

# Exploration of Cardiology Patient Hospital Presentations, Health Care Utilisation and Cardiovascular Risk Factors During the COVID-19 Pandemic



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## Objectives

COVID-19 and the lockdowns have affected health care provision internationally, including medical procedures and methods of consultation. We aimed to assess the impact of COVID-19 at two Australian hospitals, focussing on cardiovascular hospital admissions, the use of community resources and cardiovascular risk factor control through a mixed methods approach.

## Methods

Admissions data from the quaternary referral hospital were analysed, and 299 patients were interviewed from July 2020 to December 2021. With the admissions data, the number, complexity and mortality of cardiology hospital admissions, prior to the first COVID-19 lockdown (T0=February 2018–July 2019) were compared to after the introduction of COVID-19 lockdowns (T1=February 2020–July 2021). During interviews, we asked patients about hospital and community health resource use, and their control of cardiovascular risk factors from the first lockdown.

## Results

Admission data showed a reduction in hospital presentations (T0=138,099 vs T1=128,030) and cardiology admissions after the lockdown period began (T0=4,951 vs T1=4,390). After the COVID-19-related lockdowns began, there was an increased complexity of cardiology admissions (T0=18.7%, 95% CI 17.7%–19.9% vs T1=20.3%, 95% CI 19.1%–21.5%, chi-square test: 4,158.658,  $p<0.001$ ) and in-hospital mortality (T0=2.3% of total cardiology admissions 95% CI 1.9%–2.8% vs T1=2.8%, 95% CI 2.3%–3.3%, chi-square test: 4,060.217,  $p<0.001$ ). In addition, 27% of patients delayed presentation due to fears of COVID-19 while several patients reported reducing their general practitioner or pathology/imaging appointments (27% and 11% respectively). Overall, 19% reported more difficulty accessing medical care during the lockdown periods. Patients described changes in their cardiovascular risk factors, including 25% reporting reductions in physical activity.

## Conclusion

We found a decrease in hospital presentations but with increased complexity after the introduction of COVID-19 lockdowns. Patients reported being fearful about presenting to hospital and experiencing difficulty in accessing community health services.

**Keywords**

Coronavirus • COVID-19 • Cardiovascular risk factors • Cardiometabolic risk factors • Secondary prevention

## Introduction

Coronavirus disease of 2019 (COVID-19) has impacted health care on many levels including a reduction in the number of elective procedures [1]. In Australia, there was a decrease in emergency department (ED) presentations during the lockdown period particularly during the first months of the pandemic [2,3]. During the New South Wales lockdowns, where our study was performed, residents were initially mandated to stay in their homes unless to obtain food or personal goods, for work or education if unable to do so from home, exercise outdoors, for medical needs or for caring responsibilities. These restrictions continued until May 2020. Subsequently, restrictions were enforced based on community exposure and continued throughout our study period. Anecdotally, our institution experienced fewer presentations and admissions, yet patients presented later in their illness which increased their disease severity. Often patients would report delays in presentation due to fears of contracting COVID-19 as well as both difficulty and reluctance to engage with outpatient care amidst lockdowns. This study aimed to assess the number, complexity and outcome of cardiology admissions during the pandemic lockdowns from March 2020 to July 2021. We aimed to explore potential reasons to explain differences between these two time periods through interviewing patients on their hospital utilisation, outpatient care and risk factor control.

## Methods

During the 2020 and 2021 lockdowns, two major hospitals in South Western Sydney, Australia, retrospectively and prospectively recruited patients for the study.

Presentation and cardiology admissions data, including in hospital mortality and admission complexity through the Australian Refined Diagnosis Related Groups (AR-DRG)

classification system, of the quaternary principal referral hospital were analysed.

Patients were individually interviewed with a paper-based questionnaire comparing their experiences of health care resource use and risk factor control prior to the first COVID-19 lockdown (T0=February 2018–July 2019) and following the commencement of COVID-19 lockdowns (T1=February 2020–July 2021). Interviews were performed by four authors (KC, RL, DN, HD) on days subject to availability, with all patients on the wards or outpatient areas during these days approached to participate. Patients who agreed to the interview were consented and included in the study. An example of a proforma can be found in the [Appendix; Supplemental Figure 5](#).

To investigate differences in admission data between T0 and T1,  $\chi^2$  tests were used, with 95% confidence intervals obtained through Clopper-Pearson tests. To explore the effects of age, gender, country of birth, and culturally and linguistically diverse backgrounds on the likelihood of delays in hospital presentation from COVID-19 related fears, binomial logistic regression was used. All statistical analysis was performed with IBM SPSS Statistics 22 (IBM Corp, Armonk, NY, USA). Ethics approval was obtained from the South Western Sydney Local Health District Human Research Ethics Committee (2020/ETH01447).

## Results

Presentation data confirmed a 7.3% reduction in overall emergency department presentations (T0=138,099 vs T1=128,030), and admissions data revealed an 11.3% reduction in cardiology admissions following the lockdown period (T0=4,951 vs T1=4,390). During this time, there was an increased complexity from 18.7% (95% CI 17.7%–19.9%) of cardiology admissions having the highest AR-DRG to 20.3% (95% CI 19.1%–21.5%) of admissions having the highest AR-DRG (chi-square test: 4,158.658,  $p<0.001$ ). With admitted

**Table 1** Presentation and admission data before (T0) and after the introduction of COVID-19 lockdowns (T1).

	T0 (n)	T1 (n)	P-value
Total emergency department presentations	138,099	128,030	N/A
Cardiology admissions	4,951	4,390	N/A
Cardiology inpatient complexity (highest AR-DRG)	928 (18.7% of admissions highest AR-DRG)	889 (20.3% of admissions highest AR-DRG)	$\chi^2(1)=4,158.658, p<0.001$
Cardiology in-patient mortality	114 (2.3% of cardiology admissions)	123 (2.8% of cardiology admissions)	$\chi^2(1)=4,060.217, p<0.001$

Abbreviations: AR-DRG, Australian Refined Diagnosis Related Groups.

**Table 2** Baseline characteristics of interviewed patients.

Total number of patients	n=299
Median age (interquartile range)	65 (59–72.75)
Inpatients (% total)	n=138 (46%)
Outpatients (% total)	n=40 (13%)
Discharged patients (% total)	n=121 (40%)
Diabetes mellitus (% total)	n=120 (40%)
Hypertension (% total)	n=224 (75%)
Hypercholesterolaemia (% total)	n=235 (79%)
Previous or current smoker (% total)	n=173 (58%)
Obesity BMI>30 kg/m <sup>2</sup> (% total)	n=123 (41%)
No exercise within last week (% total)	n=79 (26%)

Abbreviations: BMI, body mass index.

cardiology patients, there was an increase in in-hospital mortality from T0 (n=114, 2.3% of total cardiology admissions 95% CI 1.9%–2.8%) compared to T1 (n=123, 2.8% of admissions 95% CI 2.3%–3.3%) (chi-square test: 4,060.217,  $p < 0.001$ ), with no difference in the average length of inpatient stay between the two time periods (T0=5.0 days, T1=4.9 days). A summary of our presentation and admission data is presented in Table 1.

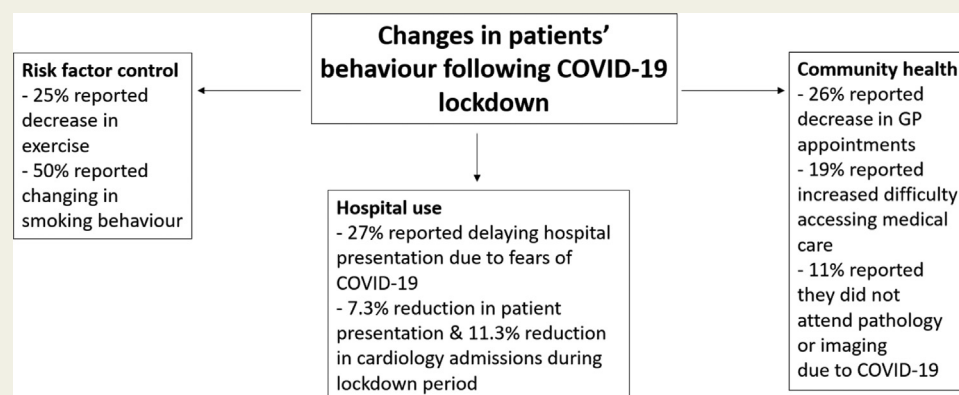
Overall, 299 interviews were conducted between July 2020 and December 2021. Patients were predominantly male (67%) with a median age of 65 years (IQR 59–72.75) and included inpatients (n=138), outpatients (n=40) and discharged patients (n=121). The diagnosis of inpatients included unstable angina (n=22), ST-elevation myocardial infarction (n=18), non ST-elevation myocardial infarction (n=30), heart failure (n=20), arrhythmia (n=22) and other (n=30), with some patients having multiple final diagnoses. A total of 26% of patients reported English as the second language with patients representing 40 different countries of birth. Patients had a high burden of cardiovascular risk factors including diabetes mellitus (40%), hypertension (75%),

hypercholesterolaemia (79%), previous or current smoker (58%) and obesity (body mass index [BMI]  $\geq 30$  kg/m<sup>2</sup>=41%, BMI  $\geq 40$  kg/m<sup>2</sup>=8%). A total of 26% of patients reported no physical exercise in the last week (i.e. no aerobic exercise, no anaerobic/strengthening exercises, no walking for at least 10 minutes for exercise, nor walking for at least 10 minutes for travel). A summary of the interviewed patients' characteristics is provided in Table 2.

During the COVID-19 lockdowns, 30% of patients reported changes in their physical exercise (25% decrease, 5% increase), 50% of patients reported changes in their smoking behaviour (25% increase, 25% decrease), with most patients reporting no change to their alcohol intake (79% no change), control of diabetes (80% no change), hypertension (82% no change), dyslipidaemia (81% no change), nor medication adherence (97% no change).

A total of 11% of patients did not attend planned pathology/imaging investigations due to fears of contracting COVID-19. Furthermore, 19% reported increased difficulty accessing medical care, 9% had delays in cardiology appointments, and 26% reported a decrease in general practitioner (GP) appointments. Some patients reported that telehealth became the only method to have an appointment with their GP (12%) and cardiologist (5%). Of those admitted to hospital, over a quarter of patients (27%) reported delaying presentation to hospital due to COVID-19 related fears. We found no evidence of an effect of gender, age, country of birth nor non-English speaking background on delays due to COVID-19 related fears. The odds ratio (OR) of males delaying because of COVID-19 fears was 0.74 (95% CI 0.272–2.014,  $p=0.56$ ) compared to females, participants who were less than 65 years of age had an OR of 0.99 (95% CI 0.371–2.636,  $p=0.98$ ), non-Australian country of birth had an OR of 1.156 (95% CI 0.199–6.729  $p=0.87$ ) and non-English speaking background participants had an OR of 0.39 (95% CI 0.26–4.138  $p=0.39$ ).

Opportunistically, once COVID-19 vaccinations became available we asked participants (n=95) from July 2021 about their beliefs about the vaccine. Seven (7) patients reported they would be against receiving a vaccine due to concerns regarding potential side-effects (n=5), disagreements due to

**Figure 1** Changes in patients' behaviour following COVID-19 lockdown.

the mandatory nature of vaccines (n=1), and fears of malicious intent (n=1).

Our main findings are summarised in [Figure 1](#).

## Discussion

Our study confirms the anecdotal experience of decreased numbers of hospital presentation in the time-period following the introduction of COVID-19 lockdowns. This was not due to a healthier cohort of patients, rather patients who were admitted during the lockdowns had higher rates of complexity and in-hospital mortality compared to previous years. Our study suggests contributing factors which may explain the decreased quantity but higher acuity of admissions include delays due to COVID-19 related fears, worsening risk-factor control and a reduction in outpatient medical care.

Our finding of a reduced number of hospital presentations with an increased admission complexity echoes results from international studies. An American study noted a 30% reduction in emergency department presentations during the COVID-19 pandemic period compared to the year prior (38,966 vs 56,443 presentations), but with higher acuity scores, higher rates of intubation, and intensive care admissions [4]. There are likely many contributing factors but avoidance behaviour is a key term that describes a reluctance to present to hospital due to fear, including of contracting COVID-19. In a recent study performed in the hospital setting involving 210 patients, the authors found avoidance behaviour was primarily driven by the stress of contracting COVID-19, rather than the consequences and logistical restrictions of lockdown [5]. In our experience at a large Australian hospital, we found patients had similar behaviours with over 25% actively delaying presentation to hospital due to COVID-19 related fears.

Avoidance behaviours have been shown to similarly affect community-based health care services, which even at a pre-COVID-19 baseline had a no-show rate of 5%–39% [6]. Alongside the COVID-19 pandemic, there have been large reductions in the use of elective and preventative services believed to be driven by variations in community exposure to COVID-19 rather than solely through lockdown policies [7]. An American study looking at Veterans Affairs data (n=37,077,013) found that despite an increase in telehealth consultations, there was a 30% decrease in total outpatient consults compared to the historical control [8]. High quality outpatient follow-up is critical for optimal patient outcomes, with for example early follow-up for heart failure patients associated with lower rates of representation, rehospitalisation and mortality [9]. Our study adds to the literature on the impact of COVID-19 on outpatient services from an Australian perspective, with patients reporting a reduction in the utilisation of health care services and resources, including pathology, imaging and general practitioner appointments.

Control of modifiable risk factors is a crucial element for primary and secondary prevention of cardiovascular

disease. From our questionnaire, patients in our population reported low levels of exercise at baseline with 25% reporting a further decrease in their exercise activity during lockdown periods (as opposed to only 5% who increased their physical activity). The reduction in physical activity is consistent with reports from countries except Belgium where citizens were actively encouraged by the government to exercise even in the face of lockdowns and restrictions. Overall, this population reported an increase in the levels of physical activity [10,11]. To note, our population in particular was strongly instructed to strictly adhere to lockdown policies, which may have further decreased physical activity. As exercise is fundamental for optimal physical and mental well-being, health care providers should consider how to encourage exercise during a lockdown, especially as further lockdowns may be implemented in the future.

Patients in our study varied in their smoking behaviours during the lockdown. Studies on smoking cessation during the COVID-19 period suggest stress is a driving factor associated with both the increases and decreases in smoking behaviour [12,13]. Studies which explored smoking cessation interventions during COVID-19, note people have more intention to quit after receiving messages that specifically mentioned COVID-related risk [14], and that patients who quit during COVID-19 were more successful in their attempt compared to historical controls [15].

Health care practitioners also modified their approach to patient care after the first lockdown, with patients reporting telehealth as the only mode of consultation with their GPs (12%) and cardiologists (5%). Unfortunately, a recent Australian study noted almost one-fifth of patients expressed dissatisfaction with telehealth, in particular patients who do not have easily accessible internet, who are older, or without a smart device (a wired or wireless content-aware electronic device capable of performing autonomous computing and connecting to other devices for data exchange) [16]. An American Medicare survey study exploring patients aged over 65 (n=5,189), found health care providers may have also contributed to the telehealth disparity, with providers less likely to offer telehealth as an option during the COVID-19 pandemic to patients who were not familiar with video/phone/conferencing calls or who did not have access to the internet [17]. Increasing digital literacy in less technologically fluent and thus potentially vulnerable patient groups may be of benefit and could be explored in future studies.

There are several limitations in our study. This is an observational study with a component including interviews of non-consecutive patients. During the interview time-period, there were significant logistical challenges due to restrictions and ward access to patients and interviewer availability. As a result, there is potential for patient selection bias. However, on days interviews were conducted, all patients on the ward or in the outpatient setting were approached, which may have decreased this potential for selection bias. Recall bias is also a limitation, as we did not



directly measure variables such as cholesterol profiles, glycosylated haemoglobin or medication adherence. Although not explored in our study, a contributing factor to the reduction of admissions may have been health practitioner-related: medical staff may have been reluctant to admit patients due to COVID-19 related bed pressure, and instead may have encouraged early outpatient follow-up. We did not explore the correlations between late presentation and mortality on a study population level, however we did encounter illustrative cases of delayed presentation leading to increased mortality—for example, a patient with an acute myocardial infarction, who presented late to hospital due to COVID fear and had lateral wall rupture related to late presentation. Lastly, given the observational design of the study, there is no mechanism to explain the results or correlate them with clinical outcomes.

## Conclusion

The COVID-19 pandemic and lockdowns significantly changed the landscape of health services. In our study, we found there was a reduction in overall hospital presentations and cardiology admissions during this period yet an increase in complexity and in-hospital mortality of cardiology patients. These findings may have been related to difficulty accessing outpatient medical care and hospital avoidance with a substantial number of interviewed patients reporting actively delaying presentation due to fears of contracting COVID-19.

## Sources of Support

NA.

## Conflicts of Interest

Nil.

## Declaration

All authors have participated in the work and have reviewed and agree with the content of the article. None of the article contents are under consideration for publication in any other journal or have been published in any journal. No portion of the text has been copied from other material in the literature (unless in quotation marks, with citation).

## Appendices

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.hlc.2022.11.013>

## References

- [1] Elliott JM, Crozier IG. Decreases in cardiac catheter laboratory workload during the COVID-19 level 4 lockdown in New Zealand. *Intern Med J*. 2020;50:1000–3.
- [2] Sutherland K, Chessman J, Zhao J, Sara G, Shetty A, Smith S, et al. Impact of COVID-19 on healthcare activity in NSW, Australia. *Public Health Res Pract*. 2020;30:3042030.
- [3] Kam AW, Chaudhry SG, Gunasekaran N, White AJ, Vukasovic M, Fung AT. Fewer presentations to metropolitan emergency departments during the COVID-19 pandemic. *Med J Aust*. 2020;213:370–1.
- [4] Baugh JJ, White BA, McEvoy D, Yun BJ, Brown DF, Raja AS, et al. The cases not seen: patterns of emergency department visits and procedures in the era of COVID-19. *Am J Emerg Med*. 2021;46:476–81.
- [5] Schmitz T, Meisinger C, Kirchberger I, Thilo C, Amann U, Baumeister SE, et al. Impact of COVID-19 pandemic lockdown on myocardial infarction care. *Eur J Epidemiol*. 2021:1–9.
- [6] Collins J, Santamaria N, Clayton L. Why outpatients fail to attend their scheduled appointments: a prospective comparison of differences between attenders and non-attenders. *Aust Health Rev*. 2003;26(1):52–63.
- [7] Ziedan E, Simon KI, Wing C. Effects of state COVID-19 closure policy on non-COVID-19 health care utilization. NBER Work Pap Ser. 2020. <https://doi.org/10.3386/w27621>.
- [8] Dev S, Fawcett J, Ahmad S, Wu WC, Schwenke D. Implementation of early follow-up care after heart failure hospitalization. *Am J Manag Care*. 2021;27(2).
- [9] Baum A, Kaboli PJ, Schwartz MD. Reduced in-person and increased telehealth outpatient visits during the COVID-19 pandemic. *Ann Intern Med*. 2021;174:129–31.
- [10] Constandt B, Thibaut E, De Bosscher V, Scheerder J, Ricour M, Willem A. Exercising in times of lockdown: an analysis of the impact of COVID-19 on levels and patterns of exercise among adults in Belgium. *Int J Environ Res Public Health*. 2020;17:4144.
- [11] Stockwell S, Trott M, Tully M, Shin J, Barnett Y, Butler L, et al. Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ Open Sport Exerc Med*. 2021;7:960.
- [12] Elling JM, Crutzen R, Talhout R, De Vries H. Tobacco smoking and smoking cessation in times of COVID-19. *Tob Prev Cessat*. 2020;6:39.
- [13] Bommelé J, Hopman P, Walters BH, Geboers C, Croes E, Fong GT, et al. The double-edged relationship between COVID-19 stress and smoking: implications for smoking cessation. *Tob Induc Dis*. 2020;18:63.
- [14] Pettigrew S, Jun M, Roberts I, Nallaiah K, Bullen C, Rodgers A. The potential effectiveness of COVID-related smoking cessation messages in three countries. *Nicotine Tob Res*. 2021;23:1254–8.
- [15] Jackson SE, Garnett C, Shahab L, Oldham M, Brown J. Association of the COVID-19 lockdown with smoking, drinking and attempts to quit in England: an analysis of 2019–20 data. *Addiction*. 2021;116:1233–44.
- [16] Adams L, Lester S, Hoon E, van Der Haak H, Proudman C, Hall C, et al. Patient satisfaction and acceptability with telehealth at specialist medical outpatient clinics during the COVID-19 pandemic in Australia. *Intern Med J*. 2021;51(7):1028–37.
- [17] Ng BP, Park C, Silverman CL, Eckhoff DO, Guest JC, Díaz DA. Accessibility and utilisation of telehealth services among older adults during COVID-19 pandemic in the United States. *Health Soc Care Community*; 2022.