

# DRO

Deakin University's Research Repository

## This is the published version:

LaMontagne, Anthony D, Sanderson, Kristy and Cocker, Fiona 2010, *Estimating the economic benefits of eliminating job strain as a risk factor for depression*, VicHealth,.

## Available from Deakin Research Online:

<http://hdl.handle.net/10536/DRO/DU:30061223>

Reproduced with the kind permission of the copyright owner.

**Copyright** : 2010, VicHealth

# Estimating the economic benefits of eliminating job strain as a risk factor for depression

October 2010

*Full report*

© Copyright Victorian Health Promotion Foundation 2010

Published in October 2010  
by the Victorian Health Promotion Foundation (VicHealth)  
Carlton, Victoria, Australia

ISBN: 978-1-921822-02-5

Publication Number: P-021-SC

**SUGGESTED CITATION:**

LaMontagne AD, Sanderson K, & Cocker F (2010): Estimating the economic benefits of eliminating job strain as a risk factor for depression. Victorian Health Promotion Foundation (VicHealth), Carlton, Australia. 37 pages.

# Estimating the economic benefits of eliminating job strain as a risk factor for depression

October 2010

Full report

A/Prof Anthony D. LaMontagne

McCaughey Centre: VicHealth Centre for the Promotion of Mental Health and Community Wellbeing, Melbourne School of Population Health, University of Melbourne, Victoria

Dr Kristy Sanderson

Ms Fiona Cocker

Menzies Research Institute, University of Tasmania, Hobart, Tasmania



## Acknowledgements

This work was prepared as part of a grant from the Victorian Health Promotion Foundation to A/Prof Anthony D. LaMontagne and Dr Kristy Sanderson. The authors thank Lauren Krnjacki for data provided from the Household, Income and Labour Dynamics in Australia (HILDA) surveys, and the Data and Analysis Section of *SafeWork Australia* for national cost estimates for mental stress-related workers compensation claims.

Further information on this report:

A/Prof Anthony D. LaMontagne

Principal Research Fellow

McCaughey Centre: VicHealth Centre for the Promotion of Mental Health & Community Wellbeing

School of Population Health

University of Melbourne VIC 3010

Email: [alamonta@unimelb.edu.au](mailto:alamonta@unimelb.edu.au)

Phone: 03 8344 0708

Dr Kristy Sanderson

Australian Research Council Future Fellow

Senior Research Fellow and Member

Menzies Research Institute

Private Bag 23

Hobart TAS 7001

Email: [kristy.sanderson@utas.edu.au](mailto:kristy.sanderson@utas.edu.au)

Phone: 03 6226 4724

## Contents

1.	Introduction and Aims.....	4
1.1	Introduction.....	4
2.	Methods .....	6
2.1	Depression and work productivity project grant.....	6
2.2	Adaptation of these methods to the present study .....	12
3.	Results.....	14
3.1	Depression in the Australian workforce.....	14
3.2	Societal cost of depression in the Australian workforce.....	14
3.3	Job strain-attributable depression and societal cost .....	15
3.4	Distribution of employment-related costs by employer and employee.....	16
4.	Sensitivity analysis .....	17
4.1	Consideration of variables not included in main analysis .....	17
4.2	Probabilistic sensitivity analysis.....	18
5.	Discussion.....	21
5.1	Summary of main findings.....	21
5.2	Limitations .....	21
5.3	Commentary .....	23
6.	Glossary.....	27
7.	References.....	35

## 1. Introduction and Aims

### 1.1 Introduction

Job stress is a large and growing concern in Australia and internationally. Workplace psychosocial stressors have been linked to poor mental and physical health in a growing body of scientific evidence. Stressors with the strongest evidence linking them to poor mental health include job demands, job control (how much say you have over how to do your work), the combination of high job demands and low job control (defined as job strain), job insecurity, low social support at work, and effort-reward imbalance (Bonde, 2008, Stansfeld and Candy, 2006, Netterstrom et al., 2008, LaMontagne et al., 2010).

Job strain, for example, approximately doubles a worker's future risk of depression after accounting for other known risk factors for depression (Stansfeld and Candy, 2006, LaMontagne et al., 2008). The job stress intervention evidence, however, also shows that job stressors can be effectively addressed by a combination of work- and worker-directed interventions (LaMontagne et al., 2007a, Bambra et al., 2007, Egan et al., 2007).

We propose that improved understanding of the economic *as well as* the health benefits of reducing or eliminating job stress will support expanded workplace stress prevention and control intervention efforts. Financial incentives to expand job stress intervention efforts would complement and reinforce legal and ethical drivers. Accordingly, this report presents estimates of the potential economic benefits of eliminating job strain-attributable depression for Australian workers, employers and society.

The approach used was to quantify the financial benefits of addressing job strain as a risk factor for depression using epidemiologic and economic modelling. This report builds on previous research reported in the VicHealth-commissioned *Workplace Stress in Victoria: Developing a Systems Approach* (LaMontagne et al., 2006), and a series of related peer-reviewed articles (Shaw & LaMontagne, 2006, LaMontagne et al., 2007b, LaMontagne et al., 2007a, LaMontagne et al., 2008, Keegel et al., 2009, LaMontagne et al., 2010).

Using Victorian survey data, we previously estimated that among working males 13.2%, and among working females 17.2%, of depression is attributable to job strain (LaMontagne et al., 2008). Stated differently, those same proportions of depression could be reduced or eliminated by reducing or eliminating job strain.

Thus, the specific aims were to:

- estimate the costs in the Australian workforce for job strain-attributable depression versus all other depression, as an indication of the potential economic benefit if job strain-attributable depression could be reduced or eliminated
- estimate the costs from three perspectives: societal, employer and individual; where individual costs were approximated from costs for employees who do not have paid sick leave.

This report and a summary version are available to download from the VicHealth website

at [www.vichealth.vic.gov.au/jobstrain](http://www.vichealth.vic.gov.au/jobstrain)



## **2. Methods**

### **2.1 Depression and work productivity project grant**

This present study is adapting the methods and results from an existing project on depression and work productivity (National Health and Medical Research Council ID 490018: K Sanderson, B Oldenburg, N Graves, J Nicholson). Full details of the methods and findings of this parent project will be forthcoming in 2010. To support interpretation of the present study, an outline of the key components of the method is presented here. The depression and productivity National Health and Medical Research Council (NHMRC) project grant is addressing the following questions:

1. What are the economic costs and health outcomes from continuing to work when ill (presenteeism) versus taking an absence from work (absenteeism)?
2. How are these costs distributed between different agents (i.e. employer versus employee)?
3. How do these costs and health outcomes vary by age, sex, occupation and financial circumstances?

#### **Design and choice of analytic strategy**

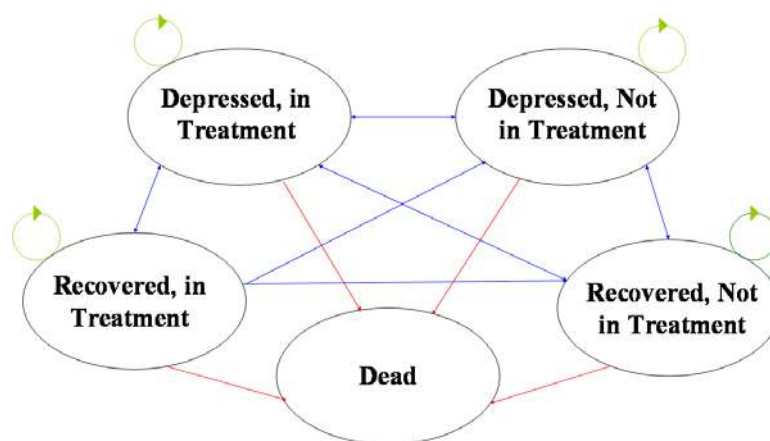
Using existing and published data, an epidemiologic-based analytic modelling study was conducted using cohort simulation (Drummond, 2005, Graves et al., 2006). Cohort simulation is used extensively in health economics and related clinical and epidemiological research to model future costs and outcomes of alternative scenarios (e.g. different treatment options, different rates of transmission of disease in populations). These models are mathematical structures that represent the health and economic outcomes of patients/groups/populations under alternative scenarios (Kuntz, 2001).

Cohort simulation and other decision analysis technologies provide a synthesis of best available evidence to answer a question that might not otherwise be readily answered, for example: extrapolation of costs and outcomes from short-term randomised controlled trials (RCTs) over a much longer time horizon (e.g. lifetime); where RCTs are unethical or too expensive; and as a cost-effective first step to answering a new question which will also help refine hypotheses and design future research. A wide range of evidence is usually included, such as epidemiological surveys, meta-analyses, and high-quality single studies (Philips et al., 2006).

For the present study, state-transition Markov models were used to capture costs and health outcomes over the shorter- and longer-term from a societal perspective (Briggs and Sculpher, 1998, Graves et al., 2006). Such models were recently used in a study of depression treatment cost-effectiveness in US employees to model future costs and benefits of a program after measurement for a trial finished (Wang et al., 2006). Our analysis takes this model as a starting point and adapts it for the present purposes.

A base case scenario is modelling the health outcomes and costs over time in the Australian population of working while ill versus work absence for depressive and anxiety disorders. The principal data source for the epidemiologic inputs is the 2007 National Survey of Mental Health and Wellbeing (Australian Bureau of Statistics, 2007). These models are amended to reflect different distribution of costs for employer versus employee using an illustrative example, where the individual has no access to paid sick leave (e.g. most casual employees). Finally, we amend the base case scenario to quantify variations across demographic and employment characteristics including sex, age (younger 18-34 years, mid-aged 35-54 years and older 55+ years workers), occupation/industry, and financial circumstances.

### Analytic structure



The comparison of costs and health outcomes for working while ill versus work absence is based on the aggregate health outcomes and costs from a state-transition Markov model. The figure above presents depression health states that employees can move in and out of over time as shown by the arrows, with each of these states having corresponding costs and health outcomes (Wang et al., 2006). Persons in a given state have a known probability of moving into one of the other states, referred to as transition probabilities.

For each iteration of the model, the transition probabilities are applied, and the number of people in each state determines the aggregate costs and health outcomes at the conclusion of the model. The difference in aggregate costs and outcomes provides a comparison of the overall health and economic burden of working while ill versus work absence, for employed adults in the Australian population.

The analysis is prevalence-based, and models the future costs and health outcomes for persons that were employed and met criteria for lifetime DSM-IV major depression (refer Glossary, p. 30) in the study reference year (2007). Lifetime depression is defined as a person having met diagnostic criteria for a major depressive disorder sometime in their life, but not necessarily currently.

The analysis does not include the future health and costs of persons who did not have a history of depression at the time of the survey interview but would be at risk of developing depression at some later time. Modelled costs and outcomes are estimated for a simulated cohort of 1,000 employed persons with lifetime depression. For the present study, these costs are then extrapolated to the Australian population.

The following steps were followed in constructing the simulated cohort models:

- Initial distribution across the Markov states, and various model parameters, were derived from the 850 persons in the 2007 National Survey of Mental Health and Wellbeing who were employed and met criteria for lifetime DSM-IV major depression based on the Composite International Diagnostic Interview (CIDI) 3.0
- Initial distribution across the Markov states (depressed in treatment, depressed not in treatment, recovered in treatment, and recovered not in treatment) for a simulated cohort of 1,000 persons was estimated using the following definitions:
  - depressed: met criteria for lifetime DSM-IV depression and reported symptoms in the past 12 months
  - recovered: met criteria for lifetime DSM-IV depression but did not report symptoms in the past 12 months
  - treatment: reported contact with a health professional for their mental health problem, at any time in the past 12 months
  - not in treatment: did not report contact with a health professional for their mental health problem in the past 12 months.

## Estimating the economic benefits of eliminating job strain as a risk factor for depression

- The probabilities of moving in and out of the different Markov states over time (health state transition probabilities) were estimated from various published sources. These probabilities include remission with and without treatment; relapse with and without treatment; treatment initiation; and mortality rates including a slightly increased mortality rate in depression states due to suicide.
- The costs arising from being in each Markov state were based on the probability of various cost-incurring events being experienced, the quantity of that event, and the unit cost for that event. Included costs from the societal perspective were:
  - health service use related to depression including contacts with general practitioners, psychologists and psychiatrists
  - use of antidepressant medication
  - lost work productivity from absenteeism and presenteeism that can be attributed to depression
  - job turnover that can be attributed to depression
  - accident costs were also considered but are not reported in the main analysis.  
Due to an inability to locate a robust estimate for the risk of accident among employees with depression, and the cost of those accidents, these costs are examined in the sensitivity analysis.
- The health outcome arising from being in each Markov state was based on health utility values using Assessment of Quality of Life (AQoL) weights derived from the 2007 National Survey of Mental Health and Wellbeing (Australian Bureau of Statistics, 2007).

### **Duration and frequency of model cycle**

The model has a lifetime time horizon, with the cohort modelled until death. We also report short-term outcomes over the first year of the model, which is consistent with most of the longitudinal data sources, and as short-term outcomes are of particular interest to employers who are most interested in maximising the outcomes of their current employees throughout their tenure. A three-month cycle was used as this reflects natural history of depression, where the median length of a depressive episode has been estimated at 12 weeks.

### Estimation of costs

Unit costs for the reference year of 2007 were obtained from standard sources (e.g. Medicare Benefits Schedule, Pharmaceutical Benefits Schedule). Where necessary, cost estimates were converted to 2007 Australian dollars using ABS Health and Health Services Consumer Price Index inflators. Costs occurring from year two onwards of the models were discounted to net present value using a discount rate of 3%.

The following types of costs were included, with a summary of their data sources and perspective shown in Table 1:

- *Lost productive time*: Survey respondents estimated the number of days they were totally unable to do their work and usual activities over the past year due to their depression. For the employed population of interest this was considered a proxy for absenteeism days. An absenteeism day was costed at the national average daily wage. The amount of lost productive time due to presenteeism from depression, expressed in equivalent days, was estimated from published sources (Australian Bureau of Statistics, 2004, Rost et al., 2004, Stewart et al., 2003) and costed in the same way as for absenteeism days.
- *Job turnover/employee replacement*: The risk of job turnover was estimated from a cohort study of employed persons with depression (Lerner et al., 2004). The cost of job turnover was based on an Australian estimate of the cost of replacing an employee who is terminated or voluntarily leaves and included recruitment, hiring, and training costs (Australian Federal Department of Education Employment and Workplace Relations, 2008).
- *Mental health-related health service use*: Survey respondents reported the number of contacts in the past year with general practitioners, psychologists, psychiatrists and hospital days due to problems with their mental health. Not all of this service use is due to depression, due to the presence of other comorbid mental health problems. The survey includes a “main problem” question which we have used to adjust for comorbidity in previous studies that used the 1997 National Survey of Mental Health and Wellbeing (Andrews et al., 2004, Issakidis et al., 2004, Sanderson et al., 2003). Service use was counted as “depression-related” where it was reported by a person who had nominated depression as their main problem. In the relatively healthy population of employed survey respondents, low hospital use for a mental health problem was reported, with no hospital days attributed to depression.

- *Antidepressant medication*: Survey respondents were asked about antidepressant use over the past two weeks. It was not known which type/s of antidepressants were used, the duration, or the dosage. The average standard dose of selective serotonin reuptake inhibitors (SSRIs), the most widely prescribed class of class of antidepressants, was costed for the full length of each model cycle (three months).

**Table 1: Health outcomes and costs: parameters and data sources**

<b>Model Parameters</b>	<b>Data Sources</b>	<b>Perspective</b>
<b>Health outcomes</b>		
Summary outcome measure	Quality-adjusted life years – derived from time spent in each state and AQoL values	Societal
Remission	Published literature	Societal
Utility value (AQoL)	2007 NSMHWB	Societal
<b>Costs</b>		
Lost productive time	2007 NSMHWB, published literature, ABS	Individual, employer, societal
Job turnover/employee replacement cost	Published literature	Employer, societal
Mental health-related health service use	2007 NSMHWB, MBS	Societal
Antidepressant medication	2007 NSMHWB, PBS	Societal

AQoL = Assessment of Quality of Life

NSMHWB = 2007 National Survey of Mental Health and Wellbeing

ABS = Australian Bureau of Statistics

MBS = Medicare Benefits Schedule

PBS = Pharmaceutical Benefits Schedule

## 2.2 Adaptation of these methods to the present study

Using these methods, the costs and outcomes for two alternative scenarios (absenteeism versus presenteeism) are produced. These results were applied to address the present study's aims as follows:

- Input data for the absenteeism and presenteeism models included past-year health service use, medication costs, lost productive time from absenteeism and presenteeism, and costs of job turnover/employee replacement. These data were weighted to the Australian population to estimate the societal cost of depression among employed Australians for the past year.
- It is assumed that the respondents in the NSMHWB with lifetime depression who were working (n=850) are broadly representative of the population of employed persons with lifetime depression.
- These cost data provide a baseline for estimating the proportion of job strain-attributable depression cost. The proportion of depression estimated to be due to job strain (LaMontagne et al., 2008) was applied to calculate the costs of job strain-attributable depression in the Australian workforce. The two studies that were used to estimate the population attributable risk had depression in the past year (Shields, 1999) (CIDI depressive episode in past 12 months) or incident depression in past two years (Ylipaavalniemi et al., 2005) as the outcome, thus the fractions were only applied to the persons with lifetime depression who reported depressive symptoms in the past year.
- Indicative costs from the employer perspective were estimated from the costs due to lost productivity and job turnover, with the exception of absenteeism costs incurred by employees without sick leave entitlements (see below).
- Indicative costs from the employee perspective were based on employees without sick leave entitlements bearing the cost of sickness absence. The proportion of employees with depression who do not have access to paid sick leave was estimated from analysis of the 2007 wave of the Household, Income and Labour Dynamics in Australia (HILDA) panel survey. In HILDA Wave 7 (2007), 29% of working participants (weighted to the Australian population) with poor mental health (SF-36 Mental Component Score [MCS]  $\leq 45$ ) in the previous year did not have access to paid sick leave. This proportion was applied to the persons with lifetime depression who reported depressive symptoms in the past year.
- The outcome from the parent model studies are expressed in quality adjusted life years which are relevant for the scenario comparisons which are undertaken as part of the NHMRC study. These are not relevant to the present analysis and are not reported.

The estimated costs must be considered conservative for a number of important reasons:

- The analysis is based on prevalent and not incident cases, and thus lifetime costs are for persons with a history of depression at the time of the survey interview in 2007. Incidence-based costs, defined as the future costs for persons without a history of depression at the time of interview who will become depressed later in their life, are not included.
- The initial cohort for the model is based on employed persons only. People who had already left the workforce (temporarily or permanently) due to job strain when the National Survey was conducted are not included and therefore their costs are not included. There is empirical evidence of job strain exposure predicting early exit from the workforce onto disability pension (Laine et al., 2009), as detailed in the *Discussion* section below.
- Indirect costs related to premature death (mortality costs) are not included. Depression-specific mortality in a healthy working population is comparatively low, and mortality costs are infrequently included in cost-of-illness studies of depression (Luppa et al., 2007).
- Costs from the employee perspective are based on absenteeism costs for persons without paid sick leave only. It is likely that job turnover also incurs costs for the employee from lost income from time without work, re-training costs, etc. Data to estimate such costs is scant and therefore these costs are not included in this report.
- The wider impact of depression in the workforce on the Australian economy was beyond the scope of this study. Interested readers are referred to a recent report by Econtech that discusses the impact of presenteeism associated with 12 chronic health conditions including depression on the economy, changes to capital investment, effects on private consumption, and exports/imports (Econtech, 2007).



### **3. Results**

#### **3.1 Depression in the Australian workforce**

In 2007, the weighted prevalence of lifetime DSM-IV depression in the Australian workforce was 14.7% (12.0% men, 18.0 % women). This is equivalent to 1.54 million persons in the Australian population. Of these persons, at the time of the survey:

- 21% reported depressive symptoms in the past year and were in treatment
- 17% reported depressive symptoms in the past year and were not in treatment
- 11% were recovered and in treatment
- 52% were recovered and not in treatment.

#### **3.2 Societal cost of depression in the Australian workforce**

An estimate of the societal costs for the 1.54 million persons with depression in the Australian workforce is shown in Table 2. Estimates are presented for the cohort of employed Australians with lifetime depression over two timeframes: one year and lifetime, based on cohort simulation models. Costs are presented as the average per person, and the total cost in the Australian population.

Total cost over one year was estimated at just over \$8,000 per person or \$12.6 billion in total, with lifetime costs at \$138,679 per person or \$213.5 billion in total. In this group of persons with depression who were currently working, the vast majority of cost related to employment including lost productive time and the cost of replacing an employee from job turnover, rather than from health condition-related costs such as health service use and medication.

**Table 2: Societal costs of lifetime depression among employed Australians, 2007**

	Cost per person AUD (million)	Total cost <sup>1</sup> AUD (million)
<b>One year</b>		
Lost productive time	2,224	3,423
Job turnover/employee replacement	5,801	8,929
Mental health-related health service use	18	27
Antidepressant medication	137	212
<b>Total</b>	<b>8,180</b>	<b>12,591</b>
<b>Lifetime<sup>2</sup></b>		
Lost productive time	45,219	69,609
Job turnover/employee replacement	91,857	141,402
Mental health-related health service use	226	348
Antidepressant medication	1,377	2,119
<b>Total</b>	<b>138,679</b>	<b>213,478</b>

<sup>1</sup> Based on a weighted population of 1,539,368 persons

<sup>2</sup> Costs are discounted at 3%.

### 3.3 Job strain-attributable depression and societal cost

LaMontagne et al. recently estimated that 13.2% of past year depression in men and 17.2% of past-year depression in women was attributable to job strain (LaMontagne et al., 2008). These population-attributable risks were applied to the present findings to estimate the total cost of job strain-attributable depression in the Australian working population (see Table 3). The attributable fractions were applied to persons with lifetime depression who reported symptoms in the past year (38%).

**Table 3: Societal costs of lifetime depression among employed Australians in 2007 that is attributable to job strain**

	Attributable to job strain		Total cost attributable to job strain %
	No Total cost AUD (million)	Yes Total cost AUD (million)	
One year	11,861	730	5.8
Lifetime	201,676	11,802	5.5

In one year, \$730 million (5.8%) of the societal cost of depression in the Australian workforce was attributable to job strain. Over a lifetime, \$11.8 billion was attributable to job strain, or 5.5% of the total. These findings provide a starting point for understanding the potential economic gain from reducing job strain in the Australian workforce. While these percentages may seem rather modest, as a total cost this is a significant burden on the Australian economy that is *potentially avertable*.

### 3.4 Distribution of employment-related costs by employer and employee

Employment-related costs borne by the employee were based on the proportion of employees with 12 month depression who did not have access to sick leave entitlements. Any costs due to absenteeism incurred by this group were attributed to the employee, as by definition any absence from work is not paid.

Of the employees with lifetime depression, 38% reported symptoms in the past 12 months. Of these, 29% were estimated not to have access to paid sick leave entitlements, or 11% of the total population of employees with lifetime depression. Of the total costs due to lost productive time, 22% were attributable to absenteeism.

When the absenteeism costs for employees without sick leave entitlements were attributed to the employee, this gave a total of \$85 million in costs from the employee perspective (Table 4). Based on this analysis, the vast majority of employment-related costs were notionally incurred by the employer.

**Table 4: Distribution of costs of depression over one year among employed Australians, 2007**

	Total cost AUD (million)
Employer perspective	
Lost productive time <sup>1</sup>	3,337
Job turnover/employee replacement cost	8,930
<b>Total</b>	<b>12,267</b>
Employee perspective	
Absenteeism <sup>2</sup>	85
<b>Total</b>	<b>85</b>

<sup>1</sup> Lost productive time excludes absenteeism costs for employees without paid sick leave entitlements.

<sup>2</sup> Absenteeism costs for employees without paid sick leave entitlements.

## **4. Sensitivity analysis**

### **4.1 Consideration of variables not included in main analysis**

As mentioned earlier, the base case analysis was originally planned to include costs due to depression-related accidents in the workplace. Accidents have been raised as a potential negative consequence of depression in employees, due to increased risk from symptoms such as poor concentration and impaired decision-making. On further investigation we were unable to locate a reliable estimate for the probability of workplace accidents due to depression, and were not able to find a specific cost for a depression-related accident versus a non-depression-related accident. Nonetheless, to explore the potential impact of this cost on the analysis, we have approximated these inputs.

The probability of a depression-related accident in the workplace was estimated from a small study in one county in the rural mid-western US state of Iowa (Tiesman et al., 2006), and the cost of a workplace accident due to depression was estimated as the average cost of a workplace injury across all causes (i.e. not specific to depression) (Australian Safety and Compensation Council, 2009). Assuming these estimates are broadly reflective of the possible cost of a depression-related workplace accident, the result of including this cost is shown in Table 5. Inclusion of workplace accidents more than triples the estimated societal cost of depression in the workforce.

**Table 5: Societal costs of lifetime depression among employed Australians, 2007, including workplace accidents**

	Cost per person AUD (million)	Total cost <sup>1</sup> AUD (million)
One year		
Lost productive time	2,224	3,423
Job turnover/employee replacement	5,801	8,929
Mental health-related health service use	18	27
Antidepressant medication	137	212
Workplace accident ( <i>weak estimate</i> )	22,381	34,453
<b>Total</b>	<b>30,561</b>	<b>47,044</b>
Lifetime <sup>2</sup>		
Lost productive time	45,219	69,609
Job turnover/employee replacement	91,857	141,402
Mental health-related health service use	226	348
Antidepressant medication	1,377	2,119
Workplace accident ( <i>weak estimate</i> )	421,761	649,245
<b>Total</b>	<b>560,440</b>	<b>862,723</b>

<sup>1</sup> Based on a weighted population of 1,539,368 persons

<sup>2</sup> Costs are discounted at 3%.

## 4.2 Probabilistic sensitivity analysis

Probabilistic sensitivity analysis is where the uncertainty in study variables is considered simultaneously. Each input into the model is entered as a distribution rather than a point estimate. Monte Carlo simulation re-runs the model numerous times (1,000 times in our analyses). Each time the model is run values for each variable are sampled from their respective distribution. This allows the estimation of variance around key model outputs.

### Cost per person

Table 6 presents the estimated 95% confidence intervals around the types of cost and total cost for the one year and lifetime time frames, for the cost per person. This shows that the point estimate for total cost per person over one year is just over \$8,000, but could be as low as \$4,770 or as high as \$9,890.

Over a lifetime, the total cost per person could be as low as \$55,508 or as high as \$213,936. The cost of job turnover had substantial uncertainty around both the probability of occurrence and the cost per episode of job turnover. Over a lifetime, for example, the cost per person from job turnover could be as low as \$38,097 or as high as \$141,422.

**Table 6: Estimate of variance around societal cost per person of lifetime depression over one year and lifetime among employed Australians, 2007**

	Cost per person <sup>1</sup>		
	AUD	95% confidence interval	
		lower bound	upper bound
<b>One year</b>			
Lost productive time	2,224	1,423	3,000
Job turnover/employee replacement	5,801	2,718	7,432
Mental health-related health service use	18	10	23
Antidepressant medication	137	114	156
<b>Total</b>	<b>8,180</b>	<b>4,770</b>	<b>9,890</b>
<b>Lifetime<sup>2</sup></b>			
Lost productive time	45,219	18,569	70,562
Job turnover/employee replacement	91,857	38,097	141,422
Mental health-related health service use	226	91	364
Antidepressant medication	1,377	621	2,020
<b>Total</b>	<b>138,679</b>	<b>55,508</b>	<b>213,936</b>

<sup>1</sup> Based on a weighted population of 1,539,368 persons

<sup>2</sup> Costs are discounted at 3%.

### Total cost in the Australian population

The corresponding figures for variance around total cost when extrapolated to the Australian population are shown in Table 7. The total cost over one year of \$12.6 billion could be as low as \$7.3 billion or as high as \$15.2 billion. Over a lifetime, the total cost in the Australian population could be as low as \$85 billion or as high as \$329 billion.

**Table 7: Estimate of variance around societal total cost of lifetime depression over one year and lifetime among employed Australians, 2007**

	Cost per '000,000 <sup>1</sup>		
	AUD	95% confidence interval	
		lower bound	upper bound
<b>One year</b>			
Lost productive time	3,423	2,190	4,618
Job turnover/employee replacement	8,929	4,185	11,440
Mental health-related health service use	27	16	35
Antidepressant medication	212	176	241
<b>Total</b>	<b>12,591</b>	<b>7,343</b>	<b>15,224</b>
<b>Lifetime<sup>2</sup></b>			
Lost productive time	69,609	28,584	108,620
Job turnover/employee replacement	141,402	58,645	217,700
Mental health-related health service use	348	140	561
Antidepressant medication	2,119	956	3,109
<b>Total</b>	<b>213,478</b>	<b>85,447</b>	<b>329,326</b>

<sup>1</sup> Based on a weighted population of 1,539,368 persons

<sup>2</sup> Costs are discounted at 3%.

## **5. Discussion**

### **5.1 Summary of main findings**

Societal cost of lifetime depression in the workforce was estimated at \$12.6 billion over one year, and \$213.5 billion over a lifetime. Not surprisingly for a group that was currently working, the vast majority of these costs related to employment (lost productive time and job turnover).

The societal cost of depression in employed Australians that is attributable to job strain was estimated at \$730 million over one year, and \$11.8 billion over a lifetime. This provides an upper bound for the potential economic benefits if job strain could be reduced at a population level. These estimates provide added economic incentive for governments and employers to develop and implement a systems approach to job stress in the Australian workforce (LaMontagne et al., 2007b, LaMontagne et al., 2007a, LaMontagne et al., 2006).

Employees without access to paid sick leave are an important component of the Australian labour market (approximately 25% of working Australians have no paid annual or sick leave) (Australian Bureau of Statistics, 2007). This study suggests that absenteeism costs for employees with depression who do not get paid for sickness absence incur a total of \$85 million over one year. This is a substantial cost borne by these individuals and may have the consequence of promoting attendance at work when unwell (presenteeism behaviour).

While this is an important subgroup to consider, this analysis suggests that the vast majority of employment-related costs from depression in the workforce were borne by employers. This reinforces previous studies that have shown that employers are already paying a high cost for depression in their workforce. The potential economic benefits identified provide a clear business incentive for employers to invest in initiatives that reduce job stress, promote mental health, and encourage help-seeking, as the return on investment is potentially in the tens of millions of dollars.

### **5.2 Limitations**

Before discussing the implications of this analysis, some important limitations in scope and interpretation are provided. The total costs presented here for depression are from a societal perspective as they include the indirect costs of lost productive time and job turnover as well as standard disease costs of health service utilisation and medication.



However other potentially relevant societal costs have not been included as they were beyond the scope of the primary study that informs this project. Such additional costs include impact on families, loss of leisure time, and the cost of workers compensation for job stress-related claims from psychological injury. Our findings can therefore be considered to be conservative, providing a lower bound for societal cost.

The cost of job turnover contributed the most to the total cost. This is an expensive incident that is estimated to occur at a higher rate in employees with depression than employees without depression. However both the estimates for probability of job turnover and cost of a job turnover incident had substantial uncertainty around them, with the sensitivity analysis showing that the 95% confidence interval around this cost type was quite wide.

Also in the sensitivity analysis, we explored the impact of adding the cost of depression-related workplace accidents. The estimates for this type of cost were weak and unlikely to generalise to all types of jobs, thus this analysis is indicative only. It indicates that workplace accidents are potentially a substantial contributor to total cost, and future effort should be directed at understanding the magnitude of this problem.

This study only included employees with a lifetime history of DSM-IV depression who were currently working, and therefore does not inform the broader costs of job strain on other psychological outcomes or the costs of persons who have already left the workforce. To produce a comprehensive estimate of the effects of job strain on mental health, other associated mental health outcomes would need to be included, such as anxiety, work-related suicide, and behavioural disorders (for example, alcoholism and nicotine addiction) (Ostry et al., 2007, Stansfeld and Candy, 2006, Head et al., 2004).

Further, job strain represents only one of several work-related psychosocial hazards. Others that have been linked to depression include effort-reward imbalance, injustice at work, job insecurity, and bullying (Stansfeld and Candy, 2006, Tsutsumi and Kawakami, 2004, Kivimaki et al., 2003). All such hazards would need to be included to estimate the full effect of psychosocial work hazards on depression in particular, and on mental health disorders in general. Thus, we would argue that the costs associated with the impacts of *all* psychosocial working conditions on depression would be higher than the estimates we have presented, and corresponding estimates for *all* affected mental health outcomes would be higher still.

In relation to persons who had already left the workforce, the phenomenon of job strain predicting elevated risk of subsequent disability pension has recently been empirically demonstrated in a large prospective cohort study of over 25,000 Finnish public sector employees (Laine et al., 2009). The odds of going on to disability pension were 2.6 times higher (95% confidence interval 1.26 to 5.34) for employees with high job strain than for those with low job strain three to five years earlier. The association remained significant after further adjustment for prevalent diseases, psychological distress, and perceived health status. Laine et al.'s (2009) findings suggest that organisational interventions to reduce job strain may also reduce early exit from work.

### 5.3 Commentary

#### Comparison with other economic studies of depression in the workforce

A recent systematic review of global evidence on the economic impact of depression highlighted that the majority of national studies were from the USA and countries in Western Europe, with eight of 13 studies reviewed including costs of absenteeism but only four including costs of presenteeism (Luppa et al., 2007). While comparisons across, and even within, countries are problematic due to differences in health care access/financing, labour markets and methods (Luppa et al., 2007), three Australian studies provide an important backdrop to present findings on lost productivity.

1. Based on data from the 1997 National Survey of Mental Health and Wellbeing, we had previously estimated that lost productivity due to current mental disorders in the full-time workforce cost \$2.7 billion in one year, with a majority of this due to depressive and anxiety disorders (Lim et al., 2000). In the present study using a different method and including any employee who had experienced depression in their lifetime, we found that lifetime depression cost \$3.4 billion (95% CI \$2.2-4.6 billion) over one year due to lost productivity. The cost would obviously be much higher with other mental disorders included.
2. Hilton and colleagues (Hilton et al., 2008) estimated the cost of lost productivity in the workforce as part of a landmark Australian study to evaluate the cost benefit of increasing help-seeking for depression among employees (Australian Work Outcomes Research Cost-benefit [WORC] study). Their estimate was \$2.6 billion in lost productivity from employees with high psychological distress, which includes depression, anxiety disorders, and non-specific distress. This falls within the confidence intervals for our estimate of \$3.4 billion (95% CI \$2.2-4.6 billion).

3. A recent report by Econtech (Econtech, 2007) commissioned by Medibank Private estimated the cost of presenteeism to the Australian economy for 12 chronic health conditions including depression (albeit based largely on US research). The impact on employers was estimated at \$17.6 billion, with depression the leading contributor to this cost along with allergies, with both accounting for 19% of the overall productivity loss (approximately \$3 billion each). Our estimate is slightly larger although this also includes absenteeism, and the Econtech study used a much broader definition of depression that included other “mental and behavioural problems”.

This study did not include the cost of workers’ compensation claims that may be attributable to a depressive disorder. Thus our study findings, combined with estimates of the cost of workers’ compensation, provide a fuller picture of the economic impact of depression in the Australian workforce.

A total national cost estimate was obtained from SafeWork Australia for 2006-07 of \$209 million for new ‘mental stress’ claims lodged in that year (this figure applies to costs accrued to date for claims lodged in this year, and may rise with continuing accumulation of claim costs).

It is important to note that chronic job stress as a mechanism leading to a ‘mental stress’ claim is only one of eight ‘mechanism’ categories, but it is consistently the most common – typically accounting for 40% (other mechanisms include ‘exposure to traumatic event’, ‘exposure to workplace violence,’ ‘harassment’, etc.).

Our estimates of job strain-attributable depression are closest to the ‘work pressure’ category, and would represent a fraction (approximately 40%) of all ‘mental stress’ claims. Thus the most relevant ‘mental stress’ claim costs for comparison to our economic benefit analyses approximate 40% of all ‘mental stress’ claims costs, or \$84 million for 2006–07. Our estimate of \$730 million for 2007 is nearly 10-fold higher. In any case, from our estimated employer costs from job strain-attributable depression are substantially larger than all stress-related claims costs. This finding provides further incentive for employers to expand efforts in job stress prevention and control.

### **A systems approach to job stress to reduce the high economic burden of depression in the workforce**

These findings further strengthen the evidence base for growing efforts nationally to address the upstream determinants of job stress as well as its downstream consequences, such as depression, job turnover, and lost productivity. Recent policy and practice advice in this direction includes recommendations from the Commonwealth Government's National Advisory Council on Mental Health to invest in 'mentally healthy workplace' studies to "explore how mental health promotion can be embedded in workplace and OH&S legislation" with indicators of success including decreased levels of workplace stress (National Advisory Council on Mental Health, 2009).

The National Preventative Health Taskforce reports also acknowledged job stress as an important preventable determinant of common chronic diseases and poor health behaviours, and recommended the need for and promise of new workplace health promotion approaches that integratively target job stress and health behaviours (National Preventative Health Taskforce, 2009).

Action on these recommendations depends on the availability of effective intervention strategies to prevent and control job stress. To address this important question, the international job stress intervention research literature has been the subject of a number of recent systematic reviews. The most comprehensive of these reviews (summarising 90 intervention studies) focused on interventions in which organisations set out to address job stress proactively (LaMontagne et al., 2007a).

This review concluded that individual-focused, low-systems approaches (e.g. coping and time management skill development) are effective at the individual level, favourably affecting individual-level outcomes such as health and health behaviours. Individual level interventions, however, tend not to have favourable impacts at the organisational level (e.g. reducing exposures, sickness absence). Organisationally focused high- and moderate-rated approaches (addressing working conditions), however, are beneficial at both individual and organisational levels (LaMontagne et al., 2007a).

Two Cochrane reviews were published soon after the afore-mentioned review (Bambra et al., 2007, Egan et al., 2007). While these had more strict inclusion criteria, they also included natural experiments, or unintended changes in stressors, such as from downsizing and restructuring (these were excluded from the systematic review described previously).

The review of organisational-level interventions to increase job control found some evidence of health benefits (e.g. reductions in anxiety and depression) when employee control increased or (less consistently) when demands decreased or support increased (Egan et al., 2007). They also found evidence of worsening employee health from downsizing and restructuring (Egan et al., 2007).

The second Cochrane review of task restructuring interventions (Bambra et al., 2007) found that interventions that increased control resulted in improved health. These recent reviews indicate that effective strategies for the prevention and control of job stress are available. Prevalent practice in Australian workplaces, however, remains disproportionately focused on individual-level intervention with inadequate attention to the reduction of job stressors (LaMontagne et al., 2006, Shaw et al., *in review*). An expanded articulation of a comprehensive or systems approach to the prevention and control of job stress is provided elsewhere, including examples of specific intervention strategies (LaMontagne et al., 2007b).

### **Future directions**

Workplace intervention strategies that integrate mental health promotion with job stress intervention hold particular promise, as they would address depression and other mental illness regardless of cause while simultaneously reducing work-related contributions (LaMontagne, 2004, Noblet and LaMontagne, 2006).

The findings of the present report suggest that employers would be the main economic beneficiaries of such efforts, through reduced turnover and improved productivity, while employees would benefit through reduced job stress and improved mental health. Wider societal benefits could include longer duration of workforce participation and reduced early exit from the workforce onto disability pensions.

Further information on integrating occupational health and workplace mental health promotion is available from various Australian (e.g. [www.beyondblue.org.au](http://www.beyondblue.org.au) and the Australian Human Rights Commission, 2010) and international (e.g. <http://www.cdc.gov/niosh/worklife/> and WHO, 2010) sources. There are also significant opportunities to link work and health concerns and intervention strategies with the more broadly embraced efforts to understand and address health disparities.

Applying a health inequalities intervention framework consistent with the systems approach described above (LaMontagne et al., 2006, LaMontagne et al., 2007a), Whitehead recently described how stressful psychosocial working conditions could be comprehensively addressed by strengthening individuals, strengthening communities, improving living and working conditions, and promoting healthy macro-policies (Whitehead, 2007). Expanded efforts in this area have the potential to benefit employers, workers, and society through improvements in physical and mental health and the ensuing economic benefits.

## 6. Glossary

### Absenteeism

In this study, *absenteeism* refers to days off work due to depression.

### Burden of disease

*Burden of disease* is the total amount of healthy years that are lost in a population due to disease. It includes healthy years lost due to disease-related disability as well as years lost from premature death.

### Confidence intervals

A *point estimate* is an average value or estimate of what a value is most likely to be, based on an observed set of values (e.g. a sample of observed values drawn from a defined population).

A *confidence interval* provides further clarification on how confident we can be in that *point estimate*.

A 95% *confidence interval* tells us that if we repeated a study 100 times, then 95 times out of a hundred (95%) the average would fall somewhere in that range. Narrow *confidence intervals* indicate greater precision in the *point estimate* and vice versa.

### DSM-IV depression

The Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> Edition (DSM-IV) is produced by the American Psychiatric Association and used to diagnose mental disorders. Major depressive disorder (depression) is defined as having experienced at least one major depressive episode that caused significant distress or disability.

A depressive episode is characterised by the presence of five or more symptoms during the same two week period, with at least one of the symptoms from the first two on the following list:

1. depressed mood
2. loss of interest and pleasure
3. weight change or appetite disturbance
4. sleep disturbance
5. psychomotor changes (moving too much or too little)
6. low energy
7. feelings of worthlessness or guilt
8. poor concentration or difficulty making decisions
9. recurrent thoughts of death or suicidal ideation, plans or attempts.

### **Epidemiologic modelling**

In this study, *epidemiologic modelling* is the process of using mathematical models to represent how many people are in different health states in relation to depression, and how people move in and out of these health states over time.

### **Job strain**

*Job strain* describes a situation where a worker has high job demands, but relatively low control over how to get the job done. Roughly one fourth of working women in OECD countries work in high strain jobs, whereas the figure is less than 20% for working men. This is due primarily to persisting sex differences in job control, with men having more control than women (even when working in the same jobs). *Job strain* predicts an approximate doubling of the risk of depression after accounting for other known risk factors for depression (Stansfeld and Candy, 2006).

### **Job stress**

*Job stress* refers to distress resulting from a situation where the demands of a job are not matched by the resources provided to get the job done. Resources might include a worker's occupational skills, job experience, or education, or organisational resources such as machinery, raw materials, or staffing levels provided to produce goods or provide services.

*Job stressors* are working conditions that increase the risk of *job stress* and *job stress* increases the risks of mental and physical illness, as well as poor health behaviours (LaMontagne et al., 2006). The US National Institute for Occupational Safety and Health defines job stress as "the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker. Job stress can lead to poor health and even injury" (NIOSH, 1999).

### **Job stressors**

*Job stressors* are the modifiable working conditions that can lead to job stress. There are different types of stressors, for examples psychosocial and physical. Psychosocial stressors (also referred to as *psychosocial working conditions*) include job demands, job control, job insecurity, bullying, harassment and more. Physical stressors include noise and ergonomic exposures (such as awkward working postures and repetitive movements). Physical and psychosocial stressors interact in the production of stress-related illness (LaMontagne et al., 2006, LaMontagne et al., 2010).

### **Lifetime depression**

A person with *lifetime depression* has experienced at least one major depressive episode that caused significant distress or disability at some point in their life.

### **Point estimates**

See *confidence intervals*.

### **Population attributable risk (PAR)**

*PAR* is the proportion or percent of a specific disease attributable to one or more specific exposures. *PAR* can be calculated using standard epidemiologic methods using population data on the prevalence of the disease in question (the proportion of people in the population affected by the disease), as well as the prevalence of exposure (the proportion of people exposed). If the exposure is preventable, then the corresponding *PAR* for a specific disease provides an estimate of the proportion of the disease that would be preventable if the exposure were eliminated (LaMontagne et al., 2008).

### **Presenteeism**

*Presenteeism* refers to a situation in which people work when they are feeling unwell.

*Presenteeism* has been linked to lower productivity. In this study, we assessed only *presenteeism* attributable to depression.

### **Psychosocial working conditions**

See *job stressors* above.

### **Sensitivity analyses**

A *sensitivity analysis* investigates how confident we can be in the output of a mathematical model. It includes the estimation of *confidence intervals* around *point estimates*, and identifies which inputs to the model are the most important contributors to the results.



### **Societal cost**

*Societal cost* is the economic cost of a disease or health condition to a society. *Societal cost* includes direct costs such as visits to health care professionals and medicines, and indirect costs that cover broader consequences of ill-health such as lost productive time.

### **Systems approaches to job stress**

A *systems approach to job stress* addresses both the antecedents and consequences of job stress. *Systems approaches* emphasise primary prevention – focusing on the reduction of job stressors as upstream determinants of job stress. Additionally, *systems approaches* integrate work-directed primary with worker-directed secondary and illness-directed tertiary intervention. Secondary-level intervention entails strengthening individual capacities to withstand job stressors (e.g. through training in coping or time management skills). Finally, tertiary-level intervention comes into play in situations where prevention has failed – it involves the treatment, compensation and rehabilitation of workers with job stress-related illness, and should feed back to the strengthening of primary and secondary intervention to prevent subsequent cases.

*Systems approaches* also include the meaningful participation of groups targeted by the intervention and are context-sensitive. Concrete examples of intervention strategies and activities are provided elsewhere (LaMontagne et al., 2007b).

A *systems approach to job stress* is roughly synonymous with ‘comprehensive job stress intervention’, ‘combined person- and work-directed intervention’ and ‘combined stress prevention (work-focused) and stress management (person-focused)’ programs.

## 7. References

- Andrews, G., Issakidis, C., Sanderson, K., Corry, J. & Lapsley, H. 2004. Utilising survey data to inform public policy: comparison of the cost-effectiveness of treatment of ten mental disorders. *Br J Psychiatry*, 184, 526-33.
- Australian Bureau of Statistics 2007. National survey of mental health and wellbeing: summary of results. Canberra: Australian Bureau of Statistics. <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4326.0>
- Australian Bureau of Statistics 2004. *Working arrangements, Australia*, Canberra, Australian Bureau of Statistics. <http://www.abs.gov.au/ausstats/abs@.nsf/productsbytitle/5E904225E4B17C0ECA2568A900139378?OpenDocument>
- Australian Federal Department of Education Employment and Workplace Relations 2008. Evaluating work and family strategies in your workplace. Canberra: Commonwealth of Australia.
- Australian Human Rights Commission 2010. Workers with Mental Illness: a Practical Guide for Managers. Sydney: Australian Human Rights Commission. [http://www.hreoc.gov.au/disability\\_rights/publications/workers\\_mental\\_illness\\_guide.html](http://www.hreoc.gov.au/disability_rights/publications/workers_mental_illness_guide.html)
- Australian Safety and Compensation Council 2009. The costs of work-related injury and illness for Australian employers, workers and community. Canberra: Australian Safety and Compensation Council. [http://www.safeworkaustralia.gov.au/NR/rdonlyres/EAD5247E-98E7-4750-A35E-A6BC9B1E7781/0/CostsofWorkRelatedInjuryAndDisease\\_Mar2009.pdf](http://www.safeworkaustralia.gov.au/NR/rdonlyres/EAD5247E-98E7-4750-A35E-A6BC9B1E7781/0/CostsofWorkRelatedInjuryAndDisease_Mar2009.pdf)
- Bambra, C., Egan, M., Thomas, S., Petticrew, M. & Whitehead, M. 2007. The psychosocial and health effects of workplace reorganisation. 2. A systematic review of task restructuring interventions. *J Epidemiol Community Health*, 61, 1028-37.
- Bonde, J. P. 2008. Psychosocial factors at work and risk of depression: a systematic review of the epidemiological evidence. *Occup Environ Med*, 65, 438-45.
- Briggs, A. & Sculpher, M. 1998. An introduction to Markov modelling for economic evaluation. *Pharmacoeconomics*, 13, 397-409.
- Drummond, M., Schulpher, M, Torrance G, O'brien B, Stoddart G 2005. *Methods for the economic evaluation of health care programmes*, Oxford, Oxford University Press.
- Econtech 2007. Economic modelling of the cost of presenteeism in Australia. Canberra: Econtech for Medibank Private. [http://www.econtech.com.au/information/Social/Medibank\\_Presenteeism\\_FINAL.pdf](http://www.econtech.com.au/information/Social/Medibank_Presenteeism_FINAL.pdf)
- Egan, M., Bambra, C., Thomas, S., Petticrew, M., Whitehead, M. & Thomson, H. 2007. The psychosocial and health effects of workplace reorganisation. 1. A systematic review of organisational-level interventions that aim to increase employee control. *J Epidemiol Community Health*, 61, 945-54.
- Graves, N., Mckinnon, L., Reeves, M., Scuffham, P., Gordon, L. & Eakin, E. 2006. Cost-effectiveness analyses and modelling the lifetime costs and benefits of health-behaviour interventions. *Chronic Illn*, 2, 97-107.
- Head, J., Stansfeld, S. A. & Siegrist, J. 2004. The psychosocial work environment and alcohol dependence: a prospective study. *Occupational and Environmental Medicine*, 61, 219-224. <http://oem.bmj.com/content/61/3/219.abstract>
- Hilton, M. F., Scuffham, P. A., Sheridan, J., Cleary, C. M. & Whiteford, H. A. 2008. Mental ill-health and the differential effect of employee type on absenteeism and presenteeism. *J Occup Environ Med*, 50, 1228-43.
- Issakidis, C., Sanderson, K., Corry, J., Andrews, G. & Lapsley, H. 2004. Modelling the population cost-effectiveness of current and evidence-based optimal treatment for anxiety disorders. *Psychol Med*, 34, 19-35.
- Keegel, T., Ostry, A. & LaMontagne, A. D. 2009. Job strain exposures versus stress-related Workers Compensation claims in Victoria (Australia): Developing a public health response to job stress. *J Public Health Policy*, 30, 17-39. <http://www.palgrave-journals.com/jphp/journal/v30/n1/abs/jphp200841a.html>
- Kivimaki, M., Vertanen, M., Vartia, M., Elovainio, M., Vahtera, J. & Keltikangas-Jarvinen, L. 2003. Workplace bullying and the risk of cardio-vascular disease and depression. *Occup Environ Med*, 60, 779-783. <http://oem.bmj.com/content/60/10/779>

- Kuntz, M. 2001. Modelling in economic evaluation. *In: Drummond, M., McGuire, A. (ed.) Economic evaluation in health care: Merging theory with practice.* Oxford: Oxford University Press.
- Laine, S., Gimeno, D., Virtanen, M., Oksanen, T., Vahtera, J., Elovainio, M., Koskinen, A., Pentti, J. & Kivimäki, M. 2009. Job strain as a predictor of disability pension: the Finnish Public Sector Study. *J Epidemiol Community Health*, 63, 24-30.
- LaMontagne, A. D. 2004. Integrating health promotion and health protection in the workplace. *In: Moodie, R. & Hulme, A. (eds.) Hands-on Health Promotion.* Melbourne: IP Communications.
- LaMontagne, A. D., Keegel, T., Louie, A. M. & Ostry, A. 2010. Job stress as a preventable upstream determinant of common mental disorders: A review for practitioners and policy-makers. *Advances in Mental Health*, 9(1), 17-35.  
<http://amh.e-contentmanagement.com/archives/vol/9/issue/1/article/3736/job-stress-as-a-preventable-upstream-determinant>
- LaMontagne, A. D., Keegel, T., Louie, A. M., Ostry, A. & Landsbergis, P. A. 2007a. A systematic review of the job stress intervention evaluation literature: 1990—2005. *Int J Occup & Environ Health*, 13, 268-280.
- LaMontagne, A. D., Keegel, T. & Vallance, D. A. 2007b. Protecting & promoting mental health in the workplace: Developing a systems approach to job stress. *Health Promotion Journal of Australia*, 18, 221-228.
- LaMontagne, A. D., Keegel, T., Vallance, D. A., Ostry, A. & Wolfe, R. 2008. Job strain—attributable depression in a sample of working Australians: Assessing the contribution to health inequalities. *BMC Public Health*, 8, 9.  
<http://www.biomedcentral.com/content/pdf/1471-2458-8-181.pdf>
- LaMontagne, A. D., Louie, A., Keegel, T., Ostry, A. & Shaw, A. 2006. Workplace Stress in Victoria: Developing a Systems Approach. Melbourne: Victorian Health Promotion Foundation.  
[http://www.vichealth.vic.gov.au/~media/ProgramsandProjects/MentalHealthandWellBeing/EconomicParticipation/WorkplaceStress/Workplace\\_stress\\_SUMMARY.ashx](http://www.vichealth.vic.gov.au/~media/ProgramsandProjects/MentalHealthandWellBeing/EconomicParticipation/WorkplaceStress/Workplace_stress_SUMMARY.ashx)
- Lerner, D., Adler, D. A., Chang, H., Lapitsky, L., Hood, M. Y., Perissinotto, C., Reed, J., McLaughlin, T. J., Berndt, E. R. & Rogers, W. H. 2004. Unemployment, job retention, and productivity loss among employees with depression. *Psychiatr Serv*, 55, 1371-8. <http://ps.psychiatryonline.org/cgi/content/full/55/12/1371>
- Lim, D., Sanderson, K. & Andrews, G. 2000. Lost productivity among full-time workers with mental disorders. *J Ment Health Policy Econ*, 3, 139-146.
- Luppa, M., Heinrich, S., Angermeyer, M. C., Konig, H. H. & Riedel-Heller, S. G. 2007. Cost-of-illness studies of depression: a systematic review. *J Affect Disord*, 98, 29-43.
- National Advisory Council on Mental Health 2009. A Mentally Healthy Future for all Australians. Canberra: National Advisory Council on Mental Health.  
[http://www.health.gov.au/internet/mentalhealth/publishing.nsf/Content/8CF8540215E98930CA2574320019D4F8/\\$File/AMentallyHealthyFutureforallAustralians.pdf](http://www.health.gov.au/internet/mentalhealth/publishing.nsf/Content/8CF8540215E98930CA2574320019D4F8/$File/AMentallyHealthyFutureforallAustralians.pdf)
- Netterstrom, B., Conrad, N., Bech, P., Fink, P., Olson, O., Rugulies, R. & Stansfeld, S. 2008. The relation between work-related psychosocial factors and the development of depression. *Epidemiological Reviews*, 30, 118-132. <http://epirev.oxfordjournals.org/cgi/reprint/30/1/118>
- NIOSH 1999. Stress at Work. Cincinnati: National Institute for Occupational Safety and Health (NIOSH), US Centres for Disease Control and Prevention. <http://www.cdc.gov/niosh/docs/99-101/>
- Noblet, A. & LaMontagne, A. D. 2006. The role of workplace health promotion in addressing job stress. *Health Promot Int*, 21, 346-53.
- NPHT 2009. Australia: The healthiest country by 2020: National Preventative Health Strategy. Canberra: National Preventative Health Taskforce (NPHT).  
[http://www.preventativehealth.org.au/internet/preventativehealth/publishing.nsf/Content/nphs-roadmap/\\$File/nphs-roadmap.pdf](http://www.preventativehealth.org.au/internet/preventativehealth/publishing.nsf/Content/nphs-roadmap/$File/nphs-roadmap.pdf)
- Ostry, A., Maggi, S., Tansey, J., Dunn, J., Hershler, R., Chen, L., Louie, A. M. & Hertzman, C. 2007. The impact of psychosocial work conditions on attempted and completed suicide among western Canadian sawmill workers. *Scand J Public Health*, 35, 265-271.

- Philips, Z., Bojke, L., Sculpher, M., Claxton, K. & Golder, S. 2006. Good practice guidelines for decision-analytic modelling in health technology assessment: a review and consolidation of quality assessment. *Pharmacoeconomics*, 24, 355-71.
- Rost, K., Smith, J. L. & Dickinson, M. 2004. The effect of improving primary care depression management on employee absenteeism and productivity. A randomized trial. *Med Care*, 42, 1202-10.
- Sanderson, K., Andrews, G., Corry, J. & Lapsley, H. 2003. Reducing the burden of affective disorders: is evidence-based health care affordable? *J Affect Disord*, 77, 109-25.
- Shaw, A., Blewett, V. & LaMontagne, A. D. in review. Shaping the regulatory space: the context for action on job stress.
- Shaw, A. & LaMontagne, A. D. Year. Acting on job stress – Do we have a context for action? In: 42<sup>nd</sup> Annual Conference of the Human Factors and Ergonomic Society of Australia, New Technology – Putting Macro and Micro in Context, 20-22 November 2006 Sydney, Australia.
- Shields, M. 1999. Long working hours and health. *Health Rep*, 11, 33-48(Eng); 37-55(Fre).  
<http://www.statcan.gc.ca/studies-etudes/82-003/archive/1999/4734-eng.pdf>
- Stansfeld, S. A. & Candy, B. 2006. Psychosocial work environment and mental health – a meta-analytic review. *Scand J Work Environ Health*, 32, 443-62.
- Stewart, W. F., Ricci, J. A., Chee, E., Hahn, S. R. & Morganstein, D. 2003. Cost of lost productive work time among US workers with depression. *JAMA*, 289, 3135-44.
- Tiesman, H. M., Peek-Asa, C., Whitten, P., Sprince, N. L., Stromquist, A. & Zwerling, C. 2006. Depressive symptoms as a risk factor for unintentional injury: a cohort study in a rural county. *Inj Prev*, 12, 172-7.
- Tsutsumi, A. & Kawakami, N. 2004. A review of empirical studies on the model of effort-reward imbalance at work: reducing occupational stress by implementing a new theory. *Soc Sci Med.*, 59, 2335-59.
- Wang, P. S., Patrick, A., Avorn, J., Azocar, F., Ludman, E., McCulloch, J., Simon, G. & Kessler, R. 2006. The costs and benefits of enhanced depression care to employers. *Arch Gen Psychiatry*, 63, 1345-53.  
<http://archpsyc.ama-assn.org/cgi/reprint/63/12/1345>
- Whitehead, M. 2007. A typology of actions to tackle social inequalities in health. *J Epidemiol Community Health*, 61, 473-8. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2465710/?tool=pubmed>
- WHO 2010. Healthy Workplaces: a model for action for employers, workers, policymakers and practitioners. Geneva: WHO. [http://www.who.int/occupational\\_health/publications/healthy\\_workplaces\\_model.pdf](http://www.who.int/occupational_health/publications/healthy_workplaces_model.pdf)
- Ylipaavalniemi, J., Kivimaki, M., Elovainio, M., Virtanen, M., Keltikangas-Jarvinen, L. & Vahtera, J. 2005. Psychosocial work characteristics and incidence of newly diagnosed depression: a prospective cohort study of three different models. *Social Science & Medicine*, 61, 111-22.



**Victorian Health Promotion Foundation (VicHealth)**  
PO Box 154 Carlton South 3053 Australia  
T. +61 3 9667 1333 F. +61 3 9667 1375  
[vichealth@vichealth.vic.gov.au](mailto:vichealth@vichealth.vic.gov.au)  
[www.vichealth.vic.gov.au](http://www.vichealth.vic.gov.au)

ISBN: 978-1-921822-02-5  
October 2010  
Publication Number: P-021-SC

