Increased unemployment from the COVID-19 pandemic, what might be the adverse impacts on cardiovascular disease in Aotearoa/New Zealand and how might this be prevented?

Nhung Nghiem, Anja Mizdrak, Nick Wilson

ABSTRACT
Despite success with eliminating the COVID-19 pandemic in Aotearoa New Zealand (at least to early August 2020), the response to the pandemic threat has resulted in a range of negative social and economic impacts, including job losses. Understanding the health consequences of these impacts will be increasingly important in the ‘recovery’ phase. This article contributes to this understanding by exploring the relationship between unemployment and cardiovascular disease (CVD)—a major contributor to health loss in Aotearoa New Zealand. We reviewed the literature about the impact of unemployment on CVD. The totality of the evidence suggested that increased unemployment arising from economic shocks is associated with increased CVD incidence, particularly for middle-aged men. Continued monitoring and active policy responses are required to prevent increases in CVD (and other health outcomes) as a result of the COVID-19 pandemic response. For example, quantifying the CVD-related health loss from pandemic-associated unemployment, along with the health costs and impact on health inequalities, could help with government decision-making to reduce CVD burdens. This could be via intensifying tobacco control, regulating the food supply (eg, to reduce salt/sodium levels), and improving uptake of CVD preventive medications such as statins and anti-hypertensives.

Background and methods
Until at least early August 2020, New Zealand had successfully eliminated community transmission of COVID-19 from the country, but then an outbreak was detected on 11 August (at the time of writing). Nevertheless, the associated response to the initial epidemic, including lockdowns and declines in global trade, has resulted in a range of negative social and economic impacts including job losses. The social and economic impacts of the COVID-19 response will have health consequences—some positive (eg, reduced road injury) and others negative (eg, increased elective surgery waiting times). Understanding the wider impacts of the COVID-19 response will be critical as we move further into the ‘recovery’ phase of the response. In this article, we contribute to this understanding by examining the relationship between unemployment (a known economic consequence of the pandemic response) and cardiovascular disease.
disease, CVD—a leading cause of health loss and health inequalities in Aotearoa New Zealand.

In April 2020, we conducted a literature search to identify studies, systematic reviews or meta-analyses that analysed the association between unemployment or economic crises and CVD. We only searched for studies that were published in the English language and from 1 January 2000 onwards. We included studies on high-income countries which had unemployment, job losses, or relevant proxies (eg, job insecurity) as the exposure, and CVD or stroke or heart disease as the outcome. Keywords were: (systematic or review or meta) AND (cardiovascular or stroke or coronary or heart) AND (unemployment or GDP or recession or “economic crisis”). A wide range of research databases were utilised, including Scopus, PubMed, Econlit, ESBCOhost, Web of Science and Google Scholar. A total of 951 articles (with duplicates) were identified in these databases and one author scanned all the titles to identify 35 articles for further investigation. Reviewing the abstracts of these articles identified eight relevant articles that investigated the association between unemployment and CVD. Additional searches using “cited by articles” in Google Scholar helped identify further 22 articles, but only one of which was relevant after reviewing abstracts. Furthermore, one author also independently searched the literature for the association between economic crises and CVD.

Findings from the literature on unemployment and CVD

Of 15 relevant articles identified (Table 1), five were review articles and the remainder were original research articles. We identified nine articles through using unemployment as a proxy,2–10 one further article using job insecurity as a proxy,11 and five further articles through additional searches.12–16

Seven out of nine studies identified through using unemployment as a proxy reported a positive association between unemployment and CVD,2–8 of which three employed individual-level data,3–5 one used population-level data6 and three were review studies (Table 1).2,7,8 These studies tended to employ data for middle-age or working adults. Among these seven studies, four reported hazard ratios (HRs) ranging from 1.19 to 1.84.2–5 The remaining two studies identified through using unemployment as a proxy reported a negative or no association between unemployment and CVD, but they both employed population-level data, implemented simple regression/correlation analyses, used outdated data and did not control for confounding factors.5,10

When considering job insecurity as a risk factor, we found one meta-analysis11 which reported that increased job insecurity was associated with increased coronary heart disease (CHD) incidence (Table 1). This meta-analysis included 174,438 participants with a mean follow-up of 9.7 years and 1,892 incident cases of coronary heart disease from 13 cohort studies.

Our additional search also found five studies that examined the association between economic crises and population level CVD (Table 1).12–16 Most of the studies found used macroeconomic and population-level data12,14,15 as opposed to individual-level data.13,16 Stuckler et al 2009 reported that as unemployment increases there was no change in overall CVD mortality but an increase in intentional violence (suicides and homicides), and a decrease in road traffic crash fatalities.12 However, this study found a strong association between unemployment and CVD mortality for middle-aged men, up to a 0.85% relative increase for a 1% relative increase in unemployment rate. In contrast, other studies have suggested a decline in CVD mortality with an increase in unemployment with many plausible mechanisms around reduced air pollution, reduced occupation stress, impact on smoking affordability and also a decline in circulating infections (eg, from reduced commuting in mass transit).13,14 However, these studies by Tapia Granados et al (2017, 2018) were limited, in particular with arguably inappropriate regression equations, considering data for a young population who had a low background level of CVD risk, and
Table 1: Summary of the relevant studies that examined the association between unemployment and CVD events in high-income countries for study publication dates from January 2000 onwards.

<table>
<thead>
<tr>
<th>Study published in the peer-reviewed literature</th>
<th>Effect size for unemployment on CVD morbidity/mortality mean (CIs)</th>
<th>Study countries</th>
<th>Study data</th>
<th>Study analysis</th>
<th>Our comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birgisdóttir et al 2020†*</td>
<td>An increase in CVD events in association with the Global Financial Crisis (GFC)</td>
<td>Iceland</td>
<td>Data period 2000–2014; N ~360,000; aged 21–70 years (working age)</td>
<td>Ischaemic heart disease (IHD) and acute myocardial infarction (AMI) events, both fatal and non-fatal; regression</td>
<td>Employed individual-level data and rigorous analysis methods; adjusted for age, sex, time trend, seasonality, variations in treatment and diagnoses, lifestyle factors. The study also explained that cycle economic downturn might be good for heart health while economic crisis or recessions are harmful.</td>
</tr>
<tr>
<td>Brenner 2016†*</td>
<td>A positive correlation but effect size was not readily interpretable</td>
<td>28 European countries</td>
<td>Data period 2000–2011</td>
<td>Unemployment and coronary heart disease (CHD)/stroke mortality</td>
<td>Population-level data; controlled for socio-economic factors and included time lags.</td>
</tr>
<tr>
<td>Dupre et al 2012†</td>
<td>HR=1.35 (1.10–1.66)</td>
<td>US</td>
<td>N=13,451; data period 1992–2010 (biaennial interview; aged 51–61 years with replacement of older adults)</td>
<td>AMI incidence only, regression; control group employed people</td>
<td>Individual level data, aged 51–61 years, free of AMI at the baseline. Adjusted for various AMI risks such as education, age, sex, ethnicity, marital status, smoking status, health insurance cover, physical exercise, BMI, etc.</td>
</tr>
<tr>
<td>Falagas et al 2009†</td>
<td>A positive correlation but no effect size was reported</td>
<td>World-wide</td>
<td>A review: economic crisis and CVD mortality</td>
<td>Data were mainly for high-income countries.</td>
<td></td>
</tr>
<tr>
<td>Karanikolos et al 2016†*</td>
<td>During the GFC (2008–09): RR_{incidence} = 1.26 (1.07–1.49)</td>
<td>Iceland, Greece and UK</td>
<td>Publication time frame 2009–2015. Three separate studies for three countries.</td>
<td>A review; CVD events, AMI events and incidence</td>
<td>This was a narrative review of the effect of the GFC on health for high-income countries. The actual data period was around the GFC 2008–2009.</td>
</tr>
<tr>
<td>Koziel et al 2010†</td>
<td>“Occupational status is associated significantly with increased risk of CVD”</td>
<td>Poland</td>
<td>N=1150, aged 40–50 years, in 2006</td>
<td>CVD incidence and mortality; regression; control group employed (professionals and skilled workers)</td>
<td>Individual level data, but data just collected in 2006; controlled for various CVD risk factors as per Framingham equation such as BMI; no prevalence of CVD at the baseline; but the association between unemployment and CVD was stronger for males and with a large confidence interval.</td>
</tr>
<tr>
<td>Meneton et al 2015†</td>
<td>HR=1.84 (1.15–2.83)</td>
<td>France</td>
<td>N=5,852 volunteers; aged 45–64; data period 12 years from 1994–95.</td>
<td>CVD incidence and mortality; Cox regression; control group employed;</td>
<td>Individual level data; control for various CVD risk factors; suggested that this association was not mediated by conventional risk factors; no prevalence of CVD at the baseline; but individual subjects volunteered and were of high socio-economic position.</td>
</tr>
<tr>
<td>Roelfs 2011†</td>
<td>A positive association between unemployment and CVD but no quantitative analysis was performed</td>
<td></td>
<td>A systematic review and meta-analysis but the main outcome was all-cause mortality.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stuckler et al 2009†</td>
<td>No overall change in CVD mortality, but for middle-aged men, up to 0.85% for 1% increase in unemployment rate.</td>
<td>European countries</td>
<td>Data period 1970–2007 for 26 European countries; all ages</td>
<td>IHD mortality; Regression; Excess death</td>
<td>Macro-economic and population-level data; controlled for trends in diseases, country specific conditions. Did not control for time-lags between economic downturns and disease mortalities. Suggested for potential use in future New Zealand modelling analysis. The reason is that this study covers a large number of European countries (which typically have some social safety nets). Results by Dupre et al from places like the US are also less generalisable to New Zealand as the social safety net provisions are weak.</td>
</tr>
</tbody>
</table>
### Table 1: Summary of the relevant studies that examined the association between unemployment and CVD events in high-income countries for study publication dates from January 2000 onwards (continued).

<table>
<thead>
<tr>
<th>Study published in the peer-reviewed literature</th>
<th>Effect size for unemployment on CVD morbidity/mortality mean (CIs)</th>
<th>Study countries</th>
<th>Study data</th>
<th>Study analysis</th>
<th>Our comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtanen et al 2013¹²</td>
<td>RR=1.19 (1.00–1.42)</td>
<td>Eight high-income countries: Denmark, Finland, US, etc</td>
<td>N=174,438 with a mean follow-up of 9.7 years and 1,892 CHD cases; middle ages at entry</td>
<td>CHD incidence; regression; control group high versus low self-reported job insecurity</td>
<td>Meta-analysis from 13 individual-level data studies. Adjusted for age, socio-economic and other risk factors. No prevalence of CHD at the baseline. Job insecurity (a partial proxy for unemployment).</td>
</tr>
</tbody>
</table>

**Studies reporting a negative or no association**

<table>
<thead>
<tr>
<th>Study published in the peer-reviewed literature</th>
<th>Effect size for unemployment on CVD morbidity/mortality mean (CIs)</th>
<th>Study countries</th>
<th>Study data</th>
<th>Study analysis</th>
<th>Our comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballester et al 2019¹⁵*</td>
<td>The largest declines in all-cause mortality trend were observed in the countries and regions with the largest economic slowdown</td>
<td>15 Europe-an countries</td>
<td>Data period 2000–2010, 400 million people, all ages</td>
<td>Only calculated year-to-year average differences in real GDP growth and changes in mortality rate, and used correlation analysis to analyse the association between real GDP and all-cause mortality; stratified by below or above 64 years.</td>
<td>Age-standardised mortality; but this study didn’t take into account other factors that may contribute to the reduction in mortality rates.</td>
</tr>
<tr>
<td>Sposato and Saposnik 2012²</td>
<td>No correlation between unemployment and CVD 30-day case fatality rate/risk of stroke/age at stroke onset.</td>
<td>World-wide</td>
<td>23 articles comprising 30 population-based studies; with recruitment period 2000–2010.</td>
<td>A meta-analysis of health outcomes and merged this data with GDP, unemployment data for each country, and then performed correlation analysis.</td>
<td>Macro- and population-level data. Simple correlation analysis. Did not control for many confounding factors.</td>
</tr>
<tr>
<td>Svensson and Krüger 2010¹⁰²</td>
<td>A negative association between economic downturns and CVD</td>
<td>Sweden</td>
<td>Data period 1911–1996</td>
<td>CVD mortality</td>
<td>The study used relatively old data, macro- and population-level data and did not control for confounding factors. It is possible that the relatively strong social safety net in Sweden, reduces the generalisability of such results to other high-income countries.</td>
</tr>
<tr>
<td>Tapia Granados and Ionides 2017¹⁺²</td>
<td>A decline in CVD mortality with an increase in unemployment during the GFC</td>
<td>European countries</td>
<td>Data period 1995–2013; all ages</td>
<td>CVD/IHD mortality; regression;</td>
<td>Suggested many plausible mechanisms around reduced air pollution, reduced occupation stress, impact on smoking and also circulating infections. Macro- and population-level data. But we suggest that the most appropriate regression equations were not used (ln(mortality rate)/absolute change in unemployment rate thus this did not capture any underlying difference between health condition and socio-economic situation in each country); the regression equation also did not adjust for age.</td>
</tr>
<tr>
<td>Tapia Granados et al 2018¹³²</td>
<td>CVD risks tended to improve during economic recessions.</td>
<td>US</td>
<td>Data period 1985–2011; young adults (mean age 37.5 years)</td>
<td>CVD risk factors; regression;</td>
<td>Individual-level data; but employing data for young population who had a low risk of CVD events, and a suboptimal definition of unemployment (ie, including voluntary unemployment).</td>
</tr>
</tbody>
</table>

*Carried out during the Global Financial Crisis (2008–09).
problematic definitions of unemployment (ie, including voluntary unemployment). Another example was the study by Ball ester et al 2019\textsuperscript{15} that reported that the largest declines in all-cause mortality were observed in the countries and regions with the largest economic slowdown during the Global Financial Crisis of 2008–09. However, this study only calculated year-to-year average differences in real GDP growth and changes in mortality rate, and used correlation analysis to analyse the association between real GDP and all-cause mortality. The study also did not take into account other factors that may contribute to the reduction in mortality rates. Finally, a study in Iceland showed an increased CVD association with a recession.\textsuperscript{16} This study employed individual-level data, working-aged adults and included various confounding factors.

In conclusion, the majority of the studies (10 out of 15) suggested a positive association between unemployment and CVD incidence and mortality, especially for middle-aged men. Those studies that suggested a negative association appeared to include data for younger populations who had lower underlying risk of CVD. Also of note is the systematic review level evidence for an association between chronic psychosocial stress and hypertension.\textsuperscript{17} In addition, it is clear that involuntary unemployment causes stress and forces most people to lower their standard of living; and there is abundant evidence that being in a less financially secure position and/or living in a deprived area, are risk factors for CVD.\textsuperscript{18–20}

**Possible impacts on CVD from pandemic-induced unemployment in New Zealand**

The unemployment rate in New Zealand due to the COVID-19 pandemic is likely to increase and be persistent over several years. Even though the unemployment figure in June 2020 (4.0%) suggested little change from the pre-pandemic response rate (4.2% in the first quarter of 2020), this is unlikely to reflect the true situation.\textsuperscript{27} For example, this figure did not account for under-employment arising from reduced hours of work. In addition, people who did not satisfy the definition of unemployment which involves actively looking for job (including during the COVID-19 pandemic related lockdown period), were classified as not in the potential labour force. Furthermore, as the Government wage subsidy was still in effect at the time of this survey (at this time it was scheduled to end on 1 September 2020), the more accurate situation with unemployment arising from the pandemic might not be revealed until the end of 2020. Finally, global economic shocks due to the pandemic might take time to have their full impact on the New Zealand economy.\textsuperscript{28}

New Zealand literature

No New Zealand studies were identified that had explicitly examined the association between unemployment and CVD. One New Zealand study that considered a form of extreme stress (an earthquake damaged house), did report increased rates of CVD and myocardial infarction in the first year after the Christchurch earthquake.\textsuperscript{23} This cohort-linkage study was able to adjust for small area deprivation.

Existing New Zealand studies do show inequalities in CVD risk and in risk of unem-
mission of the pandemic failed in New Zealand) due to people with long-term conditions being at higher risk of COVID morbidity and mortality, with a 10.5% higher COVID-19 case fatality ratio with the presence of CVD. Māori and Pacific peoples are also over-represented in the groups who are on low incomes and occupations vulnerable to economic shocks that trigger unemployment. It is important that these existing inequities in CVD risk are considered in the COVID-19 response.

Possible next steps for studying the unemployment to CVD association in New Zealand

While the evidence for unemployment being associated with CVD appears mixed, it seems likely that increased unemployment is generally associated with increased CVD incidence, particularly in middle-aged men. The nature and extent of the likely impact of COVID-19 induced unemployment on CVD is unclear and will require monitoring as part of research to understand the wider health impacts of the COVID-19 response in New Zealand. Given socio-demographic differences in COVID-19 related unemployment compared to previous economic recessions, and differences in policy responses thus far, it is difficult to predict the impact of the COVID-19 response on CVD.

The New Zealand Government response to the COVID-19 pandemic has already included a wide range of economic actions including a NZ$50 billion budget in May 2020. This is likely to reduce unemployment associated with the pandemic—by keeping some businesses more viable. The Government has also dedicated some of the budget for job retraining and there have been other measures to assist the most disadvantaged New Zealanders (including restrictions on rent increases and evictions). This differs to the more moderate responses to curb unemployment in previous recessions. Evaluation of the impact of these initiatives on CVD and other health outcomes could shape general policy responses to unemployment in the future, and avoid the negative impacts observed in many of the studies included in this brief review.

To better inform New Zealand policymakers on the problem of increased unemployment associated with the COVID-19 pandemic and impact on CVD, it seems desirable for this to be modelled and quantified. This could be in terms of quality-adjusted life years (QALYs) lost from CVD attributable to the rise in unemployment and the additional health system costs associated with additional treatment of CVD. The impact on any worsening of the already large health inequalities associated with CVD (eg, for Māori and low-income New Zealanders) could also be estimated. Such work may be achievable in coming months as Treasury has estimates for unemployment arising from the pandemic and epidemiological/health economic models for CVD in New Zealand exist. Indeed, we plan to do such work in coming months and will probably use the effect size from Stuckler et al 2009 for middle-aged men, as this appears to be the most appropriate international study findings to generalise to New Zealand (Table 1). The reason is that this study covers a large number of European countries which typically have reasonable social safety nets, as in New Zealand. In contrast, results from Dupre et al 2012 from places like the US are less generalisable to New Zealand as the social safety net provisions in the US are relatively weak.

Potential policy responses to monitor and mitigate possible negative health impacts from the response to the COVID-19 pandemic

In terms of intervening in the “unemployment to increased CVD risk” pathway, the New Zealand Government could wait until more specific quantified benefits and costs are available (eg, as we have proposed above). Nevertheless, there are multiple CVD-related interventions for New Zealand that are cost-saving or highly cost-effective, and which could be intensified now:
• Intensifying tobacco control given that tobacco is a major contributor to CVD and to health inequalities arising from CVD, and the country has a Smokefree 2025 Goal. Many New Zealand studies show that tobacco control is cost-saving to the health sector\textsuperscript{36–39} and also is likely to reduce health inequalities between Māori and non-Māori. There is potential for these tobacco control interventions to be more intensively targeted at low-income New Zealanders who are most at risk of unemployment, eg, via the thematic content of mass media campaigns to call the Quitline (another cost-saving intervention\textsuperscript{36}).

• Reducing CVD risk by reducing the permitted level of sodium in processed foods in New Zealand—with nearly all these sodium reduction interventions also being cost-saving and likely to reduce health inequalities between Māori and non-Māori.\textsuperscript{40–42}

• Enhancing use of statins and anti-hypertensives for those at increased CVD risk. Again, there is New Zealand evidence on how this is particularly cost-effective in some age/sex/ethnic groups.\textsuperscript{35,43}

Conclusions

The totality of the evidence we reviewed suggested that increased unemployment arising from economic shocks is associated with increased CVD incidence, particularly for men aged 35–64 years. Continued monitoring and active policy responses are required to prevent increases in CVD (and other health outcomes) as a result of the COVID-19 pandemic response in New Zealand. For example, quantifying the CVD-related health loss from pandemic-associated unemployment, along with the health costs and impact on health inequalities, could help with government decision-making to reduce CVD burdens. This could be via intensifying tobacco control, regulating the food supply (eg, to reduce salt/sodium levels), and improving uptake of CVD preventive medications such as statins and anti-hypertensives.


18. Chan WC, Wright C, Riddell T, et al. Ethnic and socioeconomic disparities in the prevalence of cardiovascular disease in...


40. Nghiem N, Blakely T, Cobiac LJ, et al. The health gains and cost savings...

