

## ACADEMIC: ESSAY

# The effects of health determinants and inequities on acute myocardial infarction in New Zealand: An epidemiological essay

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## Abstract

Acute myocardial infarction (AMI) causes significant health burden worldwide, including in New Zealand (NZ). While there are individual risk factors that contribute to an increased risk of AMI, from an epidemiological perspective, there are social, economic, environmental, and political risk factors at a community, national, and international level that can influence the individual risk factors. Specific health determinants include income and its relationship with economic costs and governmental policies; the effects of non-governmental organisations and an obesogenic environment on diet; and urbanisation and its downstream effects on transport, access to healthcare, and other health determinants. In addition, factors associated with inequity, which can be considered as health determinants themselves, are faced by Māori and women. This disproportionately increases the burden of AMI in those population groups. Overall, these health determinants should be targeted when considering population-based interventions to reduce the incidence and complications of AMI in NZ.

## Background

Cardiovascular disease causes significant mortality and morbidity worldwide.<sup>1,2</sup> Ischaemic heart disease (IHD) is the biggest contributor to these statistics out of all the cardiovascular diseases,<sup>2</sup> and acute myocardial infarction (AMI), commonly known as a heart attack, is the major acute event that occurs because of IHD.<sup>3</sup> AMI causes a huge burden on the health system. The All New Zealand Acute Coronary Syndrome Quality Improvement (ANZACS-QI) Registry reported that within 12 months after a first-time diagnosis of acute coronary syndrome (ACS), which encompasses AMI and unstable angina, 6% of patients experienced all-cause death, 9% experienced recurrent ACS, and 14% were readmitted to hospital with a presenting complaint related to their cardiovascular disease.<sup>4</sup> According to the Ministry of Health data, in 2016, 6.78% of deaths in New Zealand (NZ) were due to AMI alone.<sup>5</sup> The ANZACS-QI registry also stated that in 2016, 14,464 hospitalisations in NZ were due to ACS,<sup>6</sup> while the Ministry of Health data showed that AMI accounted for 11,807 (0.98%) of hospitalisations.<sup>7</sup> These statistics do not include primary healthcare visits and outpatient appointments due to AMI, which are additional costs to the health system.

There are many health determinants underlying the burden of AMI, as shown in the infographic (Figure 1). The INTERHEART study estimated that about 90% of AMI events were associated with modifiable risk factors, such as exercise, smoking, high blood pressure, and diet.<sup>8</sup> However, these individual risk factors are influenced by population-based health determinants, such as an environment that promotes a sedentary lifestyle and advertising. There are also factors

that can affect the prognosis of the AMI. Research has shown that interventional treatments (i.e. percutaneous coronary intervention and coronary artery bypass grafting<sup>9</sup>) result in better outcomes compared with non-interventional treatments (i.e. medication alone), and that a delay to accessing these treatments results in a greater risk of complications.<sup>10,11</sup> Initiatives have been conducted to address some of the determinants affecting AMI, both at an individual and population level. For example, the NZ Ministry of Health set a health target from 2012 to 2016 to improve the rate of cardiovascular and diabetes mellitus risk assessments, with rates improving from 49% to 90%.<sup>12</sup> However, the significant health burden caused by AMI remains. This epidemiological essay will focus on five of the many health determinants that affect AMI in the NZ context: income, diet, urbanisation, Māori health inequity, and gender health inequity.

## Income

The medical management of AMI involves polypharmacy.<sup>20</sup> Patients are usually on four to five cardiovascular medications when they are discharged from hospital after their AMI, which include dual antiplatelet therapy, an angiotensin-converting enzyme inhibitor, a beta-blocker, and a statin.<sup>20</sup> Even though prescriptions are subsidised,<sup>21</sup> having to unexpectedly pay \$20 to \$25 for medications may not be affordable for those on low incomes. Smoking is a significant risk factor for AMI and is another determinant that is thought to be individual because it is up to the individual's determination to quit.<sup>2</sup> However, a meta-analysis has shown that there is a higher proportion of smokers in low-income populations.<sup>17</sup> Reasons for this could include less access to smoking cessation resources, personality types (low-income people are more likely to focus on the present than future health consequences), and having a greater degree of normalisation about smoking in their community.<sup>17</sup> One of the most effective interventions to reduce smoking prevalence is to increase the price of cigarettes,<sup>17</sup> which has been implemented in NZ. It now costs, on average, \$33.40 for a packet of cigarettes.<sup>22</sup> However, this increase in cost affects low-income populations the most, as they may have to forego something to buy a packet of cigarettes,<sup>17</sup> such as medications, going to their general practitioner (GP), or buying healthier food. The Ministry of Health has set a health target of offering smoking cessation support to 90% of patients engaging with primary health services.<sup>23</sup> This is a good initiative, but relies on a patient's autonomy (to present to their GP by themselves), which may be less likely if they have low income.

## Diet

Low socioeconomic status (SES) and income limit access to a healthy diet. Evidence-based guidelines for AMI often recommend either the

- International
- National
- Local/Community
- Individual

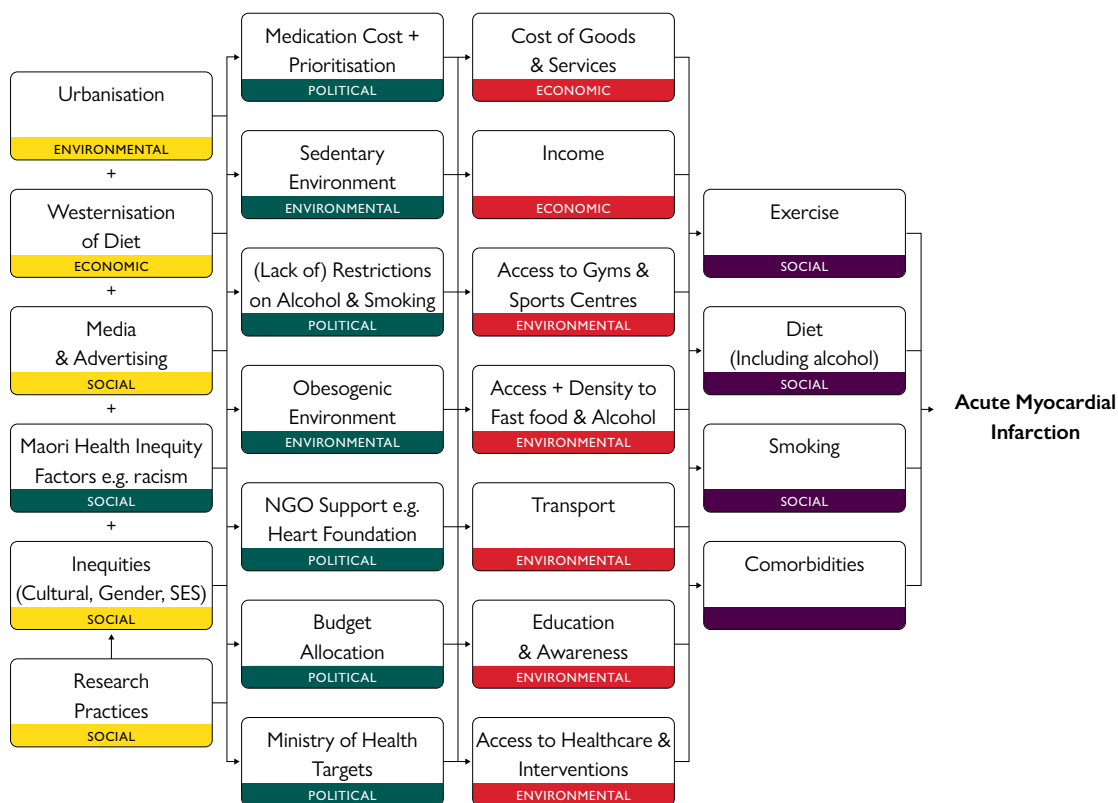


Figure 1. An infographic depicting the international (yellow) and New Zealand-specific (green) health determinants that affect local or community (red) health determinants and then affect individual (purple) health determinants. These health determinants may be social, political, economic, or environmental factors. The structure of the infographic is adapted from the Williams and Mohammed racism framework,<sup>13</sup> while the contents of the model have been obtained from various sources.<sup>14-19</sup> NGO = Non-governmental organisation; SES = Socioeconomic status.

Dietary Approach to Stopping Hypertension (DASH) diet or Mediterranean diet, as they have been shown to reduce cardiovascular risk.<sup>24,25</sup> Both of these diets are similar in that they recommend intake of fruit and vegetables, whole grains, poultry, low-fat dairy, and nuts.<sup>24,25</sup> In 2015, the average cost of the Mediterranean diet was NZ\$79.00 per week per person,<sup>26</sup> and in 2018, healthy diets costed \$13.50 more per week for a family of four compared with the standard NZ diet.<sup>18</sup>

Other than income and SES, other factors that affect AMI patients' access to a healthy diet are advertising, Westernisation of diet, an obesogenic environment, and health education. For example, 26% of unhealthy foods have a "healthy" nutritional claim on the packaging, which is misleading for those with poorer health literacy.<sup>18</sup> There is increased density of unhealthy foods around schools, a greater proportion (60%) of unhealthy food per metre of supermarket aisles, and increased advertising of unhealthy food targeted towards children.<sup>18</sup>

However, there are determinants that improve healthy diet access for AMI patients, such as the financial support of non-governmental organisations (NGO). The Heart Foundation is one NGO funded by many trusts and companies.<sup>27</sup> They have produced several cookbooks with healthy recipes, which can improve the education of AMI patients.<sup>27</sup> Some of these cookbooks focus on affordability, with each meal costing less than \$3 per serving.<sup>27</sup>

**Urbanisation**

Another health determinant to discuss is urbanisation, which has had more negative influences than positive on AMI. A positive effect is that those who live in urban centres have faster access to tertiary hospitals, where interventional treatment for AMI may be more readily available.<sup>28</sup> However, urbanisation has disadvantaged Māori AMI patients, which will be explored further in the "Inequalities faced by Māori" section below. Urbanisation has also helped to perpetuate a sedentary and obesogenic environment. Cities have been planned around motor vehicle transport, which increases the use of cars and public

transport rather than cycling or walking.<sup>19</sup> The emissions from cars have been found to increase risk of AMI.<sup>19</sup> Cities have fewer green areas compared with more rural towns, which has been associated with poorer mental health (depression is associated with worse outcomes after an AMI), stress, and decreased physical activity.<sup>29-31</sup> Stress itself has been associated with increased risk of AMI and increased risk of death following AMI.<sup>32,33</sup> Aside from transport, urban environments have greater access to various types of takeaways and unhealthy foods, which contribute to an obesogenic environment.<sup>19</sup>

Only five cities in NZ have at least one hospital with all interventional facilities: Auckland, Waikato, Wellington, Christchurch, and Dunedin.<sup>11</sup> The hospitals in these five cities not only provide interventional facilities for patients living in their respective cities, but also for those living in the wider region. For example, Wellington Regional Hospital provides these interventional services for patients living in Wellington City, Hutt Valley, Wairarapa, Palmerston North, Hawkes Bay, and Whanganui.<sup>34</sup> The centralisation of interventional services contributes to these delays, as patients from outside the Wellington region, for example, will require more time to reach Wellington Hospital than a Wellington resident.

**Inequities faced by Māori**

Māori patients who have an AMI face inequities, as they disproportionately receive more non-interventional treatments and greater delays in reaching the hospital.<sup>11</sup> Compared to non-Māori, Māori have had consistently higher rates of hospitalisation and worse outcomes due to IHD,<sup>35</sup> which can be linked to many underlying determinants. Frustratingly, this inequity is a common picture for Māori across most health conditions.<sup>36</sup> At an individual level, Māori have higher smoking rates, poorer diets, and higher rates of comorbidities, which are all factors that increase AMI risk.<sup>16,36</sup> Although these individual factors are often blamed on a person's "choice," many social, environmental, economic, and political factors underpin these, as shown in Figure 1.

For example, urbanisation in areas where European settlers were more densely populated has meant that a greater proportion of Māori live in rural areas, where there is disproportionate access to healthcare.<sup>37,38</sup> This is one of the reasons why Māori have more delayed presentations to hospital for AMI, which leads to a greater risk of complications.<sup>39</sup>

A higher proportion of Māori have a lower SES, which has been associated with worse outcomes after AMI and unstable angina.<sup>40</sup> In these areas of higher deprivation, there is often easier access to fast food and alcohol.<sup>41,42</sup> A lower SES means a lower income, which reduces a person's ability to afford healthy food, health services, and access to physical activity facilities.<sup>2</sup> These all result in more comorbidities that relate to AMI.<sup>37</sup> Māori are more likely to be born into families with lower SES, and it is harder for them these children to leave this low SES group due to poorer education, reduced job opportunities, and lower incomes.<sup>16</sup> A poorer education impacts health literacy and influences these individual-based health determinants.<sup>16</sup>

After controlling for factors that influenced a cardiologist's decision to perform coronary angiography, Māori are 5% less likely to receive angiography for AMI.<sup>39</sup> Kerr et al.<sup>39</sup> found that only 58.2% of Māori received coronary revascularisation, compared with 68.6% of Europeans. One reason for these differences could be a component of Nga Hau e Wha from the Meihana model: racism.<sup>16,43</sup> This can be seen in a health workforce that lacks Māori representation, limited cultural competency education, a Westernised model of NZ healthcare, and health budgets and policies that do not address inequities, but target large population numbers instead.<sup>44</sup> These system-level factors must be addressed to be able to reduce the burden of AMI in Māori.

### Gender inequity

There are also gender inequities that influence AMI. Part of this inequity stems from past research practices, where studies that produced our current understanding of AMI had male-only cohorts.<sup>15,45</sup> Even with today's sex-generic research practices, women make up only 30% of AMI cohorts.<sup>41,15,28,46</sup> If there is a smaller proportion of women in cohorts, study results will be more heavily influenced by the majority in the cohort, i.e. men, and studies will be less likely to have sufficient power to draw conclusions specific to women alone. More recent evidence has shown that women have a different presentation of AMI to men, where women are more likely to experience radiating pain as the primary symptom and less likely to have central chest pain.<sup>47</sup> As the "typical" AMI presentation is based on the male presentation, it may take longer for women to present to hospital and be diagnosed with AMI.<sup>48</sup> This may be one reason why women with ST elevation AMI experience greater delays than men in receiving coronary angiography and interventional treatment.<sup>49</sup> Even if women receive the same interventional treatments as men, they are still more likely to have worse outcomes after their AMI,<sup>49</sup> which has been postulated as due to a lack of understanding of AMI pathophysiology in women.<sup>15</sup> In addition, a systematic review by Resurrección et al.<sup>50</sup> showed that women have less engagement with cardiac rehabilitation. Altogether, these factors may contribute to women having a higher risk of adverse outcome following interventional treatment.<sup>9,49,51</sup>

### Conclusion

There are many health determinants at various levels (individually, within a community, nationally, and internationally) that contribute to a patient's risk of AMI as well as subsequent health risks following the AMI. A few examples include research practices, diet, and urbanisation. Several of these health determinants have led to inequities for AMI management and outcomes in Māori and women. Population-based strategies are required to mitigate the negative effects of these health determinants and reduce NZ's AMI burden.

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**Conflicts of Interests**

Gisela Kristono is the current Production Manager for the New Zealand Medical Student Journal (NZMSJ). This article has, however, gone through a double-blinded peer review process which is applied to all articles submitted to the NZMSJ, and has been accepted after achieving the standard required for publication. The author has no other conflicts of interest to declare.

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