Pandemic control: getting to the heart of unintended consequences
Bernard Wong, Seif El-Jack, Guy Armstrong

In December 2019, a cluster of pneumonia of unknown cause was reported in Wuhan, China. This was later identified to be caused by a novel coronavirus from the same family of viruses that caused previous outbreaks of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).1,2 The virus is now known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and the disease it causes is called coronavirus disease 2019 (COVID-19). The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020 after rapid spread of the disease worldwide.3

The first case of COVID-19 in New Zealand was reported on 28 February 2020. Two weeks following the announcement of a global pandemic, New Zealand closed its borders and entered a nationwide “alert level 4 lockdown”: all non-essential travel is restricted (including border closure), only essential services allowed to operate, people instructed to work from home, public gatherings banned, physical distancing of 2m applied and “stay home” adopted as the default instruction.4 A parallel COVID-19 national hospital response framework, which reflects the pandemic’s potential impact on hospitals, was designed with escalating levels of preparedness providing a nationally consistent and managed approach to clinical service delivery. Public hospitals in New Zealand reached a response level 2 (out of 4), which includes deferral of non-urgent elective investigations and procedures. This also entailed suspension of all face-to-face elective clinical encounters and instruction of patients to only seek medical care for serious symptoms and engage with their family doctors as a first step. This particularly applied to patients aged 70 years and above who are at high risk from COVID-19.

Cardiovascular disease (CVD) is one of the major causes of mortality and morbidity in New Zealand. Hospitalisation is often required for acute presentations of CVD such as acute coronary syndromes (ACS), cardiac arrhythmias or decompensated heart failure. In May 2007, there were over 1,000 admissions of suspected or confirmed ACS in New Zealand over a two-week period.5 In the year 2016/17, approximately 5% of all hospital admissions were due to CVD in New Zealand.6 During the nationwide alert level 4 period, we have observed a dramatic decrease in admissions related to CVD in our department; our district health board is one of 20 in New Zealand and it has a catchment of approximately 629,000 out of a population of five million. In this observational study, we compare the trends of hospital admissions due to CVD between the levels 4 and 3 lockdown periods and non-pandemic times and discuss some possible contributing factors to this variation.

Methods
This study focused on hospital admissions related to CVD at Waitemata District Health Board (WDHB). Common presentations of CVD were identified using ICD-10 codes from electronic records. The CVD presentations being investigated in this study are ACS, decompensated heart failure, cardiac arrhythmias and cardiac arrest. The study period is the seven-week period comprising of alert level 4 (25 March to 27 April 2020) and level 3 (28 April to 13 May 2020). The controls used were the identical dates in 2018 and 2019. These were chosen as controls to adjust for seasonal impact on various cardiac conditions. Ethics approval was not required due to the retrospective observational nature of the study, with patient data anonymised. Standard statistical analysis was performed with IBM SPSS.

Results
A total of 321 patients had 347 CVD presentations at WDHB during the seven-week lockdown period (26 patients had multiple admissions). This comprised 182 admissions for decompensated heart failure (52.4%), 152 ACS (43.8%), 11 non-fatal cardiac arrhythmias (3.2%) and two cardiac arrests (0.6%). The mean age was 74.5±14.7 years and 44.5% were women. There was no significant difference between the age or gender of patients admitted during the COVID-19 lockdown and control periods. The number of combined CVD admissions were significantly less than the control periods in 2018 (526 admissions, 467 patients) and 2019 (479 admissions, 436 patients).

The combined number of weekly CVD admissions during the lockdown period are compared to corresponding controls in Figure 1. The weekly variation in CVD admissions during the lockdown period were significant when compared to the controls. During the first three weeks of lockdown, the mean number of CVD admissions per week was 42 compared to 69 in 2018 and 65 in 2019. Admissions peaked during weeks four and five of the lockdown, followed by a decrease in the final two weeks. The weekly admission numbers for decompensated heart failure and ACS are shown in Figures 2A and 2B respectively. Although both admissions for decompensated heart failure and ACS increased during weeks four and five of lockdown, this rebound was more dramatic for ACS as it exceeded the admission numbers of the corresponding control periods. The combined number of ACS admissions in weeks four and five of lockdown were 63, compared to 59 in 2018 and 52 in 2019. We did not observe an age variation in the likelihood of presenting to hospital during the study period.

Discussion
The unprecedented national lockdown period due to COVID-19 had significant impact on the numbers and pattern of CVD presentations to hospital. A decline in ACS admissions have similarly been described in European countries.7,8 There are several patient-related, healthcare-related and environmental hypotheses which may explain the findings of our study. The strict stay-home message, especially for those aged over 70 years, announced by the government and escalating cases of COVID-19 in the early phase of the lockdown likely caused a degree of apprehension for people with cardiac symptoms to seek medical care. A total of 15 COVID-19 cases (confirmed plus probable) were admitted to hospital at WDHB during the lockdown period, which could have been

Figure 1: Number of combined cardiology admissions (heart failure, acute coronary syndrome, arrhythmia and cardiac arrest) during 2020 alert levels 4 and 3 lockdown compared with control years.
a further deterrent for patients presenting to hospital. Additionally, staying at home during lockdown would have resulted in a more sedentary lifestyle for the majority of people which may mask exertional angina or dyspnoea due to ACS or heart failure. The use of non-contact telephone consultations by general practitioners and specialists during lockdown may have resulted in limitations or delay in diagnosis of patients with CVD. The lack of physical examination performed in usual face-to-face consultations have taken away the ability of clinicians to identify subtle signs of heart failure such as pitting oedema or elevated jugular venous pressure.

The effects of air pollution on cardiovascular disease and in particular heart failure has been well established. The benefit of air pollution reduction on non-COVID-19 mortality during pandemic has been described in China. The reduction of CO2 emissions in New Zealand during lockdown was 41.1% compared to the same time in 2019, the second largest relative decrease in the world. This dramatic change is likely to be temporary and reflects the reduction in CO2 emissions from transportation and relatively aggressive lockdown measures implemented by the New Zealand government compared to other countries. It may have indirectly positively impacted heart failure admissions.

Our analysis has its limitations. Hospital mortality and serious morbidity during medium and long-term follow up was not included in the study.
assessed. Our catchment population may not reflect the national demographic in age, morbidity, geographic density and access to various health services. Some moderately sick patients that traditionally were referred to hospital may have been successfully managed in the community by their family doctors. Finally, community mortality was not collated.

In conclusion, we have observed an overall reduction in CVD admissions and rebound in weeks four and five during the COVID-19 lockdown. Although our study does not assess adverse outcomes, it raises the concern that the delay in CVD presentations may have been an unintended consequence of pandemic control measures.

Competing interests:
Nil.

Author information:
Bernard Wong, Cardiology Trainee, Department of Cardiology, Waitemata District Health Board, Auckland; Seif El-Jack, Cardiologist, Department of Cardiology, Waitemata District Health Board, Auckland; Guy Armstrong, Cardiologist, Department of Cardiology, Waitemata District Health Board, Auckland.

Corresponding author:
Bernard Wong, Cardiovascular Unit, North Shore Hospital, 124 Shakespeare Road, Takapuna, Auckland 0620.
bernardwong@hotmail.co.nz

URL:

REFERENCES: