example, where a worker is forced to retire from the workplace in 1995–96, then as far as possible an estimate of the resource costs over their remaining working lives is included (discounted to a net present value). The UK approach is a prevalence–based approach.

Costs derived are generally multiplied by the prevalence of injury or illness to derive total costs. The HSE breaks costs down into individual costs, employer costs and society costs.

The individual is assumed to incur the following costs:

- Financial costs (loss of income and "extra expenditure"). The HSE include extra expenditure costs such as the purchase of medicines, travel to the hospital for treatment and increased shopping bills.
- Human costs or loss of quality of life. A willingness-to-pay approach is used and a figure of UK£766,000

(1995–96 price) is used as the human cost of a fatality (ie, a VSL). Values are also derived for non-fatal injuries using different approaches.

The employer is assumed to incur the following costs:

- Employee absence costs (including the cost of maintaining output, sick pay and administrative costs).
- Replacement of personnel.
- Materials and equipment damage.
- Compensation and insurance.

Society is assumed to incur the following costs:

- Loss of output.
- Other resource costs (damage, administration, medical and investigation costs).
- Human costs.

The HSE does not distinguish between direct and indirect costs. They are concerned with calculating total costs for each of the three groups (ie, individual, employer and society). Transfer payments from the various sectors of the community are discussed and included to ensure that double counting of costs is not undertaken. Many of the society costs therefore are derived as residuals from other components.

Generally, the UK HSE methodology uses estimates of the number of injuries and illness for 1995–96. Assumptions are made regarding the number of working days lost, which are then multiplied by the individual cost items mentioned above. Many assumptions are made with respect to the cost calculations, primarily based on UK-based work. Some of the calculation methods used by the HSE are discussed in the following sections.

2.2.3 AUSTRALIA

The Industry Commission report[4] mentioned in Section 2.1.3 was a significant report whose methods were used by Head and Harcourt[3] to undertake a similar costing for New Zealand and, until recently, also formed the basis for Australian estimates by the former National Occupational Health and Safety Commission (NOHSC), now the Office of the Australian Safety and Compensation Council (OASCC).

The other significant Australian piece of work was undertaken by the Monash University Accident Research Centre with a report titled *The cost of injury to Victoria*.[17] The aim of this study was to describe the epidemiology of injury across all severity levels and to estimate the total lifetime costs of injury to the Victorian community. It assesses the lifetime cost of injury for all work and non-work related case incidents in 1993–94 using the human capital approach. Results indicate that, in 1993–94:

- total lifetime costs were $2.583 billion
- of this, 29% were direct costs and 71% indirect
- mortality costs accounted for 45% of total indirect costs, and morbidity accounted for 55%
- of all injuries in Victoria, 11% were estimated to be work-related.

Direct costs were identified as those relating to actual injury-related expenditure such as medical bills, rehabilitation and treatment costs. Indirect costs included lost output due to decreased productivity (morbidity) and premature death (mortality), loss of future production, the unpaid contribution of victims to their household and the productive time lost by care-givers of child injury victims.

Their human capital approach follows work done by Rice et al.[8]

Access Economics (2004) report for NOHSC

In early 2004, Access Economics undertook analysis for NOHSC to review the earlier 1995 Industry Commission methodology, leading to the development of a new methodology for costing occupational injury and disease and a revised estimate for the year 2000–01.[5, 18]

The NOHSC Office had developed a preliminary estimate of the cost of workplace injury and disease to the Australian economy in 2000–01 of around $35 billion, based on methodology developed by the Industry Commission in 1995. Access Economics reviewed the methodology and data on which that estimate was based, in light of the international and Australian literature, and identified strengths and weaknesses. The report made some suggestions for enhancing and extending the methodology, and resolving some key issues in areas of interest. Implementing these suggestions, a revised estimate was calculated of $33.2 billion (5.0% of GDP). If, based on recent methodological advances, an estimate of the cost of pain and early death is added, the total cost to the economy would increase by at least $57 billion. The large contribution of pain and early death is in line with the findings of leading international studies.

The review confirmed that it is sensible to use an incidence approach (ie, to attribute the whole-of-life costs of each workplace incident to the year in which it occurs). It also recommended distinguishing:

- compensated from uncompensated cases
- injury from disease
- (five) different severity categories
- types of costs
- who bears the cost (employer, worker or society).

It suggested that:

- the distinction between direct and indirect costs is not particularly helpful
- more work could be done in refining some of the estimates for uncompensated workers, where blanket assumptions are sometimes used, for example, in relation to the average weeks lost per incident. Case studies may assist in this area, as it is a significant driver of some cost items.

The report recommended a more structured categorisation of costs that distinguished real economic costs from financial transfers. This is important since the total economic cost is that of the real resources that are used when there is an occupational incident, while the transfers are financial flows that impact on who bears the cost, but not its overall level. This avoids previous double-counting and misallocation, for example:

- including both human capital costs and lifetime lost earnings, where the former is a real cost while the latter is the component borne by the worker
- including welfare payments and taxation losses as part of total real costs, when they are in fact transfers from society to the worker.

The report also recommended using a lower real discount rate (1.55%), which increases the present value of future cost streams, offsetting the removal of the double-counting effect mentioned above.

The report identified six conceptual cost groups, consistent with the thrust of the literature, where each group can be viewed as contributing a total net cost to Australia. Within each group there may be flows between the "burden-bearers" – employers, workers and society. How each item is calculated will then depend on the available data, knowing that, for each item, the identity must be satisfied that the total equals the sum of the parts. This provides integrity within the system, as well as cross-checks. The conceptual groups are outlined below.

- **Production disturbance costs (A$1.4 billion)** comprise the value of production lost between the incident and when a worker either returns to work or is (fully or partially) replaced, as well as the staff turnover costs. Staff

turnover cost is treated as a cost "brought forward", and a lower estimate of this cost is suggested than NOHSC (6 months' rather than a full year's wages). The employer bears a significant proportion of the production disturbance cost burden (A$600 million) through overtime premium payments, sick leave and employer excess payments. Use of the Australian Bureau of Statistics (ABS) average weekly earnings (AWE) and average weekly ordinary time earnings (AWOTE) measures were recommended (NOHSC had developed more complex measures), and an updated on-cost premium of 12.5% was used rather than the former 25.4%.

- **Human capital costs (A$25.7 billion)** are the most important single item, reflecting the lost productive capacity of the worker over the longer term – until retirement age. A$11.7 billion of this cost is borne by workers through lower incomes, while A$14 billion is borne by society through welfare payments ($4.8 billion), taxation losses ($4.3 billion) and compensation payments (around $4.8 billion).
- **Medical costs (A$2.0 billion),** including rehabilitation costs of A$1 billion, cover the health and "return to work" expenses of the worker. These may be understated since it is unclear the extent to which the compensation data are capturing unbilled transactions, such as treatment at public hospitals, as well as private health insurance claims or other gaps. These amounts may be large, so it could be useful to do more work to refine this item, since the only way to estimate the total is as the sum of the parts borne by the employer, worker and society.
- **Administration costs (A$1.4 billion in total)** include legal costs (A$454m), the cost of investigating claims and administration of the compensation system (A$524m), travel costs for workers (A$419m) and the cost of bringing forward funerals (A$8m). These items tend to be smaller, and the NOHSC methodology was retained in most cases, with only minor refinements.
- **Transfer costs (A$1.5 billion in total)** are the deadweight cost of administering the welfare system (A$257m) and the efficiency losses associated with the need to fund additional welfare payments and replace lost income tax (A$1.1 billion) following occupational incidents.
- Other costs result from changes to the scope of the estimates:
  - **Costs of damage to property** are conceptually different and outside of the scope of measuring the costs of occupational incidents that result in injury or illness to humans. It may, however, be useful to cost these items in a different context. Similarly, the **loss of goodwill** consequent on injury or disease was considered unlikely to be substantial or readily measured.
  - Recommended for inclusion, however, was the **real costs of carers (A$895m) and of aids and modifications (A$281m**) that can be required by former workers who develop disabilities as a result of occupational incidents. Various data sources were suggested for this cost item.
  - The major recommendation of the report was to include an estimate of **the cost of suffering and early death,** utilising willingness-to-pay methodology and the concept of the value of a statistical life (VSL). This produces results in line with those from a major recent study in the US, in that this cost item is substantially higher than all the other cost items put together, ranging from $57 billion to as much as $126 billion. Since the underlying concepts and their measurement are still somewhat controversial, it was suggested that this cost item be separately identified.

The report accepted the existent approach of identifying the numbers of people in each sub-category and multiplying by the average cost for each sub-category. It is thus important to have robust estimates for "N", the number of people in each sub-category. These were sourced from the NOHSC National Dataset and Australian Bureau of Statistics (ABS) data.

- NOHSC was rightly concerned about potential understatement of disease cases. When cross-checked against a very conservative estimate using attributable fractions (the proportion of total disease incidence attributable to occupational exposures), the number of disease cases appeared to be understated by at least a third. However, relative to the total including injury, this is a much more minor understatement (4%), although it was noted that the range is broad (up to 48%) and more work needs to be done in this area.

- Offsetting this increase, the estimate of the number of uncompensated injury cases in the least severe category was reduced by 17,300 people who stated in the ABS Survey that they did not receive compensation for their injury because they "felt it was inconvenient or involved too much effort or paperwork".
- Overall it was estimated there were just under 350,000 occupational incidents in 2000–01, a little lower than NOHSC's estimate of 353,000, but still around 3.8% of the workforce. This estimate included a slightly lower proportion of people in the least severe category.

Employers bore an estimated A$1 billion (3%) of the total costs. Workers bore around A$13.7 billion (41%) and society – through the compensation system and government sector – bore A$18.5 billion (56%). However, it is important to note that employers also pay the workers' compensation premiums from which society meets in part its lion's share. Were an "ex ante" measurement approach adopted rather than an "ex post" one, the community share would be lower (around 35%) and the employer share would be higher (around 24%), since over A$7 billion extra would be borne by the employers. Employers, in turn, may pass on the higher premiums in higher prices, or may use them to negotiate lower overall wage and salary payments. Thus, in general equilibrium, the compensation costs are spread across the economy.

2.3 COSTING ISSUES

It is worth identifying a few key definitional and conceptual issues up front, since the edges of the task might otherwise be fuzzy. First, it is the cost of workplace incidents involving injury or illness of humans that is sought. Thus injuries or illnesses primarily developed outside the workplace are excluded.

It should also be stated up front that not all incidents relate to deficiencies by the employer. Employers may meet all guidelines, but incidents can still occur through personal negligence or for other reasons – "acts of God" – as they do at home or elsewhere.

2.3.1 COMPENSATED AND UNCOMPENSATED CASES

For incidents that are compensated, there is a clear legal basis for inclusion in the cost estimates. However, not all incidents lead to a formal compensation claim, although many of these may warrant inclusion. For example:

- injuries or illness of the self-employed, who are not part of a compensation scheme
- information or cultural asymmetries where a worker or the relatives of a worker are unaware of the right to claim or prosecute, or unaware of the epidemiological linkages between their condition and risk factors from their workplace
- choices not to claim or prosecute for personal or other reasons
- incidents involving bystanders
- conditions that are only uncovered some time later, and the relevant firm or employer no longer exists.

2.3.2 TIME DIMENSIONS FOR ANALYSIS

The timing of when injuries occur and when illnesses/diseases are diagnosed, and the allocation of these to a period of analysis, is one of the first issues to be resolved by researchers. For example, an illness may not be diagnosed at the time of the initial onset of the disease, and is unlikely to be linked to a workplace cause at the time of diagnosis. In addition, costs associated with a particular illness/disease may be incurred prior to its diagnosis. As stated by Weil,[19] "the diagnosis of an illness may not signal the beginning of the economic consequences associated with that illness".

Similarly, accidents or injuries occurring in one year may not be reported until a later date, particularly where claims for compensation take time to prepare. Freeman et al[20] found that, in the US, 99% of injuries and 86% of claimed illnesses were not reported to the appropriate authorities until the end of the second year following an incident.

There are two approaches identified in the literature[19, 20] dealing with ways of measuring compensated occupational injuries and illnesses:

- **Incidence approach** – This approach assesses the number of people entering the workers' compensation system in a particular year. It generally assesses the number of accidents and illnesses diagnosed for a particular year and the associated costs (both current and expected future costs) are assigned to that year. This is described as a "bottom-up" approach to the allocation of costs.
- **Prevalence approach** – This approach assesses the number of people "within the system" at a given point in time, regardless of when the injury occurred or illness was diagnosed. Costs are generally allocated in a top-down manner, where total expenditures for a given year are proportioned across the categories of injury/illness.

Incidence and prevalence approaches can also conceptually apply to total (including uncompensated) incidents and costs, not just those in the compensation system.

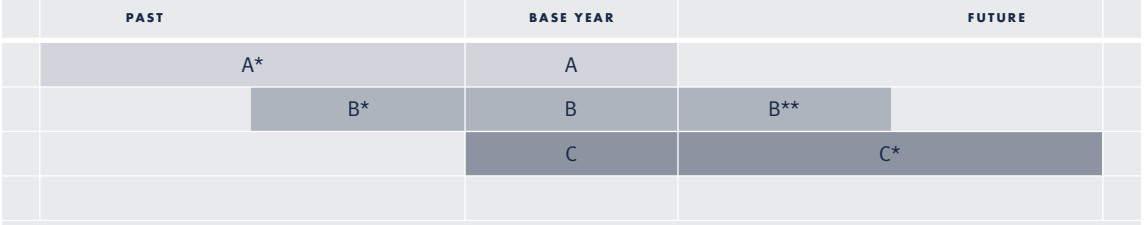
Until more recently, the prevalence approach was generally used to allocate total known costs for a given year. Miller[10] is one example of the top-down prevalence-based approach to allocating national expenditure data. The UK HSE work[16] is another prevalence-based approach, although it then uses a mix of top-down and bottom-up approaches to determining costs. Leigh et al[9] use the incidence approach. The literature provides little guidance as to what approach should be adopted. There appears to have been a move away from the prevalence-based approach and to the use of the incidence approach (if data allows) in the more recent and comprehensive articles such as the Leigh et al study. The distinction between the incidence and prevalence approaches becomes particularly relevant when assessing disease costing. As stated earlier, Leigh et al use a mix of approaches.

There is a need to choose between an incidence and prevalence approach, and then to refine the approach to ensure that costs are allocated consistently to the correct year. For our base year, we can choose to attribute costs on the basis that this was the period:

- when the person entered the compensation system (direct incidence approach)
- when an incident occurred/was registered (total incidence approach)
- when a person was in the compensation system (direct prevalence approach), or
- when a person was suffering from a work-related injury or illness (total prevalence approach).

The ACC data track both the date of lodgement of a claim and the date of occurrence. The data sources thus lend themselves to utilisation of an incidence approach to measurement of costs, as depicted in Figure 2.2 for a given base year.

FIGURE 2.2 Incidence cf. prevalence approaches to incidents and costs



Prevalence costs = A + B + C; Incidence = C + present value of C*

Consider person A, who was injured in the past (say, 1990) and entered the compensation system in 1991, was compensated and off work for ten years and died during the base year (say, 2004–05). Although in the compensation system in 2004–05, he and his associated costs over the whole period (A + A*) would not be counted for the base year using an incidence approach. Person B developed a work-related illness between 1990 and 2004–05 and reduced work, although was not compensated for the illness, retiring in 2010. She and her costs (B + B* + B**) also would not be counted using an incidence approach, although she too would have incurred costs during 2004–05. Person C was involved in an incident in 2004–05, and hence his costs (C + C*) would be included, including the present value of future costs (C*). If a prevalence approach had been used, costs would equate to the sum of the areas A plus B plus C, whereas the incidence approach yields the sum of costs C plus C*.

2.3.3 COST CLASSIFICATIONS

Many studies look into the aspect of classifying specific costs relating to workplace injuries and illnesses, without actually measuring those costs. Examples of classifications include direct versus indirect costs, fixed versus variable costs, and insured versus uninsured costs.

The classification system used is particularly important to ensure that a structure exists such that double-counting of broad types of costs is avoided. It is necessary to distinguish real costs from transfer costs. Real costs use up real resources, such as capital or labour, or reduce the economy's overall capacity to produce goods and services. Transfer costs involve payments from one economic agent to another and do not use up real resources, for example, a legal fine or penalty is a cost incurred by the employer but transferred back to the community. This important economic distinction is pivotal in avoiding double-counting, yet the literature reviewed (except for Australia) is fairly silent on the matter, particularly with respect to transfer costs. It is when costs are classified into different categories (such as the employer/employee/community split) that the potential for double-counting occurs, particularly when using an incidence approach. The UK study considered transfer costs in order to ensure double-counting did not occur between the classification of costs to employers, employees and the community.[16]

The system of classifying costs will depend upon the purpose of carrying out the study. The ILO highlights a number of classification systems.[11]

Economic versus non-economic costs

Economic costs are classified by Dorman as those that can be calculated in some manner. They encompass "loss of goods and services that have a price in the market or that could be assigned an approximate price by an informed observer". Non-economic costs include the emotional cost to the victim and their family and the damage to social values.

Dorman's definition of economic costs leaves some room for interpretation, relating more to financial, measurable, calculable or tangible costs. In a purist sense, economic costs need not be tangible/calculable, but nonetheless reflect what is given up in order to gain something else (opportunity costs). Thus, in New Zealand, Head and Harcourt[3] and DOL[6] rightly treat loss of wellbeing as a (socio)economic cost, and then make a further comment relating to measurability. Moreover, as methodologies evolve to better measure socioeconomic costs such as wellbeing, this distinction becomes a bit of a moving feast.

Fixed versus variable costs

This approach differentiates between those costs that remain constant, irrespective of the level of severity of an injury/illness, and those that vary with severity or incidence. Here, overhead costs for insurance and regulation systems are allocated to the fixed category, while variable costs might include insurance rates that may vary because of a change in claims. The significance of this classification is that it can aid in the determination of the

economic incentive for managers to reduce the likelihood of incidents. That said, it is not particularly relevant to this analysis and not further discussed.

Ex ante versus ex post costs

Yet another distinction is between ex ante and ex post costs. This distinction provides two ways of measuring the same thing. For example, an ex ante cost might be workers' compensation premiums as compared to the ex post cost of workers' compensation payments. The ex post version tends to be more common for measuring workers' compensation, due to greater ease of data collection, however, either could conceptually be used to measure the non-compensated, or indirect, costs. The conceptual issue is not to include both measures and double count.

Some classifications are more common than others and these are discussed below.

Direct and indirect costs

Generally, the distinction is made in the literature between direct and indirect costs. Typically, specific costs are identified as direct costs, and all others are indirect. The cost lists, however, vary between different studies, making comparisons of results somewhat difficult.

Leigh et al[9] identify direct costs as medical costs (including payments to doctors, hospitals and drug companies) and insurance administration. Insurance administration costs cover overheads for running either an insurance agency or equivalent government agency. Direct costs therefore represent actual dollars spent or anticipated to be spent on providing medical care and administering the insurance system. Indirect costs consist primarily of lost wages while workers cannot work, plus costs of fringe benefits, retraining and workplace disruption.

Dorman[11] also outlines a direct versus indirect classification of costs. He classifies direct costs as those that are identifiable, costed and attributed to a firm's OHS system, that is, the costs that are measured and allocated through a firm's routine accounting system, for example, legal costs and insurance premiums. All other costs are indirect. The significance of this classification is that is helps to determine whether a manager will actually perceive the economic incentives that actually exist.

Brady et al[21] published a study aiming to inform management on how to define, measure and predict their total health and safety costs. They use a direct versus indirect cost categorisation. Costs are classified by (1) direct costs, (2) indirect costs related to a specific illness or injury, and (3) indirect costs related to other health and safety requirements, but not related to a specific illness or injury. Brady et al conclude that, based on their literature review, it became clear that "direct health care costs can be defined and measured more readily than indirect costs" and that "[their] study revealed considerable variation in the definition of indirect and total health and safety costs". It is interesting to note that they state, and we concur (and hence the adoption of this practice in Australia), that it is more important to include an estimate of all costs, than to define them as either direct or indirect.

While most studies define direct costs as those that involve a form of actual monetary payment, indirect costs are more difficult to define, vary considerably between analyses and generally do not include estimates of pain and suffering. We conclude from this that the distinction between direct and indirect costs is not necessarily a useful distinction to be made, particularly if comparisons to other countries are required. A more useful distinction is likely to be compensated versus uncompensated, which is more readily definable.

Classification by who pays

Berger et al[22] argue that valuing indirect costs is a "matter of perspective" between the individual, society and the employer:

- From an individual/worker's perspective, indirect costs are those associated with lost or impaired ability to work or engage in leisure activities, as well as costs to dependants.
- From society's perspective (which is the more common perspective taken when researchers assess indirect costs), the measurement of costs is based on the value of an individual's work and their contribution to society. This is generally measured in terms of a person's potential income generation, which can then be classified into mortality costs (the present value of forgone future income) and morbidity costs (measured as lost income from missed work).
- From the employer's perspective, the value of morbidity and mortality should only include those costs incurred by the employer. For example, work loss costs might include higher wages, lost production, idle assets and other non-wage costs. With mortality, costs might include the cost of rehiring and retraining. This differs from the societal perspective in that it excludes the present value of future earnings.

Internal versus external costs

Dorman[11] discusses a further classification of costs on the basis of internal versus external costs. This distinction is made depending upon "whether the cost is paid by the economic unit that generates it", in which case it is classified as an internal cost, otherwise it is an external cost.

The significance of this classification is that it assesses the gap between the economic incentives of the employer and society to reduce incidents. As stated by Reville,[23] "by creating a safe working environment and providing workers with equipment, employers may have greater ability to control the number and severity of injuries than workers have, and therefore, accurate estimation of the full costs to employers is critical for education of the employer community and for the design of policies intended to improve safety."

This categorisation provides a useful distinction in costs, particularly for separating out the costs borne by employers, the individual and the community, and is becoming widely utilised, including in Access Economics[5] and in this analysis.

Classification by severity of the impacts of the incident

According to the Industry Commission,[4] 82% of all costs are due to 13% of incidents.[24] For this reason it is important to sub-categorise costs at a more detailed level, via the nature of injury or severity of injury.

Leigh et al[9] classify incidents as follows:

- Deaths
- Non-fatal injuries
  - Non-disabling
  - Disabling
    - Permanent total disability
    - Permanent partial disability
    - Temporary (total and partial) disability
    - One to seven days lost
- Hospitalisations.

The use of this classification system, as opposed to the use of the nature of injury, was due to the availability of cost-related data.

Weil[19] also describes a classification system according to the severity of the incident, as follows:

- Fatality
- Impairment
  - Short-spell, full return to work

- Short-spell, change in earnings, with return to work
- Long-spell, change in earnings, with return to work
- Long-spell, work instability
- Withdrawal from the labour market.

In this analysis, we consulted with ACC and decided on a cost classification by severity that was amenable to their data. This classification is presented in Section 3.3.2.

2.3.4 VALUING LIFE AND HEALTH

Since Schelling's discussion of the economics of life saving,[25] the economic literature has properly focused on willingness-to-pay (willingness-to-accept) measures of mortality and morbidity risk. Using evidence of market trade-offs between risk and money, including numerous labour market and other studies (such as installing smoke detectors, wearing seatbelts or bike helmets etc), economists have developed estimates of the value of a statistical life (VSL).

> The willingness to pay approach estimates the value of life in terms of the amounts that individuals are prepared to pay to reduce risks to their lives. It uses stated or revealed preferences to ascertain the value people place on reducing risk to life and reflects the value of intangible elements such as quality of life, health and leisure. While it overcomes the theoretical difficulties of the human capital approach, it involves more empirical difficulties in measurement.[26]

Viscusi and Aldy[27] summarise the extensive literature in this field, most of which has used econometric analysis to value mortality risk and the "hedonic wage", by estimating compensating differentials for on-the-job risk exposure in labour markets, in other words, determining what dollar amount would be accepted by an individual to induce him/her to increase the possibility of death or morbidity by x%. They find the VSL ranges between US$4 million and US$9 million, with a median of US$7 million (in year 2000 US dollars), which is similar but marginally higher than the VSL derived from US product and housing markets, and also marginally higher than non-US studies, although all in the same order of magnitude. They also review a parallel literature on the implicit value of the risk of non-fatal injuries.

> A particular life may be regarded as priceless, yet relatively low implicit values may be assigned to life because of the distinction between identified and anonymous (or 'statistical') lives. When a 'value of life' estimate is derived, it is not any particular person's life that is valued, but that of an unknown or statistical individual.[28]

Weaknesses in this approach, as with human capital, are that there can be substantial variation between individuals. Extraneous influences in labour markets such as imperfect information, or income/wealth or power asymmetries can cause difficulty in correctly perceiving the risk or in negotiating an acceptably higher wage.

Viscusi and Aldy[27] do not include any New Zealand studies in their meta-analysis (and we were unable to locate any) but they do include two Australian studies, notably Kniesner and Leeth[29] of the Australian Bureau of Statistics (ABS), with VSL of US2000$4.2 million, and Miller et al[10] of the National Occupational Health and Safety Commission (NOHSC), with quite a high VSL of US2000$11.3m–19.1 million (Viscusi and Aldy,[27] Table 4, pp92-93). There is also the issue of converting foreign (US) data to New Zealand dollars using either exchange rates or preferably purchasing power parity and choosing a period.

Access Economics[30] presents outcomes of studies from Yale University[31] – where VSL is estimated as $US2.66m; University of Chicago[32] – US$5m; and Cutler and Richardson[33] – who model a common range from US$3 million to US$7m, noting a literature range of $US0.6 million to $US13.5 million per fatality prevented (1998 US dollars).

These eminent researchers apply discount rates of 0% and 3% (favouring 3%) to the common range to derive an equivalent of $US75,000 to $US150,000 for a year of life gained.

DALYs and QALYs

In an attempt to overcome some of the issues in relation to placing a dollar value on a human life, in the last decade an alternative approach to valuing human life has been derived. The approach is non-financial, where pain, suffering and premature mortality are measured in terms of disability-adjusted life years (DALYs), with 0 representing a year of perfect health and 1 representing death – the converse of a QALY or quality-adjusted life year, where 1 represents perfect health. This approach was developed by the World Health Organization (WHO), the World Bank and Harvard University and provides a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990, projected to 2020.[34] Methods and data sources are detailed further in Murray et al.[35]

The DALY approach has been adopted and applied in New Zealand by the Ministry of Health[36] and in Australia by the Australian Institute for Health and Welfare (AIHW).[37] Premature mortality (YLL) and morbidity (YLD) components are separately identified. In any year, the disability weight of a disease (for example, 0.18 for a broken wrist) reflects a relative health state. In this example, 0.18 would represent losing 18% of a year of healthy life because of the inflicted injury.

> Martin Tobias and the New Zealand Burden of Disease Study (NZBDS) team utilised the global and Australian studies to estimate the burden of disease for New Zealand.[36] Estimates of YLL, YLD and DALYs for over 100 conditions in nine age groups for both genders and two major ethnic groups (Māori and non-Māori) are provided for the year 1996.

The DALY approach has been successful in avoiding the subjectivity of individual valuation and is capable of overcoming the problem of comparability between individuals and between nations, although nations have subsequently adopted variations in weighting systems.

The main problem with the DALY approach is that it is not financial and is thus not directly comparable with most other cost measures. In public policy-making, therefore, there is always the temptation to re-apply a financial measure conversion to ascertain the cost of an injury or fatality, or the value of a preventive health intervention. Such financial conversions tend to utilise willingness-to-pay or risk-based labour market studies described above.

The Australian Department of Health and Ageing[38] (based on work by Applied Economics) has adopted a very conservative approach to this issue, placing the value of a human life year at around A$60,000 per annum, which is lower than most international lower bounds on the estimate.

> In order to convert DALYs into economic benefits, a dollar value per DALY is required. In this study, we follow the standard approach in the economics literature and derive the value of a healthy year from the value of life. For example, if the estimated value of life is A$2 million, the average loss of healthy life is 40 years, and the discount rate is 5 per cent per annum, the value of a healthy year would be $118,000.[ii] Tolley, Kenkel and Fabian[39] review the literature on valuing life and life years and conclude that a range of US$70,000 to US$175,000 per life year is reasonable. In a major study of the value of health of the US population, Cutler and Richardson[40] adopt an average value of US$100,000 in 1990 dollars for a healthy year.
>
> Although there is an extensive international literature on the value of life,[41] there is little Australian research on this subject. As the Bureau of Transport Economics (BTE)[26] notes, international research using willingness to pay values usually places the value of life at somewhere between A$1.8 and A$4.3 million. On the other hand, values of life that reflect the present value of output lost (the human capital approach) are usually under $1 million.

ii *In round numbers, $2,000,000 = $118,000/1.05 + $118,000/(1.05)2 + ... + $118,000/(1.05).* [The actual value should be $116,556, not $118,000 even in round numbers.]

> The BTE[26] adopts estimates of $1 million to $1.4 million per fatality, reflecting a 7 per cent and 4 per cent discount rate respectively. The higher figure of $1.4 million is made up of loss of workforce productivity of $540,000, loss of household productivity of $500,000 and loss of quality of life of $319,000. This is an unusual approach that combines human capital and willingness to pay concepts and adds household output to workforce output.
>
> For this study, a value of $1 million and an equivalent value of $60,000 for a healthy year are assumed.[iii] In other words, the cost of a DALY is $60,000. This represents a conservative valuation of the estimated willingness to pay values for human life that are used most often in similar studies.[iv]

As the citation concludes, the estimate of A$60,000 per DALY is very low. The Viscusi[41] meta-analysis referred to reviewed studies with values of a human life ranging between $US0.5 million and $US16m, all in pre-1993 US dollars. Even the lowest of these, converted to 2003 Australian dollars, exceeds the estimate adopted (A$1m) by nearly 25%. The BTE study[26] cited tends to disregard the literature at the higher end and also adopts a range (A$1–$1.4m) below the lower bound of the international range that it identifies (A$1.8–$4.3m).

The rationale for adopting very low estimates is not provided explicitly. Certainly it is in the interests of fiscal restraint to present as low an estimate as possible. That said, in OHS applications, low valuation of human life can lead to an under-investment in safety measures, and we believe it is sensible to adopt a more realistic VSL measure.

The majority of the literature detailed above supports VSLs in the range presented in Table 2.4, which Access Economics believes is important to utilise in disease costing applications and decisions. The US dollar values of the lower bound, mid-range and upper bound are shown at left. The "average" estimate is the average of the range, excluding the high NOHSC outlier. Equal weightings are used for each study because:

- the Viscusi and Aldy meta-analysis summarises 60 recent studies
- the ABS study is Australian (possibly more like New Zealand than elsewhere, in the absence of New Zealand studies)
- the Yale and Harvard studies are based on the conclusions of eminent researchers in the field after conducting literature analysis.

Where there is no low or high US dollar estimate for a study, the mid-range estimate is used to calculate the average. The mid-range estimates are converted to Australian dollars at purchasing power parity (PPP, as this is less volatile than exchange rates) of USD=0.7281AUD for 2003, as estimated by the OECD. Access Economics concludes the VSL range in Australia lies between A$3.7 million and A$9.6m, with a mid-range estimate of A$6.5m. These estimates have conservatively not been inflated to 2005 prices, given the uncertainty levels, and were used in our work for NOHSC. In turn, we convert these to New Zealand dollars in the far right column, using PPP.

The VSL range in New Zealand lies between NZ$3.9 million and NZ$10.1m, with a mid-range estimate of NZ$6.9m. We conservatively use the lowest estimate, NZ$3.9m, in this study.

Discount rate

The validity of both the human capital and willingness-to-pay methods rely substantially on the choice of an appropriate discount rate. Discount rates ranging between 0 and 10% net of inflation effects are used in the literature, although the most common range is around 3% (see examples in the previous section). The period of discounting depends largely on the age cohort (and hence years till retirement), which can also have a substantial impact on results, and should match, if applicable, the average expected age to death (or retirement) in the source study.

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iii The equivalent value of $60,000 assumes, in broad terms, 40 years of lost life and a discount rate of 5 per cent. [AE comment: More accurately the figure should be $58,278.]

iv In addition to the cited references in the text, see for example Murphy and Topel's study (1999) on the economic value of medical research. [AE comment. Identical reference to our Murphy and Topel.[32]]

TABLE 2.4 Estimates of VSL, various years, US$, A$ and NZ$

	US$M			A$M	NZ$M
	LOWER	MID-RANGE	UPPER	0.7281	.6892
Viscusi and Aldy meta-analysis[27]	4	7	9	**9.6**	**10.1**
Australian: ABS[29]		4.2		5.8	6.1
NOHSC[18]	11.3		19.1		
Yale[31]		2.66		**3.7**	**3.9**
Harvard[33]	0.6	5	13.7	6.9	7.3
Average*	2.9	**4.7**	7.4	**6.5**	**6.9**

** Average of range excluding high NOHSC outlier, using mid-range if no data; conservatively not inflated.*

A$ and NZ$ conversions are at the OECD 2003 PPP rate.

Choosing an appropriate discount rate for present valuations in cost analysis is a subject of some debate, and can vary depending on which future income or cost stream is being considered. There is a substantial body of literature, which often provides conflicting advice, on the appropriate mechanism by which costs should be discounted over time, properly taking into account risks, inflation, positive time preference and expected productivity gains.

The absolute minimum option that one can adopt in discounting future income and costs is to set future values in current day dollar terms, on the basis of a risk-free assessment about the future (that is, assume the future flows are similar to the near-certain flows attaching to a long-term government bond).

Wages should be assumed to grow in dollar terms according to best estimates for inflation. In selecting discount rates for New Zealand projects, we have settled upon the following as the preferred approach.

- **Positive time preference** – We use the long-term nominal bond rate of 6.0% pa (from recent history in trading of NZ Government 10-year bonds) as the parameter for this aspect of the discount rate. (If there were no positive time preference, people would be indifferent between having something now or a long way off in the future, so this applies to all flows of goods and services.)
- **Inflation** – The Reserve Bank of New Zealand has an agreement with the New Zealand government to pursue monetary policy that delivers 1% to 3% inflation on average over the medium term. Over the past few years, inflation has consistently remained in the top half of this band and is expected to remain above 2.5% until 2008[42] and so we use an assumption of 2.2% pa for this variable. (It is important to allow for inflation in order to derive a real, rather than nominal, rate.)

The discount rate used is thus:

- 6.0 - 2.2 = 3.8%

We note this does not take into account potential productivity growth.

Annualising the VSL of NZ$3.9 million in Table 2.4 using the discount rate of 3.8% over an average 40 years expected life span (the average from the meta-analysis of wage-risk studies) provides an estimate of the value of a life year (VLY) of $184,216.

Property damage

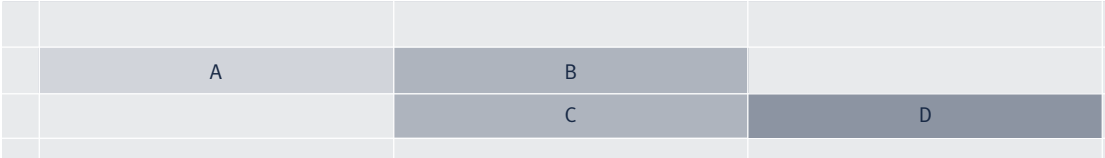
Property damage refers to damage to a machine, tools or other property, or spoilage of material and replacement of equipment and other materials.

Little was found in the literature regarding property damage. Miller[10] separates out employer costs of occupational, off-the-job and motor vehicle injuries, and argues that "property damage costs are not injury costs". In his study, employer property damage costs are only calculated for motor vehicle accidents. Occupational crashes are estimated to cost employers US$38 billion per year, which is approximately one-quarter the value of occupational injury costs.

Although the Industry Commission[4] argued for the inclusion of property damage in estimating the costs of workplace accidents and injury, they were unable to cost it and, given its lack of support in the literature, we question the case for its inclusion. As per Access Economics,[5] we argue that if property damage were to be included, then so would costs such as the attendance of fire, police and medical vehicles to an accident,[10] even if no injury to humans were sustained but whenever property damage was incurred. In some cases, such as an after-hours explosion at a plant, for example, there may be hundreds of millions of dollars of property damage but no human injuries. We conclude that this category of cost does not belong in an estimate of the costs of workplace injury and illness, which are essentially human costs. It is thus not included in this study.

Figure 2.3 illustrates the concept that there are two types of occupational incidents – those involving humans (the OHS and compensation realm) and those involving property (the business insurance realm). Suppose the cost of incidents involving humans, but without property damage, is represented by A, and the cost of incidents involving both humans and property is B + C where B is the cost of damage to humans and C is the cost of damage to property. Finally, suppose D is the cost of incidents involving property damage but no human injury or disease, such as vandalism or a fire after hours when no-one was around. Although B and C are costs from the same incident, they are nonetheless distinct, and to include the costs for C in estimating human costs would seem spurious reasoning unless one also included the costs of D, and estimated all the property and human costs, but then the purpose of the exercise would have changed from the one we set out to accomplish. Moreover, all the property costs (all business insurance claims except possibly theft) may well dwarf the human costs.

FIGURE 2.3 Costs of incidents involving humans and property



Costs of incidents involving humans = A + B

Costs of incidents involving property = C + D

If, in a separate and different exercise, all property costs were to be estimated, possibly in the process separating out those that involved damage to humans, the simplest way of doing that would be either the ex ante or ex post fashion – the sum of business insurance premiums or claims across New Zealand for property theft, accident, natural disaster and other insurable damage. There might also be an estimate for uninsured items.

However, our conclusion is that there is no need for NOHSAC to estimate property damage, except as an item of peripheral interest.

Loss of goodwill and corporate image

As with property costs, this item was argued for by the Industry Commission[4] but not costed, and has been identified in other literature as an issue. For example, Allens Consulting Group in Australia recommended to NOHSC in 2003 that, to measure loss of goodwill arising from occupational injury and disease, a case study analysis be adopted of major incidents (smaller incidents are unlikely to be measurable) and their relationship to changes in share prices and changes in revenue in ensuing months (as compared to trend). Allens suggested that the magnitude was "likely to be large for some individual firms that experience high-profile incidents, but small in relation to overall costs".

- While some large-scale incidents might provide a testing ground for this hypothesis, there are unlikely to be sufficient New Zealand incidents where data would be available for robust econometric analyses of such trends.
- On other evidence, it is dubious whether the cost of measuring such impacts would be worthwhile, given that the effects may well be minor. Just 0.5% of US mutual funds are devoted to "ethical investment". In order to guide ethical investment flows, there are a number of research organisations that rank industrial organisations according to their social responsibility – only a subset of these includes worker safety issues. Corporate worker safety records don't seem to be a significant issue within the investor community – investor indifference may well reflect consumer indifference.

As with Access Economics' 2004 work for NOHSC,[5] we are sceptical about the value to be added from exploring this item, relative to the likely effort, and have not included it in this New Zealand study.

The association of the loss of goodwill to a particular workplace incident is, in the first place, very difficult to make, and secondly, the valuation of the loss is fairly subjective, or at least difficult to ascertain. Goodwill is something that is built up over time by a company and, although a well-publicised or large incident or accident occurring at that company will damage goodwill, a less publicised incident may cause no loss to goodwill.

The concept of including goodwill as a cost of workplace accidents and injuries is also subjective. In a similar manner to property damage not necessarily being linked to the human costs associated with a workplace incident, it could also be argued that goodwill is not related to the human costs of a workplace incident.

We therefore recommend that there is not a strong case for NOHSAC to include an estimate of the cost for lost goodwill from occupational incidents in its calculations of the cost of workplace injury and illness, although it may be an interesting exercise in a different context.

Prevention

The costs of prevention, although discussed in some of the literature, is generally not costed, nor assigned as a cost of workplace injuries and illnesses. Brady et al,[21] who look into the total costs of health and safety in the workplace, include preventive measures (such as health and safety policy development, regulatory compliance costs and health and safety committees) as an indirect cost not associated with a specific injury or illness.

We argue, in Access Economics[5] and here, that prevention costs are not a part of the actual cost of an occupational injury or disease, but rather a possible response to an incident or maintained as a pre-emptor to potential incidents. Prevention is an important component in the health and safety of workplaces, but should be used as a comparator to the actual costs incurred from incidents. Valuing prevention is important in the economic decision to increase preventive measures to the point where the marginal gain from preventing an injury/illness equates to the marginal cost of prevention. Indeed, spending more on prevention should be seen as a positive step towards a safer work environment, not as a cost that should be avoided.

SECTION THREE

COMPENSATION DATA

3

Incidents of occupational injury and disease may be compensated or uncompensated, as noted earlier. As well as compensation not covering all cases of occupational injury and disease, it is unlikely to cover all the costs of such incidents. Indeed, it is expected to fall well short of the mark, particularly for more severe conditions and for certain types of conditions. As such, there are fundamental flaws in extrapolating information from compensation data to a full costing of occupational incidents or as a basis for policy decisions. However, analysis of the compensation data is an essential starting point on which to build certain cost elements, to be able to estimate who bears the costs of occupational incidents.

As a first step, it is necessary to estimate the number of uncompensated incidents. In Australia, there are independently gathered survey data available from the Australian Bureau of Statistics (*Work-related injuries*, ABS Catalogue Number 6324.0) that provide estimates of the aggregate number of work-related injuries for persons aged 15 years or over in the twelve months prior to being surveyed. These data were adjusted to take account of those who were considered, from their survey responses, to be ineligible for various reasons.[5]

In New Zealand, there is no similar independent survey that would enable a top-down estimate of the total number of incidents of occupational injuries (or diseases), so a bottom-up approach has been adopted instead, building up from what is known regarding compensated cases of occupational injury and disease, and utilising other data from the literature investigation, in particular Driscoll et al.[1]

To this end, compensation data were requested from the ACC for the most recent year available (in the event, 2004–05) and the preceding three years (2001–02, 2002–03, 2003–04) were requested for the number of claims, average and median cost per claim disaggregated by:

- age group (15–24, 25–44, 45–64, ≥65 years)
- gender (male, female)
- ethnicity (Māori, Asian, NZ European, Pacific Islander and other unknown)
- injury/illness (by major ICD-10 category)
- type of cost (medical, transport, legal etc – whatever your classifications are)
- industry (ACC classification system)
- cause (ACC classification system) and
- severity, in turn, disaggregated by:
  - temporary absence, full return to work (with average number of days off work)
  - temporary absence, partial return to work (with average number of days off work AND days worked on return compared to before the incident)
  - permanent incapacity
  - fatality.

There was an attempt to optimise matrices within the ACC data to enable multiple cross-tabulations without generating high standard errors or breaching confidentiality restrictions. Refinements to this data specification are briefly discussed below.

3.1 ACC DATASET ISSUES

3.1.1 COVERAGE OF INCIDENTS

The ACC data provided covered any work-related claim that was registered with ACC. It was noted that 10–15% of claims were declined or pending. The ACC were not aware of any reason why the rejected claims would reasonably be considered to be valid occupational injuries or illnesses. Discussion and estimation of the likely number of uncompensated incidents is detailed in Section 4.1.

3.1.2 YEAR OF INCIDENT, YEAR OF REGISTRATION

As noted in the literature, time lags between when incidents occur and when compensation claims are registered can be problematic (particularly for diseases) in attempts to calculate costs that relate to defined time periods. However, the ACC advised that historical data showed that over 95% of claims are registered within six months of the incident, and almost all of the remaining 5% are registered within one to two years, suggesting a relatively unskewed distribution and lending confidence to the use of data based on date of the incident or date of claim lodgement, although this might change if there were a trend, for example, towards a greater proportion of compensated disease cases over time.

- Using year of incident would risk understatement of the number of recent incidents (those that had not yet been registered), in particular for certain types of conditions that tend to be late-registered due to long lead times, eg, asbestos and hearing loss claims.
- Using year of registration would not accurately reflect the year in which the incidents occurred, which is conceptually less pure when trying to match with uncompensated incidents or make comparisons over time.

3.1.3 MATCHING COST PERIODS

In a similar vein to matching periods for actual and registered incidents due to lags, there is also a need to allow for further lags between when costs are incurred (eg, lost wages, medical expenses) and when the compensation payment is banked. ACC make allowance for this by calculating, in addition to “paid costs”, the “ultimate cost” (future expected costs) estimated for each time period, based on historical trends of open claims that are subsequently paid out, using the Statistical Case Estimate Model.

3.1.4 TYPES OF COSTS

A process of consultation with ACC led to the following cost categorisation, which matches conceptually and enables a classification schema in line with that of NOHSC,[18] as depicted in Table 3.1.

TABLE 3.1 Schema for cost classification

CONCEPTUAL GROUP	TOTAL (T)	EMPLOYER (E)	WORKER (W)	SOCIETY (S)
Production disturbance costs (PDC)	Value of production (including overtime)	Overtime premium; employer excess payments; sick leave	Loss of income prior to return or permanent replacement, net of compensation, welfare and tax	Compensation and welfare payments transferred to worker for temporary loss of wage; tax losses prior to return or permanent replacement
	Staff turnover costs	Staff turnover costs	Zero	Zero
Human capital costs (HKC)	Present value of earnings before incident minus earnings after incident	Zero	Loss of income after return or permanent replacement, net of compensation, welfare and tax	Compensation and welfare payments for lost income earning capacity; tax losses after return or permanent replacement
Health and rehabilitation costs (MEDC)	Medical, hospital, other health and rehabilitation costs incurred as a result of the injury	Threshold medical payments	Gap payments for medical, hospital and rehabilitation services	Compensation medical, hospital and rehabilitation payments; public health system payments; private sector/health insurance payments
Administrative costs (ADMINC)	Legal costs	Real legal costs incurred plus fines and penalties	Real legal costs incurred	Real legal and enforcement costs incurred minus fines and penalties credit
	Investigation costs	Employer investigation costs	Zero/negligible	Real costs of running the compensation system (including investigation of claims)
	Travel costs	Zero/negligible	Travel costs, net of compensation	Compensation for travel costs
	Cost of funeral today minus present value of future cost	Zero	Net costs of bringing forward funeral	Compensation for funeral costs
Transfer costs (TRANC)	Real deadweight costs of transfer payments (welfare and tax)	Negligible	Zero (accounted for in netting other items)	Deadweight costs of welfare payments (DSP, SA, Mobility Allowance, Rent Assistance); deadweight costs of tax losses

CONCEPTUAL GROUP	TOTAL (T)	EMPLOYER (E)	WORKER (W)	SOCIETY (S),
Other (OTHERC)	Carers	Zero	Carer costs net of carer payment/ allowance	Payments to carers plus deadweight cost
	Aids, equipment and modifications	Zero	Aids etc (net cost after reimbursements)	Reimbursements for aids etc, plus deadweight cost
Suffering/early death (SUFFC)		Zero	Suffering, early death (net of compensation)	Compensation payments for same
T= E + W + S for each line. Total financial costs = PDC + HKC + MEDC + ADMINC + TRANC + OTHERC.				
Suffering and early death are reported separately due to uncertainty levels.				
Each cell is sub-categorised by severity level, compensated/uncompensated and disease/injury.				
Note: Property damage and prevention costs are conceptually different and thus excluded.				

The ACC categories are listed below.

- Weekly compensation
- Independence allowance/lump sum payments (for permanent impairment)
- Death benefits
- Rehabilitation costs – these include attendant care, home help, residential care and capital/equipment costs (eg, wheelchairs)
- Hospital treatment costs
- Medical treatment costs – these include ambulance, GPs, allied health and other non-hospital costs
- Transport costs
- Legal costs
- Total paid costs
- Ultimate cost total.

3.1.5 OTHER DATA ISSUES

Diagnosis

The ACC advised that around 3% of injuries in recent years have no ICD-10 category coding, and around 15% of claims have multiple diagnoses listed. This is in part due to free-field entry and thus text that is interpreted from what a doctor or other health professional has recorded. For the analysis, this categorisation was thus based on the primary diagnosis, and the missing codes were recorded as “unknown”.

Industry codes

ACC classify industries using the ANZIC (Australia New Zealand Industry Classification) system. In around 20% of claims, the industry is not recorded (low cost claims). The missing data were categorised as “unknown”.

Under-estimation of hospital costs

Paid costs recorded against a claim exclude any acute public health care costs, ie, hospital emergency department, acute inpatient bed stay costs and outpatient treatment. Elective surgery costs are included. Steps are underway to link the ACC and NZHIS hospital databases; however, this process was not sufficiently advanced to be used for this analysis. These items are thus seriously under-estimated. If it were assumed that all private health costs were included in the compensation paid, then an alternative approach would be to calculate the average cost of care per ICD-10 category in the private system and then attribute public sector care costs on this basis.

Data enhancements and other notes

For claims paid weekly compensation, an estimate of actual paid duration was available and was provided by ACC. Claims with only a partial return to work were able to be identified and average days worked estimated. Their pre-accident work pattern was also available. For open claims, an estimate of future expected weekly compensation duration was also available.

Permanent impairment is recorded as a percentage of the whole person in 10% bands, but there may be a significant delay until the claimant is stabilised before an assessment is made.

3.2 DATA INTERROGATION METHODOLOGY

Data analysis was performed in SAS, with a copy of the code used supplied to NOHSAC. A separate dataset for each data series was created. The first dataset contained the relevant claim data from the year of accident, and the second dataset contained the same information collected in the year the claim was actually paid. A summary table was created to check the average claim amount in each year as well as the total for the dataset, to verify the unit record data agreed with a supplied summary of the totals by the ACC. The following data adjustments were made:

- The data were scanned for any extreme outliers and, while some outliers were found, these were retained, as they were interpreted to be reasonable since they were usually of severity category 5 and 6 (no return to work and fatality).
- The ICD-10 category data, which were supplied as 21 categories, were meta-categorised into Injury (ICD Categories 19–22), Disease (ICD Categories 01 to 18, excluding 15) and Musculoskeletal (ICD-10 category 15).
- The cause data, which were supplied as 40 categories as shown in Table 3.2 below, were meta-categorised as follows:
  - Categories 1 to 19 — Loss of balance or personal control
  - Categories 21 to 29 and 91 — Loss of control of vehicle
  - Categories 31 to 39 — Fire or explosion
  - Categories 51 to 69 and 89 — Collapse, overturn or inundation
  - Category 92 — Lifting/carrying/strain
  - Category 71 — Work property or characteristics
  - Categories, 81, 96 to 99 and 0 — Other

TABLE 3.2 ACC cause codes

CATEGORY	CAUSE	CATEGORY	CAUSE
1	Slipping, skidding on foot	21	Puncture
2	Tripping or stumbling	23	Mechanical malfunction
3	Pushed or pulled	25	Swerving/evasive action
4	Loss of consciousness/sleep/giddy	27	Skid
5	Something giving way underfoot	28	Driving into hole/object/animal etc
8	Twisting movement	29	Other loss of control of vehicle
9	Lurching/jerks in vehicles etc	31	Fire
11	Misjudgement of support	33	Explosion/blasting/implosion
12	Loss of hold	35	Shooting
13	Struck by hand-held tool/implement	37	Electrical shock/short circuit
15	Struck by person/animal	38	Boiling (violent and inadvertent)
19	Other loss balance/personal control	39	Other or unclear fire or explosion

CATEGORY	CAUSE	CATEGORY	CAUSE
51	Collapse of stack/goods in bulk	81	Exposure to elements
53	Object coming loose/goods shifting	89	Bursting/breakage/distortion
55	Collision with/knocked over by object	91	Inadvertent machine/vehicle movement
57	Recoil/ejection	92	Lifting/carrying/strain
59	Folding/collapse	96	Medical treatment
61	Flooding/overflow/escape of liquid	98	Criminal act
69	Other collapse/overturning/inundation	99	Other or unclear cause
71	Work property or characteristics	0	Other/undefined

Cross-tabulations were created for each year by severity, age group, ethnicity, injury/disease, ICD descriptors, industry and cause. Details of these groupings are in the table below.

TABLE 3.3 Summary of categories for data cross-tabulations

FIELD	CATEGORIES
Severity	1 Off work for less than 7 days 2 >7 days and full return to work 3 >7 days and staged return to work 4 >7 days and partial return to work 5 No return to work 6 Fatality 9 Other
Age group	15–24 25–44 45–64 65 plus
Ethnicity	NZ European NZ Māori Pacific Islander Asian Other
Injury/disease	Disease Injury Musculoskeletal
ICD descriptors	01 Medical and surgical procedures 02 Infectious and parasitic diseases 03 Neoplasms 04 Endocrine, nutritional and metabolic diseases and immunity disorders 05 Diseases of blood and blood forming organs 06 Mental disorders 07 Disease of the nervous system and sense organs 08 Diseases of the circulatory system 09 Diseases of the respiratory system 10 Diseases of the oral cavity, salivary glands, and jaws 11 Diseases of the digestive system 12 Diseases of the genitourinary system 13 Complications of pregnancy, childbirth, and the puerperium 14 Diseases of the skin and subcutaneous tissue 15 Diseases of the musculoskeletal system and connective tissue 16 Congenital anomalies 18 Symptoms, signs, and ill-defined conditions

FIELD	CATEGORIES
	19 Fractures 20 Dislocations 21 Sprains and strains 22 Injury and poisoning
Industry	A Agriculture, forestry and fishing B Mining C Manufacturing D Electricity, gas and water supply E Construction F Wholesale trade G Retail trade H Accommodation, cafes and restaurants I Transport and storage J Communication services K Finance and insurance L Property and business services M Government administration and defence N Education O Health and community services P Cultural and recreational service Q Personal and other services Z Classification unknown
Cause	1 Loss of balance or personal control 2 Loss of control of vehicle 3 Fire or explosion 4 Collapse, overturn or inundation 5 Work property or characteristics 6 Lifting/carrying/strain 9 Other

3.3 COMPENSATED INCIDENTS AND COSTS

The ACC data revealed that:

- in 2004–05, there were a total of 253,812 occupational incidents with compensated cost of $204.5 million in that year and "ultimate" expected cost of $479.9 million
- the number of incidents has grown by 1.1% per annum on average over the three years to 2004–05
- paid costs have fallen on average by 4.0% per annum (reflecting lags in recent payments) while ultimate cost has grown on average by 14.6% per annum.

This trend is also evident in the cost per case data, as summarised in Table 3.4 and Figure 3.1.

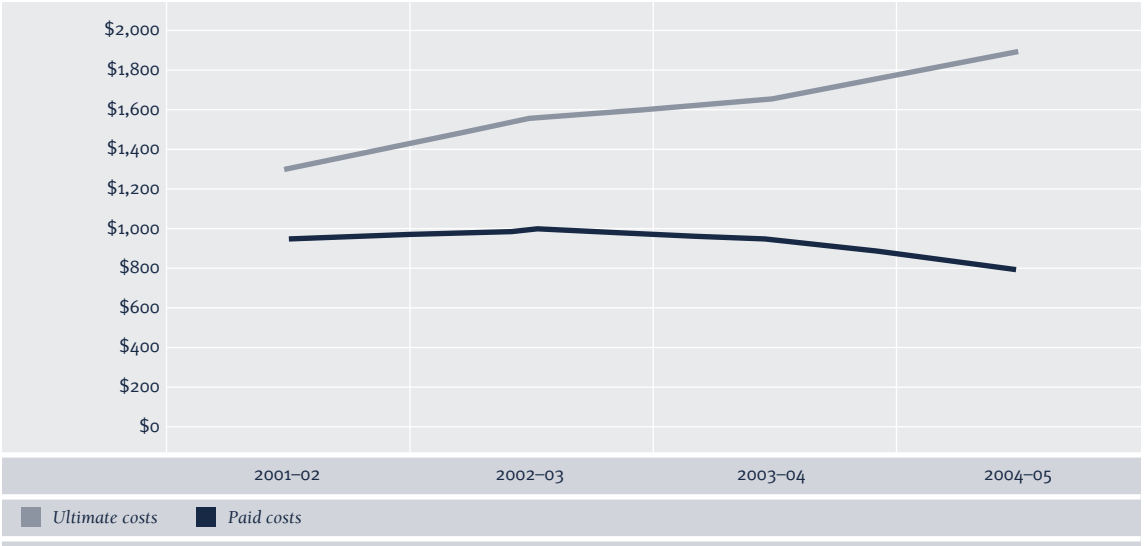
TABLE 3.4 Compensated incidents and costs, 2001–02 to 2004–05

	CASES	PAID COST ($M)	ULTIMATE COST ($M)
2001–02	245,861	235.2	321.5
2002–03	256,956	258.1	401.0
2003–04	254,093	242.9	423.2
2004–05	253,812	204.5	479.9
% CHANGE			
2001–02 to 2002–03	4.5%	10%	25%
2002–03 to 2003–04	-1.1%	-6%	6%
2003–04 to 2004–05	-0.1%	-16%	13%
3-year average	1.1%	-4.0%	14.6%

Note: Totals may not sum due to rounding.

Source: ACC data special request.

FIGURE 3.1 Compensated costs per case, paid and ultimate, 2001–02 to 2004–05



Source: ACC data special request

3.3.1 BY DEMOGRAPHIC GROUPS

Analysis by age reveals that paid cost per case increases with age group in 2004–05.

- Workers aged 15–24 years receive on average less than half the average payout, ie, 8–9% of total cost while representing 19% of cases.
- Workers aged 45–64 received 28% higher than average payouts, ie, 42% of total cost but 33% of cases. In 2004–05, these workers received:
  - $2,427 compared to $1,891 on average for ultimate cost per case
  - $1,029 compared to $806 on average for paid cost per case.
- This may reflect more severe incidents (eg, fatalities from chronic disease) disproportionately affecting older workers.
- While paid cost per case for the oldest workers was highest, ultimate cost per case was less than the average, suggesting quicker settlements (lump sums).
- The results were similar for the previous years.

TABLE 3.5	Compensated incidents and costs, by age, 2004–05				
	TOTAL COST			COST PER CASE	
AGE GROUP (YEARS)	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
15–24	47,867	18.4	37.9	385	793
25–44	114,817	84.4	227.8	735	1,984
45–64	82,983	85.4	201.4	1,029	2,427
65 and over	8,145	16.3	12.8	2,004	1,567
All ages	**253,812**	**204.5**	**479.9**	**806**	**1,891**
	% OF TOTAL			RATIO TO ALL-AGE AVERAGE	
15–24	19%	9%	8%	0.48	0.42
25–44	45%	41%	47%	0.91	1.05
45–64	33%	42%	42%	1.28	1.28
65 and over	3%	8%	3%	2.49	0.83
All ages	**100%**	**100%**	**100%**	**1.00**	**1.00**
Note: Totals may not sum due to rounding.					
Source: ACC data special request.					

Analysis by gender reveals that cost per case is higher for males (all years), again potentially reflecting greater severity of incidents (Table 3.6).

- Males comprised 75% of cases each year but around 80% of costs. In 2004–05:
  - the paid cost per case for males was $862 compared to $633 for females
  - the ultimate cost per case for males was $2,002 compared to $1,548 for females.

TABLE 3.6	Compensated incidents and costs, by gender, 2004–05				
	TOTAL COST			COST PER CASE	
GENDER	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
Females	62,372	39.5	96.6	633	1,548
Males	191,440	165.0	383.4	862	2,002
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
	% OF TOTAL			RATIO TO AVERAGE	
Females	25%	19%	20%	0.79	0.82
Males	75%	81%	80%	1.07	1.06
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**
Note: Totals may not sum due to rounding.					
Source: ACC data special request.					

Analysis by ethnicity reveals that cost per case is lower for people of Asian and Pacific Island ethnicity (all years).

- Paid cost per case for Pacific Island and Asian New Zealanders was around 70–80% of the average, while ultimate cost per case was around 80–90% of the average respectively (Table 3.7).

TABLE 3.7	Compensated incidents and costs, by ethnicity, 2004–05				
	TOTAL COST			COST PER CASE	
ETHNICITY	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
NZ European	179,694	149.1	338.3	830	1,883
NZ Māori	32,394	24.9	62.7	770	1,936
Pacific Islands	13,019	7.6	19.8	583	1,522
Asian	8,470	5.3	14.1	629	1,669
Other	20,235	17.6	45.0	870	2,223
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
	% OF TOTAL			RATIO TO AVERAGE	
NZ European	71%	73%	70%	1.03	1.00
NZ Māori	13%	12%	13%	0.96	1.02
Pacific Islands	5%	4%	4%	0.72	0.81
Asian	3%	3%	3%	0.78	0.88
Other	8%	9%	9%	1.08	1.18
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**

Note: Totals may not sum due to rounding.

Source: ACC data special request.

3.3.2 BY SEVERITY CATEGORIES

Analysis by severity reveals that cost per case was highest for people who were permanently disabled, prohibiting return to work (severity category 5).

- These people represented less than 0.05% of cases and around 1–2% of costs, which was similar to people partially returning to work and for fatalities, although cost per case for fatal incidents was around half the cost of permanent disabilities.
- People who are off work for less than 7 days represent around 90% of cases and around 25% of costs.
- People who were absent for more than 7 days but who have a full return to work (including those with a staged but full return) represent a further 8–9% of cases and around 60% of costs.
- Finally, the "other" category, while only 0.2% of cases, represents around 10% of costs, as these cases are likely to be the ones where it is still uncertain whether and how a partial/staged return to work may be possible.
- Table 3.8 includes the "all years" shares data as well 2004–05, as it seems to indicate that, as expected, over time the shares of severity categories 1, 2 and 3 fall, while 4, 5 and 6 increase.

TABLE 3.8 Compensated incidents and costs, by severity, 2004–05 (and all years)

SEVERITY, 2004–05	TOTAL COST			COST PER CASE	
	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
1. Less than 7 days	230,546	52.8	114.6	229	497
2. Full return to work	15,494	70.8	169.4	4,569	10,934
3. Staged return to work	6,222	49.5	125.5	7,954	20,164
4. Partial return to work	215	2.0	4.8	9,266	22,148
5. No return/permanent disability	30	2.3	3.5	77,655	118,322
6. Fatality	64	2.5	5.2	39,276	81,386
7. Other	1,241	24.6	56.9	19,809	45,848
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
2004–05	**% OF TOTAL**			**RATIO TO AVERAGE**	
1. Less than 7 days	90.8%	25.8%	23.9%	0.3	0.3
2. Full return to work	6.1%	34.6%	35.3%	5.7	5.8
3. Staged return to work	2.5%	24.2%	26.1%	9.9	10.7
4. Partial return to work	0.1%	1.0%	1.0%	11.5	11.7
5. No return/permanent disability	0.0%	1.1%	0.7%	96.4	62.6
6. Fatality	0.0%	1.2%	1.1%	48.7	43.0
7. Other	0.5%	12.0%	11.9%	24.6	24.2
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**
ALL YEARS					
1. Less than 7 days	91.0%	21.6%	22.9%	0.2	0.3
2. Full return to work	6.7%	38.8%	34.7%	5.8	5.2
3. Staged return to work	2.0%	27.7%	29.2%	13.9	14.6
4. Partial return to work	0.1%	1.2%	1.5%	21.0	26.0
5. No return/permanent disability	0.0%	1.8%	0.9%	240.8	126.1
6. Fatality	0.0%	2.0%	1.9%	63.6	59.9
7. Other	0.2%	6.9%	8.9%	37.0	47.9
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**

Note: Totals may not sum due to rounding.

Source: ACC data special request.

3.3.3 BY TYPES OF COST

Weekly compensation payments were the highest cost item (50.7% of paid costs or $103.7 million), followed by medical (25.5% or $52.2 million), rehabilitation (11.5% or $23.5 million) and hospital payments (8.8% or $18.0 million) in 2004–05.

TABLE 3.9 Compensated incidents and costs, by type of cost, 2004–05

2005–06	WEEKLY COMP	IA LUMP SUM	DEATH BENEFITS	REHABILITATION	MEDICAL TREATMENT	HOSPITAL TREATMENT	TRANSPORT	LEGAL	PAID COST	ULTIMATE COST	DURATION DAYS
Disease	9.0	1.1	0.2	12.3	8.1	3.3	0.3	0.0	34.4	60.2	0.2
Injury	73.6	0.1	0.4	8.4	37.2	11.0	3.3	0.0	134.1	329.0	1.3
Musculoskeletal	19.5	0.0	-	2.4	6.2	3.4	0.3	0.0	31.7	80.9	0.3
Other	1.6	0.5	0.7	0.4	0.7	0.3	0.1	0.0	4.3	9.8	0.0
Total	**103.7**	**1.7**	**1.3**	**23.5**	**52.2**	**18.0**	**4.0**	**0.1**	**204.5**	**479.9**	**1.8**
	AVERAGE COST PER CASE ($)										
Disease	703	87	19	960	633	260	24	1	2,685	4,694	12.0
Injury	333	1	2	38	168	50	15	0	607	1,489	6.1
Musculoskeletal	1,218	0	-	147	385	210	18	1	1,980	5,051	19.4
Other	389	113	174	98	178	80	29	3	1,067	2,419	6.5
Total	**409**	**7**	**5**	**93**	**206**	**71**	**16**	**0**	**806**	**1,891**	**7.2**
	% OF TOTAL (%)										
Disease	26.2%	3.2%	0.7%	35.7%	23.6%	9.7%	0.9%	0.0%	100.0%		
Injury	54.9%	0.1%	0.3%	6.3%	27.7%	8.2%	2.4%	0.0%	100.0%		
Musculoskeletal	61.5%	0.0%	0.0%	7.4%	19.4%	10.6%	0.9%	0.1%	100.0%		
Other	36.5%	10.6%	16.3%	9.2%	16.7%	7.5%	2.7%	0.3%	100.0%		
Total	**50.7%**	**0.8%**	**0.6%**	**11.5%**	**25.5%**	**8.8%**	**2.0%**	**0.0%**	**100.0%**		

3.3.4 BY INDUSTRIES AND CAUSES

Table 3.10 presents paid and ultimate costs by industry. One in five incidents (and more than $1 in $5 of costs) occur in the manufacturing sector, although costs per case are highest in the mining industry, ultimately $3,941 per incident occurring in 2004–05.

TABLE 3.10 Compensated incidents and costs, by industry, 2004–05

	TOTAL COST			COST PER CASE	
INDUSTRY GROUP	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
A Agriculture, forestry and fishing	25,942	35.6	82.8	1,373	3,191
B Mining	1,065	1.5	4.2	1,446	3,941
C Manufacturing	51,422	46.3	107.4	901	2,089
D Electricity, gas and water supply	1,253	1.1	2.7	909	2,172
E Construction	28,905	35.5	82.5	1,229	2,854
F Wholesale trade	7,338	5.9	14.4	808	1,966
G Retail trade	18,751	14.2	32.7	758	1,745
H Accommodation, cafes and restaurants	7,431	4.9	13.0	660	1,755
I Transport and storage	10,140	14.0	31.6	1,376	3,116
J Communication services	1,569	1.2	2.9	777	1,832
K Finance and insurance	1,110	0.6	1.5	521	1,351
L Property and business services	11,918	9.5	23.2	801	1,948
M Government administration and defence	4,595	2.4	4.7	529	1,031
N Education	7,331	4.0	9.9	545	1,351
O Health and community services	9,922	8.1	20.5	818	2,063
P Cultural and recreational service	6,305	6.2	15.7	982	2,484
Q Personal and other services	5,627	4.2	8.5	754	1,506
Z Classification inknown	53,185	9.1	21.7	170	408
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
		% OF TOTAL		RATIO TO AVERAGE	
A Agriculture, forestry and fishing	10.2%	17.4%	17.2%	1.70	1.69
B Mining	0.4%	0.8%	0.9%	1.79	2.08
C Manufacturing	20.3%	22.7%	22.4%	1.12	1.10
D Electricity, gas and water supply	0.5%	0.6%	0.6%	1.13	1.15
E Construction	11.4%	17.4%	17.2%	1.53	1.51
F Wholesale trade	2.9%	2.9%	3.0%	1.00	1.04
G Retail trade	7.4%	6.9%	6.8%	0.94	0.92
H Accommodation, cafes and restaurants	2.9%	2.4%	2.7%	0.82	0.93
I Transport and storage	4.0%	6.8%	6.6%	1.71	1.65
J Communication services	0.6%	0.6%	0.6%	0.96	0.97
K Finance and insurance	0.4%	0.3%	0.3%	0.65	0.71
L Property and business services	4.7%	4.7%	4.8%	0.99	1.03
M Government administration and defence	1.8%	1.2%	1.0%	0.66	0.55

	% OF TOTAL			RATIO TO AVERAGE	
N Education	2.9%	2.0%	2.1%	0.68	0.71
O Health and community services	3.9%	4.0%	4.3%	1.02	1.09
P Cultural and recreational service	2.5%	3.0%	3.3%	1.22	1.31
Q Personal and other services	2.2%	2.1%	1.8%	0.94	0.80
Z Classification unknown	21.0%	4.4%	4.5%	0.21	0.22
Total	100%	100%	100%	1.00	1.00

Table 3.11 summarises costs by cause. Over one-third of incidents and costs were due to loss of balance or personal control. Lifting, carrying and strains accounted for a further quarter of incidents and costs. Around 10% of costs were in the catch-all "other" category. Apart from this category, there was not a great deal of variation in cost per case as a result of different causes.

TABLE 3.11 Compensated incidents and costs, by cause, 2004–05

		TOTAL COST		COST PER CASE	
CAUSE	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
1 Loss of balance or personal control	88,588	72.1	175.1	813	1,977
2 Loss of control of vehicle	3,495	2.7	7.0	786	2,004
3 Fire or explosion	1,991	0.9	3.0	473	1,519
4 Collapse, overturn or inundation	21,443	12.3	32.2	574	1,502
5 Work property or characteristics	42,275	43.2	88.1	1,021	2,084
6 Lifting/carrying/strain	63,555	52.1	127.0	820	1,998
9 Other	32,465	21.2	47.5	653	1,462
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
	% OF TOTAL			RATIO TO AVERAGE	
1 Loss of balance or personal control	34.9%	35.2%	36.5%	1.01	1.05
2 Loss of control of vehicle	1.4%	1.3%	1.5%	0.98	1.06
3 Fire or explosion	0.8%	0.5%	0.6%	0.59	0.80
4 Collapse, overturn or inundation	8.4%	6.0%	6.7%	0.71	0.79
5 Work property or characteristics	16.7%	21.1%	18.4%	1.27	1.10
6 Lifting/carrying/strain	25.0%	25.5%	26.5%	1.02	1.06
9 Other	12.8%	10.4%	9.9%	0.81	0.77
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**

3.3.5 BY DISEASE AND INJURY TYPE

Table 3.12 presents detailed information on the number of incidents and compensated costs by ICD-10 category, while Table 3.13 summarises these by disease/injury group.

- In total, injuries represented 87.0% of incidents and two-thirds of costs:
  - Injuries are the aggregate of categories 19 to 22 inclusive.
  - Over 82% of incidents (but less than half of costs) were classified in categories 21 Sprains and strains and 22 Injury and poisoning.
  - Fractures and dislocations (categories 19 and 20) were less than 5% of incidents but some 18% of costs.

- Diseases, including medical and surgical procedures, represented 5% of cases but over 12% of costs.
  - Cancer (category 3 Neoplasms) and cardiovascular disease (category 8) were most expensive per case, at over $40,000 each. However, there were only 34 and 10 cases respectively in 2004–05 that were compensated, combined less than 0.5% of costs.
  - Diseases of the nervous system and sense organs (category 7) represented 2.4% of incidents and up to 10% of costs.
- Musculoskeletal disease (separated from other disease and injuries), was a further 6.3% of incidents and over 15% of costs (ICD-10 category 15).
- "Other" cases represented 1.6% of incidents and around 2% of costs.

TABLE 3.12 Compensated incidents and costs, by ICD-10 category, 2004–05

		TOTAL COST		COST PER CASE	
CAUSE	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
01 Medical & surgical procedures	708	4.9	11.1	6,870	15,725
02 Infectious & parasitic diseases	102	0.2	0.6	2,367	5,471
03 Neoplasms	34	1.2	1.5	36,065	45,267
04 Endocrine, nutritional & metabolic diseases & immunity disorders	1	0.0	0.0	201	215
05 Diseases of blood & blood forming organs	1	0.0	0.0	13	277
06 Mental disorders	170	1.3	4.4	7,610	25,631
07 Diseases of the nervous system & sense organs	6,186	21.4	32.2	3,452	5,210
08 Diseases of the circulatory system	10	0.1	0.4	14,282	42,112
09 Diseases of the respiratory system	111	0.6	1.3	5,075	12,006
10 Diseases of the oral cavity, salivary glands & jaws	517	0.2	0.2	303	387
11 Diseases of the digestive system	894	3.7	5.9	4,101	6,570
12 Diseases of the genitourinary system	10	0.0	0.1	2,905	14,092
14 Diseases of the skin & subcutaneous tissue	4,040	0.8	2.3	209	573
15 Diseases of the musculoskeletal system & connective tissue	16,019	31.7	80.9	1,980	5,051
18 Symptoms, signs, & ill-defined conditions	33	0.0	0.1	1,007	1,718
19 Fractures	8,354	26.7	66.5	3,195	7,963
20 Dislocations	3,661	9.3	21.7	2,543	5,936
21 Sprains & strains	106,220	66.2	160.2	624	1,508
22 Injury & poisoning	102,688	31.9	80.6	310	785
Other	4,053	4.3	9.8	1,067	2,419
Total	**253,812**	**204.5**	**479.9**	**806**	**1,891**
		% OF TOTAL		RATIO TO AVERAGE	
01 Medical & surgical procedures	0.3%	2.4%	2.3%	8.5	8.3
02 Infectious & parasitic diseases	0.0%	0.1%	0.1%	2.9	2.9
03 Neoplasms	0.0%	0.6%	0.3%	44.8	23.9
04 Endocrine, nutritional, & metabolic diseases & immunity disorders	0.0%	0.0%	0.0%	0.2	0.1

	% OF TOTAL			RATIO TO AVERAGE	
05 Diseases of blood & blood forming organs	0.0%	0.0%	0.0%	0.0	0.1
06 Mental disorders	0.1%	0.6%	0.9%	9.4	13.6
07 Diseases of the nervous system & sense organs	2.4%	10.4%	6.7%	4.3	2.8
08 Diseases of the circulatory system	0.0%	0.1%	0.1%	17.7	22.3
09 Diseases of the respiratory system	0.0%	0.3%	0.3%	6.3	6.3
10 Diseases of the oral cavity, salivary glands & jaws	0.2%	0.1%	0.0%	0.4	0.2
11 Diseases of the digestive system	0.4%	1.8%	1.2%	5.1	3.5
12 Diseases of the genitourinary system	0.0%	0.0%	0.0%	3.6	7.5
14 Diseases of the skin & subcutaneous tissue	1.6%	0.4%	0.5%	0.3	0.3
15 Diseases of the musculoskeletal system & connective tissue	6.3%	15.5%	16.9%	2.5	2.7
18 Symptoms, signs, & ill-defined conditions	0.0%	0.0%	0.0%	1.2	0.9
19 Fractures	3.3%	13.0%	13.9%	4.0	4.2
20 Dislocations	1.4%	4.6%	4.5%	3.2	3.1
21 Sprains & strains	41.8%	32.4%	33.4%	0.8	0.8
22 Injury & poisoning	40.5%	15.6%	16.8%	0.4	0.4
Other	1.6%	2.1%	2.0%	1.3	1.3
Total	**100%**	**100%**	**100%**	**1.00**	**1.00**

TABLE 3.13 Compensated incidents and costs, by disease/injury group, 2004–05

		TOTAL COST		COST PER CASE	
GROUP	CASES	PAID COST ($M)	ULTIMATE COST ($M)	PAID COST ($)	ULTIMATE COST ($)
Disease	12,817	34.4	60.2	2,685	4,694
Injury	220,923	134.1	329.0	607	1,489
Musculoskeletal	16,019	31.7	80.9	1,980	5,051
Other	4,053	4.3	9.8	1,067	2,419
All groups	**253,812**	**204.5**	**479.9**	**806**	**1,891**
	% OF TOTAL			RATIO TO ALL-AGE AVERAGE	
Disease	5.0%	16.8%	12.5%	3.33	2.48
Injury	87.0%	65.6%	68.6%	0.75	0.79
Musculoskeletal	6.3%	15.5%	16.9%	2.46	2.67
Other	1.6%	2.1%	2.0%	1.32	1.28
All groups	**100%**	**100%**	**100%**	**1.00**	**1.00**

Note: Totals may not sum due to rounding.

Source: ACC data special request.

SECTION FOUR

TOTAL COST

ESTIMATES

4

Costs calculations are derived by first estimating the total number of incidents (cases) of workplace injury and disease in 2004–05, and then applying the methodology from NOHSC[18] together with the ACC and other New Zealand average cost data to estimate total costs. The first step involves estimating the number of uncompensated cases, which is addressed in the following section.

4.1 UNCOMPENSATED CASES AND THE "N" MATRIX

A number of sources are relevant when estimating the number of uncompensated cases of work-related disease and injury in New Zealand in 2004–05.

- Driscoll et at[1] estimated that, each year in New Zealand, there are:
  - about 700–1,000 deaths from occupational disease
  - about 100 deaths from occupational injury
  - 17,000–20,000 new cases of work-related disease
  - about 200,000 occupational accidents resulting in ACC claims.
- Australian survey data suggested that there were, in fact, many cases of occupational injuries that were not included in compensation datasets because either a linkage could not be proven, or the injuries were relatively minor and the employees reported that they did not believe they were eligible to claim, or that they believed the possible compensation was not worth the effort (or the perceived repercussions) of lodging a claim.
- The literature (notably Head and Harcourt[3]) suggested that compensation was believed to be more generous, widely available and easily accessible in New Zealand than overseas, with a direct comparison to Australian compensation (recall Section 2.1.3).
- Section 3.1.1 noted that the ACC data covered work-related claims registered, with 10–15% of claims declined or pending, and the view that this coverage was relatively comprehensive.
- Another New Zealand view reflected was that compensation coverage of injuries may be better than for diseases, in terms of incidents covered.

Piecing together these pieces of information and the compensation data from the previous chapter, a matrix was derived of a "base case" scenario for 2004–05 of the number of incidents by disease and injury, cross-tabulated to severity, derived in turn from a "low" (best) case scenario and a "high" (worst) case scenario.

- The **low case** uses the lower bounds from Driscoll et al[1] and the most positive view of the accessibility of compensation for injuries, postulating 700 deaths from occupational disease, 17,000 cases of work-related disease, 90 fatal workplace injuries and no uncompensated non-fatal workplace injuries.
- The **high case** uses the upper bounds from Driscoll et al[1] and accessibility of compensation for injuries on par with that of Australia, postulating 1,000 deaths from occupational disease, 20,000 cases of work-related disease, 110 fatal workplace injuries and uncompensated workplace injuries estimated as a further 39% of the number of compensated injuries.[18]
- The **base case** takes a mid-range of these scenarios, with 850 deaths from occupational disease, 18,500 cases of work-related disease, 100 fatal injuries and total workplace injuries estimated as the average of those of the low and high scenarios.

The conceptual approach is summarised in Table 4.1.

TABLE 4.1	Conceptual framework for estimating the number of incidents		
	COMPENSATED	UNCOMPENSATED	TOTAL
Injuries	ACC data	Derived as residual	Factored up based of average of a minimum from Driscoll et al[1] and a maximum from Australian estimates
Disease	ACC data	Derived as residual	Estimated from attributable fractions[1]
Total	ACC data	Vertical sum and horizontal residual	Vertical and horizontal sum

Two final points should also be made:

- In estimating the severity splits for compensated injuries and diseases, the "musculoskeletal" and "other" compensated incidents were allocated 94.5% to injuries and 5.5% to disease, in line with the ratio of defined injuries to diseases. Thus instead of the 253,812 cases being allocated 220,923 to injuries, 12,817 to disease and 20,072 to "musculoskeletal and other", they were simply allocated 239,894 to injury and 13,918 to disease.
- In addition, the non-fatal severity splits for uncompensated injuries and diseases were allocated in the same proportions as the compensated ones, which may tend to err on the conservative side, which is desirable when evidence is lacking.

The resulting estimate of the total number of incidents in 2004–05 is 305,150 (256,894 to 353,407), with the severity and injury/disease sub-categorisations estimated as shown in Table 4.2.

COMPARISONS WITH AUSTRALIA

These findings suggest that, in New Zealand, the number of compensated workplace incidents is about 83% of the total, compared to 69% in Australia, which bears out the general view that, across the board, access to compensation is relatively good.

However, excluding the relatively large number of the least severe incidents in both countries reveals that only 81% of the remaining incidents are compensated in New Zealand, compared to 87% in Australia, which also seems to bear out the anecdotes (eg, in relation to relatively poor access to compensation for more severe conditions such as cancer). Moreover, while the estimates from Driscoll et al[1] are the best currently available, it should be noted that they appear very conservative, and thus in our view there is considerable risk that the number and proportion of uncompensated cases (particularly for disease) in New Zealand is in fact higher than the estimates presented in this report.

Moreover, in making comparisons between the two countries, it must be noted that the overall per capita rates of occupational injury and disease appear much higher in New Zealand than in Australia – some 15% of the workforce relative to around 4% per annum respectively.

TABLE 4.2	Estimated workplace incidents, by severity and disease/injury, 2004–05		
TOTAL CASES	**COMPENSATED**	**UNCOMPENSATED**	**TOTAL**
1. Less than 7 days	230,546	45,839	276,386
2. Full return to work	15,494	3,112	18,606
3. Staged return to work	6,222	1,247	7,469
4. Partial return to work	215	44	259
5. No return/permanent disability	30	7	37
6. Fatality	64	886	950
7. Other	1,241	203	1,444
Total	**253,812**	**51,338**	**305,150**
INJURY			
1. Less than 7 days	218,515	42,589	261,104
2. Full return to work	14,270	2,781	17,051
3. Staged return to work	5,768	1,124	6,893
4. Partial return to work	191	37	229
5. No return/permanent disability	11	2	13
6. Fatality	42	58	100
7. Other	1,097	164	1,261
Total	**239,894**	**46,756**	**286,650**
DISEASE			
1. Less than 7 days	12,031	3,250	15,282
2. Full return to work	1,224	331	1,555
3. Staged return to work	454	123	576
4. Partial return to work	24	6	30
5. No return/permanent disability	19	5	24
6. Fatality	22	828	850
7. Other	144	39	183
Total	**13,918**	**4,582**	**18,500**

4.2 TOTAL COST ELEMENTS

In line with the schema presented in Section 3.1.4 (Table 3.1), this section explains the calculation of costs by type, severity and compensated/uncompensated, in line with the NOHSC methodology,[18] although with some methodological variations to accommodate differences in New Zealand data and parameters. Note that in each case the cost elements are multiplied by the "N" matrix, that is, the matrix of incidents in each relevant category as derived in the previous section.

4.2.1 PRODUCTION DISTURBANCE COSTS (PDC)

Production disturbance costs (PDC) are the extra cost of production or the value of production lost while the sidelined worker is off work, prior to either return (full or partial) or permanent replacement, together with the costs of such replacement if required.

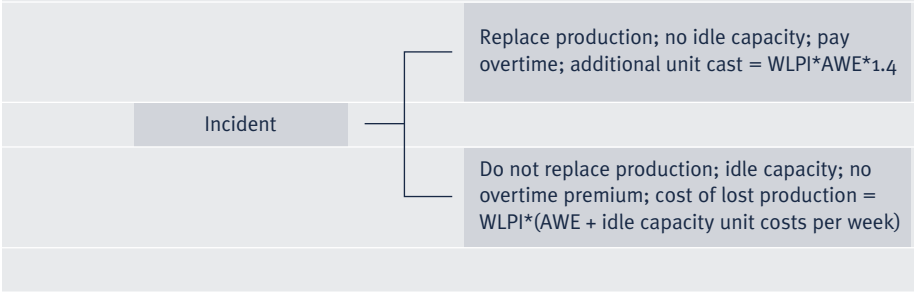
Walsh et al[43] state that "absenteeism is the most frequently measured component of indirect costs" and that it is quite often used as a proxy for productivity losses.[21] The Industry Commission[4] defined loss of productivity as

"the hours not worked, yet paid for by the employer". This definition is used in NOHSC[18] and measured using average wages plus on-costs, multiplied by an assumed period of absence following a workplace incident.

Value of production (VOP) lost

An important consideration in PDC is that the employer/producer may either lose the production (and suffer idle capacity of associated plant and equipment) or utilise alternative labour usually at a premium price (and hence continue to employ other inputs of production at normal levels) to maintain production, or some combination of these. These pathways are mutually exclusive in total, as illustrated in Figure 4.1. We utilise the real world observation that producers prefer, where possible, to maintain production. Hence, we estimate the cost of that path, noting that if the costs of idle capacity are to be included in the future, the method for calculating this item would have to change.

FIGURE 4.1 Value of production pathways



The ordinary value of production of the sidelined worker is average weekly earnings (AWE), plus a mark-up for on-costs.

- In New Zealand, we use average weekly earnings of $794.83,[44, 45] including full-time and part-time earnings, from the March 2005 quarter, to accord with the ACC data. The on-cost mark-up used is 12.5%, bringing total AWE including on-costs to $894.18.
- This wage rate is multiplied by the average weeks lost per incident (WLPI) for each severity category, from the ACC data (with five work days in a week).
- The overtime premium payment (OTP) in the case of the production being replaced, is estimated as:

OTP = WLPI*AWE*0.4

  - The overtime premium of 40% is based on NOHSC[18] and is lower than the 50% used by the Industry Commission,[4] citing work by Oxenburgh[46] who suggested an overtime rate of 50 to 100%.
  - The lower rate was used noting that, in the presence of slack labour resources internal to some affected workplaces, it is possible that there may be less overtime and over-employment costs for some incidents, so that employers may make up lost production through use of salaried or part-time employees to make up the production at ordinary or no additional wage costs.
  - Note also that this approach implicitly assumes that the distribution of overtime worked is the same as the distribution of incidents.
- Thus in total, the value of production (VOP) is defined by the equation:

VOP = WLPI*AWE*1.4

Staff turnover costs (STC)

Further to the cost of production at a premium price, there is also a disruption to production, in severity categories other than 1 and 2, of bringing forward the employment and training of new staff to make up production that is unable to be continued by the sidelined worker in the medium to long term – the staff turnover and training cost (STC).

Literature analysis revealed that staff turnover and training costs vary markedly between studies. Leigh et al[9] indicate that the "cost of hiring and training are difficult to estimate" and "few studies have addressed the issue".

Barron, Black and Lowenstein[47] estimate that 161 hours of managers' and co-workers' time is required to hire and train new workers during the first three months of their tenure. Leigh states that this calculation is likely to be an under-estimate, given the sample used by the authors. Leigh nevertheless uses this figure (which equates to US$2,454 in 1992) as the cost for hiring, training and disruption to a company for every death, permanent total injury and permanent partial injury. He then assumes that temporary injuries add US$149 apiece and all other disabling injuries cost US$12 apiece.

Other studies provide considerable variance on these figures:

- Access Economics[48] estimates hiring costs alone to average US$3,310 in 1994.
- Miller and Galbraith[49] assumed that a fatal injury would cost the employer four months of wages to pay for recruitment, retraining and loss of special skills. This appears to be an arbitrary assessment with no reasoning stated.
- The HSE[16] use an average figure of UK£1,918 per employee turned over. This includes leaving costs, replacement costs, transition costs and other indirect costs associated with loss in customer service/satisfaction. However, the authors of this study state that, since employees will leave at some point irrespective of their injury/illness, it is only the cost of bringing forward labour turnover that should be included.
- The Council for Equal Opportunity Employment (CEOE) in Australia stated in 2004 that labour turnover costs range between 50–130% of the incumbent's salary.[v] This includes costs associated with separation (exit interviews, administration, separation pay), replacement of staff (job advertising, administration, interviews, testing, staff meeting, post-employment dissemination of information), training, lost productivity and lost business costs.
- The Information Industries Bureau of the Queensland government used an even higher estimate of the costs of turnover, of 80–200% of the incumbent's salary depending upon skill and responsibility level.[50] This was based on a very similar list of components to that of the CEOE and also included intangible costs such as intellectual capital, employee attitudes and innovation.
- Access Economics[5] concluded the following from this evidence:
  - Overseas data used to estimate this item ranges from four weeks (covering hiring, training and "disruption" which the US study acknowledges is conservative) and around five weeks (more comprehensive coverage in the UK study[vi]) to 16 weeks in Miler and Galbraith.[49]
  - In Australia, the costs appear much higher, ranging from 26 to 104 weeks salary, and covering separation, recruitment, training and (less relevantly) lost productivity and lost business costs.
  - In contrast to NOHSC's pre-2004 54.5 weeks in total, we estimate the costs more conservatively at the low end of the Australian spectrum, that is 26 weeks.
  - Staff turnover costs are assumed to be brought forward by three years, based on average staff turnover of 15% per annum, which implies that people change jobs, on average, approximately once every 6.7 years, so the sidelined worker on average, therefore, was likely to have had 3 years to his/her next job change before the incident occurred.

Therefore, in New Zealand, the cost of bringing forward the staff turnover is estimated as:

$$STC_{(3\text{-}7)} = 26*AWOTE - (26*AWOTE)/(1+r)3$$

An added complexity in the "bring-forward" is that the worker's replacement will also have earlier replacement costs – ie, the firm will need to recruit again in six years rather than 9, and in 12 rather than 15, and so on. We have conservatively limited this analysis to the first round effects, however.

v Information obtained from http://www.eowa.gov.au/, accessed on 5 January 2004.

vi Assuming AWE around £400, applied to the average figure of £1,918 per employee turned over.

Total PDC

Total PDC is defined as the sum of the value of production lost and the staff turnover costs.

$$PDC = VOP_{(1\text{-}7)} + STC_{(3\text{-}7)}$$

Results for New Zealand are presented in Table 4.3 below showing:

- total cost of the disturbance to production was estimated as $572.9 million in 2004–05, of which $471.9 million (82%) was for compensated cases and $101.0 million (18%) was for uncompensated cases
- the value of production lost was $557.6 million (97%), while the staff turnover costs were $15.3 million (3%).

TABLE 4.3 PDC costs, by severity and compensation status, 2004–05 ($m)

SEVERITY	WEEKS LOST PER INCIDENT	COMPENSATED CASES	UNCOMPENSATED CASES	TOTAL
	VALUE OF PRODUCTION			
<7 days	0.20	56.4	11.2	67.6
Full return	10.50	203.8	40.9	244.7
Staged return	16.87	131.4	26.3	157.8
Partial return	20.99	5.6	1.1	6.8
Permanent	41.47	1.6	0.4	1.9
Fatal	6.11	0.5	6.8	7.3
Other	39.58	61.5	10.1	71.6
Total	**1.45**	**460.7**	**96.8**	**557.6**
	STAFF TURNOVER COSTS			
Staged return		7.4	1.5	8.9
Partial return		0.5	0.1	0.6
Permanent		0.1	0.0	0.1
Fatal		0.2	2.1	2.3
Other		3.0	0.5	3.4
Total		**11.1**	**4.2**	**15.3**
	TOTAL PDC			
<7 days		56.4	11.2	67.6
Full return		203.8	40.9	244.7
Staged return		138.9	27.8	166.7
Partial return		6.2	1.3	7.4
Permanent		1.6	0.4	2.0
Fatal		0.6	8.9	9.5
Other		64.4	10.6	75.0
Total		**471.9**	**101.0**	**572.9**

A breakdown of PDC by who bears those costs – employers, workers or society – is derived in the following sections.

PDC borne by the employer

The employer pays for the staff turnover costs and the overtime premium for the employees who must work overtime to do the sidelined worker's job. The normal VOP cost, for the sidelined worker, however, is borne in part by the employer, in part by the community and in part by the individual. In compensated cases, the employer pays an excess payment (EEP), while in both uncompensated and some compensated cases, sick leave (SL) may be taken in the short term as it is available. Thus:

$$PDCE = OTP + STC + EEP + SL$$

Employer excess payment (EEP)

For moral hazard reasons, insurers do not compensate employees their full wage. The literature discusses the potential of insurance payments changing the behaviour of employers and employees. For example, for employees, moral hazards include spending a longer period of time out of work, the filing of a workers' compensation claim for a non work-related injury, or failing to take proper safety precautions. For employers, moral hazards might include the failure to provide appropriate safety training or not providing appropriate work to injured workers.[51]

Reville cites work on the moral hazards issue, showing that higher disability benefits lead to higher disability claims. This work has also shown that higher benefits lead to greater time out of work for those with a temporary disability. There is, however, debate regarding the reasons for this.

In the US, Miller[10] states that the average compensation system pays:

- 86% of temporary disability after-tax wage losses
- 50% of after-tax wage losses for permanent disabilities.

Miller also indicates that state laws in the US set qualifying thresholds, ranging from two to nine days, before wage loss compensation kicks in. In the meantime, employees usually remain on sick leave and on the payroll. The duration of this period impacts on the split of the cost between the employer, employee and community. With a longer threshold, the employer bears more of the cost.

NOHSC[18] models employer excess payments using the weighted average proportion of workers' wages paid by employers (96.5%) and the average excess period (3.3 days out of 5-day work week).

- The parameters were based on compensation, ABS and Commonwealth Government data and are also used for the New Zealand calculation, with the exception that for category 1 workers, WLPI is much less than in Australia (1.0 rather than 2.2) so naturally the New Zealand parameter is used instead.
- It is important to note that the EEP must be based on average weekly ordinary time earnings (AWOTE), rather than AWE.
- New Zealand AWOTE was $770.44,[44, 45] including full-time and part-time earnings, from the March 2005 quarter, to accord with the ACC data. The on-cost mark-up used is 12.5%, bringing total AWOTE including on-costs to $866.75.

$$EEP_{(1\text{-}7,c)} = .965 * AWOTE * [1.0/5_{(1,c)} , 3.3/5_{(2\text{-}7,c)}]$$

In total, EEP was thus estimated as $52.1 million in New Zealand in 2004–05, with the severity disaggregation shown in Table 4.4. Note that there is no EEP associated with uncompensated payments, so the split between injury and disease cases is shown instead.

TABLE 4.4	Employer excess payments by severity and disease/injury, 2004–05 ($m)		
SEVERITY	INJURIES	DISEASE	TOTAL
<7 days	37.2	2.0	39.2
Full return	7.9	0.7	8.6
Staged return	3.2	0.3	3.4
Partial return	0.1	0.0	0.1
Permanent	0.0	0.0	0.0
Fatal	0.0	0.0	0.0
Other	0.6	0.1	0.7
Total	**49.0**	**3.1**	**52.1**

Sick leave

As noted above, the literature search revealed that sick leave may be taken by compensated workers and that the employer bears the cost of processing it.[10] The latter cost is small, and the literature includes it in administrative costs as it is not part of the productivity disturbance per se.

- NOHSC[18] found that, for compensated workers, sick leave only applied to those workers in category 3 (a partial return to work – category 4 in New Zealand), whereas for uncompensated cases, sick leave was used by all but category 1 workers (and including category 5 fatalities, notably for disease).
- In each case, two weeks' sick leave were assumed to be taken.

These assumptions might need to be reviewed and adjusted in New Zealand, but since they have no bearing on the total cost estimate and only a small impact on the distribution of costs between the employer and the individual, the assumptions are retained in this costing.

A final methodology issue to note is that the average cost per worker of sick leave is based on the product of AWOTE (not AWE) and the average number of weeks taken of sick leave for each severity category is assumed to be 2. Algebraically,

$$SL_{(2\text{-}7,u \text{ and } 4,c)} = 2 * AWOTE$$

Total sick leave cost due to occupational injury and disease was thus estimated as $9.9 million in 2004–05 (Table 4.5).

TABLE 4.5	Sick leave by severity and compensation status, 2004–05 ($m)		
SEVERITY	COMPENSATED CASES	UNCOMPENSATED CASES	TOTAL
<7 days	-	-	-
Full return	-	5.4	5.4
Staged return	-	2.2	2.2
Partial return	0.4	0.1	0.4
Permanent	-	0.0	0.0
Fatal	-	1.5	1.5
Other	-	0.4	0.4
Total	**0.4**	**9.5**	**9.9**

PDC borne by the worker

For the period of the productivity disturbance, workers bear the difference between what they would have earned in the absence of the incident and the income they receive in the period until they either return to work or are replaced. This income may be sourced from sick leave, the employer excess payment, compensation and welfare payments, and they also pay less personal income tax overall.

All the income source items for the sidelined worker are calculated separately. As we have seen, the employer's sick leave and excess payments go to the worker, so these equate exactly with the worker's receipts. Moreover, the compensation and welfare paid by society also goes entirely to the worker. Hence this item is calculated as a residual of $61.3 million (Table 4.6).

PDC borne by society

In society, the insurance sector pays compensation payments to some workers for lost wages, as well as public welfare payments to support workers who have lost earnings through occupational hazard and disability. Note that for this item we are only interested in these payments for the period of the production disturbance.

In some cases, the worker may also receive additional private insurance benefits (such as income protection insurance) but these are likely to displace welfare payments, are small in the short term and do not affect real costs, only transfers. Hence our view is that this extra sophistication is not particularly valuable in modelling.

For each severity category, average compensation payments for lost wages in the short term ($CPWS_{(1\text{-}7,c)}$) are derived from the ACC data, applying only to compensated workers. The "short term" is the period before returning to work or permanent replacement.

The provision of welfare payments is quite complex, and is detailed in Section 4.2.5. It is the short-term welfare payments that are relevant here, so we call the matrix WPS.

The final element of the production disturbance cost borne by society is the loss of taxation revenue from the displaced worker (the TAXS matrix). While it is noted that there is also greater additional taxation revenue from the replacement worker (greater because of the overtime premium), this is essentially a transfer from one economic unit to another within the society group so, for simplicity, it is not itemised. The TAXS matrix is explained in Section 4.2.5. To summarise:

$$PDC_s = CPWS + WPS + TAXS$$

Altogether, the PDC costs borne by society are estimated as $274.9 million (Table 4.6). Thus overall the shares of production disturbance costs borne:

- by the employer is 41%
- by the worker is 11%, noting that the after tax (disposable income) position of category 1 workers is estimated to improve by $8.9 million overall
- by society is 48%.

TABLE 4.6	PDC by severity and bearer of cost, 2004–05 ($m)			
SEVERITY	EMPLOYER	WORKER	SOCIETY	TOTAL
<7 days	58.5	-8.9	17.9	67.6
Full return	83.9	1.2	159.7	244.7
Staged return	59.6	45.3	61.8	166.7
Partial return	3.1	1.6	2.7	7.4
Permanent	0.7	0.5	0.9	2.0
Fatal	5.9	0.8	2.8	9.5
Other	24.9	20.9	29.1	75.0
Total	**236.6**	**61.3**	**274.9**	**572.9**

4.2.2 HUMAN CAPITAL COSTS (HKC)

Conceptual and methodological issues

One of the most significant costs of workplace injury and disease is the long-term loss of work and productivity. There are two broad approaches for measuring this loss described in the literature:

- lost wages/human capital method
- friction method.

The lost wages/human capital method is based on neoclassical economic theory. Wages and other marginal costs are assumed to equal the value of the marginal revenue generated by an additional worker under conditions of full employment.[22] Lost product is thus the value of the wages (measured as average earnings) plus other inputs to production (capital, plant and equipment, land, enterprise etc) multiplied by the number of work days missed. For reduced productivity while working, a percentage of this calculation is used.

The limitations with this approach are that it does not incorporate quality of life dimensions, and the choice of wage rate is an issue. Most studies use an all-industry average wage rate, whereas some use a minimum wage or industry-specific rate. The choice of time period is also an issue, with some studies using a fixed period and others using a variable period (such as life expectancy). It also does not allow for the situation where a previously unemployed person takes on the work of the injured employee. In this situation, society may not suffer as large a loss, as the previously unemployed worker who generated no income now generates an income, while the injured worker no longer generates an income. This leads us to the alternative friction method of calculating productivity losses.

The friction method was developed by Koopmanschap, Rutten, van Ineveld and van Roijen.[52] This approach estimates production losses for the time period required to restore production to its pre-incident state. This contrasts to the human capital method where, for example, the potential loss of production from a disease is calculated over a much longer timeframe. The time period used under the friction method could be determined by when the employee returns to work, or by when a replacement is found.[21] This method generally assumes that there is unemployment, and that a person who was previously not earning an income replaces the injured worker.

Predominantly the human capital/lost wages method is used, and indeed this is what Leigh et al[9] used in the US and NOHSC/Industry Commission in Australia. The reason for choosing the human capital method tends to be a general recognition that, after the initial disruption, until production is restored to former levels (most relevant for minor injuries), there is essentially the loss of the labour resource (when there is permanent disability or fatality) over the longer term, which reduces the capacity of the economy to produce at any given level of unemployment.

> The human capital approach is an accounting approach that uses the discounted present value of a worker's future earnings as a proxy for the cost of premature death, injury or illness. It characterises people as a labour source and input to the production process and implies the value to society of preventing an incident is the saving in potential output or productivity capacity.[26]

This human capital approach is also considered appropriate in New Zealand, as a developed economy operating at near full capacity, and that the human capital losses are not sufficient to influence the average wage.

For employees who only return to work on a reduced basis, there is the issue of their earnings profile. Weil[19] depicts three earnings profiles:

- Minimal economic loss – where the employee re-enters the workplace with a lower level of earnings (prior to their accident), but where their earnings then rise quickly to the pre-injury earnings profile.
- Moderate economic loss – where upon re-entry to the workforce, at a lower level of pay, the post-injury earnings profile has a reduced rate of earnings to that which would have otherwise ensued.
- Significant economic loss – where there are multiple entries and exits from the workforce and the absolute level of earnings falls each time.

According to Weil, a number of studies have looked into earning profiles associated with injuries and return to work schedules. In particular, Weil cites Reville[23] and Peterson et al[53] to state that, over the five years following an injury, workers receive approximately 40% lower earnings on average than an equivalent control group of employees.

Section 2.3.4 summarised the approach to distinguishing human capital and productivity measures from the more recent and comprehensive literature on willingness-to-pay methods that enable valuation of the non-financial aspects of the value of leisure, health and human life.

NOHSC[18] correctly considers the human capital cost (HKC) as the stream of lifetime earnings that is lost when workers with an injury or illness are unable to re-enter the workforce at their former level, until average retirement age. This is the difference between the present value of the earnings before the incident – PV(EBI) – and the present value of earnings after the incident – PV(EAI). Mathematically:

$$HKC_{(3\text{-}7)} = PV(EBI) - PV(EAI) \text{ where}$$

$$PV(EBI) = SUM(i=1...RETA\text{-}RTWA)EBI/(1+r)^i \text{ and}$$

$$PV(EBI) = SUM(i=1...RETA\text{-}RTWA)EBI/(1+r)^i$$

The sum is over the period of years remaining – that is, retirement age (RETA = 62 years in New Zealand) minus the average age following the incident at which the worker returns to work (RTWA = 40 years in New Zealand).

- The RETA parameter estimate (which is in fact the same as in Australia) is drawn from OECD.[vii, 54]
- RTWA is derived from the ACC data (it is three years younger than in Australia) based on the average age of an incident (39.6 years) plus the average time off work (175.1 days).

The summations are thus over a period of 62-40=22 years. The discount rate is 3.8% as derived in Section 2.3.4.

A few points are worth noting:

- For all workers, **EBI = AWE*52** (where AWE is the Statistics New Zealand estimate plus the 12.5% on-cost loading).

vii See in particular Figure 1 Retirement ages vary widely in the OECD: Estimated effective retirement age of older male workers in 2000, based on Duval R (2003) *The retirement effects of old-age pension and early retirement schemes in OECD countries,* OECD Economics Department Working Papers, No. 370.

- For category 3, 4 and 7 workers, we use the NOHSC[18] estimate that $\mathbf{EAI_{(3,4,7)} = 0.64 * EBI}$ for workers experiencing a partial return to work. This may be conservative since some of the "other" workers may not, in fact, return to work.
- For category 5 and 6 workers, $\mathbf{EAI_{(5\text{-}6)} = 0}$ since there is no contribution to production from those workers after the incident.
- The sum over all injured workers will depend on the distribution of their ages on leaving the workforce, as well as on their average age. This is because the net present value of lost future earnings varies non-linearly with age. However, we do not make this refinement in this analysis.
- $46,498 is the average pre-incident wages, so the present value of the future incomes stream is $711,001.
- $29,758 is the average post-incident wage (64% of the pre-incident wage), so the present value of the future incomes stream is $455,041 and the lost earnings are $255,960.

HKC by bearer of cost

None of the HKC is borne by the employer. It is borne in part by the worker, as loss of income, and in part by society, through compensation and welfare payments.

As with PDC, it makes sense to calculate the worker's loss of earnings as a residual – the difference between the total HKC and the welfare, compensation and tax losses borne by society (since the employer burden is zero).

HKC borne by society

Average compensation payments for longer-term loss of earnings for severity categories 3 to 7 (a matrix we call $CPWL_{(3\text{-}7,c)}$) is derivable from the ACC data. As with the CPWS matrix for PDC, this matrix is zero for uncompensated workers. The "long term" is defined as the period after the workers are permanently replaced (partially or fully).

As noted earlier, the provision of welfare and tax payments is complex, detailed in 4.2.5. We call the long-term welfare payment matrix WPL and the long-term tax matrix TAXL. So:

$$\mathbf{HKCS = CPWL + WPL + TAXL}$$

Total human capital cost is thus estimated as $3.05 billion (Table 4.7) of which:

- $1.88 billion (62%) is borne by the worker
- $1.17 billion (38%) is borne by society.

TABLE 4.7 HKC by severity and bearer of cost, 2004–05 ($m)

SEVERITY	TOTAL	EMPLOYER	WORKER	SOCIETY
<7 days	-	-	-	-
Full return	-	-	-	-
Staged return	1,911.7	-	1,109.0	802.8
Partial return	66.2	-	38.0	28.2
Permanent	26.5	-	17.6	9.0
Fatal	675.5	-	522.4	153.0
Other	369.7	-	194.5	175.1
Total	**3,049.6**	**-**	**1,881.5**	**1,168.1**

4.2.3 HEALTH AND REHABILITATION COSTS (MEDC)

ACC were able to provide compensation data for the various sub-components here – medical costs, hospital costs and rehabilitation costs. Essentially these costs include the real expenditures of treating and rehabilitating workers to enhance their health and assist them back into work.

MEDC is the sum of:

- threshold payments made by employers (MED_E)
- payments made by society including:
  - compensation medical and hospital payments ($CPMED_S$)
  - compensation rehabilitation payments ($CPREHAB_S$)
  - public hospital payments ($PUBHOSP_S$) payments paid directly
  - other social funders of uncompensated services, including private health funds, other publicly funded services and the not for profit sector
- payments made by workers including:
  - gap payments for health services (GAPW)
  - their own rehabilitation costs, for uncompensated cases.

$$\mathbf{MEDC = MED_E + GAP_W + REHAB_W + CPMED_S + CPREHAB_S + PUBHOSP_S + PHIETC_S}$$

MEDC borne by the employer

Our understanding is that employers are liable for the first or "threshold" payment of medical expenses for compensated employees. NOHSC[18] estimated this component as A$145 for category 1 workers and A$290 for other workers. In the absence of other New Zealand data, we have simply converted these threshold payments into New Zealand dollars using purchasing power parity estimates (see Section 2.3.4). Thus, in New Zealand dollars, the employer cost is estimated as:

$$\mathbf{MED_E = \$153_{(1,c)} + \$306_{(2\text{-}7,\,c)}}$$

The estimate for New Zealand in 2004–05 is thus $42.5 million in total, of which $35.3 million is for category 1 incidents.

MEDC borne by the worker

This item comprises two components.

- The worker "gap" payments are calculated as 16.1% of the "residual" estimated, once other components have been estimated, for all but the least severe category of incidents. The 16.1% parameter is based on the proportion of health system costs borne by the household sector in New Zealand.[55] Of other health expenditure, 77.9% was publicly financed, 5.7% was borne by private health insurers and 0.3% by the not for profit sector. The least severe incidents are excluded as there do not appear to be significant gaps for these incidents.
- The rehabilitation payments borne by workers are estimated as the average rehabilitation payment (from ACC data) applied to uncompensated workers. In the absence of evidence to the contrary, it is assumed that uncompensated workers bear the same average rehabilitation costs as compensated workers, rather than some discounted amount (in line with NOHSC[18]).

$$\mathbf{MED_W = GAP_{W\,(2\text{-}7)} + REHAB_{W\,(1\text{-}7,u)}}$$

The total bill for workers is estimated as $35.3 million – $22.3 million in health gaps and $13.0 million in uncompensated rehabilitation costs (Table 4.8).

TABLE 4.8	Health and rehabilitation costs borne by workers, by severity, 2004–05 ($m)		
SEVERITY	HEALTH GAPS	REHABILITATION	TOTAL
<7 days	-	5.5	5.5
Full return	10.7	1.9	12.6
Staged return	7.1	2.1	9.2
Partial return	0.3	0.1	0.4
Permanent	0.6	0.7	1.4
Fatal	0.5	2.0	2.5
Other	3.2	0.7	3.8
Total	**22.3**	**13.0**	**35.3**

MEDC borne by society

This item comprises the remaining four components.

$$MED_S = CPMED_S + CPREHAB_S + PUBHOSP_S + PHIETC_S$$

The compensation payments for health (the CPMED matrix) and rehabilitation (CPREHAB) are calculated from the average paid cost by severity level, factored up by the ratio of ultimate costs to paid costs, reflecting the incidence approach.

- This ratio is 2.3 in total, 2.1 for injuries and 1.8 for disease (the latter matrix derived as a residual).
- CPMED includes both medical and compensated hospital (ie, private hospital) payments.

The public hospital component is derived based on averaging a low and high estimate of the number of hospitalisations, and then applying the average cost-weight multiplier for all hospitalisations in New Zealand.

- The low estimate is based on Driscoll et al[1] of 14,724.
- The high estimate is based on the total number of incidents in categories 2 through 7 (although indeed some category 1 workers may also be hospitalised, and some more severe incidents may not), yielding 55,454.

Driscoll et al[1] referenced to Statistics New Zealand[56] notes that:

> New Zealand's non-fatal injury statistics are only available for counts of injury hospitalisations (stays in hospital of at least one day). The ACC data for work-related injuries used here provides no information on whether injured workers were hospitalised…
>
> Between 1 July 2001 and 30 June 2002, 14,724 work-related injuries treated solely in a hospital accident and emergency department and/or by admission in the hospital were not included in the available information.

Cost-weights for stays in public hospitals are calculated via a complex algorithm that takes account of length of stay as well as other issues related to cost complexity of admissions.[57]

- The cost-weight multiplier converts the cost-weight to a dollar amount; in 2003–04 the multiplier was $2,728.55 for medical/surgical inpatients.
- The 2003–04 multiplier was inflated to $2,807.68 in 2004–05, based on health cost inflation of 2.9%.

The average estimate of public hospital costs is thus $98.5 million ($41.3 million to $155.7 million).

Once the public hospital component is known, it is possible to estimate total health and rehabilitation costs from this, as Access Economics' previous disease cost burden studies have shown there to be a fairly stable relationship

between public inpatient and total costs for similar types of conditions. Specifically, Access Economics[58] estimated the costs of all types of arthritis in New Zealand, a condition that is likely to be similar to occupational injury and disease, given the large component of the latter that is due to sprains, strains and other conditions in the musculoskeletal category, and the fact that arthritic conditions represent over half of the musculoskeletal chapter of the ICD-10.

The report indicated that public inpatient costs were some 14.2% of total costs, which included medical, specialist, pharmaceutical, allied health and residential care recurrent costs, as well as taking into account a non-recurrent loading for capital expenditures, public health and administration, research and consumables/equipment.

This fraction is used to factor up the $98.5 million estimate to generate a total estimate for health and rehabilitation costs of $693.8 million in 2004–05.

Given the total cost estimate, a residual can then be calculated that includes the uncompensated medical and hospital expenses (that are not public hospital expenses) as well as any other health or rehabilitation costs ie, the sum of the GAP payments borne by the worker and the PHI and other socially-financed elements.

The severity distribution for the public hospital and residual cost matrices are based on the average of the other components for which there are data available.

The health and rehabilitation costs borne by society are summarised in Table 4.9, while total costs are summarised in Table 4.10.

TABLE 4.9 Health and rehabilitation costs borne by society, by severity, 2004–05 ($m)

SEVERITY	CPMED	CPREHAB	PUBHOSP	PHIETC	TOTAL
<7 days	89.2	27.5	56.0	180.9	353.6
Full return	39.0	9.6	20.1	55.8	124.5
Staged return	23.4	10.4	13.6	37.1	84.6
Partial return	0.9	0.4	0.5	1.4	3.3
Permanent	0.4	3.0	1.3	3.3	8.1
Fatal	0.0	0.1	0.9	2.5	3.5
Other	11.9	4.1	6.1	16.5	38.6
Total	**164.8**	**55.1**	**98.5**	**297.6**	**616.0**

Overall, employers bore 6.1% of these costs, workers 5.1% and society 88.8%. Injuries accounted for 78.5% and occupational diseases 21.5%.

TABLE 4.10	MEDC, by severity, disease/injury and bearer of cost, 2004–05 ($m)			
SEVERITY	EMPLOYER	WORKER	SOCIETY	TOTAL
		TOTAL		
<7 days	35.3	5.5	353.6	394.4
Full return	4.7	12.6	124.5	141.9
Staged return	1.9	9.2	84.6	95.7
Partial return	0.1	0.4	3.3	3.7
Permanent	0.0	1.4	8.1	9.4
Fatal	0.0	2.5	3.5	6.0
Other	0.4	3.8	38.6	42.8
Total	42.5	35.3	616.0	693.8
		INJURIES		
<7 days	33.5	0.4	248.6	282.5
Full return	4.4	11.4	112.3	128.1
Staged return	1.8	8.5	78.8	89.1
Partial return	0.1	0.3	2.8	3.2
Permanent	0.0	0.7	4.6	5.3
Fatal	0.0	0.2	0.4	0.6
Other	0.3	3.5	35.7	39.5
Total	40.0	25.0	483.3	548.3
		DISEASE		
<7 days	1.8	5.0	105.0	111.8
Full return	0.4	1.2	12.2	13.8
Staged return	0.1	0.7	5.7	6.5
Partial return	0.0	0.1	0.5	0.5
Permanent	0.0	0.6	3.5	4.1
Fatal	0.0	2.3	3.1	5.4
Other	0.0	0.4	2.8	3.3
Total	2.4	10.3	132.7	145.5

4.2.4 ADMINISTRATIVE COSTS (ADMINC)

Legal and administrative costs, although identified in a few studies, are generally not costed. Administrative costs generally cover the costs associated with the administration of compensation programmes, processing of claims and sick leave, injury investigation, record-keeping and injury reporting.[10]

Leigh et al,[9] citing work by Nelson,[59] uses the difference between premiums paid and benefits paid to measure the administrative (or overhead) costs for the workers' compensation system. It is estimated that 31% of the medical benefits paid represent administrative expenses of the system. He then goes on to note that this 31% would not necessarily apply to uncompensated cases, and assumes 15% for non-compensated medical payments (after removing those medical costs paid directly by the patients, which was estimated at 18.4% of the total). Leigh uses the same figures in calculating administrative costs associated with other indemnity benefits, such as payments by social security, private disability insurance and other welfare payments.

The HSE[16] assume that administrative costs associated with dealing with absences (such as the calculation and payments of benefits, processing of sick leave and extra management time) equates to an average of 30 minutes per day of absence. This is applied to the average wage (including non-wage labour costs) for an accounts/wages clerk. For administrative costs and profits associated with insurance companies, the HSE assume this to be 15% of gross claims.

These sources provided guidance that was utilised in Access Economics,[5] which first separated these various elements into their respective cost types – production and administrative (legal and administration elements) – and then refined the estimation therein, based on the available data. This approach is also adopted here for New Zealand, based on the ACC cost categories and data, to provide estimates for:

- legal costs
- administration costs
- investigation costs
- the bring-forward of funeral expenses.

Legal costs

Legal fees and associated costs are borne by workers, the employer and society.

Society bears the compensated legal costs. Compensation data provided by ACC are used and, as with medical, hospital and rehabilitation paid costs, are factored up by the ratio between ultimate and paid costs in order to estimate, on an incidence approach basis, the compensated costs for 2004–05, by injury, disease and severity. However, the compensated legal cost thus calculated was only $190,000.

This estimate is well short of those in the literature. Miller[10] calculates administration and legal fees for employers to be 13% of insurance payments, but does not separate out the two components, with overheads/profits a further 5.15%. The New South Wales Workcover Annual Report indicates that, for 2000–01, legal fees amounted to 11.8% of their claims payments.

However, the "no fault" policy in New Zealand may mean that legal costs are very much lower than overseas. Thus, conservatively, the compensated component is used as the basis for the estimate, ie, the component borne by society. For compensated cases, as with NOHSC,[18] it seems reasonable that employers' legal costs would be similar to workers' (reimbursed through the compensation system). In this sense, it would be argued that, where an individual needed legal advice, so did the employer. Thus for compensated cases, the total cost estimate is twice the compensated costs ($380,000), shared equally between the employer and society. For uncompensated cases, the legal costs are assumed to be small and are thus not estimated (Table 4.11).

Total legal costs are thus estimated as $0.4 million, with employers and society bearing 50% each, and workers not bearing any of the costs.

TABLE 4.11 Legal costs, by severity, 2004–05 ($m)

SEVERITY	EMPLOYER	WORKER	SOCIETY	TOTAL
<7 days	0.07	-	0.07	0.14
Full return	0.06	-	0.06	0.11
Staged return	0.02	-	0.02	0.04
Partial return	-	-	-	-
Permanent	0.00	-	0.00	0.00
Fatal	0.01	-	0.01	0.02
Other	0.03	-	0.03	0.07
Total	**0.19**		**0.19**	**0.38**

NOHSC[18] also calculates legal penalties and fines imposed by the court system, with the employer bearing the cost of those prosecutions resulting in convictions. However, it was noted that the fines imposed are a transfer cost from the employer to society, and therefore the cost does not add to the bottom line. Although those cases that are prosecuted but where no conviction ensues also impose a small real cost, this was only A$1.2 million in Australia, and the value of the transfer was only A$10 million, so no attempt was made to estimate the cost of penalties and fines in New Zealand, as it was likely to be extremely small.

Investigation costs

Investigation costs were sourced from ACC data, together with parameter estimates from the available literature.

- The HSE calculated that the investigation costs of compensation schemes were 4.7% of total claim payments, very similar to the investigation figures of New South Wales Workcover of 5.1% in 2000–01.[viii] In New Zealand, we thus use an average of 4.9% to calculate the social cost of investigations, which total $23.5 million in 2004–05.
- NOHSC[18] estimated that the relationship between social investigation costs (of the compensation schemes) and those of employers, was in the ratio 390:134.
- On the basis of this ratio, the employer investigation cost is estimated as $8.1 million in 2004–05, bringing the total investigation cost to $31.6 million.

Investigation costs were distributed by severity on the basis of the shares of the other three administrative cost elements.

Travel costs

The Industry Commission defined these compensation payments as those intended to cover "travel to doctor(s), rehabilitation centres, solicitors and the like".

The ACC data provide the start point for estimating travel costs, with paid costs per case factored up to derive ultimate costs paid by society, with the same average costs applied to uncompensated incidents to estimate travel costs paid by workers. There may be some other public support for injured workers' travel costs through the welfare system but, given the size of this component, the value of this item was not estimated.

Moreover, although there may be some travel costs involved for the employer, for example, travelling to and from court, solicitors etc, as in NOHSC,[18] these are also likely to be minor and are therefore not included.

Travel costs are summarised in Table 4.12, which shows that total travel costs were estimated in 2004–05 as $23.2 million, of which $5.4 million (23%) were borne by workers and $17.9 million (77%) were borne by society.

TABLE 4.12 Travel costs, by severity, 2004–05 ($m)

SEVERITY	EMPLOYER	WORKER	SOCIETY	TOTAL
<7 days	-	1.2	6.2	7.4
Full return	-	1.1	5.7	6.9
Staged return	-	0.7	3.6	4.4
Partial return	-	0.1	0.4	0.4
Permanent	-	0.0	0.2	0.3
Fatal	-	1.9	0.1	2.0
Other	-	0.2	1.6	1.9
Total	**-**	**5.4**	**17.9**	**23.2**

viii Workcover Annual Report 2001/02 http://www.workcover.nsw.gov.au/Publications/General/AnnualReports/annualreport0102.htm

Funeral costs

NOHSC[18] points out that the relevant cost of funerals is in fact the cost of bringing them forward (since everyone dies eventually). This real cost was very small – only A$8 million in Australia, using the estimated average funeral cost of A$3,617.

Converted to New Zealand dollars using purchasing power parity, this average cost is estimated as $3,822.

The degree to which costs are brought forward depends on average life expectancy, which is based on New Zealand life expectancy tables[60] for the average age of a fatality (52 from the ACC data). At this age, New Zealanders on average would have an estimated 29 years of further life. The calculation for the funeral cost brought forward becomes:

$$\mathbf{FUNC_{(w,6)} = \$3{,}822 - \$3{,}822 / (1+r)\text{^}i = \$2{,}542}$$
$$\mathbf{\text{with } i = 29 \text{ and } r = 3.8\%}$$

This figure is multiplied by the number of fatalities and attributed to the worker. There is no difference between injury and disease-related fatalities, or compensated and uncompensated fatalities.

It is noted that, in New Zealand, a funeral grant may be available to the partner, child, parent or guardian of someone who has died, to help towards the cost of the funeral. The grant of $1,611.65 is income and asset tested.[ix] However, the total cost of this item rounds to zero so the transfer element is not calculated.

Summary of administrative costs

A summary of the administrative cost elements is provided in Table 4.13 showing total administrative costs of $55.4 million of which:

- $8.3 million (15%) is borne by employers
- $5.6 million (10%) is borne by workers
- $41.6 million (75%) is borne by society.

TABLE 4.13 Administrative costs, by severity, 2004–05 ($m)

SEVERITY	EMPLOYER	WORKER	SOCIETY	TOTAL
<7 days	0.5	1.2	7.6	17.6
Full return	27.2	25.1	15.0	16.2
Staged return	20.1	18.5	10.4	10.3
Partial return	0.8	0.7	0.7	1.0
Permanent	0.6	0.6	0.4	0.6
Fatal	8.2	9.3	2.9	5.3
Other	8.8	8.0	4.6	4.5
Total	**8.3-**	**5.6**	**41.6**	**55.4**

4.2.5 TRANSFER COSTS (TRANC)

As highlighted in the literature review and particularly in Section 2.3.3, it is important to estimate transfer costs in order to allocate costs by who bears them, as well as to estimate the deadweight losses (DWLs) associated with the administration of and distortionary impacts from these transfer costs.

ix See **http://www.workandincome.govt.nz/** as at 1 April 2005.

Transfer payments do not add to the total "bottom line" costs of work-related incidents. Instead, they affect the allocation of costs to employers, workers and society. However the DWLs associated with a transfer payment, including administration costs, do add to the bottom line of total costs.

The chapter so far has accounted for transfers within various cost items (eg, some compensated payments, public health system costs). This section addresses the remaining transfers, in both the short term (until the worker either returns to work or ceases work) and in the longer term (after this point), thus enabling resolution of the PDC and HKC matrices. Deadweight losses of the transfers are then calculated.

Taxation and compensation transfers

In order to estimate the value of the transfers, we use an average personal income tax rate for New Zealand of 22%, as estimated in the Access Economics macroeconomic model estimate for 2005.

Taxation payments are thus calculated as:

$$\mathbf{TAXS = 22\% * VOP \text{ and } TAXL_{(3\text{-}5)} = 22\% * HKC}$$

So the short-term tax transfer is $122.7 million, and the long-term tax transfer is $670.9 million (Table 4.14).

Compensation payments for lost production are calculated from ACC compensation data for the remaining items of total cost – notably weekly compensation payments, independence allowance, lump sum payments and death benefits.

As previously, the paid costs are factored up to estimate ultimate costs, and then applied to the number of compensated workers ($221.1 million in total). The payments for category 1 and 2 workers are allocated to the CPS (short-term) matrix, while the remaining costs by severity category are allocated in the same proportion as the non-employer PDC relative to the HKC (11%). Because of the large number of claims in the "full return to work" category, CPS is in fact greater than CPL – $117.2 million compared to $103.9 million (Table 4.14).

TABLE 4.14 Taxation and compensation transfers, by severity, 2004–05 ($m)

SEVERITY	TAXS	TAXL	CPS	CPL
<7 days	14.9	-	3.1	-
Full return	53.8	-	101.2	-
Staged return	34.7	420.6	7.8	63.3
Partial return	1.5	14.6	0.3	2.6
Permanent	0.4	5.8	0.2	1.5
Fatal	1.6	148.6	0.5	4.4
Other	15.7	81.3	4.0	32.1
Total	**122.7**	**670.9**	**117.2**	**103.9**

Welfare payments

Welfare payments from society to the worker, while unable to work, are estimated from data from the Ministry of Social Development.[x]

There are two main welfare payments that a worker may receive while unable to work:

- Sickness benefit is provided for New Zealanders who are temporarily off work or working at a reduced level because of sickness, injury, pregnancy or disability. Age, family income and other conditions (eg, medical certificates) apply. A weighted average sickness benefit of $173.56 per week is calculated based on the age

x Ministry of Social Development website **http://www.workandincome.govt.nz/** for data as at 1 April 2005.

distribution of the workforce (19% are under 25 years) and equal splits (27% each) between payment rates to couples, sole parents and singles over 25.

- Disability allowance reimburses people for ongoing regular costs that they incur because they have a disability. There is an income test that must be met. The amount of allowance paid depends on a person's costs. A maximum payment of $49.48 per week is payable, with the assumption that workers in categories 3, 4, 5 and 7 would be eligible for this payment. The disability allowance for permanent incapacity would be payable until age 65 (ie, 25 years from average RTWA of 40 years). The present value of this income stream, with a discount rate of 3.8%, is estimated as $42,701.

A similar method to that of NOHSC[18] applies:

- Category 1 workers are deemed not to receive welfare payments.
- For category 2 workers (full return to work), compensated workers are deemed not to receive welfare payments, while uncompensated workers would receive sickness allowance in the short term (for the WPLI minus two weeks of sick leave).
- For category 3, 4, 5 and 7 workers (more serious incapacity):
  - In the short term, both compensated and uncompensated workers would receive sickness allowance (for the WPLI minus two weeks of sick leave), the same as for the uncompensated category 2 workers.
  - In the long term (ie, after workforce separation or return to work at reduced capacity), both compensated and uncompensated workers would receive the present value of the disability allowance. The reason for this is that the income threshold for disability allowance is $591.31 per week on average, while average earnings after the incident (EAI) were estimated as 64% of AWE (without the on-costs), which would be only $508.69, so the gap is twice the size of the payment.
- For category 6 workers (fatal incidents):
  - In the short term, both compensated and uncompensated workers would receive sickness allowance (for the WPLI minus two weeks of sick leave), while noting that, in actuality, the compensated amount here rounds to zero and the uncompensated amount is also very small.
  - In the long term (ie, after the worker has died), neither compensated nor uncompensated workers receive disability allowance.

Putting together these various elements results in estimation of the WPS and WPL matrices (welfare payments in the short term and long term), summarised in Table 4.15.

- Total welfare payments in the short run are $35.1 million, with $25.1 million to compensated workers and $35.1 million to uncompensated workers.
- Total welfare payments in the long run are $393.2 million, with $329.1 million to compensated workers and $64.1 million to uncompensated workers.

TABLE 4.15	Welfare transfers, by severity and compensation status, 2004–05 ($m)					
SEVERITY	WPS			WPL		
	COMPENSATED	UNCOMPENSATED	TOTAL	COMPENSATED	UNCOMPENSATED	TOTAL
<7 days	-	-	-	-	-	-
Full return	-	4.6	4.6	-	-	-
Staged return	16.1	3.2	19.3	265.7	53.2	318.9
Partial return	0.7	0.1	0.9	9.2	1.9	11.0
Permanent	0.2	0.0	0.3	1.3	0.3	1.6
Fatal	0.0	0.6	0.7	-	-	-
Other	8.1	1.3	9.4	53.0	8.7	61.7
Total	**25.1**	**10.0**	**35.1**	**329.1**	**64.1**	**393.2**

Calculation of deadweight losses

Taxation payments transfer income from individual members of society to the government, who then transfers it again to other members of the community through the welfare system and government services. In reality, these transfers are not costless to orchestrate. For example, administration of a taxation system has costs. In Australia, a comparison of the total amounts spent and revenue raised in 2000–01, relative to the Commonwealth department running costs, suggests that administration costs account for 1.25% of each taxation dollar raised.[58] Even greater costs are incurred due to the distortionary impact that taxation has on workers' work and consumption choices. Work by the Australian Productivity Commission[61] found the efficiency cost (or deadweight loss – DWL) associated with these distortions amounts to 27.5% of each tax dollar.

In New Zealand, studies by Diewert and Lawrence[62, 63] found that, in 1991, the deadweight loss associated with personal income tax was 18% and for consumption taxes around 14%. They also noted that the DWLs associated with labour taxation increased from 5% to over 18% in the 20 years up to 1991. In this report, we use the 18% for the estimate of the deadweight losses, noting that it may be a conservative estimate in view of another study[64] based on 1988 data that generated estimates ranging from 24.6% to 146.2% of taxes raised. The use of 18% balances the upside risk that the DWLs have continued to increase since 1991 against the downside risk that tax raised from non-labour sources has lower associated DWLs.

The 18% parameter is applied to both the taxation receipts lost and the welfare payments and other government expenditures incurred, since, in a budget neutral setting, the latter also required taxation to be raised and hence its distortionary impacts. In sum then it is applied to:

- TAXS and TAXL
- WPS and WPL
- PUBHOSP (PHIETC is conservatively not excluded).

In total, the deadweight losses are estimated as $237.7 million in 2004–05, of which $191.0 million are due to cases of occupational injury and $45.8 million to cases of occupational disease (Table 4.16).

TABLE 4.16	Deadweight losses from transfers, by severity and injury/disease, 2004–05 ($m)		
SEVERITY	**INJURIES**	**DISEASE**	**TOTAL**
<7 days	9.8	3.0	12.8
Full return	12.7	1.4	14.1
Staged return	133.8	11.4	145.3
Partial return	4.5	0.6	5.1
Permanent	0.7	1.0	1.7
Fatal	2.9	24.5	27.3
Other	27.5	3.8	31.4
Total	**191.9**	**45.8**	**237.7**

4.2.6 OTHER COSTS (OTHERC)

Workers who suffer permanent workplace injuries or disease are likely to require personal care and services, either from family and friends on a voluntary basis or through accessing the formal care sector through any of a variety of public programmes, or both. These services include personal care, bathing, mobility assistance and home tasks such as house cleaning, gardening, meals, laundry assistance and house maintenance.

Category 3, 4, 5 and 7 workers who suffer workplace injuries or disease and their families and carers may also require a variety of additional equipment, aids and home modifications in order to continue living at home safely. These include bathing and toileting aids (eg, shower accessories), safety aids (eg, handrails and lighting), adapted cutlery and common items (eg, clothing with Velcro), mobility/transport aids (eg, walking frames, wheelchairs), nursing aids (eg, pressure-relief mattresses), equipment for lifting and transfers (eg, hoists), leisure and recreation, mobility, seating and transport and modifications to their homes.

Whether paid for privately or publicly, all these items incur additional real costs. NOHSC[18] estimated these from data summarised in Frisch[65] (18, Table 1), who had undertaken detailed survey work of the costs of such items in Australia, based in turn on data from the Department of Family and Community Services Survey of Disability Support Pensioners originally reported in Walsh and Chappell.[66] The original data are mean annualised costs for people with musculoskeletal impairments with non-zero costs for a particular expenditure category. As with the hospital data, because these are people with musculoskeletal conditions that are likely to have similar disability impacts as many occupational incidents, these data are considered appropriate to apply in this New Zealand cost estimation also, once again adjusted based on PPP. The annual costs are thus estimated as:

- $1,783 per annum for carers on average
- $560 per annum for aids, equipment and home modifications.

We assume these costs are incurred for category 3, 4, 5 and 7 workers each year from the time of the injury (RTWA = 40 years) till death (ALE = 80 years at age 40, again from the New Zealand life expectancy tables). The present values for carer costs (CARERC) and for aids, equipment and modifications (AEMC) are thus calculated with r=3.8% as:

$$\mathbf{CARERC_{(3.4.3.7)} = SUM(i=1...ALE\text{-}RTWA)\$1{,}783/(1+r)\text{^}i = \$\ 37{,}745 \text{ and}}$$

$$\mathbf{AEMC = SUM(i=1...ALE\text{-}RTWA)\$560/(1+r)\text{^}i = \$11{,}865}$$

In total, the other costs were estimated as $293.1 million in 2004–05, of which:

- $223.0 million was for carers
- $70.1 million was for aids, equipment and home modifications (Table 4.17).

TABLE 4.17 Other costs, by severity, 2004–05 ($m)

SEVERITY	CARERS	AIDS, EQUIPMENT AND HOME MODIFICATIONS	TOTAL
<7 days	-	-	-
Full return	-	-	-
Staged return	180.4	56.7	237.1
Partial return	6.2	2.0	8.2
Permanent	1.4	0.4	1.9
Fatal	-	-	-
Other	34.9	11.0	45.9
Total	**223.0**	**70.1**	**293.1**

None of these costs are borne by employers. Rather, they are shared between individuals and the community. Given that the original data reflected musculoskeletal conditions, it may be fair to assume that the average costs apply equally well to injury and disease sub-categories. It was unclear from the Ministry for Social Development website whether carers or workers are entitled to government payments to assist them in meeting these costs, or how much they may receive. Also, in Australia, the value was quite small (only A$9.5 million for carer allowance resulting from workplace incidents).

Estimating the value of such transfer payments may be a future refinement for NOHSAC to undertake, to better estimate the split between the costs borne by the individual and those borne by society. In this analysis, they are simply allocated to the worker, while noting that in fact in may be the friends and family of the worker who bear the brunt of these costs.

Costs not included

Adams et al[2] noted that relationship breakdown was an important impact of workplace injury and disease.

> One set of indirect costs that were considerable arose from family separations, both physical and emotional. In four cases relationships were broken, with a further two cases losing their pre-injury relationships permanently. In addition, there were major lifestyle changes for many of the families, with many participants changing their careers, beginning or stopping study, and giving up hobbies to care for the family member.

When families separate, the real costs can be quite large. Access Economics estimated, for example, in a 2004 report for the federal Office for Women (now located in the Department of Family and Community Services) that, in cases of domestic violence, the consumption losses resulting from separation of partners and households were in fact around one-third of the total costs of A$8.1 billion.

It may thus be worthwhile to better estimate the relative likelihood of separations resulting from workplace incidents, in which case such costs could be included in future estimates. However, given current data availability, these are not able to be confidently estimated at the time being.

4.2.7 COSTS OF SUFFERING AND PREMATURE DEATH (SUFFC)

Gross cost of suffering

> In all cases there was a degree of suffering, in some suffering was extreme for both participants and their families.[2]

The literature on willingness to pay provided an estimate of the value of a life year (VLY) in New Zealand of $184,216, based on the value of a statistical life of $3.9 million with a discount rate of 3.8% per annum over 40 years (Section 2.3.4).

We apply this valuation to all the severity categories to estimate the average cost of suffering and premature death (SUFFC). Critical parameters are the disability weightings from NOHSC,[18] in turn based on Mathers et al[37] and according with the New Zealand weights from the Ministry of Health's burden of disease and injury study also.[36]

These weights are the same for compensated and uncompensated cases, and are summarised in Table 4.18. For each event, a number of possible examples are included.

TABLE 4.18 Disability weights used for estimating costs of suffering

SEVERITY	WEIGHT	INJURY EXAMPLES	DISEASE EXAMPLES
1	0.1	Open wound (0.108)	Moderate hearing loss (0.120)
		Short-term eye injury (0.108)	Slipped disc, chronic pain (0.125)
2	0.2	Rib fracture (0.199)	Melanoma, primary treatment (0.190)
		Internal injuries (0.208)	Severe asthma (0.230)
3, 4, 7	0.4	Femur fracture (0.372)	Colorectal/liver cancer, primary therapy (0.430)
		Burn, 20–60% (0.441)	Hypertensive heart disease (0.352)
5	0.6	Spinal cord injury (0.725)	Occupational overuse syndrome, severe (0.516)
		Poisoning (0.608)	AIDS (0.560)
6	1.0	Transport accident	Stroke/heart failure
		Electrocution	Lung cancer/mesothelioma

For severity categories 1 and 2, the pain and suffering is presumed temporary, so is limited to the average time off work. Hence the gross cost of suffering is:

$$\text{Gross SUFFC}_{(1\text{-}2)} = \text{WLPI}_{(1\text{-}2)}/52 * \text{VLY} * \text{Weight}_{(1\text{-}2)}$$

For categories 3 through 7, however, the human cost in terms of suffering and premature death is presumed to impact until ALE of 80 years at age 40 (from the New Zealand life expectancy tables), so the calculation is a present value one, with the discount rate of 3.8%. The equation is:

$$\text{Gross SUFFC}_{(3\text{-}5)} = \text{SUM(i=1...ALE-RTWA) VLY} * \text{Weight}_{(3\text{-}5)} /(1+r)\text{^i}$$

Using this methodology, the gross cost of suffering from occupational incidents in New Zealand is estimated as $18.3 billion in 2004–05.

Net cost of suffering

There is another important consideration. Since this calculation of suffering and early death is based on a willingness-to-pay approach from wage-risk studies, this item conceptually includes in the VSL the workers' perceptions of the costs that they would bear from loss of healthy life, taking into account all known personal

impacts – the suffering itself, lost wages/income, out-of-pocket personal health costs and so on. To avoid double counting, the latter elements must be netted out and an estimate of the net cost of suffering calculated. However, costs specific to the incidents that are not borne by the worker, and are thus unlikely to have entered into the calculations of people in the source wage/risk studies (for example, publicly financed health spending), should not be netted out.

The known financial impacts (to the worker) deducted from the gross cost of suffering are the matrices PDC_w, HKC_w, GAPW, $REHAB_w$, $LEGAL_w$, $TRAVEL_w$ and OTHERC (presumed all borne by the worker), which together amount to $2.3 billion.

Note that, due to the transfer impacts noted earlier, the net cost of suffering borne by workers in category 1 is negative, ie, the increases in disposable income are estimated to outweigh the financial costs, on average.

With these adjustments, the net cost of suffering and premature death due to workplace incidents in 2004–05 is $16.0 billion.

TABLE 4.19 Gross and net cost of suffering, by severity, 2004–05 ($m)

SEVERITY	GROSS SUFFERING COST	SUM OF FINANCIAL COSTS BORNE BY WORKERS	NET SUFFERING COST
<7 days	19.1	-2.2	21.3
Full return	138.5	14.9	123.6
Staged return	11,651.4	1,401.3	10,250.1
Partial return	403.5	48.3	355.3
Permanent	87.3	21.3	66.0
Fatal	3,705.0	527.6	3,177.4
Other	2,253.0	265.4	1,987.6
Total	**18,257.8**	**2,276.6**	**15,981.3**

Comparison with international results

Leigh et al[9] estimated that the cost of suffering and early death were over twice, and possibly up to six times, as high as all the other costs put together, at least US$350 billion with a crude range "between US$533 and US$905 billion" (p7), compared to US$155.5 billion. Human capital costs, in contrast, were "only" $67 billion (one-fifth of the lowest end of the pain and suffering estimates). Hence, our results parallel these proportions closely. Human capital estimates are likely to be in the $3 billion range – so five times this would be $15 billion. If total financial costs are around $5 billion, then our pain and suffering estimates are also between two and six times as high – just over three times in fact. These results also accord with the Australian proportionalities from NOHSC,[18] unsurprisingly, given methodological similarities.

As in the US and Australian studies, the human life and suffering estimates are included in the conclusions but as a separate item, given the uncertainty surrounding the estimates of VSL and VLY.

4.3 SUMMARY OF TOTAL COSTS

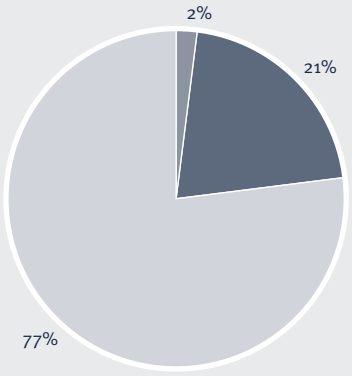
This section summarises the costs that have been calculated in preceding sections.

4.3.1 THE COST MATRIX – TYPE OF COST BY BEARER

Putting all these estimates together, we derive a total financial cost for occupational injury and disease in 2004–05 of $4.9 billion (3.4% of GDP), excluding the cost of suffering and early death.

The latter cost element is conservatively estimated as a further $16.0 billion. The components are summarised in Table 4.20.

FIGURE 4.2 Costs, by compensation share of total, 2004–05 (%)



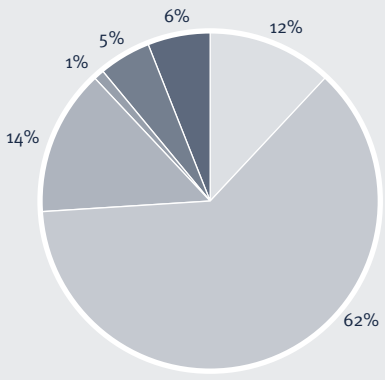
Total 2004–05 = $20.9 billion

Compensated financial costs *Uncompensated financial costs* *Suffering (uncompensated)*

Employers bore an estimated $287 million (5.9%) of the total financial costs. Workers bore around $2.28 billion (46.4%) and society – primarily through the compensation system and government sector – bore $2.34 billion (47.7%).

However, it is important to note that employers also pay the workers' compensation premiums from which society meets in part its lion's share. Were we adopting an "ex ante" measurement approach rather than an "ex post" one, the community share would be lower (around 38%) and the employer share would be higher (around 16%), since $480 million extra would be borne by the employers. We should also note that employers, in turn, may pass on the higher premiums in higher prices, or may use them to negotiate lower overall wage and salary payments. Thus, in general equilibrium, the compensation costs are spread across the economy.

FIGURE 4.3 Costs, by type, share of total (%)



PDC *HKC* *MEDC* *ADMINC* *TRANSC* *OTHERC*

Of the total $4.9 billion of financial costs in 2004–05 (estimated from March 2004 to March 2005), Figure 4.3 illustrates that:

- production disturbance costs accounted for $573 million (12% of total financial costs)
- human capital costs accounted for $3.05 billion (62%)
- health and rehabilitation costs accounted for $694 million (14%)
- administrative costs (including legal, investigation, travel and funeral costs) accounted for $55 million (1%)
- the deadweight costs associated with transfers were an estimated $238 million (5%)
- carer cost and the costs of aids, equipment and modifications for workers involved in incidents were estimated as $223 million and $70 million respectively (6% together).

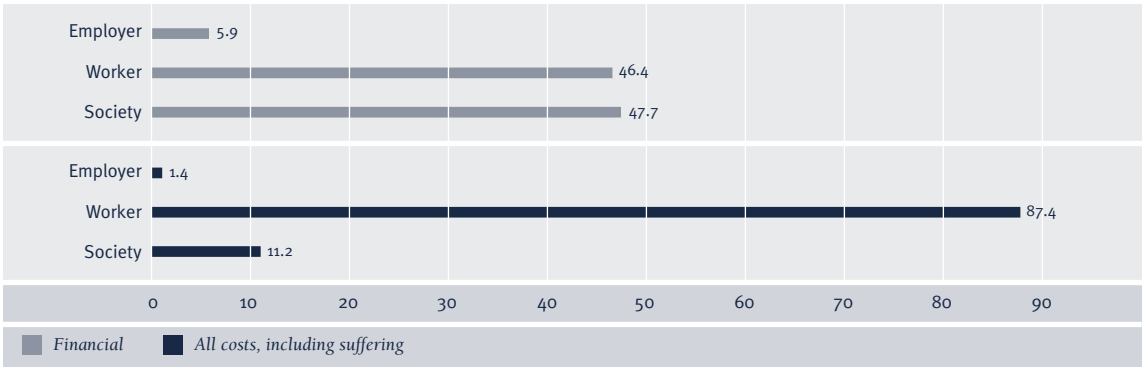
The number of incidents is the key single driver of overall results.

TABLE 4.20 Summary of costs, by type of cost and bearer, 2004–05 ($m)

TOTAL COSTS	TOTAL		EMPLOYER		WORKER		SOCIETY	
PDC	VOP	558	OTP	159			WPS	35
Production disturbance costs			EEP	52			TAXS	123
			SL	10			CPS	117
	STC	15	STC	15				
	Total PDC	**573**	**PDC(E)**	**237**	**PDC(W)**	**61**	**PDC(S)**	**275**
HKC							WPL	393
Human capital costs							TAXL	671
							CPL	104
	Total HKC	**3,050**	**HKC(E)**	**-**	**HKC(W)**	**1,882**	**HKC(S)**	**1,168**
MEDC					GAP	22	CPMED	165
Health and rehabilitation costs					REHAB(W)	13	CPREHAB	55
							PUBHOSP	99
							PHIETC	298
	Total MEDC	**694**	**MED(E)**	**42**	**MED(W)**	**35**	**MED(S)**	**616**
ADMINC								
Administrative costs								
Legal	Total LEGALC	0	LEGALC(E)	0	LEGALC(W)	0	LEGALC(S)	0
Investigation	Total INVESTC	32	INVEST(E)	8		-	INVEST(S)	24
Travel	Total TRAVC	23			TRAVC(W)	5	TRAVC(S)	18
Funerals	Total FUNC	0			FUNC(W)	0		
	Total ADMINC	**55**	**ADMINC(E)**	**8**	**ADMINC(W)**	**6**	**ADMINC(S)**	**42**
TRANSC								
Transfer costs								
	Total TRANSC	**238**					**TRANSC(S)**	**238**
OTHERC								
Other costs								
Carers	Total CARERC	223			CARERC(W)	223		
Aids & modifications	Total AEMC	70			AEMC(W)	70		
SUBTOTAL		**4,902**		**287**		**2,277**		**2,338**
				5.9%		**46.4%**		**47.7%**
Suffering, early death	**Total SUFFC**	**15,981**			**SUFFC(W)**	**15,981**		
TOTAL inc. suffering		**20,884**		**287**		**18,258**		**2,338**
				1.4%		**87.4%**		**11.2%**

If the value of suffering and premature death is included and attributed to workers, then their estimated share of the costs of workplace injury and disease is 87.4%, with 11.2% borne by society and 1.4% by employers. Figure 4.4 illustrates the very small share of total costs (2%) that are compensated.

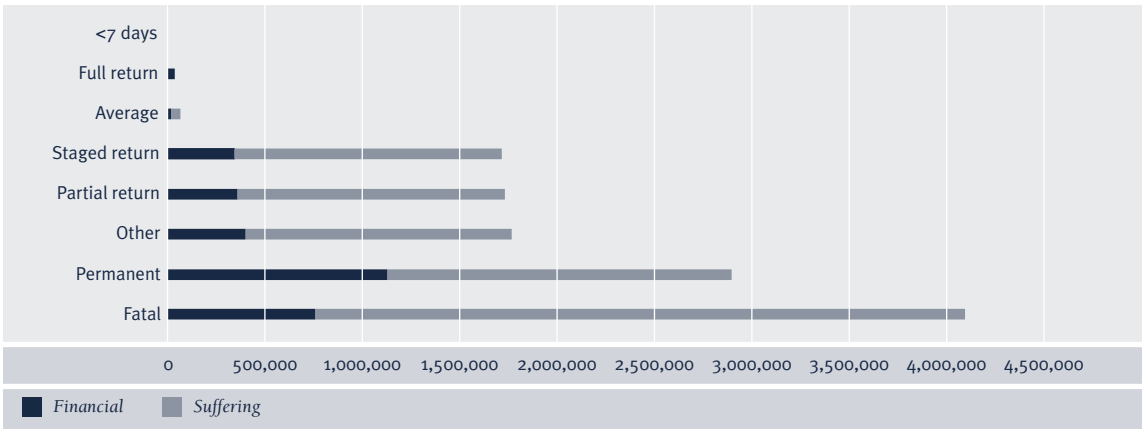
FIGURE 4.4 Costs, by bearer, share of total, 2004–05 (%)



4.3.2 SEVERITY CATEGORIES

The financial cost per case is highest for permanent disabilities, while the total cost per case (including suffering) is highest for fatalities (Figure 4.5).

FIGURE 4.5 Cost per case, by severity of the incident, 2004–05 ($)



This impact is further detailed in Table 4.21, with human capital costs driving the high financial costs of staged returns and suffering dominating the total cost profile.

Figure 4.6 depicts the dominant profile of the costs of staged return incidents in the profile, representing $2.6 billion of the total $4.9 billion of costs (over half).

Staged returns accounted for two thirds of the suffering costs, due to the combination of high per capital costs and a relatively large number of incidents.

FIGURE 4.6 Total annual cost, by severity of the incident, 2004–05 ($m)

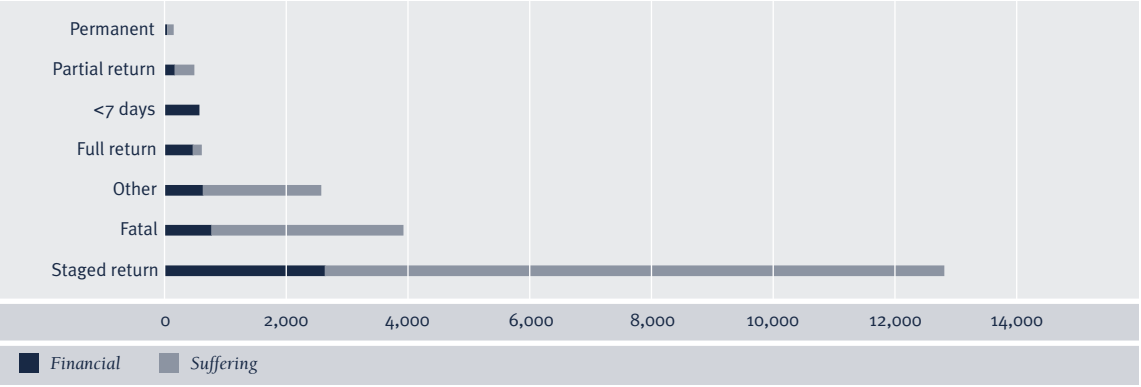


TABLE 4.21 Total annual costs, by severity, disease/injury and type of cost, 2004–05 ($m)

	PDC	HKC	MEDC	ADMINC	TRANSC	OTHERC	TOTAL FINANCIAL COSTS	SUFFERING	GRAND TOTAL
<7 days	67.6	-	394.4	17.6	12.8	-	492.3	21.3	513.7
Full return	244.7	-	141.9	16.2	14.1	-	416.9	123.6	540.5
Staged return	166.7	1,911.7	95.7	10.3	145.3	237.1	2,566.7	10,250.1	12,816.9
Partial return	7.4	66.2	3.7	1.0	5.1	8.2	91.6	355.3	446.9
Permanent	2.0	26.5	9.4	0.6	1.7	1.9	42.1	66.0	108.1
Fatal	9.5	675.5	6.0	5.3	27.3	-	723.6	3,177.4	3,901.0
Other	75.0	369.7	42.8	4.5	31.4	45.9	569.1	1,987.6	2,556.7
Total	**572.9**	**3,049.6**	**693.8**	**55.4**	**237.7**	**293.1**	**4,902.4**	**15,981.3**	**20,883.7**
	INJURIES								
<7 days	63.9	-	282.5	11.6	9.8	-	367.8	25.1	392.9
Full return	220.5	-	128.1	8.4	12.7	-	369.6	112.2	481.8
Staged return	150.0	1,764.2	89.1	5.5	133.8	218.8	2,361.4	9,459.6	11,821.0
Partial return	6.4	58.6	3.2	0.2	4.5	7.3	80.1	314.2	394.3
Permanent	0.9	9.2	5.3	0.5	0.7	-	17.2	22.4	39.6
Fatal	0.8	71.1	0.6	5.1	2.9	-	80.4	335.2	415.7
Other	66.5	322.9	39.5	2.1	27.5	40.1	498.5	1,736.6	2,235.2
Total	**508.9**	**2,225.9**	**548.3**	**33.3**	**191.9**	**266.8**	**3,775.1**	**12,005.4**	**15,780.5**
	DISEASE								
<7 days	3.7	-	111.8	6.0	3.0	-	124.5	-3.8	120.7
Full return	24.2	-	13.8	7.8	1.4	-	47.2	11.4	58.6
Staged return	16.7	147.5	6.5	4.8	11.4	18.3	205.3	790.6	995.9
Partial return	1.0	7.7	0.5	0.8	0.6	0.9	11.6	41.0	52.6
Permanent	1.1	17.4	4.1	0.0	1.0	1.2	24.9	43.6	68.5
Fatal	8.7	604.4	5.4	0.2	24.5	-	643.2	2,842.1	3,485.3
Other	8.5	46.8	3.3	2.4	3.8	5.8	70.6	251.0	321.6
Total	**64.0**	**823.7**	**145.5**	**22.1**	**45.8**	**26.3**	**1,127.3**	**3,975.9**	**5,103.2**

This table also highlights the share of financial costs attributable to injuries and disease:

- $3.8 billion (77.0%) is due to occupational injuries
- $1.1 billion (23.0%) is due to occupational disease.

The shares do not change much when the costs of suffering are included (75.6% compared to 24.4%).

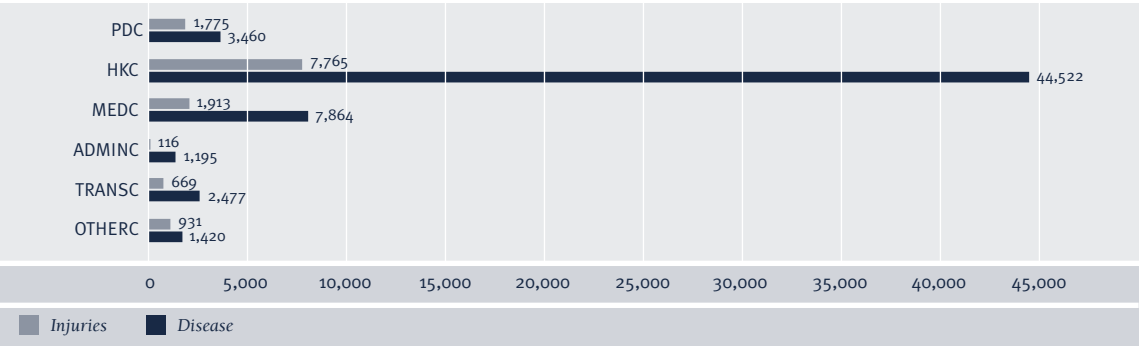
Costs per case are presented in Table 4.22, where the high costs of permanent disabilities and fatalities are evidenced, driven by human capital costs in both cases and by health and rehabilitation costs for incidents causing permanent incapacity.

TABLE 4.22 Costs per case, by severity, disease/injury and type of cost, 2004–05 ($)

	PDC	HKC	MEDC	ADMINC	TRANSC	OTHERC	TOTAL FINANCIAL COSTS	SUFFERING	GRAND TOTAL
<7 days	245	-	1,427	64	46	-	1,781	77	1,859
Full return	13,150	-	7,624	871	760	-	22,406	6,643	29,049
Staged return	22,318	255,960	12,807	1,374	19,451	31,750	343,661	1,372,384	1,716,045
Partial return	28,664	255,960	14,279	3,795	19,821	31,750	354,270	1,373,347	1,727,617
Permanent	54,304	711,001	252,931	15,757	45,596	49,610	1,129,199	1,768,763	2,897,962
Fatal	10,030	711,001	6,308	5,621	28,748	-	761,708	3,344,615	4,106,322
Other	51,931	255,960	29,611	3,088	21,715	31,750	394,055	1,376,235	1,770,291
Average	**1,877**	**9,994**	**2,274**	**182**	**779**	**960**	**16,066**	**52,372**	**68,437**
	INJURIES								
<7 days	245	-	1,082	45	37	-	1,409	96	1,505
Full return	12,930	-	7,511	491	746	-	21,678	6,580	28,258
Staged return	21,757	255,960	12,931	791	19,418	31,750	342,608	1,372,439	1,715,048
Partial return	27,852	255,960	13,855	796	19,758	31,750	349,971	1,373,408	1,723,380
Permanent	70,177	711,001	412,270	42,334	50,693	49,610	1,336,085	1,738,420	3,074,505
Fatal	8,068	711,001	5,628	51,157	28,525	-	804,379	3,352,369	4,156,748
Other	52,729	255,960	31,325	1,636	21,810	31,750	395,211	1,376,678	1,771,889
Average	**1,775**	**7,765**	**1,913**	**116**	**669**	**931**	**13,170**	**41,882**	**55,051**
	DISEASE								
<7 days	243	-	7,319	391	197	-	8,150	-248	7,901
Full return	15,569	-	8,863	5,048	909	-	30,390	7,329	37,719
Staged return	29,019	255,960	11,327	8,345	19,846	31,750	356,247	1,371,729	1,727,976
Partial return	34,881	255,960	17,527	26,745	20,305	31,750	387,170	1,372,879	1,760,048
Permanent	45,928	711,001	168,848	1,732	42,906	49,610	1,020,026	1,784,775	2,804,801
Fatal	10,260	711,001	6,389	263	28,774	-	756,688	3,343,702	4,100,390
Other	46,419	255,960	17,785	13,106	21,057	5,471	359,799	1,373,181	1,732,980
Average	**3,460**	**44,522**	**7,864**	**1,195**	**2,477**	**1,420**	**60,937**	**214,913**	**275,850**

Figure 4.7 highlights the dominant nature of the human capital costs per case for occupational disease, some six times the next largest cost item.

FIGURE 4.7 Financial cost per case, by severity and injury/disease, 2004–05 ($)



4.3.3 COSTS BY DISEASE/INJURY TYPE

Applying the analysis of costs per case by severity and disease/injury type to the categories enables a calculation of the financial and total costs for each category, which can then be compared with the compensated component (Table 4.23).

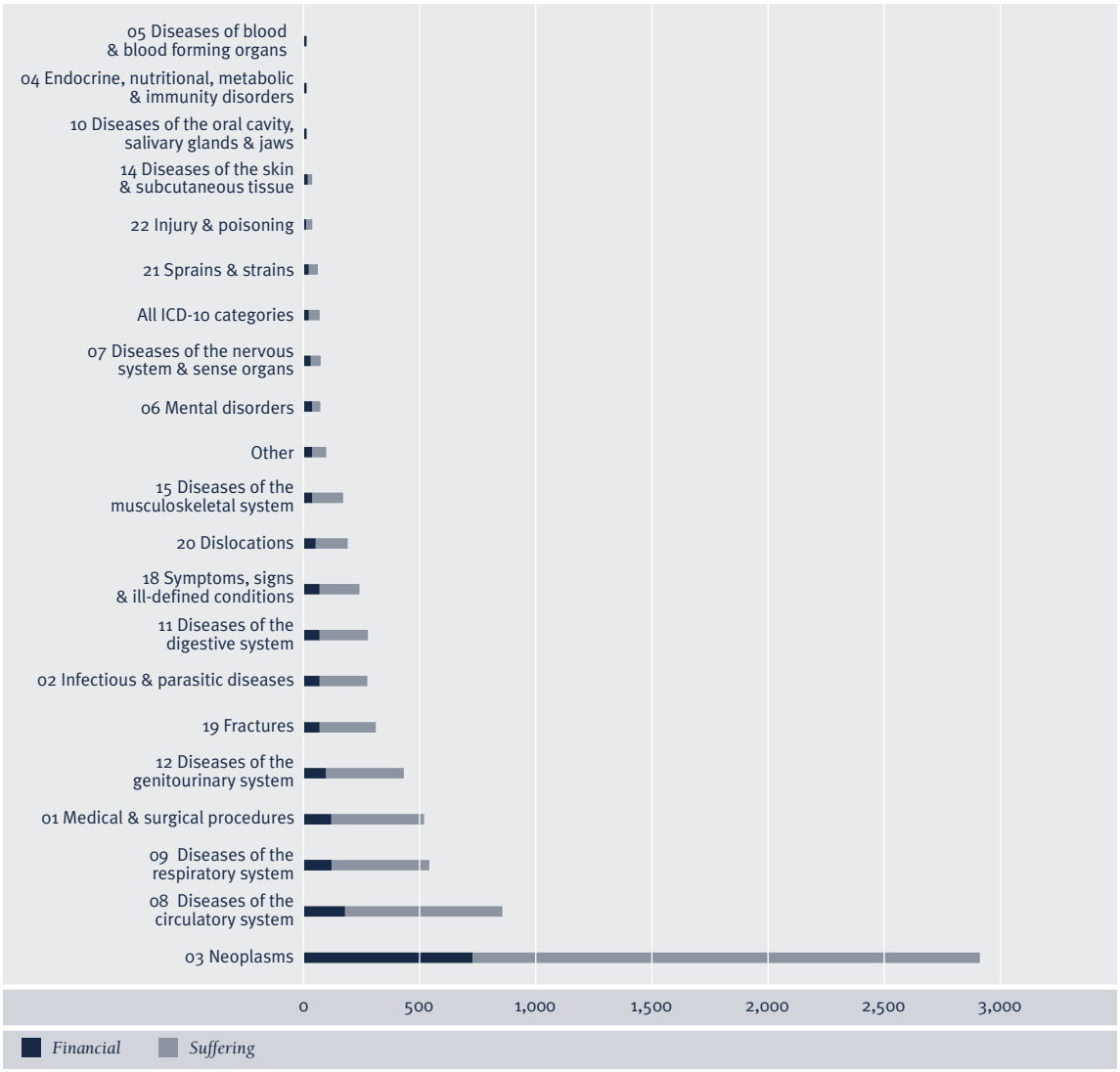
- Neoplasms (cancers) are, per case, by far the most costly condition, at over $700,000 in financial costs and $2.9 million per case (including suffering) in 2004–05.
- Only 5.2% of the financial costs of cancer and 1.3% of the total costs are compensated.
- In contrast, the least financially costly are cases of injury and poisoning ($8,350 per case), although total case costs are some four times the financial case costs.
- Table 3.12 showed there was only one least severe case in each of categories 4 and 5, so the low sample size explains the identical costs per case for 2004–05.
- Costs are relatively best compensated for nervous system and sense disorders but, even so, this only extends to cover 6.3% of the total costs.
- On average, only 9.8% of financial costs per case and 2.3% of total costs per case are compensated.

TABLE 4.23 Financial and total cost per case, by ICD-10 category, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
CATEGORY	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
01 Medical & surgical procedures	113,129	509,143	11.6%	2.6%
02 Infectious & parasitic diseases	67,838	268,011	6.7%	1.7%
03 Neoplasms	724,373	2,906,392	5.2%	1.3%
04 Endocrine, nutritional, metabolic & immunity disorders	9,400	9,488	1.9%	1.9%
05 Diseases of blood & blood forming organs	9,400	9,488	2.4%	2.4%
06 Mental disorders	119,101	544,567	17.9%	3.9%
07 Diseases of the nervous system & sense organs	22,328	69,270	19.4%	6.3%
08 Diseases of the circulatory system	178,512	847,607	19.6%	4.1%
09 Diseases of the respiratory system	114,586	536,145	8.7%	1.9%
10 Diseases of the oral cavity, salivary glands & jaws	9,449	9,557	3.4%	3.4%
11 Diseases of the digestive system	67,132	266,828	8.1%	2.0%
12 Diseases of the genitourinary system	94,829	429,737	12.4%	2.7%
14 Diseases of the skin & subcutaneous tissue	14,477	32,216	3.3%	1.5%
15 Diseases of the musculoskeletal system & connective tissue	35,487	163,037	11.8%	2.6%
18 Symptoms, signs, & ill-defined conditions	53,947	229,672	2.6%	0.6%
19 Fractures	66,055	308,692	10.0%	2.1%
20 Dislocations	39,429	180,278	12.5%	2.7%
21 Sprains & strains	13,777	59,266	9.1%	2.1%
22 Injury & poisoning	8,350	33,183	7.8%	2.0%
Other	20,105	87,784	10.0%	2.3%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

Figure 4.8 illustrates the expensiveness of cancer, with circulatory disease a rather distant second and respiratory disease third.

FIGURE 4.8 Cost per case, by ICD-10 category, 2004–05 ($000)

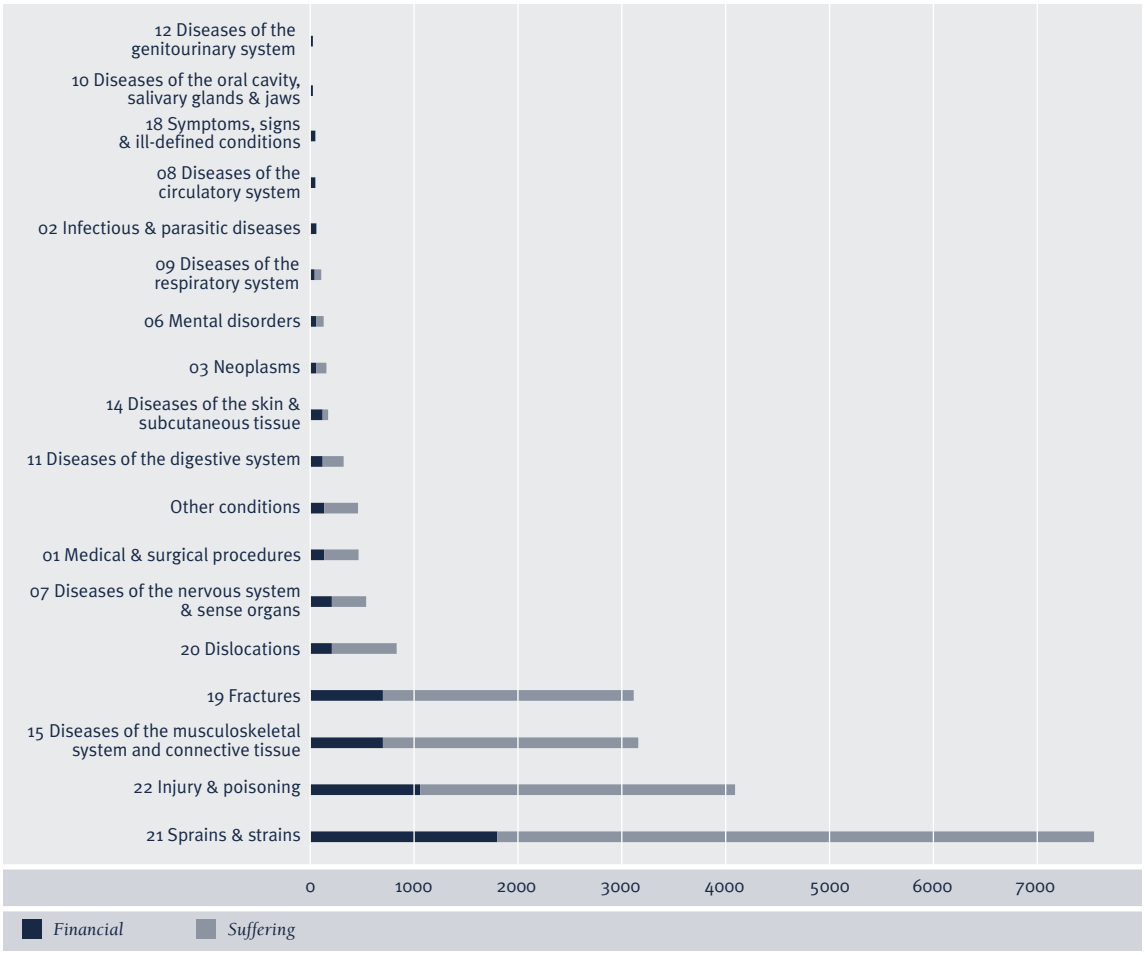


Total costs are presented in Table 4.24 and Figure 4.9. Sprains and strains are largest at $1.8 billion in financial costs and $7.6 billion in total costs (36% of the total).

TABLE 4.24 Financial and total cost, by ICD-10 category, 2004–05 ($m)

	COSTS		% OF TOTAL	
CATEGORY	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
01 Medical & surgical procedures	96	433	2.0%	2.1%
02 Infectious & parasitic diseases	8	33	0.2%	0.2%
03 Neoplasms	30	119	0.6%	0.6%
04 Endocrine, nutritional, metabolic & immunity disorders	0	0	0.0%	0.0%
05 Diseases of blood & blood forming organs	0	0	0.0%	0.0%
06 Mental disorders	24	111	0.5%	0.5%
07 Diseases of the nervous system & sense organs	166	515	3.4%	2.5%
08 Diseases of the circulatory system	2	10	0.0%	0.0%
09 Diseases of the respiratory system	15	72	0.3%	0.3%
10 Diseases of the oral cavity, salivary glands & jaws	6	6	0.1%	0.0%
11 Diseases of the digestive system	72	287	1.5%	1.4%
12 Diseases of the genitourinary system	1	5	0.0%	0.0%
14 Diseases of the skin & subcutaneous tissue	70	156	1.4%	0.7%
15 Diseases of the musculoskeletal system & connective tissue	683	3,140	13.9%	15.0%
18 Symptoms, signs, & ill-defined conditions	2	9	0.0%	0.0%
19 Fractures	663	3,100	13.5%	14.8%
20 Dislocations	174	793	3.5%	3.8%
21 Sprains & strains	1,759	7,569	35.9%	36.2%
22 Injury & poisoning	1,031	4,097	21.0%	19.6%
Other	98	428	2.0%	2.0%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.9 Total annual cost, by ICD-10 category, 2004–05 ($m)



4.3.4 COSTS BY INDUSTRY

Applying the analysis of costs per case by severity and disease/injury type to the industry categories enables a calculation of the financial and total costs for each industry, which can then be compared with the compensated component (Table 4.25).

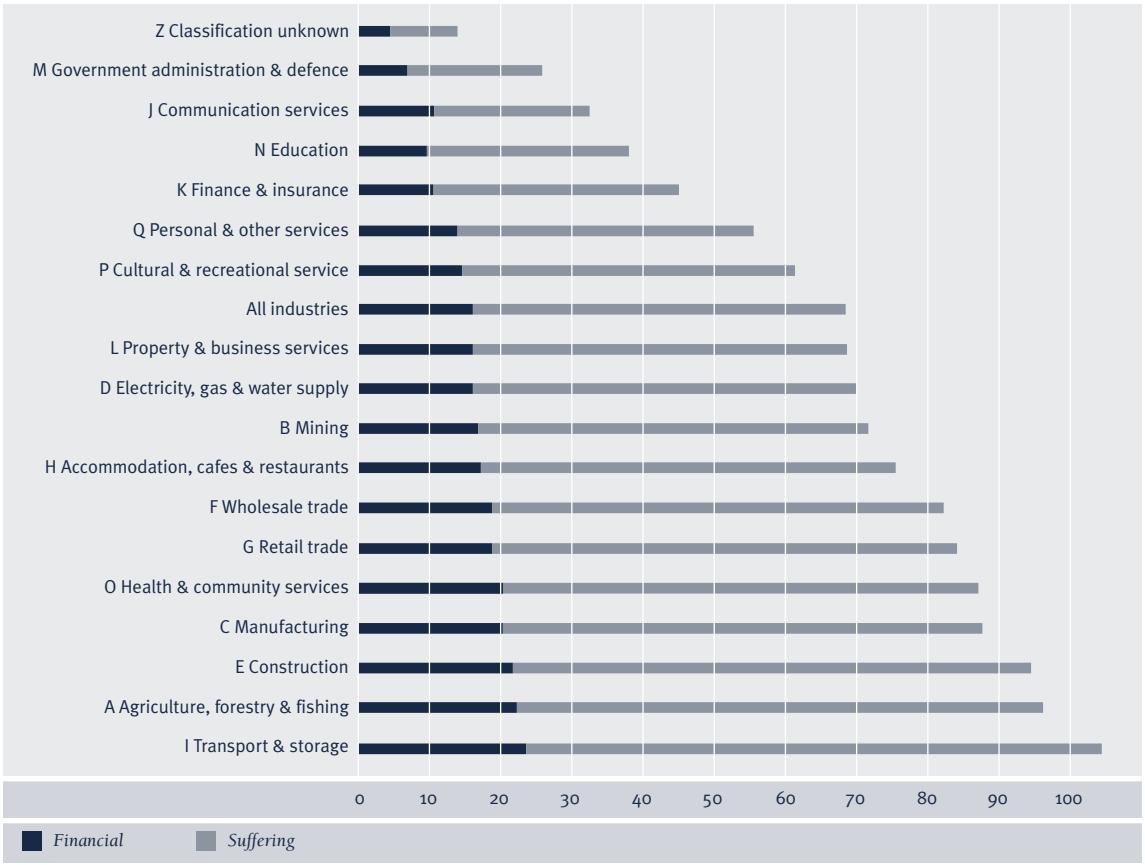
- There is not a great deal of difference in cost per case by industry, although financial costs in the transport and storage industry (the most costly at nearly $24,000 per case) are over three times those in government administration and defence (the least costly at just over $7,000 per case).
- Costs are relatively best compensated in the communication services industry but, even so, this only extends to cover 4.7% of total costs.
- Agriculture, forestry and fishing; construction; and manufacturing rank second, third and fourth most costly respectively, in terms of financial costs per case in 2004–05.

Figure 4.10 presents the relative costs per case. As expected, the unclassified category represents the least expensive incidents.

TABLE 4.25 Financial and total cost per case, by industry, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
INDUSTRY GROUP	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
A Agriculture, forestry & fishing	22,174	96,191	12.0%	2.8%
B Mining	16,952	71,603	19.3%	4.6%
C Manufacturing	20,452	88,136	8.5%	2.0%
D Electricity, gas & water supply	16,275	70,031	11.1%	2.6%
E Construction	21,571	94,516	11.0%	2.5%
F Wholesale Trade	18,718	82,302	8.7%	2.0%
G Retail Trade	18,754	84,105	7.7%	1.7%
H Accommodation, cafes & restaurants	17,315	75,467	8.4%	1.9%
I Transport & storage	23,764	104,616	10.9%	2.5%
J Communication services	10,810	32,753	14.1%	4.7%
K Finance & insurance	10,507	45,352	10.7%	2.5%
L Property & business services	16,201	68,795	10.0%	2.4%
M Government administration & defence	7,166	26,230	12.0%	3.3%
N Education	9,424	38,032	11.9%	3.0%
O Health & community services	20,060	87,283	8.6%	2.0%
P Cultural & recreational service	14,706	61,630	14.0%	3.4%
Q Personal & other services	13,766	55,929	9.1%	2.2%
Z Classification unknown	4,459	14,172	7.6%	2.4%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

FIGURE 4.10 Cost per case, by industry, 2004–05 ($000)

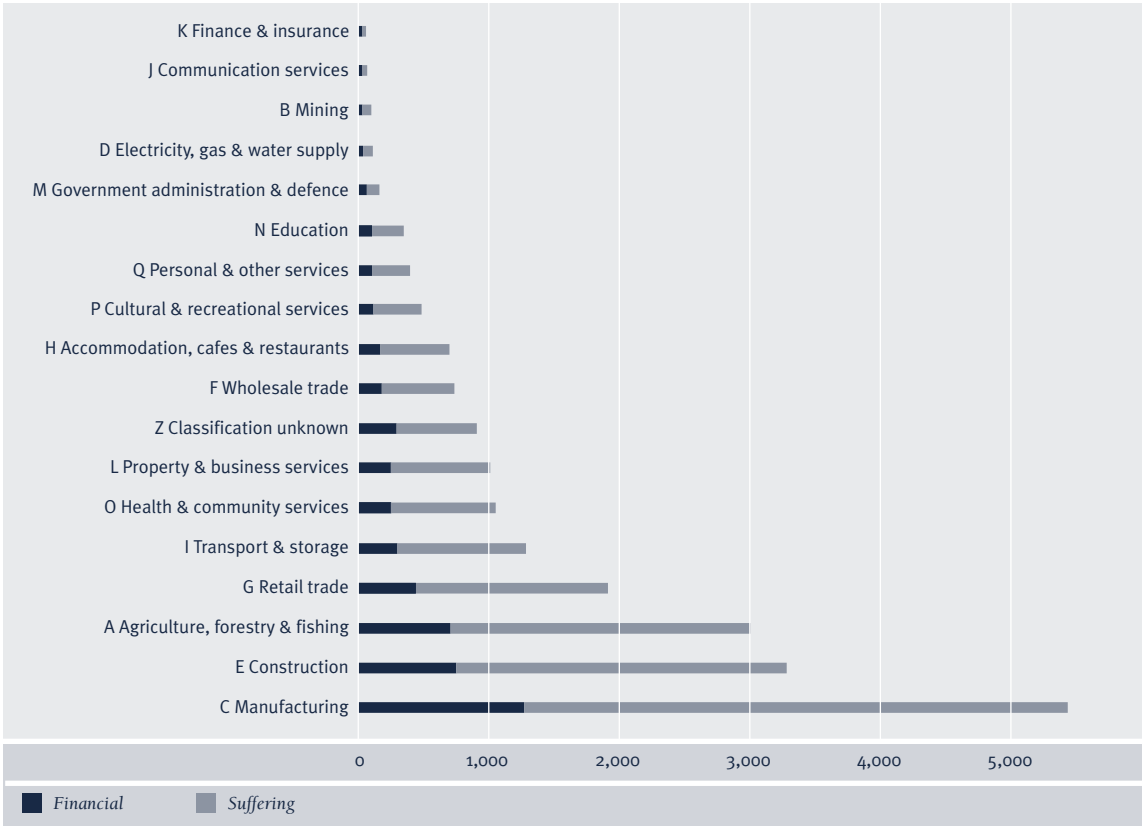


Total costs are presented in Table 4.26 and Figure 4.11. Manufacturing is largest at $1.3 billion in financial costs and $5.4 billion in total costs (one-quarter of the total).

TABLE 4.26 Financial and total cost, by industry, 2004–05 ($m)

	COSTS		% OF TOTAL	
INDUSTRY GROUP	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
A Agriculture, forestry & fishing	692	3,000	14.1%	14.4%
B Mining	22	92	0.4%	0.4%
C Manufacturing	1,264	5,449	25.8%	26.1%
D Electricity, gas & water supply	25	106	0.5%	0.5%
E Construction	750	3,285	15.3%	15.7%
F Wholesale trade	165	726	3.4%	3.5%
G Retail trade	423	1,896	8.6%	9.1%
H Accommodation, cafes & restaurants	155	674	3.2%	3.2%
I Transport & storage	290	1,275	5.9%	6.1%
J Communication services	20	62	0.4%	0.3%
K Finance & insurance	14	61	0.3%	0.3%
L Property & business services	232	986	4.7%	4.7%
M Government administration & defence	40	145	0.8%	0.7%
N Education	83	335	1.7%	1.6%
O Health & community services	239	1,041	4.9%	5.0%
P Cultural & recreational service	111	467	2.3%	2.2%
Q Personal & other services	93	378	1.9%	1.8%
Z Classification unknown	285	906	5.8%	4.3%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.11 Total annual cost, by industry, 2004–05 ($m)



4.3.5 COSTS BY CAUSE

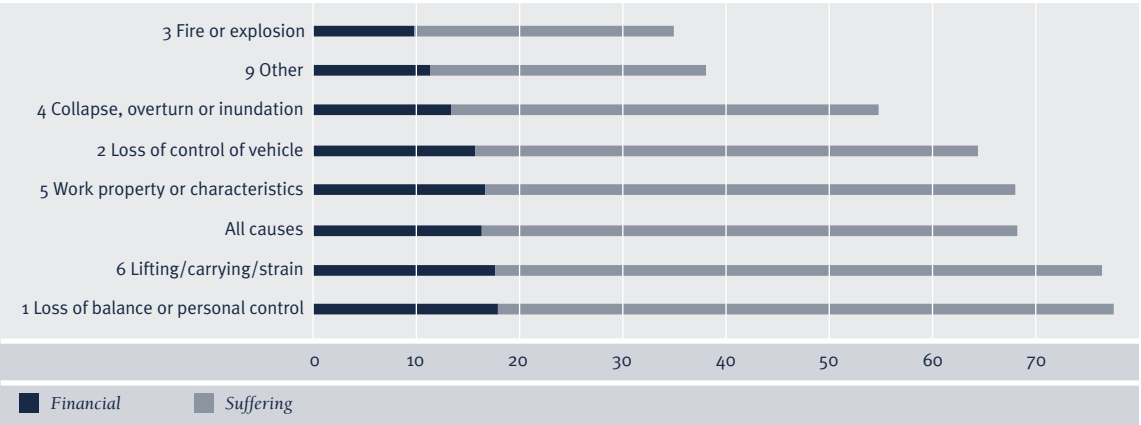
Applying the analysis of costs per case by severity and disease/injury type to the cause categories enables a calculation of the financial and total costs for each cause, which can then be compared with the compensated component (Table 4.27 and Figure 4.12).

- The spread of variation in financial costs is even less by cause than by industry, largely because the catch-all category "work property or characteristics" is so large (as seen by the proximity of costs to the average for all categories).
- Cost per case was highest for "loss of balance or personal control", although "lifting/carrying/strain" was a very close second in 2004–05.
- Surprisingly (to the authors at least), "fire or explosion" was in fact the least costly per case and best compensated.

TABLE 4.27 Financial and total cost per case, by cause, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
CAUSE CATEGORY	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
1 Loss of balance or personal control	17,775	77,878	9.3%	2.1%
2 Loss of control of vehicle	15,527	64,752	10.7%	2.6%
3 Fire or explosion	9,399	34,980	13.4%	3.6%
4 Collapse, overturn or inundation	13,073	54,828	9.6%	2.3%
5 Work property or characteristics	16,255	68,282	10.7%	2.5%
6 Lifting/carrying/strain	17,411	76,663	9.5%	2.2%
9 Other	10,965	38,214	11.1%	3.2%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

FIGURE 4.12 Cost per case, by cause, 2004–05 ($000)

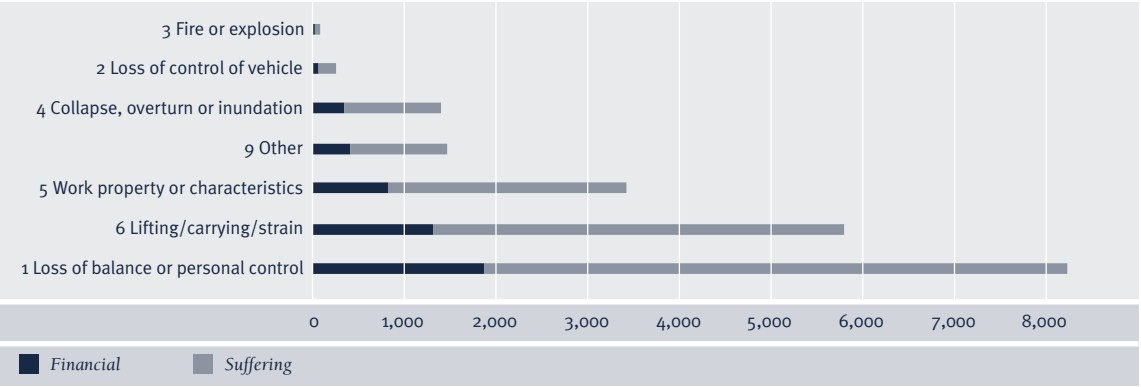


Total costs are presented in Table 4.28 and Figure 4.13. "Loss of balance or personal control" is again largest at $1.9 billion in financial costs and $8.3 billion in total costs (approaching 40% of the total).

TABLE 4.28 Financial and total cost, by cause, 2004–05 ($m)

	COSTS		% OF TOTAL	
CAUSE CATEGORY	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
1 Loss of balance or personal control	1,893	8,295	38.6%	39.7%
2 Loss of control of vehicle	65	272	1.3%	1.3%
3 Fire or explosion	22	84	0.5%	0.4%
4 Collapse, overturn or inundation	337	1,413	6.9%	6.8%
5 Work property or characteristics	826	3,471	16.9%	16.6%
6 Lifting/carrying/strain	1,330	5,858	27.1%	28.0%
9 Other	428	1,492	8.7%	7.1%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.13 Total annual cost, by cause, 2004–05 ($m)



4.3.6 COSTS BY ETHNICITY

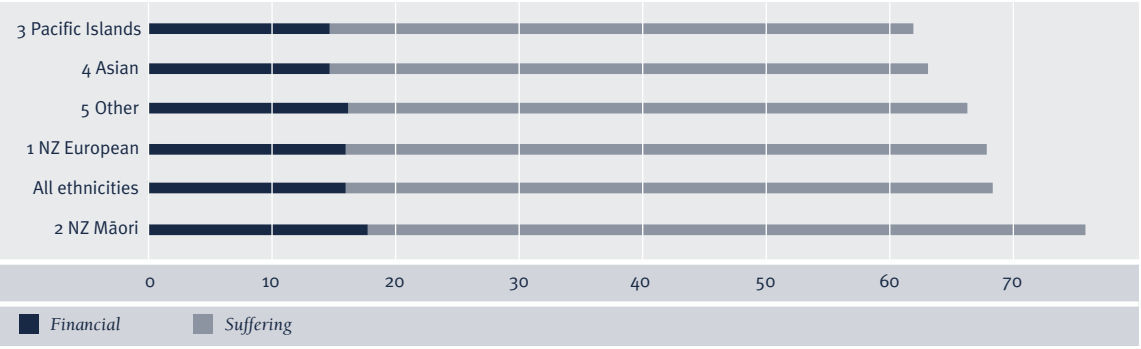
Applying the analysis of costs per case by severity and disease/injury type to the ethnicity categories enables a calculation of the financial and total costs for each group, which can then be compared with the compensated component (Table 4.29 and Figure 4.14).

- As with cause, the very large share of one group – in this case NZ Europeans – reduces the spread of variation in costs.
- Cost per case was highest for NZ Māori people and lowest for Pacific Island and then Asian people in 2004–05.
- There was very little difference in compensation rates between ethnic groups.

TABLE 4.29 Financial and total cost per case, by ethnicity, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
ETHNICITY	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
1 NZ European	15,937	68,001	9.8%	2.3%
2 NZ Māori	17,816	76,037	9.0%	2.1%
3 Pacific Islands	14,561	62,078	8.7%	2.0%
4 Asian	14,622	63,401	9.5%	2.2%
5 Other	15,979	66,351	11.6%	2.8%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

FIGURE 4.14 Cost per case, by ethnicity, 2004–05 ($000)

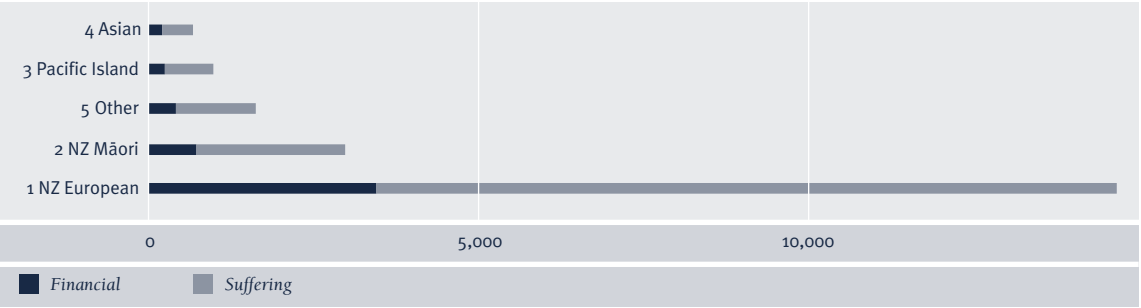


Total costs are presented in Table 4.30 and Figure 4.15. Costs for NZ Europeans were, reflecting their population share, the largest cost component at $3.4 billion in financial costs and $14.7 billion in total costs (70% of the total).

TABLE 4.30 Financial and total cost, by ethnicity, 2004–05 ($m)

	COSTS		% OF TOTAL	
ETHNICITY	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
1 NZ European	3,443	14,691	70.2%	70.3%
2 NZ Māori	694	2,961	14.2%	14.2%
3 Pacific Islands	228	972	4.6%	4.7%
4 Asian	149	646	3.0%	3.1%
5 Other	389	1,614	7.9%	7.7%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.15 Total annual cost, by ethnicity, 2004–05 ($m)



4.3.7 COSTS BY AGE GROUP

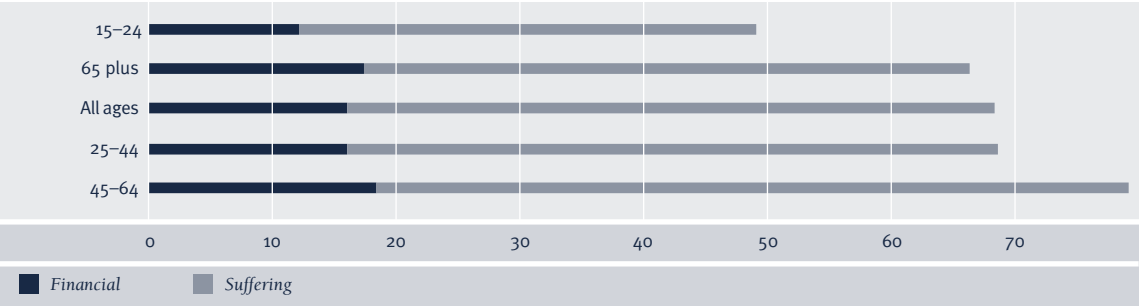
Applying the analysis of costs per case by severity and disease/injury type to the age categories enables a calculation of the financial and total costs for each group, which can then be compared with the compensated component (Table 4.31 and Figure 4.16).

- The cost pattern mirrors that of the compensated cases, with workers aged 45–64 years incurring the highest cost per case.
- The youngest workers (15–24 years) incur the least cost per case, and are least well compensated.

TABLE 4.31 Financial and total cost per case, by age group, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
AGE GROUP	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
15–24 years	11,953	49,143	5.5%	1.3%
25–44 years	16,004	68,766	10.3%	2.4%
45–64 years	18,403	79,288	11.0%	2.5%
65 years and over	17,295	66,653	7.5%	2.0%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

FIGURE 4.16 Cost per case, by age, 2004–05 ($000)

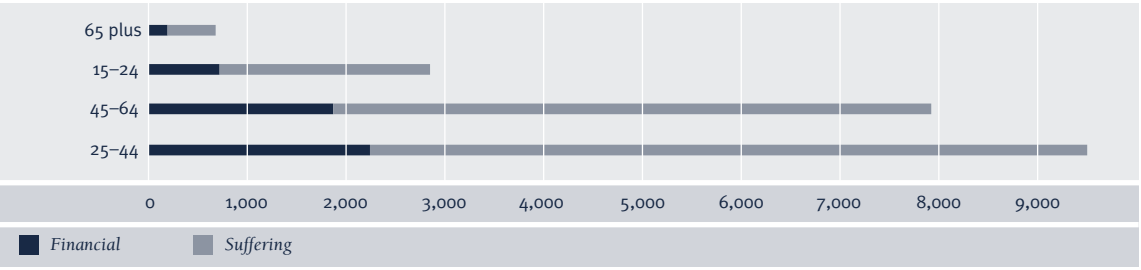


Total costs are presented in Table 4.32 and Figure 4.17. Costs for workers aged 25–44 years were largest at $2.2 billion in financial costs and $9.5 billion in total costs (over 45% of the total).

TABLE 4.32 Financial and total cost, by age, 2004–05 ($m)

	COSTS PER CASE		% OF TOTAL	
AGE GROUP	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
15–24 years	688	2,828	14.0%	13.5%
25–44 years	2,209	9,493	45.1%	45.5%
45–64 years	1,836	7,910	37.5%	37.9%
65 years and over	169	653	3.5%	3.1%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.17 Total annual cost, by age, 2004–05 ($m)



4.3.8 COSTS BY GENDER

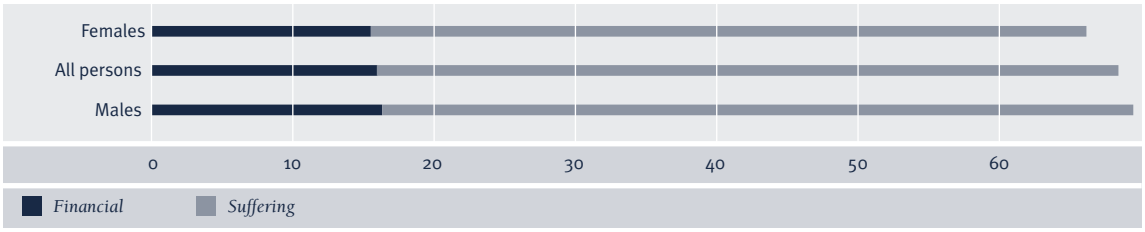
Applying the analysis of costs per case by severity and disease/injury type to the gender categories enables a calculation of the financial and total costs for males and females, which can then be compared with the compensated component (Table 4.33 and Figure 4.18).

- As expected, there is relatively little difference between overall cost patterns for males and females. This finding has been influenced by the use of overall average weekly earnings and the same value of a life year for men and women.
- Even so, costs per case are a little higher for men, and they are a little better compensated, relatively.

TABLE 4.33 Financial and total cost per case, by gender, 2004–05 ($)

	COSTS PER CASE		COMPENSATION AS % OF TOTAL	
GENDER	FINANCIAL ($)	TOTAL ($)	FINANCIAL COSTS	TOTAL COSTS
Males	16,280	69,212	10.2%	2.4%
Females	15,407	66,061	8.4%	1.9%
Average	**16,066**	**68,437**	**9.8%**	**2.3%**

FIGURE 4.18 Cost per case, by gender, 2004–05 ($000)

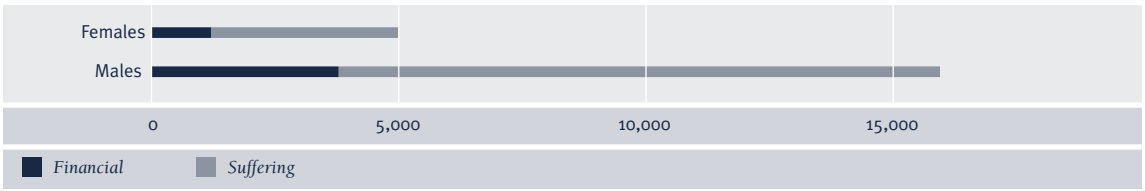


Total costs are presented in Table 4.34 and Figure 4.19. Costs for males were $3.7 billion in financial costs and $15.9 billion in total costs (76% of the total).

TABLE 4.34 Financial and total cost, by gender, 2004–05 ($m)

	COSTS PER CASE		% OF TOTAL	
GENDER	FINANCIAL ($M)	TOTAL ($M)	FINANCIAL COSTS	TOTAL COSTS
Males	3,747	15,930	76.4%	76.2%
Females	1,155	4,954	23.6%	23.8%
Total	**4,902**	**20,884**	**100.0%**	**100.0%**

FIGURE 4.19 Total annual cost, by gender, 2004–05 ($m)



SECTION FIVE

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