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## Changes in demand for emergency ambulances during a nationwide lockdown that resulted in elimination of COVID-19: an observational study from New Zealand.

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# Changes in demand for emergency ambulances during a nationwide lockdown that resulted in elimination of COVID-19: An observational study from New Zealand.

Bridget Dicker<sup>a,b</sup>, Andy Swain<sup>a,c</sup>, Verity Todd<sup>a,b</sup>, Bronwyn Tunnage<sup>a,b</sup>, Emma Mcconachy<sup>a</sup>, Haydn Drake<sup>a</sup>, Michelle Brett<sup>b</sup>, Dan Spearing<sup>b</sup>, Graham Howie<sup>a,b</sup>

- a. Paramedicine Department, Auckland University of Technology, Auckland, New Zealand
- b. Clinical Audit and Research, St John New Zealand, Auckland, New Zealand
- c. Wellington Free Ambulance, Wellington, New Zealand

Corresponding author:

Bridget Dicker

St John New Zealand

604 Great South Road

Ellerslie

Auckland 1051

New Zealand

Telephone: +64 27 705 2617

Email: [bridget.dicker@stjohn.org.nz](mailto:bridget.dicker@stjohn.org.nz)

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## Keywords

COVID-19; Ambulance Demand, Emergency medical service, Paramedic, Lockdown, Pandemic

## Abstract

### Objective

To examine the impact of a 5-week national lockdown on ambulance service demand during the COVID-19 pandemic in New Zealand.

### Design

A descriptive cross-sectional, observational study.

### Setting

High quality data from ambulance electronic clinical records, New Zealand.

### Participants

Ambulance records were obtained from 588,690 attendances during Pre-Lockdown (prior to 17 Feb 2020) and from 36,238 records during the Lockdown period (23 March to 26 April 2020).

### Main outcome measures

Ambulance service utilisation during Lockdown was compared to Pre-Lockdown: a) Descriptive analyses of total ambulance events and proportions of event types for each period (Chi-Square  $\chi^2$  test), b) Rates of ambulance attendance (event types / week) for each period (Independent t-test).

### Results

During Lockdown ambulance patients were more likely to be attended at home and disproportionately female. The proportion of younger patients (0-25 years) decreased. Ethnicity and Rurality remained unchanged.

There was a significant increase in the proportion of lower acuity patients attended (87.45% vs 85.93%,  $p<0.001$ ) and a corresponding increase in patients not transported from scene (30.5% vs 20.91%,  $p<0.001$ ).

Road Traffic Crashes ( $p<0.001$ ) and alcohol-related incidents ( $p<0.001$ ) significantly decreased.

There was a decrease in the absolute number of weekly ambulance attendances (Ratio (95%CI), 0.89 (0.87 - 0.91),  $p<0.001$ ), attendances to Respiratory Conditions (0.74 (0.61 - 0.86),  $p=0.01$ ), and Trauma (0.81 (0.77 - 0.85),  $p<0.001$ ). However, there was a significant increase in ambulance attendances for Mental Health Conditions (1.37 (1.22 - 1.51),  $p=0.005$ ).

2

## Conclusions

Despite the relative absence of COVID-19 in the community during the 5-week nationwide lockdown there were significant differences in ambulance utilisation during this period. Confinement of the population to their homes was associated with a reduction in ambulance attendances for Road Crashes and at incidents where alcohol was a contributing factor. However, increased Mental Health attendances are of concern.

## Strengths

- In New Zealand we were able to implement a lockdown strategy that successfully eliminated COVID-19 for a period of 3 months. This provided a unique opportunity to study ambulance utilisation during the lockdown period in an environment free from confounders of the presence of COVID-19 in the community.
- Our study is a retrospective cohort study of over 600,000 ambulance records.
- The study is national study encompassing ambulance services across the whole of New Zealand.

## Limitations

- Our 'Clinical Impressions' are relatively broad categories, clustering some disparate diseases together. (For example, asthma, COPD and chest infections are all categorised as 'Respiratory Conditions'.) However, this provides a broad overview of ambulance utilisation, and was applied consistently across both Pre-Lockdown and Lockdown periods.
- Lockdown was instituted less than a month after COVID-19 reached New Zealand. As a result, data was analysed retrospectively and this unavoidably influences the interpretation of results.

## Introduction

Between December 2019 and January 2020, the first cases of coronavirus COVID-19 were detected in Wuhan, China<sup>1</sup>. By the end of January 2020 more than 7818 cases were reported worldwide<sup>2</sup>. In New Zealand, a high-income island nation in the South Pacific, the first cases of the COVID-19 virus were detected on the 28 February 2020 and peaked at 89 new cases per day on 5 April 2020<sup>3</sup>. A stringent public health intervention strategy was successfully utilised to prevent the community spread of the virus in New Zealand. This required all residents to stay at home other than for essential purposes. All businesses, schools and facilities were closed from 23 March until 27 April. Citizens were required to isolate within domestic 'bubbles'; two-metre physical distancing was stipulated outside the home boundary. Primary healthcare consultations were undertaken by phone or video, with prescriptions being dispatched to pharmacies close to the patient. Governmental messaging urged citizens to avoid hospitals where possible<sup>4</sup>. There was widespread compliance with the 'Stay at Home' mandate and this nationwide lockdown which included border closures effectively curtailed community transmission of the virus. As of the end of the lockdown period (27 April 2020) New Zealand, with a population of 4.8 million, had 1476 COVID-19 cases and 19 deaths; by comparison Ireland, a country of a similar population (4.9 million), experienced 20253 cases and 1190 deaths<sup>4,5</sup>.

Lockdowns can slow or even eliminate a viral pandemic, however enforced lockdowns may also have profound effects on healthcare utilisation by the population<sup>6</sup>. In particular, there is concern that the public may be fearful of contracting infection by attending a medical facility or general practitioner. In England presentations to emergency departments decreased by 25% during the second week of their lockdown<sup>7</sup>. Similarly, Austria recorded a decrease in admissions for acute coronary syndromes during their quarantine/lockdown period<sup>8</sup>. In areas of high COVID-19 prevalence there may have been reluctance or advice not to present to emergency departments due to an overwhelmed health system<sup>9</sup>. In the above examples it is difficult to determine whether it is the effects of the lockdown, or the presence of COVID-19 in the community, that changes the normal demand for health support.

If the pandemic response changes healthcare utilisation by the public, what impact does this have on ambulance services? The progressive eradication of COVID-19 for a period of three months in New Zealand gave us the opportunity to study the impacts of a nationwide and border lockdown on ambulance service utilisation. This will inform health authorities of the likely impact of future pandemic lockdowns on ambulance services.

## Methods

### Design

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1  
2 This was a descriptive, cross-sectional study of ambulance attendances within New Zealand during Pre-  
3 lockdown and Lockdown periods. The study was performed at a national level.  
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## 6 **The data**

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9 Details for all events attended by New Zealand road ambulances (St John and Wellington Free Ambulance  
10 services) are recorded electronically by Paramedics at the scene. Data for this study were extracted  
11 retrospectively from this dataset.  
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## 14 **Inclusion and exclusion criteria**

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17 The Pre-lockdown dataset included all ambulance attendances during the periods 1 March 2018 (when  
18 clinical data went electronic) to 30 Nov 2018, and 1 July 2019 to 16 Feb 2020, a total of 72weeks. Data from  
19 1 December 2018 to 30 June 2019 was not available due to ambulance service industrial action during this  
20 time.  
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25 The nationwide Lockdown included all ambulance attendances during the 5-week period 23 March 2020 to  
26 26 April 2020.  
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## 29 **Population demographics**

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32 Variables included: Sex, Age, Ethnicity, Rurality, and Location type (Aged Care Facility, Healthcare Facility,  
33 Public/other, Home). Three ethnicity groupings were analysed: Māori (the indigenous population of New  
34 Zealand), Pacific Peoples (people predominantly from South Pacific Islands including Samoa, Cook Islands,  
35 Tonga and Niue), and European/Others. All other ethnicities, which comprised less than 5% of the dataset,  
36 were included within the European/Others cohort.  
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41 Rurality (urban versus rural) was determined by Statistics New Zealand 2013 Census Meshblocks aligned to  
42 the address/location of the event<sup>10</sup>. For the purposes of this study, urban and rural were defined by the  
43 following Statistics New Zealand Meshblock descriptors: urban included 'Main Urban Area' and 'Secondary  
44 Urban Area', whilst rural included 'Minor Urban Area', 'Rural Centre' and 'Other Rural'<sup>10</sup>.  
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## 49 **Clinical presentation and disposition**

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52 Clinical Impression is the ambulance clinician's working diagnosis. For the purposes of this study, over 600  
53 possible Clinical Impressions were up-grouped into generic categories to enable an overarching descriptive  
54 analysis. The grouping of these clinical impressions is available as Supplementary Table 1. Mechanism of  
55 Injury is recorded only for trauma cases. Patient Disposition variables included Transport versus non-  
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2 Transport with reasons. Final patient acuity is defined by five assigned Status Codes (1-immediate threat to  
3 life, 2-potential threat to life, 3-unlikely threat to life, 4-no threat to life, 0-dead).  
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## 6 **Patient and public involvement**

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9 This research did not draw on patient or public involvement. Patients were not invited to comment on the  
10 study design and were not consulted to develop patient relevant outcomes or interpret the results. Research  
11 findings will be widely disseminated through public, official, personal, and social communication tools.  
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## 14 **Statistical analyses**

15  
16 The distribution of variables within each time period were described as totals and percentages of total  
17 numbers. Pearson's Chi-Square test and the z-test for column proportions were used to compare nominal  
18 values.  
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22 The two-tailed independent samples t-test was used to compare mean changes in ambulance attendances  
23 per week. Data presented are: mean, standard deviation and ratios with 95% confidence intervals (CI). Data  
24 analysis was performed using IBM SPSS (V.26.0). A p-value of <0.05 was considered statistically significant.  
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## 29 **Results**

30  
31 Overall, 624,928 patients were attended by New Zealand Ambulance services and were included in the study.  
32 These were 588,690 patients during the Pre-lockdown period and 36,238 during the Lockdown period.  
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## 36 **Demographics**

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38 Compared to the Pre-lockdown period, there were significant differences in the distribution of cases during  
39 the Lockdown. A higher proportion of female patients were attended, a lower proportion of patients were  
40 attended in the youngest age groups (0-25 years) and a higher proportion were attended between the ages  
41 26-65 years, Table 1. There were no differences in the proportions of patients according to ethnicity or  
42 rurality.  
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48 During Lockdown there was a large increase in the proportion of patients attended in their homes, and a  
49 decrease in the proportion of patients attended in all other locations (Aged Care, Healthcare, Public and  
50 Other), Table 1.  
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54 **Table 1. Descriptive analysis, demographics (n=624,928). Analysis of distribution of events within a time period.**

	Pre-Lockdown n=588,690	Lockdown n=36,238	P-value
Sex			0.01

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Female	309991 (52.7%)	19326 (53.4%)	
Male	278232 (47.3%)	16854 (46.6%)	
Age			<0.001
0-5	27258 (4.6%)	1326 (3.7%)	
6-15	21401 (3.6%)	934 (2.6%)	
16-25	57119 (9.7%)	2875 (7.9%)	
26-45	92530 (15.7%)	6201 (17.1%)	
46-65	122699 (20.9%)	7948 (22.0%)	
>65	267540 (45.5%)	16917 (46.7%)	
Ethnicity			0.07
European/Other	424918 (82.6%)	25998 (83.1%)	
Māori	61858 (12.0%)	3664 (11.7%)	
Pacific Peoples	27709 (5.4%)	1623 (5.2%)	
Rurality			0.25
Rural	129002 (22.5%)	7948 (22.3%)	
Urban	444054 (77.5%)	27774 (77.8%)	
Location			<0.001
Aged Care Facility	33334 (5.7%)	1689 (4.7%)	
Healthcare Facility†	51831 (8.8%)	1404 (3.9%)	
Public / other	111771 (19.0%)	2930 (8.1%)	
Home	390934 (66.5%)	30166 (83.4%)	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent T-test for continuous values. Missing values were <3% for all variables except Ethnicity (14.6%), the proportion of missing values for this variable was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding. †Healthcare Facility refers to non-hospital treatment localities such as a general practice clinic.

## Clinical Presentation

Compared to Pre-lockdown, there was a difference in the distribution of Clinical Impressions during the Lockdown period. The proportions of patients presenting with Collapse, Metabolic Conditions, Poisoning, Respiratory Conditions and Trauma all decreased, Table 2. Correspondingly, there were increases in the proportions of patients with Abdominal Pain, Cardiac Conditions, Mental Health Conditions, Other Medical, Pain and Stroke, Table 2.

The proportion of incidents with suspected alcohol involvement decreased during Lockdown, Table 2.

When comparing the Mechanisms of Injury to the Pre-lockdown period, there was a decrease in the proportion of Assaults and Road Traffic Crashes, with a corresponding increase in the proportion of Falls and Other trauma.

**Table 2. Descriptive analysis, Clinical impression (n=624,928). Changes in distribution.**

	Pre-Lockdown n=588,690	Lockdown n=36,238	P-value
<b>Clinical Impression</b>			<b>&lt;0.001</b>
Abdominal Pain	45479 (7.8%)	3240 (9.1%)	
Cardiac	61083 (10.4%)	4082 (11.4%)	
Collapse	27296 (4.7%)	1516 (4.2%)	
Haemorrhage	10932 (1.9%)	717 (2.0%)	
Infection	37374 (6.4%)	2369 (6.6%)	
Mental Health	13966 (2.4%)	1318 (3.7%)	
Metabolic	28580 (4.9%)	1616 (4.5%)	
Other Medical	76741 (13.1%)	4875 (13.6%)	
Pain	68678 (11.7%)	4333 (12.1%)	
Poisoning	18519 (3.2%)	802 (2.2%)	
Respiratory	67144 (11.5%)	3449 (9.6%)	
Stroke	13652 (2.3%)	916 (2.6%)	
Trauma	117127 (20.0%)	6535 (18.3%)	
<b>Did alcohol contribute</b>			<b>&lt;0.001</b>
No	417011 (93.3%)	25493 (95.2%)	
Yes	30076 (6.7%)	1300 (4.9%)	
<b>Mechanism of injury</b>			<b>&lt;0.001</b>
Assault	8924 (6.0%)	445 (5.7%)	
Fall	75225 (50.8%)	4603 (58.9%)	
Other trauma	39278 (26.6%)	2254 (28.8%)	
Road traffic crash	24534 (16.6%)	518 (6.6%)	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables except whether Alcohol Contributed (27.1%) and Mechanism of Injury (15.1%, of Trauma cases), the proportion of missing values for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding.

### Patient disposition

During Lockdown, there were significant changes in patient disposition. The proportion of patients that were deemed by ambulance staff not to require transport by ambulance increased, as did the proportion of lowest acuity patients (Status 3 and 4), Table 3.

**Table 3. Descriptive analysis, patient disposition and acuity (n=624,928).**

	Pre-Lockdown n=588,690	Lockdown n=36,238	P-value
<b>Disposition</b>			<b>&lt;0.001</b>
Transport	465237 (79.1%)	25112 (69.5%)	
Non-Transport	122975 (20.9%)	11022 (30.5%)	
<b>Non-transport reason</b>			<b>&lt;0.001</b>
Ambulance staff decision not to transport	105236 (85.6%)	9804 (89.0%)	
Patient declined transport	17740 (14.4%)	1218 (11.1%)	
<b>Final status</b>			<b>&lt;0.001</b>
0	6692 (1.1%)	418 (1.2%)	
Status 1 & Status 2	75940 (12.9%)	4110 (11.4%)	
Status 3 & Status 4	504533 (85.9%)	31550 (87.5%)	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding.

### Event rates, mean number of attendances per week

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2 During Lockdown there was an overall decrease in the absolute number of incidents per week attended by  
3 ambulance and this involved all clinical impressions, although the decreases seen in Cardiac, Infection,  
4 Haemorrhage and Stroke rates were non-significant. The rate for Abdominal Pain rose, but was statistically  
5 non-significant. Figure 1 and Supplementary Table 2.  
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9 During the lockdown there was a significant increase in the mean weekly rate of attendance to patients with  
10 clinical presentations of Mental Health, Figure 1 and Supplementary Table 2.  
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13 Attendances at traumatic events were significantly decreased during the Lockdown period, as were rates of  
14 attendance at incidents where alcohol was considered a contributing factor, Figure 2 and Supplementary  
15 Table 3. Weekly rates for all traumatic mechanisms of injury fell during Lockdown.  
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## 18 19 20 Discussion

21  
22 There was a striking difference in ambulance service utilisation during a national lockdown of the population  
23 in New Zealand. The lockdown lasted five weeks where everyone except essential workers were required to  
24 isolate at home, and only permitted to leave home for exercise within the local area while maintaining social  
25 distancing<sup>11</sup>. There were notable changes in demographics, patient acuity, disposition and mechanism of  
26 injury. Absolute numbers of weekly patient attendances diminished alongside attendances to a number of  
27 pertinent Clinical Impressions. There was a stark and significant increase in absolute numbers of ambulance  
28 attendances for Mental Health Conditions.  
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34 During the lockdown there was an increase in the proportion of females attended, a reduction in the  
35 proportion of younger people (<26 years) attended and an increase in ambulance attendances to the home  
36 location. The banning of all rigorous recreation and sports activities alongside the reduction in all types of  
37 trauma (including paediatric) may have altered the balance between male and female ambulance utilisation.  
38 Traumatic and sporting injuries are known to occur more frequently in males, with 73% of Major Trauma  
39 Injuries in New Zealand occurring in males<sup>12</sup>.  
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45 A reduction in ambulance attendance to young people may be attributable to a potential decrease in usual  
46 community acquired infection through increased hygiene practices such as handwashing<sup>13 14</sup>. Additionally,  
47 studies have demonstrated an increased frequency of illness in association with day care or school  
48 attendance<sup>15-17</sup>. Thus, the closure of schools and the confinement of children within the family could be  
49 expected to reduce the frequency of such community acquired illnesses.  
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54 A greater proportion of calls were to events located at home, with a lesser proportion in public places. This  
55 likely reflects the government instruction for the population to stay at home. Lockdown did not appear to  
56 alter utilisation of ambulance care by different ethnic groups or the rural sector.  
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2 The proportion of high acuity work decreased, as did the proportion of patients transported to an emergency  
3 department. This could be due to reluctance to transport patients to hospitals which might already be  
4 stretched with COVID-19 admissions, or perhaps patients were reluctant to be transported to facilities where  
5 they thought they might become infected themselves. It is noteworthy that during the total lockdown the  
6 number of actual COVID-19 cases in New Zealand was relatively small and hospital capacity never became an  
7 issue. In our study the reason for non-transport of patients was primarily at the recommendation of the  
8 attending staff, inferring that the patients did not require ambulance transport, rather than patients declining  
9 to be transported. Interestingly, this study indicates that during Lockdown a greater proportion of low acuity  
10 patients were requesting ambulance service attendance, and that many of them were not acutely unwell  
11 enough to require transport to a medical facility by ambulance. Perhaps this could also be a manifestation of  
12 decreased access to primary care services. General practice consultations were undertaken by phone or  
13 video during Lockdown and this could have presented a barrier to access for those unfamiliar with and/or  
14 without access to this technology.  
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24 There was a reduction in road traffic crashes, which may demonstrate compliance with the strict restrictions  
25 on travel that were imposed during lockdown. This was evident through Google Mobility data that indicated  
26 an average 88% reduction in the use of recreational and retail spaces during lockdown compared to  
27 baseline<sup>18</sup>. Supporting this, Ministry of Transport data demonstrated a reduction of retail petrol and diesel  
28 sales by 80%<sup>19</sup>. Also in line with our findings of an absolute reduction in trauma, there were 34 fewer fatal  
29 road traffic crashes during the lockdown compared to the same period in 2019<sup>19</sup>. The decrease in incidents  
30 involving alcohol is noteworthy. A recent survey conducted by the Health Promotion Agency indicated that  
31 during lockdown 47% of people drank the same as normal, whilst 34% drank less than normal with the  
32 remaining 19% drinking more than normal<sup>20</sup>. The majority of survey respondents who drank less than normal  
33 attributed this decrease to the closure of bars and night clubs, and an inability to socialise.  
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42 During the lockdown period, ambulance use diminished for almost every type of medical or traumatic event.  
43 In one sense, the requirement to 'Stay at Home' may have had a protective effect on the New Zealand  
44 population. Recent statistics indicate a decrease in weekly mortality in the first 23 weeks of 2020 compared  
45 with the same time in the preceding 3 years<sup>21</sup>. Attendance to Respiratory Conditions declined, which may be  
46 related to a decrease in transmission of usual airborne illnesses through decreases in social contact. Data  
47 collected from the New Zealand FluTracking website indicated an almost 10% decrease in self-reported  
48 influenza-like illness in the week ending 19 April 2020 compared with the same period in 2019<sup>22</sup>. A reduction  
49 in the level of NO<sub>2</sub> in Asian and European countries indicative of a reduction in air pollution has been noted  
50 during periods of lockdown; such improvements in air quality may also have a protective effect from coryzal  
51 type illness<sup>23</sup>. This reduction in air pollution during lockdown was also found in New Zealand, with a 41%  
52 reduction in daily carbon emissions during the 5 week period<sup>24</sup>.  
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2 The one type of ambulance presentation that dramatically increased, both in proportion of attendances and  
3 in absolute rates per week, was mental health conditions. These may have been triggered by the imposition  
4 of social isolation with its restriction in human-to-human contact<sup>25 26</sup>. Additionally, there was the impact of  
5 uncertainty directly related to the pandemic: the fear of contracting COVID-19, or of losing friends and family  
6 through the virus, plus for many, fear of financial difficulties, loss of employment or the family home. In New  
7 Zealand, the COVID-19 pandemic response was associated with the most severe restrictions on social  
8 freedoms in modern history, along with significant economic impacts. Although these measures were  
9 effective in eliminating community transmission of coronavirus, it appears to have affected the mental health  
10 of some citizens. Pandemic-induced increases in psychological distress have been reported in both Australia  
11 and the United Kingdom and more so among women, younger age groups, and those living with young  
12 children<sup>25 27</sup>. Those with pre-existing health inequalities such as older age and low income were at increased  
13 risk<sup>27</sup>. Lockdown has also been associated with a significant negative impact on the wellbeing of children and  
14 adolescents<sup>28</sup>. This impact is of particular concern, because routines and social interaction are critical factors  
15 for normal psychological development in these age groups.

16  
17 In contrast to many other developed nations, New Zealand's lockdown restrictions were enforced early so  
18 that the health system was not overwhelmed and experienced a reduction in overall volume. There was no  
19 significant rise in referrals to secondary mental health services during lockdown, though this was hardly  
20 surprising considering the reduction in primary care consultations (which are the predominant referral route  
21 to secondary mental health services)<sup>29</sup>. However, while there were physical restrictions on access to primary  
22 care during lockdown, no such restrictions existed for ambulance service utilisation, which saw a dramatic  
23 increase in attendances for mental health conditions.

24  
25 When planning for additional periods of COVID-19 lockdown or for future pandemics, ambulance services  
26 should prepare to meet this increase in mental ill-health. The alteration in ambulance service demand  
27 between Pre-Lockdown and Lockdown conditions is unlikely to be due to community COVID-19 itself as the  
28 number of cases was minimal in New Zealand at the time of the lockdown. This study represents a unique  
29 analysis of ambulance service demand under the conditions of strict Lockdown.

## 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 **Limitations**

49  
50 Our 'Clinical Impressions' are relatively broad categories, clustering together some disparate disease  
51 conditions. (For example, asthma, COPD and chest infections are all categorised as 'Respiratory Conditions'.)  
52 However, this provided a broad overview of ambulance utilisation, and was applied consistently across both  
53 Pre-Lockdown and Lockdown periods. Similarly, our current data does not differentiate between common  
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2 mental health presentations, such as depression, anxiety, psychological distress; that will be the task of a  
3 separate publication.  
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5  
6 Lockdown was instituted less than a month after COVID-19 reached New Zealand. As a result, data has had  
7 to be analysed retrospectively and this unavoidably influences the interpretation of results.  
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9  
10 Three of our variables had more than 10% missing data in the categories of Ethnicity, Alcohol Contribution  
11 and Mechanism of Injury. Although the proportion of missing data was not different between Pre-Lockdown  
12 and Lockdown periods, this may have biased analysis of these categories of data.  
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## 15 16 **Conclusions**

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19 A nationwide Lockdown during the COVID-19 pandemic proved to be very effective in controlling and  
20 eliminating the spread of the coronavirus in New Zealand, but it significantly altered the pattern of demand  
21 on ambulance care. 'Stay at Home' orders led to a reduction in many types of ambulance call-out, notably  
22 respiratory conditions, trauma, and incidents involving alcohol. In contrast, Mental Health Conditions rose  
23 significantly during this period of pandemic uncertainty, relating especially to confinement at home, reduced  
24 social contact, and loss of earnings for many. These changes occurred in the relative absence of COVID-19 in  
25 the community.  
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## 32 **Footnotes**

## 33 34 35 **Contributors**

36  
37 BD contributed to the study design, contributed to the literature review, conducted the analysis and was  
38 primarily responsible for the article preparation. GH contributed to the literature review and to the  
39 interpretation of data and preparation of the paper. AS contributed to the study design, provided oversight  
40 of the project, interpretation of results and article preparation. VT, BT, EM, HD, MB and DS contributed to  
41 the study design, the literature review and to the interpretation of data and preparation of the paper.  
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48  
49 All researchers involved contributed as a course of their usual academic employment. The authors have no  
50 other financial support to declare.  
51  
52

## 53 54 **Competing interests**

55  
56 None declared.  
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## Patient consent for publication

Not required.

## Ethics

Ethical approval for this study was provided by the Auckland University of Technology Ethics Committee (No. 20/151).

## Provenance and peer review

Not commissioned, externally peer reviewed.

## Data availability statement

Data are not available in accordance with the ethics committee approval.

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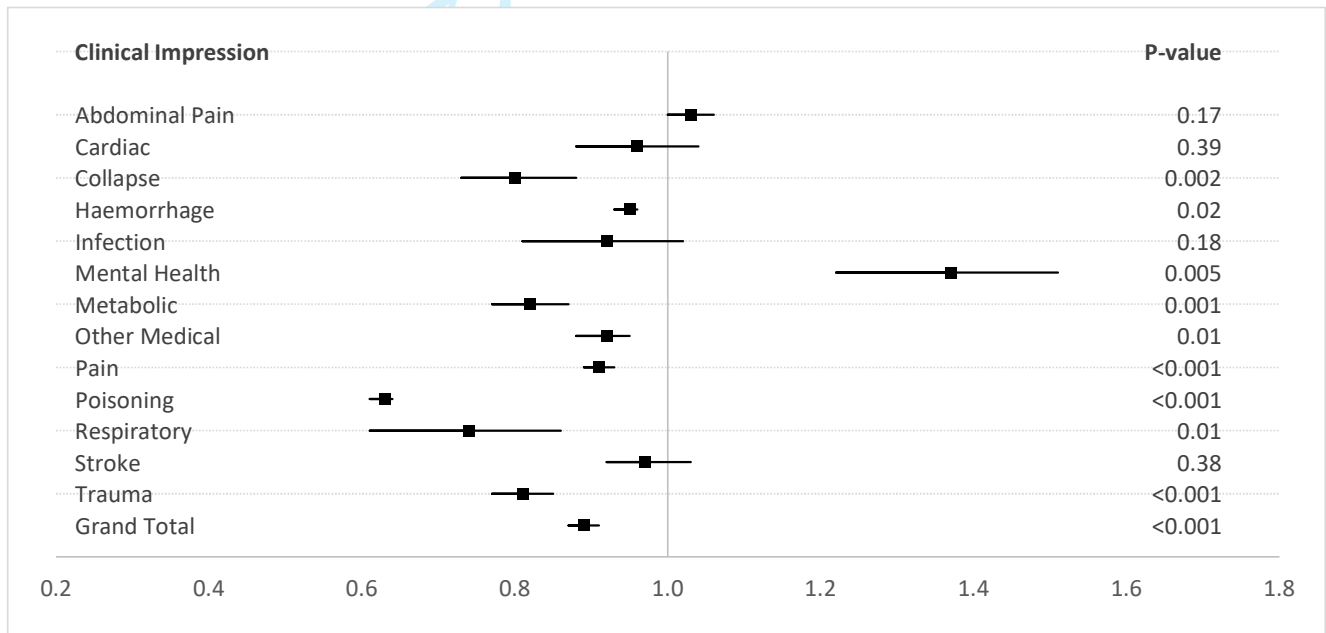
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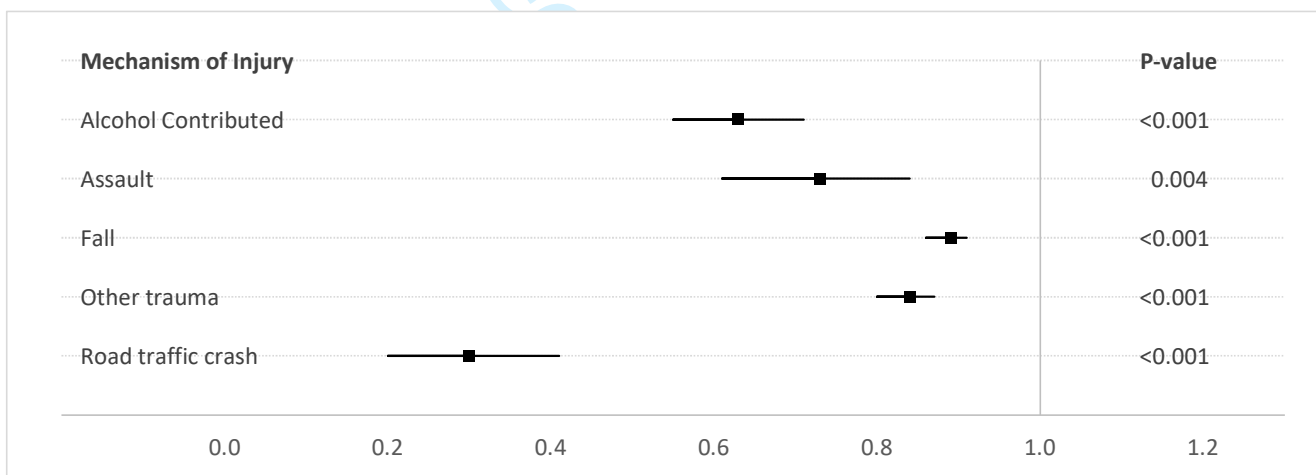
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**Supplementary Table 1. Clinical Impression groupings.**

Row Labels	Higher grouping	SNOMED
Abdominal aortic aneurysm	Abdominal Pain	195268001
Abdominal distension	Abdominal Pain	314212008
Abdominal mass	Abdominal Pain	314212008
Abdominal pain - cause unknown	Abdominal Pain	314212008
Abdominal pain (ACC & MED)	Abdominal Pain	314212008
Appendicitis	Abdominal Pain	74400008
Biliary colic	Abdominal Pain	37389005
Bowel obstruction	Abdominal Pain	81060008
Chronic constipation	Abdominal Pain	14760008
Constipation	Abdominal Pain	14760008
Cramp	Abdominal Pain	314212008
Epigastric pain	Abdominal Pain	79922009
Hernia	Abdominal Pain	414403008
Hernia of abdominal wall	Abdominal Pain	414403008
Incisional hernia	Abdominal Pain	414403008
Inguinal hernia	Abdominal Pain	414403008
Kidney stone	Abdominal Pain	7093002
Leaking abdominal aortic aneurysm	Abdominal Pain	195268001
Left flank pain	Abdominal Pain	314212008
Left iliac fossa pain	Abdominal Pain	314212008
Left lower quadrant pain	Abdominal Pain	314212008
Left sided abdominal pain	Abdominal Pain	314212008
Left upper quadrant pain	Abdominal Pain	314212008

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3		Abdominal	
4	Reflux	Pain	79922009
5		Abdominal	
6	Renal Colic	Pain	7093002
7		Abdominal	
8	Right flank pain	Pain	314212008
9		Abdominal	
10	Right iliac fossa pain	Pain	314212008
11		Abdominal	
12	Right lower quadrant pain	Pain	314212008
13		Abdominal	
14	Right sided abdominal pain	Pain	314212008
15		Abdominal	
16	Right upper quadrant pain	Pain	314212008
17		Abdominal	
18	Rupture of abdominal aortic aneurysm	Pain	195268001
19		Abdominal	
20	Torsion of testis	Pain	81996005
21		Abdominal	
22	Torsion of testis (ACC & MED)	Pain	81996005
23	Acute myocardial infarction of anterior wall	Cardiac	401303003
24	Acute myocardial infarction of anterolateral wall	Cardiac	401303003
25	Acute myocardial infarction of inferior wall	Cardiac	401303003
26	Acute myocardial infarction of inferolateral wall	Cardiac	401303003
27	Acute myocardial infarction of inferoposterior wall	Cardiac	401303003
28	Acute myocardial infarction of septum	Cardiac	401303003
29	Acute ST segment elevation myocardial infarction	Cardiac	401303003
30	Angina	Cardiac	426396005
31	Atrial fibrillation	Cardiac	49436004
32	Atrial flutter	Cardiac	698247007
33	Atrial tachycardia	Cardiac	698247007
34	Bradycardia	Cardiac	48867003
35	Cardiac arrest	Cardiac	410429000
36	Cardiac Chest Pain	Cardiac	426396005
37	Cardiac dysrhythmia	Cardiac	698247007
38	Cardiogenic pulmonary oedema	Cardiac	360371003
39	Cardiogenic Shock	Cardiac	89138009
40	Congestive heart failure	Cardiac	42343007
41	Deceased	Cardiac	419099009
42	Disorder of implantable defibrillator	Cardiac	234228008
43	Left bundle branch block	Cardiac	698247007
44	Mobitz type 1 heart block	Cardiac	698247007
45	Mobitz type 2 heart block	Cardiac	698247007
46	Myocardial ischaemia	Cardiac	414795007
47	Non-cardiac chest pain	Cardiac	274668005
48	Palpitations	Cardiac	80313002
49	Pericarditis	Cardiac	3238004
50	Right bundle branch block	Cardiac	698247007
51	Right Heart Failure	Cardiac	42343007
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3	Sick sinus syndrome	Cardiac	698247007
4	ST elevation myocardial infarction	Cardiac	401303003
5	SUDI - Sudden unexpected death of an infant	Cardiac	419099009
6	Supraventricular tachycardia	Cardiac	6456007
7	Tachycardia	Cardiac	3424008
8	Third degree heart block	Cardiac	698247007
9	Ventricular fibrillation	Cardiac	410429000
10	Ventricular tachycardia	Cardiac	25569003
11	Brief loss of consciousness	Collapse	271594007
12	Collapse	Collapse	162709009
13	Collapse - cause unknown	Collapse	162709009
14	Syncope	Collapse	271594007
15	Bleeding	Haemorrhage	50960005
16	Epistaxis	Haemorrhage	12441001
17	Haematuria	Haemorrhage	53298000
18	Haematuria ; Blood in urine	Haemorrhage	53298000
19	Haemorrhage	Haemorrhage	50960005
20	PR bleeding	Haemorrhage	12063002
21	PR bleeding (ACC & MED)	Haemorrhage	12063002
22	PV bleeding/Vaginal Bleeding	Haemorrhage	289543006
23	Vaginal bleeding	Haemorrhage	289543006
24	Varicose veins of the leg with rupture (ACC & MED)	Haemorrhage	50960005
25	Abscess	Infection	128477000
26	Abscess of ankle	Infection	128477000
27	Abscess of back except buttock	Infection	128477000
28	Abscess of buttock	Infection	128477000
29	Abscess of chest wall	Infection	128477000
30	Abscess of ear	Infection	128477000
31	Abscess of elbow	Infection	128477000
32	Abscess of eye	Infection	128477000
33	Abscess of face	Infection	128477000
34	Abscess of finger(s)	Infection	128477000
35	Abscess of flank	Infection	128477000
36	Abscess of foot	Infection	128477000
37	Abscess of forearm	Infection	128477000
38	Abscess of groin	Infection	128477000
39	Abscess of hand	Infection	128477000
40	Abscess of hip	Infection	128477000
41	Abscess of jaw	Infection	128477000
42	Abscess of knee	Infection	128477000
43	Abscess of lip	Infection	128477000
44	Abscess of lower leg	Infection	128477000
45	Abscess of neck	Infection	128477000
46	Abscess of nose	Infection	128477000
47	Abscess of shoulder	Infection	128477000
48	Abscess of thigh	Infection	128477000
49	Abscess of toe	Infection	128477000
50	Abscess of tongue	Infection	128477000
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Abscess of upper arm	Infection	128477000
Abscess of wrist	Infection	128477000
Cellulitis	Infection	128045006
Cellulitis (ACC & MED)	Infection	128045006
Chickenpox	Infection	38907003
Dermatitis	Infection	182782007
Epiglottitis	Infection	80384002
Eye infection	Infection	128351009
Fever	Infection	386661006
Gallstone	Infection	235919008
Gangrene of foot	Infection	128045006
Gangrene of hand	Infection	128045006
Infected face	Infection	40733004
Infected hand	Infection	40733004
Infected insect bite	Infection	40733004
Infected thumb	Infection	40733004
Infection	Infection	40733004
Infection after injection infusion transfusion or vaccination	Infection	40733004
Infection of ear	Infection	40733004
Infection of finger(s)	Infection	40733004
Infection of foot	Infection	40733004
Infection of nail(s)	Infection	40733004
Infection of obstetric surgical wound	Infection	58126003
Infection of peritoneal dialysis catheter	Infection	40733004
Infection of skin	Infection	40733004
Infection of toe(s)	Infection	40733004
Joint swelling (ACC & MED)	Infection	40733004
Kidney infection ; Pyelonephritis	Infection	45816000
Measles	Infection	14189004
Meningitis	Infection	7180009
Meningococcaemia	Infection	76571007
Meningococcal infectious disease	Infection	23511006
Mumps	Infection	36989005
Norovirus	Infection	721763002
Other abscess (describe in notes)	Infection	128477000
Other infection (describe in notes)	Infection	40733004
Other infectious disease (describe in notes)	Infection	40733004
Pharyngitis ; Sore throat	Infection	405737000
Phlebitis	Infection	40733004
Postoperative wound infection	Infection	58126003
Rigor(s)	Infection	40733004
Rotavirus	Infection	186150001
Sepsis (ACC & MED)	Infection	40733004
Septic shock	Infection	76571007
Shingles	Infection	40733004
Sinusitis	Infection	36971009
Sore Throat	Infection	17741008



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3	Tonsillitis	Infection	17741008
4	Tuberculosis	Infection	56717001
5	Urinary Tract Infection	Infection	68566005
6	Whooping Cough	Infection	27836007
7	Wound Infection	Infection	128045006
8	Anxiety	Mental Health	48694002
9	At risk for suicide	Mental Health	267073005
10	Chronic depression	Mental Health	413307004
11	Delirium	Mental Health	2776000
12	Dementia	Mental Health	52448006
13	Mental Health Problem	Mental Health	413307004
14	Suicidal	Mental Health	267073005
15	Abnormal behaviour	Metabolic	40917007
16	Agitated state	Metabolic	24199005
17	Confusion	Metabolic	40917007
18	DKA - Diabetic ketoacidosis	Metabolic	80394007
19	Epilepsy	Metabolic	91175000
20	Febrile convulsion	Metabolic	41497008
21	Hyperglycaemia	Metabolic	80394007
22	Hyperkalaemia	Metabolic	14140009
23	Hypoglycaemia	Metabolic	302866003
24	Post-ictal state	Metabolic	91175000
25	Seizure	Metabolic	91175000
26	Status Epilepticus	Metabolic	230456007
27	Abdominal pain in pregnancy	Other Medical	289209003
28	Abnormal gait	Other Medical	3219008
29	Abnormal involuntary movement	Other Medical	3219008
30	Abnormal vision	Other Medical	397540003
31	Accidental removal of catheter	Other Medical	439377004
32	Acute confusion	Other Medical	130987000
33	Allergic contact dermatitis	Other Medical	609328004
34	Allergic reaction to drug (ACC)	Other Medical	609328004
35	Allergic reaction to food (ACC)	Other Medical	609328004
36	Allergy	Other Medical	609328004
37	Altered sensation	Other Medical	3219008
38	Amnesia	Other Medical	3219008
39	Anaphylaxis	Other Medical	39579001
40	Anaphylaxis (ACC)	Other Medical	39579001
41	Angio-oedema	Other Medical	41291007
42	Antepartum haemorrhage	Other Medical	34842007
43	Aphasia	Other Medical	3219008
44	Birth	Other Medical	3950001
45	Bladder pain	Other Medical	102835006
46	Blocked catheter	Other Medical	275413005
47	Blurred vision	Other Medical	397540003
48	Breech presentation	Other Medical	289209003
49	Child at risk (ACC)	Other Medical	160877008
50	Complication occurring during labour and delivery	Other Medical	35874009
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Complication of catheter	Other Medical	73862001
Complication of haemodialysis	Other Medical	85223007
Complication of urinary catheter	Other Medical	73862001
Decreased mobility	Other Medical	3219008
Dehydration	Other Medical	34095006
Diarrhoea	Other Medical	62315008
Diarrhoea and vomiting	Other Medical	62315008
Difficulty passing urine	Other Medical	102835006
Difficulty swallowing	Other Medical	288939007
Dizziness	Other Medical	399153001
Drug withdrawal	Other Medical	363101005
Dysarthria	Other Medical	8011004
Dysphasia	Other Medical	20301004
Dysuria	Other Medical	102835006
Ear problem	Other Medical	300197009
Ectopic pregnancy	Other Medical	34801009
End of Life Care	Other Medical	182964004
Food poisoning	Other Medical	422400008
Gastrointestinal bleeding	Other Medical	74474003
Generalised aches and pains (ACC & MED)	Other Medical	3219008
Generally unwell	Other Medical	3219008
Haematemesis	Other Medical	8765009
Haematemesis/ Vomitting Blood	Other Medical	8765009
Hallucinations	Other Medical	3219008
Hearing problem	Other Medical	300197009
Heat stroke (ACC & MED)	Other Medical	50177009
Hyperemesis of pregnancy	Other Medical	289209003
Hypertension	Other Medical	62275004
Hyperthermia	Other Medical	50177009
Hypotension	Other Medical	45007003
Hypothermia	Other Medical	386689009
Hypothermia (ACC & MED)	Other Medical	386689009
Hypovolaemia	Other Medical	28560003
Hypovolaemic shock (ACC & MED)	Other Medical	39419009
Illness of unknown cause	Other Medical	3219008
Labour	Other Medical	35874009
Lethargy	Other Medical	214264003
Lightheadedness	Other Medical	399153001
LOC - Loss of consciousness	Other Medical	419045004
Loss of consciousness	Other Medical	419045004
Malaise	Other Medical	214264003
Melaena	Other Medical	289209003
Miscarriage	Other Medical	17369002
Multiple birth	Other Medical	3950001
NAD - No abnormality detected (ACC & MED)	Other Medical	281900007
Nausea	Other Medical	422587007
Nausea and vomiting	Other Medical	422587007
No abnormality detected	Other Medical	281900007

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3	Other illness or medical condition (describe in notes)	Other Medical	3219008
4	Palliative care	Other Medical	103735009
5	Peripheral ischaemia	Other Medical	233958001
6	Peripheral oedema	Other Medical	271809000
7	Photophobia	Other Medical	397540003
8	Postpartum haemorrhage	Other Medical	47821001
9	Pregnancy problem	Other Medical	289209003
10	Premature delivery	Other Medical	3950001
11	Premature labour	Other Medical	6383007
12	Presentation for social reasons	Other Medical	313331005
13	Pressure ulcer	Other Medical	46742003
14	Pre-term Labour	Other Medical	6383007
15	Priapism	Other Medical	6273006
16	Referral for Social reason	Other Medical	313331005
17	Retained placenta	Other Medical	289209003
18	Skin problem	Other Medical	297982009
19	Skin Ulcer	Other Medical	46742003
20	Skin ulcer(s)	Other Medical	46742003
21	Undifferentiated illness	Other Medical	3219008
22	Urticaria	Other Medical	297982009
23	Vertigo	Other Medical	399153001
24	Visual difficulty	Other Medical	397540003
25	Vomiting	Other Medical	422400008
26	Weakness present	Other Medical	3219008
27	Acute back pain	Pain	209565008
28	Acute low back pain	Pain	278862001
29	Acute Pain	Pain	274663001
30	Acute pelvic pain (ACC and MED)	Pain	274663001
31	Anterior chest wall pain (ACC & MED)	Pain	102589003
32	Arthritis	Pain	3723001
33	Atypical chest pain	Pain	102589003
34	Chest pain - atypical	Pain	102589003
35	Chronic arthritis	Pain	3723001
36	Chronic back pain	Pain	134407002
37	Chronic low back pain	Pain	134407002
38	Chronic pain	Pain	82423001
39	Deep venous thrombosis	Pain	274663001
40	Flank pain	Pain	274663001
41	Gout	Pain	90560007
42	Headache	Pain	25064002
43	Hip pain	Pain	49218002
44	Hip pain (ACC & MED)	Pain	49218002
45	Joint pain	Pain	279069000
46	Low back pain	Pain	279039007
47	Migraine	Pain	37796009
48	Muscle pain (ACC & MED)	Pain	279069000
49	Musculoskeletal pain	Pain	279069000
50	Musculoskeletal pain (ACC)	Pain	279069000

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Neck pain	Pain	81680005
Pain	Pain	274663001
Sciatica	Pain	82423001
Sprain of lumbar back (ACC)	Pain	209565008
Thoracic back pain	Pain	279038004
Toothache	Pain	27355003
Accidental poisoning by drug (ACC)	Poisoning	72431002
Accidental poisoning by substance other than drug (ACC)	Poisoning	72431002
Acute Drug Intoxication	Poisoning	231466009
Acute drug intoxication (ACC)	Poisoning	231466009
Adverse reaction to drug	Poisoning	62014003
Adverse reaction to drug (ACC & MED)	Poisoning	62014003
Alcohol abuse	Poisoning	25702006
Alcohol intoxication	Poisoning	25702006
Intentional Poisoning	Poisoning	410061008
Intentional poisoning by drug (ACC)	Poisoning	410061008
Intentional poisoning by substance other than drug (ACC)	Poisoning	410061008
Poisoning of unknown intent	Poisoning	269736006
Substance abuse (ACC)	Poisoning	231466009
Unintentional Poisoning	Poisoning	72431002
Abnormal breathing (ACC & MED)	Respiratory	386813002
Apnoea	Respiratory	1023001
Asphyxiation	Respiratory	66466001
Asphyxiation (ACC)	Respiratory	66466001
Aspiration of food (ACC)	Respiratory	275498002
Aspiration pneumonia (ACC & MED)	Respiratory	275498002
Asthma	Respiratory	195967001
Breathing painful	Respiratory	386813002
Breathing problem of unknown cause	Respiratory	386813002
Bronchiectasis	Respiratory	12295008
Bronchiolitis	Respiratory	4120002
Bronchitis	Respiratory	275498002
Choking	Respiratory	249489001
Choking (ACC & MED)	Respiratory	249489001
Chronic obstructive pulmonary disease	Respiratory	13645005
Common cold	Respiratory	82272006
Cough	Respiratory	49727002
Croup	Respiratory	71186008
Exacerbation of CORD	Respiratory	13645005
Haemoptysis	Respiratory	66857006
Hyperventilation	Respiratory	68978004
Hypoxia	Respiratory	386813002
ILI - Influenza-like illness	Respiratory	95891005
Influenza-like illness	Respiratory	49727002
Left pneumothorax	Respiratory	36118008
Pleuritic pain	Respiratory	2237002
Pneumonia	Respiratory	275498002

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3	Pneumothorax	Respiratory	36118008
4	Pneumothorax (ACC & MED)	Respiratory	36118008
5	Pulmonary embolism	Respiratory	59282003
6	Respiratory arrest	Respiratory	87317003
7	Respiratory tract infection	Respiratory	275498002
8	Right pneumothorax	Respiratory	36118008
9	Shortness of breath	Respiratory	386813002
10	Smoke Inhalation	Respiratory	426936004
11	Smoke Inhalation (ACC)	Respiratory	426936004
12	Stridor	Respiratory	70407001
13	Tachypnoea	Respiratory	386813002
14	Traumatic pneumothorax (ACC)	Respiratory	36118008
15	Stroke	Stroke	230690007
16	Transient ischaemic attack	Stroke	266257000
17	Transient ischaemic attack (TIA)	Stroke	266257000
18	Abrasion	Trauma	399963005
19	Abrasion of abdominal wall (ACC)	Trauma	399963005
20	Abrasion of ankle (ACC)	Trauma	399963005
21	Abrasion of back (ACC)	Trauma	399963005
22	Abrasion of buttock (ACC)	Trauma	399963005
23	Abrasion of chest wall (ACC)	Trauma	399963005
24	Abrasion of face (ACC)	Trauma	399963005
25	Abrasion of finger (ACC)	Trauma	399963005
26	Abrasion of flank (ACC)	Trauma	399963005
27	Abrasion of foot (ACC)	Trauma	399963005
28	Abrasion of forearm area (ACC)	Trauma	399963005
29	Abrasion of hand (ACC)	Trauma	399963005
30	Abrasion of head &or neck (ACC)	Trauma	399963005
31	Abrasion of hip (ACC)	Trauma	399963005
32	Abrasion of knee (ACC)	Trauma	399963005
33	Abrasion of lower leg (ACC)	Trauma	399963005
34	Abrasion of multiple fingers (ACC)	Trauma	399963005
35	Abrasion of scalp (ACC)	Trauma	399963005
36	Abrasion of shoulder (ACC)	Trauma	399963005
37	Abrasion of thigh (ACC)	Trauma	399963005
38	Abrasion of toe(s) (ACC)	Trauma	399963005
39	Abrasion of trunk (ACC)	Trauma	399963005
40	Abrasion of upper arm (ACC)	Trauma	399963005
41	Amputation	Trauma	262595009
42	Amputation of ear (ACC)	Trauma	262595009
43	Amputation of finger (ACC)	Trauma	262595009
44	Amputation of foot (ACC)	Trauma	262595009
45	Amputation of hand (ACC)	Trauma	262595009
46	Amputation of limb (ACC)	Trauma	262595009
47	Amputation of thumb (ACC)	Trauma	262595009
48	Amputation of toe (ACC)	Trauma	262595009
49	Animal bite	Trauma	418975000
50	Animal bite (ACC)	Trauma	418975000

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Assault (ACC)	Trauma	52684005
At risk for falls	Trauma	85151000119101
Avulsion	Trauma	284554003
Avulsion of eye (ACC)	Trauma	284554003
Avulsion of scalp (ACC)	Trauma	284554003
Bends (ACC)	Trauma	89684003
Broken teeth	Trauma	196439008
Burn	Trauma	125666000
Burn <10% (ACC)	Trauma	125666000
Burn >90% (ACC)	Trauma	125666000
Burn 10-19% (ACC)	Trauma	125666000
Burn 20-29% (ACC)	Trauma	125666000
Burn 30-39% (ACC)	Trauma	125666000
Burn 40-49% (ACC)	Trauma	125666000
Burn 50-59% (ACC)	Trauma	125666000
Burn 60-69% (ACC)	Trauma	125666000
Burn 70-79% (ACC)	Trauma	125666000
Burn 80-89% (ACC)	Trauma	125666000
Concussion	Trauma	81371004
Concussion (ACC)	Trauma	81371004
Contusion	Trauma	125667009
Contusion of abdominal wall (ACC)	Trauma	125667009
Contusion of ankle (ACC)	Trauma	125667009
Contusion of back (ACC)	Trauma	125667009
Contusion of breast (ACC)	Trauma	125667009
Contusion of buttock (ACC)	Trauma	125667009
Contusion of cheek (ACC)	Trauma	125667009
Contusion of chest (ACC)	Trauma	125667009
Contusion of chin (ACC)	Trauma	125667009
Contusion of clavicular area (ACC)	Trauma	125667009
Contusion of coccyx (ACC)	Trauma	125667009
Contusion of ear (ACC)	Trauma	125667009
Contusion of elbow & or forearm (ACC)	Trauma	125667009
Contusion of elbow (ACC)	Trauma	125667009
Contusion of eye socket (black eye) (ACC)	Trauma	125667009
Contusion of face (ACC)	Trauma	125667009
Contusion of finger (ACC)	Trauma	125667009
Contusion of flank (ACC)	Trauma	125667009
Contusion of foot (ACC)	Trauma	125667009
Contusion of forearm (ACC)	Trauma	125667009
Contusion of forehead (ACC)	Trauma	125667009
Contusion of genitals (ACC)	Trauma	125667009
Contusion of groin (ACC)	Trauma	125667009
Contusion of heel (ACC)	Trauma	125667009
Contusion of hip (ACC)	Trauma	125667009
Contusion of jaw (ACC)	Trauma	125667009
Contusion of knee (ACC)	Trauma	125667009
Contusion of lip (ACC)	Trauma	125667009

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3	Contusion of lower back (ACC)	Trauma	125667009
4	Contusion of lower leg (ACC)	Trauma	125667009
5	Contusion of mouth (ACC)	Trauma	125667009
6	Contusion of multiple fingers (ACC)	Trauma	125667009
7	Contusion of multiple sites (ACC - describe in notes)	Trauma	125667009
8	Contusion of neck (ACC)	Trauma	125667009
9	Contusion of nose (ACC)	Trauma	125667009
10	Contusion of pelvic region (ACC)	Trauma	125667009
11	Contusion of scalp (ACC)	Trauma	125667009
12	Contusion of shoulder region (ACC)	Trauma	125667009
13	Contusion of thigh (ACC)	Trauma	125667009
14	Contusion of throat (ACC)	Trauma	125667009
15	Contusion of toe(s) (ACC)	Trauma	125667009
16	Contusion of upper arm (ACC)	Trauma	125667009
17	Contusion of wrist &or hand (ACC)	Trauma	125667009
18	Contusion of wrist (ACC)	Trauma	125667009
19	Crush injury	Trauma	125665001
20	Crush injury of ankle &or foot excluding toe(s) (ACC)	Trauma	125665001
21	Crush injury of elbow &or forearm (ACC)	Trauma	125665001
22	Crush injury of hand excluding finger(s) (ACC)	Trauma	125665001
23	Crush injury of head &or neck (ACC)	Trauma	125665001
24	Crush injury of hip &or thigh (ACC)	Trauma	125665001
25	Crush injury of knee &or lower leg (ACC)	Trauma	125665001
26	Crush injury of shoulder &or upper arm (ACC)	Trauma	125665001
27	Crush injury of toe(s) (ACC)	Trauma	125665001
28	Crush injury of trunk (ACC)	Trauma	125665001
29	Crush injury of wrist &or hand (ACC)	Trauma	125665001
30	Decompression Sickness	Trauma	89684003
31	Degloving injury of finger (ACC)	Trauma	284554003
32	Degloving injury of hand (ACC)	Trauma	284554003
33	Degloving injury of multiple fingers (ACC)	Trauma	284554003
34	Dislocated ankle (ACC)	Trauma	108367008
35	Dislocated elbow (ACC)	Trauma	108367008
36	Dislocated finger or thumb (ACC)	Trauma	108367008
37	Dislocated hip (ACC)	Trauma	108367008
38	Dislocated patella (ACC)	Trauma	108367008
39	Dislocated shoulder (ACC)	Trauma	108367008
40	Dislocated wrist (ACC)	Trauma	108367008
41	Dislocation	Trauma	108367008
42	Dislocations sprains and strains involving head with neck (ACC)	Trauma	108367008
43	Dog bite	Trauma	217697000
44	Dog bite (ACC)	Trauma	217697000
45	Drowning	Trauma	40947009
46	Drowning (ACC)	Trauma	40947009
47	Electrocution	Trauma	219359001
48	Electrocution (ACC)	Trauma	219359001
49	Explosion (ACC)	Trauma	219340003
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Eye Injury	Trauma	282752000
Eye symptom	Trauma	282752000
Fall (ACC)	Trauma	398117008
Fall minor injury	Trauma	398117008
Fall without injury	Trauma	85151000119101
Foreign body	Trauma	125670008
Foreign body in anus &or rectum (ACC)	Trauma	125670008
Foreign body in bladder &or urethra (ACC)	Trauma	125670008
Foreign body in ear (ACC)	Trauma	125670008
Foreign body in mouth &or oesophagus &or stomach (ACC)	Trauma	125670008
Foreign body in nose (ACC)	Trauma	125670008
Foreign body in pharynx &or larynx (ACC)	Trauma	125670008
Foreign body in vulva &or vagina (ACC)	Trauma	125670008
Foreign body on external eye (ACC)	Trauma	125670008
Fracture	Trauma	125605004
Fracture of ankle (ACC)	Trauma	125605004
Fracture of clavicle (ACC)	Trauma	125605004
Fracture of face bones (ACC)	Trauma	125605004
Fracture of finger(s) (ACC)	Trauma	125605004
Fracture of foot (ACC)	Trauma	125605004
Fracture of humerus (ACC)	Trauma	125605004
Fracture of knee (ACC)	Trauma	125605004
Fracture of neck of femur (ACC)	Trauma	125605004
Fracture of patella (ACC)	Trauma	125605004
Fracture of pelvis (ACC)	Trauma	125605004
Fracture of radius &or ulna (ACC)	Trauma	125605004
Fracture of ribs (ACC)	Trauma	125605004
Fracture of scapula (ACC)	Trauma	125605004
Fracture of shaft of femur (ACC)	Trauma	125605004
Fracture of skull (ACC)	Trauma	125605004
Fracture of sternum (ACC)	Trauma	125605004
Fracture of tibia &or fibula (ACC)	Trauma	125605004
Fracture of toe(s) (ACC)	Trauma	125605004
Fracture of wrist &or hand (ACC)	Trauma	125605004
Fractures involving multiple body regions (ACC)	Trauma	125605004
Fractures of multiple limbs (ACC)	Trauma	125605004
Frostbite of face (ACC)	Trauma	86018005
Frostbite of foot (ACC)	Trauma	35195001
Frostbite of hand (ACC)	Trauma	4763005
Gun shot	Trauma	283545005
Gun shot (ACC)	Trauma	283545005
Haematoma (ACC)	Trauma	125667009
Haemothorax	Trauma	31892009
Hanging	Trauma	219329006
Hanging strangulation or suffocation of unknown intent (ACC)	Trauma	219329006
Insect sting (ACC)	Trauma	23361001



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3	Insect sting/bite	Trauma	23361001
4	Intentional hanging (ACC)	Trauma	219329006
5	Laceration	Trauma	312608009
6	Laceration of abdomen (ACC)	Trauma	312608009
7	Laceration of ankle (ACC)	Trauma	312608009
8	Laceration of back (ACC)	Trauma	312608009
9	Laceration of breast (ACC)	Trauma	312608009
10	Laceration of buttock (ACC)	Trauma	312608009
11	Laceration of calf (ACC)	Trauma	312608009
12	Laceration of cheek (ACC)	Trauma	312608009
13	Laceration of chest wall (ACC)	Trauma	312608009
14	Laceration of ear region (ACC)	Trauma	312608009
15	Laceration of elbow (ACC)	Trauma	312608009
16	Laceration of eye (ACC)	Trauma	312608009
17	Laceration of eye region (ACC)	Trauma	312608009
18	Laceration of eyebrow (ACC)	Trauma	312608009
19	Laceration of eyelid (ACC)	Trauma	312608009
20	Laceration of finger (ACC)	Trauma	312608009
21	Laceration of foot (ACC)	Trauma	312608009
22	Laceration of forearm (ACC)	Trauma	312608009
23	Laceration of forehead (ACC)	Trauma	312608009
24	Laceration of genitalia (ACC)	Trauma	312608009
25	Laceration of hand (ACC)	Trauma	312608009
26	Laceration of head (ACC)	Trauma	312608009
27	Laceration of head and neck (ACC)	Trauma	312608009
28	Laceration of hip (ACC)	Trauma	312608009
29	Laceration of knee (ACC)	Trauma	312608009
30	Laceration of lip (ACC)	Trauma	312608009
31	Laceration of lower leg (ACC)	Trauma	312608009
32	Laceration of neck (ACC)	Trauma	312608009
33	Laceration of nose (ACC)	Trauma	312608009
34	Laceration of shin (ACC)	Trauma	312608009
35	Laceration of shoulder (ACC)	Trauma	312608009
36	Laceration of thigh (ACC)	Trauma	312608009
37	Laceration of thumb (ACC)	Trauma	312608009
38	Laceration of toe (ACC)	Trauma	312608009
39	Laceration of upper arm (ACC)	Trauma	312608009
40	Laceration of upper limb (ACC)	Trauma	312608009
41	Laceration of wrist (ACC)	Trauma	312608009
42	Left hemiparesis	Trauma	90584004
43	Loss of teeth due to an accident (ACC)	Trauma	196439008
44	Major trauma of multiple regions	Trauma	219340003
45	Multi-system trauma (ACC)	Trauma	262519004
46	NAI - Non-accidental injury (ACC)	Trauma	420025004
47	Other injury (ACC - describe in notes)	Trauma	417746004
48	Other abrasion &or friction burn (ACC - describe in notes)	Trauma	399963005
49	Other contusion (ACC - describe in notes)	Trauma	125667009
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Other crush injury (ACC - describe in notes)	Trauma	125665001
Paralysis (ACC)	Trauma	90584004
Paraplegia	Trauma	90584004
Quadriplegia	Trauma	90584004
Right hemiparesis	Trauma	90584004
Rupture of achilles tendon (ACC)	Trauma	282026002
Self inflicted lacerations to wrist	Trauma	312608009
Sexual abuse (ACC)	Trauma	213017001
Sexual assault (ACC)	Trauma	422608009
Shock (ACC & MED)	Trauma	27942005
Skin tear	Trauma	428220001
Skin tear (ACC)	Trauma	428220001
Soft tissue injury	Trauma	282026002
Spinal cord injury	Trauma	90584004
Sprain of ankle &or foot (ACC)	Trauma	282026002
Sprain of elbow &or forearm (ACC)	Trauma	282026002
Sprain of finger (ACC)	Trauma	282026002
Sprain of hip (ACC)	Trauma	282026002
Sprain of knee (ACC)	Trauma	282026002
Sprain of shoulder (ACC)	Trauma	282026002
Sprain of thumb	Trauma	282026002
Sprain of wrist &or hand (ACC)	Trauma	282026002
Stab wound	Trauma	425322008
Stab wound (ACC)	Trauma	425322008
Sunburn (ACC)	Trauma	125666000
Superficial abrasion (ACC)	Trauma	399963005
Superficial bruising (ACC)	Trauma	125667009
Suspected victim of child abuse	Trauma	162596006
Swollen eye(s) (ACC)	Trauma	282752000
Traumatic brain injury	Trauma	127295002
Traumatic brain injury (ACC)	Trauma	127295002
Traumatic cervical spine pain (ACC)	Trauma	90584004
Traumatic haemothorax (ACC)	Trauma	31892009
Wound of ankle (ACC)	Trauma	312608009
Wound of buttock (ACC)	Trauma	312608009
Wound of chest (ACC)	Trauma	312608009
Wound of ear (ACC)	Trauma	312608009
Wound of face (ACC)	Trauma	312608009
Wound of finger(s) (ACC)	Trauma	312608009
Wound of forearm (ACC)	Trauma	312608009
Wound of hand (ACC)	Trauma	312608009
Wound of hip &or thigh (ACC)	Trauma	312608009
Wound of knee (ACC)	Trauma	312608009
Wound of lip (ACC)	Trauma	312608009
Wound of lower abdomen (ACC)	Trauma	312608009
Wound of mouth (ACC)	Trauma	312608009
Wound of neck (ACC)	Trauma	312608009
Wound of nose (ACC)	Trauma	312608009

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Wound of scalp (ACC)	Trauma	312608009
Wound of upper abdomen (ACC)	Trauma	312608009
Wound of upper arm (ACC)	Trauma	312608009
Wounds of multiple areas (ACC)	Trauma	312608009

For peer review only

## Supplementary data

**Supplementary Table 2. Changes in absolute event rates per week during the Lockdown compared to Pre-Lockdown period.**

	Pre-Lockdown	Lockdown	Ratio (95% CI)	P-value
	Mean $\pm$ SD/week	Mean $\pm$ SD/week		
Abdominal Pain	629 $\pm$ 37	648 $\pm$ 25	1.03 (1.00 - 1.06)	0.17
Cardiac	846 $\pm$ 67	816 $\pm$ 67	0.96 (0.88 - 1.04)	0.39
Collapse	377 $\pm$ 25	303 $\pm$ 26	0.80 (0.73 - 0.88)	0.002
Haemorrhage	151 $\pm$ 18	143 $\pm$ 5	0.95 (0.93 - 0.96)	0.02
Infection	515 $\pm$ 66	474 $\pm$ 56	0.92 (0.81 - 1.02)	0.18
Mental Health	193 $\pm$ 27	264 $\pm$ 30	1.37 (1.22 - 1.51)	0.005
Metabolic	395 $\pm$ 29	323 $\pm$ 21	0.82 (0.77 - 0.87)	0.001
Other Medical	1062 $\pm$ 73	975 $\pm$ 41	0.92 (0.88 - 0.95)	0.01
Pain	949 $\pm$ 94	867 $\pm$ 32	0.91 (0.89 - 0.93)	<0.001
Poisoning	255 $\pm$ 21	160 $\pm$ 6	0.63 (0.61 - 0.64)	<0.001
Respiratory	932 $\pm$ 191	690 $\pm$ 119	0.74 (0.61 - 0.86)	0.01
Stroke	188 $\pm$ 16	183 $\pm$ 11	0.97 (0.92 - 1.03)	0.38
Trauma	1616 $\pm$ 129	1307 $\pm$ 73	0.81 (0.77 - 0.85)	<0.001
Grand Total	8139 $\pm$ 253	7248 $\pm$ 188	0.89 (0.87 - 0.91)	<0.001

\*P<0.05 is significant; Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding.

**Supplementary Table 3. Mechanism of Injury.**

	Pre-Lockdown	Lockdown	Ratio (95% CI)	P-value
	Mean $\pm$ SD/week	Mean $\pm$ SD/week		
Alcohol Contributed - Yes	411 $\pm$ 35	260 $\pm$ 31	0.63 (0.55 - 0.71)	<0.001
Assault	122 $\pm$ 15	89 $\pm$ 13	0.73 (0.61 - 0.84)	0.004
Fall	1039 $\pm$ 50	921 $\pm$ 27	0.89 (0.86 - 0.91)	<0.001
Other	539 $\pm$ 44	451 $\pm$ 21	0.84 (0.80 - 0.87)	<0.001
Road traffic crash	340 $\pm$ 39	104 $\pm$ 31	0.30 (0.20 - 0.41)	<0.001

\*P<0.05 is significant; Independent t-test for continuous values. Missing values were Mechanism of Injury (15.1%, of Trauma cases) and whether Alcohol Contributed (27.1%). The proportion of missing values for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding.

**STROBE Statement**

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	X
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	X
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	X
Objectives	3	State specific objectives, including any prespecified hypotheses	X
Study design	4	Present key elements of study design early in the paper	X
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up and data collection	X
Participants	6	<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	X
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	X
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	X
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
		(a) Describe all statistical methods, including those used to control for confounding	X
		(b) Describe any methods used to examine subgroups and interactions	X
		(c) Explain how missing data were addressed	X
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	
Statistical methods	12	<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	

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Section/Topic	Item No	Recommendation	Reported on Page No
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	X
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	X
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	X
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	X
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	X
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	X
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	X
Generalisability	21	Discuss the generalisability (external validity) of the study results	X
<b>Other Information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	X

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Changes in demand for emergency ambulances during a nationwide lockdown that resulted in elimination of COVID-19: an observational study from New Zealand.

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# Changes in demand for emergency ambulances during a nationwide lockdown that resulted in elimination of COVID-19: An observational study from New Zealand.

Bridget Dicker<sup>a,b</sup>, Andy Swain<sup>a,c</sup>, Verity Todd<sup>a,b</sup>, Bronwyn Tunnage<sup>a,b</sup>, Emma Mcconachy<sup>a</sup>, Haydn Drake<sup>a</sup>, Michelle Brett<sup>b</sup>, Dan Spearing<sup>b</sup>, Graham Howie<sup>a,b</sup>

- a. Paramedicine Department, Auckland University of Technology, Auckland, New Zealand
- b. Clinical Audit and Research, St John New Zealand, Auckland, New Zealand
- c. Wellington Free Ambulance, Wellington, New Zealand

Corresponding author:

Bridget Dicker

St John New Zealand

604 Great South Road

Ellerslie

Auckland 1051

New Zealand

Telephone: +64 27 705 2617

Email: [bridget.dicker@stjohn.org.nz](mailto:bridget.dicker@stjohn.org.nz)

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## Keywords

COVID-19; Ambulance Demand, Emergency medical service, Paramedic, Lockdown, Pandemic

## Abstract

### Objective

To examine the impact of a 5-week national lockdown on ambulance service demand during the COVID-19 pandemic in New Zealand.

### Design

A descriptive cross-sectional, observational study.

### Setting

High quality data from ambulance electronic clinical records, New Zealand.

### Participants

Ambulance records were obtained from 588,690 attendances during Pre-Lockdown (prior to 17 Feb 2020) and from 36,238 records during the Lockdown period (23 March to 26 April 2020).

### Main outcome measures

Ambulance service utilisation during Lockdown was compared to Pre-Lockdown: a) Descriptive analyses of ambulance events and proportions of event types for each period, b) Absolute rates of ambulance attendance (event types / week) for each period.

### Results

During Lockdown ambulance patients were more likely to be attended at home and less likely to be aged between 16 and 25 years old.

There was a significant increase in the proportion of lower acuity patients (Status 3 and Status 4) attended ( $p<0.001$ ) and a corresponding increase in patients not transported from scene ( $p<0.001$ ).

Road Traffic Crashes ( $p<0.001$ ) and alcohol-related incidents ( $p<0.001$ ) significantly decreased.

There was a decrease in the absolute number of weekly ambulance attendances (Ratio (95%CI), 0.89 (0.87 - 0.91),  $p<0.001$ ), attendances to Respiratory Conditions (0.74 (0.61 - 0.86),  $p=0.01$ ), and Trauma (0.81 (0.77 - 0.85),  $p<0.001$ ). However, there was a significant increase in ambulance attendances for Mental Health Conditions (1.37 (1.22 - 1.51),  $p=0.005$ ).

## Conclusions

Despite the relative absence of COVID-19 in the community during the 5-week nationwide lockdown there were significant differences in ambulance utilisation during this period. The lockdown was associated with an increase in ambulance attendances for Mental Health conditions and is of concern. In considering future lockdowns the potential implications on a population's mental well-being will need to be seriously considered against the benefits of elimination in community rates of virus transmission.

## Strengths and limitations of this study

- Ambulance utilisation during the lockdown period was able to be studied in an environment with minimal presence of COVID-19 in the community.
- Our study is a retrospective cohort study of over 600,000 ambulance records.
- The study is national, encompassing ambulance services across the whole of New Zealand.
- The 'Clinical Impressions' are relatively broad categories, clustering some disparate diseases together.
- Data was analysed retrospectively, and this unavoidably influences the interpretation of results.

## Introduction

Between December 2019 and January 2020, the first cases of coronavirus COVID-19 were detected in Wuhan, China<sup>1</sup>. By the end of January 2020 more than 7818 cases were reported worldwide<sup>2</sup>. In New Zealand, a high-income island nation in the South Pacific, the first cases of the COVID-19 virus were detected on the 28 February 2020 and peaked at 89 new cases per day on 5 April 2020<sup>3</sup>. A stringent public health intervention strategy was successfully utilised to prevent the community spread of the virus in New Zealand. This required all residents to stay at home other than for essential purposes. All businesses, schools and facilities were closed from 23 March until 27 April. Citizens were required to isolate within domestic 'bubbles'; two-metre physical distancing was stipulated outside the home boundary. Primary healthcare consultations were undertaken by phone or video, with prescriptions being dispatched to pharmacies close to the patient. Governmental messaging urged citizens to avoid hospitals where possible<sup>4</sup>. There was widespread compliance with the 'Stay at Home' mandate and this nationwide lockdown which included border closures effectively curtailed community transmission of the virus. As of the end of the lockdown period (27 April 2020) New Zealand, with a population of 4.8 million, had 1476 COVID-19 cases and 19 deaths; by comparison Ireland, a country of a similar population (4.9 million), experienced 20253 cases and 1190 deaths<sup>4,5</sup>.

Lockdowns can slow or even eliminate a viral pandemic, however enforced lockdowns may also have profound effects on healthcare utilisation by the population<sup>6</sup>. In particular, there is concern that the public may be fearful of contracting infection by attending a medical facility or general practitioner. In England presentations to emergency departments decreased by 25% during the second week of their lockdown<sup>7</sup>. Similarly, Austria recorded a decrease in admissions for acute coronary syndromes during their quarantine/lockdown period<sup>8</sup>. In areas of high COVID-19 prevalence there may have been reluctance or advice not to present to emergency departments due to an overwhelmed health system<sup>9</sup>. In the above examples it is difficult to determine whether it is the effects of the lockdown, or the presence of COVID-19 in the community, that changes the normal demand for health support.

If the pandemic response changes healthcare utilisation by the public, what impact does this have on ambulance services? The progressive eradication of COVID-19 for a period of three months in New Zealand gave us the opportunity to study the impacts of a nationwide and border lockdown on ambulance service utilisation. The objective of this study was to examine the impact of a 5-week national lockdown on ambulance service demand during the COVID-19 pandemic in New Zealand. This will inform health authorities of the likely impact of future pandemic lockdowns on ambulance services.

## Methods

## Design

This was a descriptive, cross-sectional study of ambulance attendances within New Zealand during Pre-lockdown and Lockdown periods. The study was performed at a national level.

## The data

Details for all events attended by New Zealand road ambulances (St John and Wellington Free Ambulance services) are recorded electronically by Paramedics at the scene. Data for this study were extracted retrospectively from this dataset.

## Inclusion and exclusion criteria

The Pre-lockdown dataset included all ambulance attendances during the periods 1 March 2018 (when clinical data went electronic) to 30 Nov 2018, and 1 July 2019 to 16 Feb 2020, a total of 72 weeks. Data from 1 December 2018 to 30 June 2019 was not available due to ambulance service industrial action during this time.

The nationwide Lockdown included all ambulance attendances during the 5-week period 23 March 2020 to 26 April 2020.

## Population demographics

Variables included: Sex, Age, Ethnicity, Rurality, and Location type (Aged Care Facility, Healthcare Facility, Public/other, Home). Three ethnicity groupings were analysed: Māori (the indigenous population of New Zealand), Pacific Peoples (people predominantly from South Pacific Islands including Samoa, Cook Islands, Tonga and Niue), and European/Others. All other ethnicities, which comprised less than 5% of the dataset, were included within the European/Others cohort.

Rurality (urban versus rural) was determined by Statistics New Zealand 2013 Census Meshblocks aligned to the address/location of the event<sup>10</sup>. For the purposes of this study, urban and rural were defined by the following Statistics New Zealand Meshblock descriptors: urban included 'Main Urban Area' and 'Secondary Urban Area', whilst rural included 'Minor Urban Area', 'Rural Centre' and 'Other Rural'<sup>10</sup>.

## Clinical presentation and disposition

Clinical Impression is the ambulance clinician's working diagnosis. For the purposes of this study, over 600 possible Clinical Impressions were up-grouped into generic categories to enable an overarching descriptive analysis. The grouping of these Clinical Impressions is available as supplementary data, table S1. Mechanism

1  
2 of Injury is recorded only for trauma cases. Patient Disposition variables included Transport versus non-  
3 Transport with reasons. Final patient acuity is defined by the attending paramedics utilising five assigned  
4 Status Codes (1-immediate threat to life, 2-potential threat to life, 3-unlikely threat to life, 4-no threat to life,  
5 0-dead). Status 3 and Status 4 patients were considered low acuity.  
6  
7  
8  
9

## 10 **Patient and public involvement**

11  
12 This research did not draw on patient or public involvement. Patients were not invited to comment on the  
13 study design and were not consulted to develop patient relevant outcomes or interpret the results. Research  
14 findings will be widely disseminated through public, official, personal, and social communication tools.  
15  
16  
17

## 18 **Statistical analyses**

19  
20 The distribution of variables within each time period were described as totals and percentages of total  
21 numbers. Pearson's Chi-Square test and the z-test for column proportions were used to compare nominal  
22 values. Statistically significant differences were considered to be meaningful only if they differed during  
23 Lockdown compared with Pre-Lockdown by more than 1.5%. Effect size was calculated using the Cohen's *d*  
24 test. Effect size was considered Small 0.2 – 0.4, Medium 0.5 to 0.7 and Large  $\geq 0.8$ .  
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29  
30 The two-tailed independent samples t-test was used to compare mean changes in ambulance attendances  
31 per week. Data presented are: mean, standard deviation and ratios with 95% confidence intervals (CI). Data  
32 analysis was performed using IBM SPSS (V.26.0). A p-value of  $<0.05$  was considered statistically significant.  
33  
34  
35

## 36 **Results**

37  
38  
39 Overall, 624,928 patients were attended by New Zealand Ambulance services and were included in the study.  
40 These were 588,690 patients during the Pre-lockdown period and 36,238 during the Lockdown period.  
41  
42  
43

## 44 **Demographics**

45  
46 Compared to the Pre-lockdown period, there were statistically significant differences in the distribution of  
47 cases during the Lockdown (supplementary data, table S2). Those variables which differed during Lockdown  
48 compared with Pre-Lockdown by more than 1.5% included a lower proportion of patients attended who were  
49 in the 16 to 25 years age group (table 1). There were no statistical differences in the proportions of patients  
50 according to ethnicity or rurality.  
51  
52  
53

54  
55 During Lockdown there was a large increase in the proportion of patients attended in their homes, and a  
56 decrease in the proportion of patients attended in other locations (Healthcare, Public/Other) (table 1).  
57  
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60 6

**Table 1. Descriptive analysis, demographics (n=624,928). Changes in distribution.**

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	Δ % = LD – PL	P-value
<b>Sex</b>				<b>0.01</b>
Female	309991 (52.7%)	19326 (53.4%)	0.7%	
Male	278232 (47.3%)	16854 (46.6%)	-0.7%	
<b>Age</b>				<b>&lt;0.001</b>
0-5	27258 (4.6%)	1326 (3.7%)	-1.0%	
6-15	21401 (3.6%)	934 (2.6%)	-1.1%	
16-25	57119 (9.7%)	2875 (7.9%)	<b>-1.8%</b>	
26-45	92530 (15.7%)	6201 (17.1%)	1.4%	
46-65	122699 (20.9%)	7948 (22.0%)	1.1%	
>65	267540 (45.5%)	16917 (46.7%)	1.3%	
<b>Ethnicity</b>				<b>0.07</b>
European/Other	424918 (82.6%)	25998 (83.1%)	0.5%	
Māori	61858 (12.0%)	3664 (11.7%)	-0.3%	
Pacific Peoples	27709 (5.4%)	1623 (5.2%)	-0.2%	
<b>Rurality</b>				<b>0.25</b>
Rural	129002 (22.5%)	7948 (22.3%)	-0.3%	
Urban	444054 (77.5%)	27774 (77.8%)	0.3%	
<b>Location</b>				<b>&lt;0.001</b>
Aged Care Facility	33334 (5.7%)	1689 (4.7%)	-1.0%	
Healthcare Facility†	51831 (8.8%)	1404 (3.9%)	<b>-4.9%</b>	
Public / other	111771 (19.0%)	2930 (8.1%)	<b>-10.9%</b>	
Home	390934 (66.5%)	30166 (83.4%)	<b>16.9%</b>	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent T-test for continuous values. Missing values were <3% for all variables except Ethnicity (14.6%), the proportion of missing values for this variable was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding. †Healthcare Facility refers to non-hospital treatment localities such as a general practice clinic.

## Clinical Presentation

Compared to Pre-lockdown, there was a statistically significant difference in the distribution of Clinical Impressions during the Lockdown period (supplementary data, table S3). Respiratory Conditions and Trauma were the Clinical Impressions whose proportions of patients decreased by more than 1.5% (table 2).

The proportion of incidents with suspected alcohol involvement decreased during Lockdown (table 2).

When comparing the Mechanisms of Injury to the Pre-lockdown period, there was a decrease in the proportion of Road Traffic Crashes, with a corresponding increase in the proportion of Falls and Other trauma.

**Table 2. Descriptive analysis, Clinical Impression (n=624,928). Changes in distribution.**

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	$\Delta$ % = LD – PL	P-value
<b>Clinical Impression</b>				<0.001
Abdominal Pain	45479 (7.8%)	3240 (9.1%)	1.3%	
Cardiac	61083 (10.4%)	4082 (11.4%)	1.0%	
Collapse	27296 (4.7%)	1516 (4.2%)	-0.4%	
Haemorrhage	10932 (1.9%)	717 (2.0%)	0.1%	
Infection	37374 (6.4%)	2369 (6.6%)	0.3%	
Mental Health	13966 (2.4%)	1318 (3.7%)	1.3%	
Metabolic	28580 (4.9%)	1616 (4.5%)	-0.4%	
Other Medical	76741 (13.1%)	4875 (13.6%)	0.5%	
Pain	68678 (11.7%)	4333 (12.1%)	0.4%	
Poisoning	18519 (3.2%)	802 (2.2%)	-0.9%	
Respiratory	67144 (11.5%)	3449 (9.6%)	<b>-1.8%</b>	
Stroke	13652 (2.3%)	916 (2.6%)	0.2%	
Trauma	117127 (20.0%)	6535 (18.3%)	<b>-1.7%</b>	
<b>Did alcohol contribute?</b>				<0.001
No	417011 (93.3%)	25493 (95.2%)	<b>1.9%</b>	
Yes	30076 (6.7%)	1300 (4.9%)	<b>-1.9%</b>	
<b>Mechanism of Injury</b>				<0.001
Assault	8924 (6.0%)	445 (5.7%)	-0.3%	
Fall	75225 (50.8%)	4603 (58.9%)	<b>8.0%</b>	
Other trauma	39278 (26.6%)	2254 (28.8%)	<b>2.3%</b>	
Road traffic crash	24534 (16.6%)	518 (6.6%)	<b>-10.0%</b>	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables except Did alcohol contribute? (27.1%) and Mechanism of Injury (15.1%, across all Trauma cases), the proportion of missing values for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding.

### Patient disposition

During Lockdown, there were significant changes in patient disposition. The proportion of patients that were deemed by ambulance staff not to require transport by ambulance increased, as did the proportion of lowest acuity patients (Status 3 and 4) (table 3 and supplementary data, table S4).

**Table 3. Descriptive analysis, patient disposition and acuity (n=624,928). Changes in distribution.**

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	$\Delta$ % = LD – PL	P-value
<b>Disposition</b>				<0.001
Transport	465237 (79.1%)	25112 (69.5%)	<b>-9.6%</b>	
Non-Transport	122975 (20.9%)	11022 (30.5%)	<b>9.6%</b>	
<b>Non-transport reason</b>				<0.001
Ambulance staff decision not to transport	105236 (85.6%)	9804 (89.0%)	<b>3.4%</b>	
Patient declined transport	17740 (14.4%)	1218 (11.1%)	<b>-3.4%</b>	
<b>Final status</b>				<0.001
Status 0	6692 (1.1%)	418 (1.2%)	0.0%	
Status 1 & Status 2	75940 (12.9%)	4110 (11.4%)	<b>-1.5%</b>	
Status 3 & Status 4	504533 (85.9%)	31550 (87.5%)	<b>1.5%</b>	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding.



## Event rates, mean number of attendances per week

During Lockdown there was an overall decrease in the absolute number of incidents per week attended by ambulance and this involved almost all Clinical Impressions, although the decreases seen in Cardiac, Infection, and Stroke rates were non-significant. The rate for Abdominal Pain rose, but was statistically non-significant (figure 1 and supplementary table S5). For all the Clinical Impressions that exhibited statistically significant decreases, this correlated with effect sizes in the 'medium to large' range, by the Cohen's *d* test (supplementary data, table S5).

During the lockdown there was a significant increase with a large effect size in the mean weekly rate of attendance to patients with clinical presentations of Mental Health (figure 1 and supplementary data, table S5).

Attendances at traumatic events were significantly decreased during the Lockdown period, as were rates of attendance at incidents where alcohol was considered a contributing factor (figure 2 and supplementary data, table S6). Weekly rates for all traumatic mechanisms of injury fell during Lockdown.

## Discussion

There was a striking difference in ambulance service utilisation during a national lockdown of the population in New Zealand. The lockdown lasted five weeks where everyone except essential workers were required to isolate at home, and only permitted to leave home for exercise within the local area while maintaining social distancing<sup>11</sup>. There were notable changes in demographics, patient acuity, disposition and mechanism of injury. Absolute numbers of weekly patient attendances diminished alongside attendances to a number of pertinent Clinical Impressions. There was a stark and significant increase in absolute numbers of ambulance attendances for Mental Health.

During the lockdown there was a reduction in the proportion of people aged 16-25 years attended and an increase in ambulance attendances to the home location.

A reduction in ambulance attendance to young people may be attributable to a potential decrease in usual injuries, recreational or accidental, as they may have been less exposed to sport or risk. Young people were also less exposed to endemic community infections through the closure of schools, workplaces, bars and night clubs, and confinement within the home. Studies have demonstrated an increased frequency of illness in association with school attendance<sup>12-14</sup>. Any going out at night, gathering and socialising of young adults in the 16 to 25 age group was prevented during lockdown. Additionally, increased hygiene practices such as handwashing could be expected to reduce the frequency of community acquired illnesses<sup>15 16</sup>.

1  
2 A greater proportion of calls were to events located at home, with a lesser proportion in public places. This  
3 likely reflects the government instruction for the population to stay at home. Lockdown did not appear to  
4 alter utilisation of ambulance care by different ethnic groups or the rural sector.  
5  
6

7  
8 The proportion of high acuity work decreased, as did the proportion of patients transported to an emergency  
9 department. This could be due to reluctance to transport patients to hospitals which might already be  
10 stretched with COVID-19 work, or perhaps patients were reluctant to be transported to facilities where they  
11 thought they might become infected themselves. It is noteworthy that during the total lockdown the number  
12 of actual COVID-19 cases in New Zealand was relatively small and hospital capacity never became an issue.  
13 In our study the reason for non-transport of patients was primarily at the recommendation of the attending  
14 staff, inferring that the patients did not require ambulance transport, rather than patients declining to be  
15 transported. Interestingly, this study indicates that during Lockdown a greater proportion of low acuity  
16 patients were requesting ambulance service attendance, and that many of them were not acutely unwell  
17 enough to require transport to a medical facility by ambulance. Perhaps this could also be a manifestation of  
18 decreased access to primary care services. General practice consultations were undertaken by phone or  
19 video during Lockdown and this could have presented a barrier to access for those unfamiliar with and/or  
20 without access to this technology.  
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31 There was a reduction in road traffic crashes, which may demonstrate compliance with the strict restrictions  
32 on travel that were imposed during lockdown. This was evident through Google Mobility data that indicated  
33 an average 88% reduction in the use of recreational and retail spaces during lockdown compared to  
34 baseline<sup>17</sup>. Supporting this, Ministry of Transport data demonstrated a reduction of retail petrol and diesel  
35 sales by 80%<sup>18</sup>. Also in line with our findings of an absolute reduction in trauma, there were 34 fewer fatal  
36 road traffic crashes during the lockdown compared to the same period in 2019<sup>18</sup>. The decrease in incidents  
37 involving alcohol is noteworthy. A recent survey conducted by the Health Promotion Agency indicated that  
38 during lockdown 47% of people drank the same as normal, whilst 34% drank less than normal with the  
39 remaining 19% drinking more than normal<sup>19</sup>. The majority of survey respondents who drank less than normal  
40 attributed this decrease to the closure of bars and night clubs, and an inability to socialise.  
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49 During the lockdown period, ambulance use diminished for almost every type of medical or traumatic event.  
50 In one sense, the requirement to 'Stay at Home' may have had a protective effect on the New Zealand  
51 population. Recent statistics indicate a decrease in weekly mortality in the first 23 weeks of 2020 compared  
52 with the same time in the preceding 3 years<sup>20</sup>. Attendance to Respiratory Conditions declined, which may be  
53 related to a decrease in transmission of usual airborne illnesses through decreases in social contact. Data  
54 collected from the New Zealand FluTracking website indicated an almost 10% decrease in self-reported  
55 influenza-like illness in the week ending 19 April 2020 compared with the same period in 2019<sup>21</sup>. A reduction  
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2 in the level of nitrous oxide in Asian and European countries indicative of a reduction in air pollution has been  
3 noted during periods of lockdown; such improvements in air quality may also have a protective effect from  
4 coryzal type illness<sup>22</sup>. This reduction in air pollution during lockdown was also found in New Zealand, with a  
5 41% reduction in daily carbon emissions during the 5 week period<sup>23</sup>.  
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9 The one type of ambulance presentation that dramatically increased, both in proportion of attendances and  
10 in absolute rates per week, was mental health conditions. These may have been triggered by the imposition  
11 of social isolation with its restriction in human-to-human contact<sup>24 25</sup>. Additionally, there was the impact of  
12 uncertainty directly related to the pandemic: the fear of contracting COVID-19, or of losing friends and family  
13 through the virus, plus for many, fear of financial difficulties, loss of employment or the family home. In New  
14 Zealand, the COVID-19 pandemic response was associated with the most severe restrictions on social  
15 freedoms in modern history, along with significant economic impacts. Although these measures were  
16 effective in eliminating community transmission of coronavirus, it appears to have affected the mental health  
17 of some citizens. Pandemic-induced increases in psychological distress have been reported in both Australia  
18 and the United Kingdom and more so among women, younger age groups, and those living with young  
19 children<sup>24 26</sup>. Those with pre-existing health inequalities such as older age and low income were at increased  
20 risk<sup>26</sup>. Lockdown has also been associated with a significant negative impact on the wellbeing of children and  
21 adolescents<sup>27</sup>. This impact is of particular concern, because routines and social interaction are critical factors  
22 for normal psychological development in these age groups.  
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33 In contrast to many other developed nations, New Zealand's lockdown restrictions were enforced early so  
34 that the health system was not overwhelmed and it experienced a reduction in overall volume. There was no  
35 significant rise in referrals to secondary mental health services during lockdown, though this was hardly  
36 surprising considering the reduction in primary care consultations (which are the predominant referral route  
37 to secondary mental health services)<sup>28</sup>. However, while there were physical restrictions on access to primary  
38 care during lockdown, no such restrictions existed for ambulance service utilisation, which saw a dramatic  
39 increase in attendances for mental health conditions.  
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46 When planning for additional periods of COVID-19 lockdown or for future pandemics, ambulance services  
47 should prepare to meet this increase in mental ill-health. The alteration in ambulance service demand  
48 between Pre-Lockdown and Lockdown conditions is unlikely to be due to community COVID-19 itself as the  
49 number of cases was minimal in New Zealand at the time of the lockdown. This study represents a unique  
50 analysis of ambulance service demand under the conditions of strict Lockdown.  
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## 55 **Limitations**

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2 Our 'Clinical Impressions' are relatively broad categories, clustering together some disparate disease  
3 conditions. (For example, asthma, COPD and chest infections are all categorised as 'Respiratory Conditions'.)  
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5 However, this provided a broad overview of ambulance utilisation, and was applied consistently across both  
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7 Pre-Lockdown and Lockdown periods. Similarly, our current data does not differentiate between common  
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9 mental health presentations, such as depression, anxiety, psychological distress; that will be the task of a  
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11 separate publication. In addition, the Poisoning category includes intentional poisoning and alcohol  
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13 intoxication. This categorisation may remove some potential suicide risk or self-harm cases from the Mental  
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15 Health group, and the reduction in alcohol consumption during lockdown may be obscuring smaller increases  
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17 in other types of poisoning within this broad Clinical Impression.

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19 Emergency call centre data was not included within this study. We only looked at ambulance attendance to  
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21 patients. As such, it is unknown if there were changes in the frequency and/or acuity of calls made to the  
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23 emergency services during the lockdown period.

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25 The data set has not been adjusted for seasonality or population growth. The broad Clinical Impressions and  
26  
27 population ages analysed meant that any such adjustment could be nuanced: changes in different Clinical  
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29 Impressions may differ by season, and changes in population growth in accordance with age may also impact  
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31 ambulance utilisation differently (for example, older populations have a higher utilisation of the ambulance  
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33 service). Future studies will focus on single Clinical Impressions and their sub-categories, and these will be  
34  
35 adjusted based on seasonality and population growth accordingly. Potential factors to adjust for overall  
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37 demand have been included within the supplementary data however the data-set (supplementary data, table  
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39 S7.)

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41 Lockdown was instituted less than a month after COVID-19 reached New Zealand. As a result, data has had  
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43 to be analysed retrospectively and this unavoidably influences the interpretation of results.

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45 Three of our variables had more than 10% missing data in the categories of Ethnicity, Alcohol Contribution  
46  
47 and Mechanism of Injury. Although the proportion of missing data was not different between Pre-Lockdown  
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49 and Lockdown periods, this may have biased analysis of these categories of data.

## 50 51 52 53 54 55 56 57 58 59 60

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61 A nationwide Lockdown during the COVID-19 pandemic proved to be very effective in controlling and  
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63 eliminating the spread of the coronavirus in New Zealand, but it significantly altered the pattern of demand  
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65 on ambulance care. 'Stay at Home' orders led to a reduction in many types of ambulance call-out, notably  
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67 respiratory conditions, trauma, and incidents involving alcohol. In contrast, Mental Health Conditions rose  
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69 significantly during this period of pandemic uncertainty, relating especially to confinement at home, reduced

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2 social contact, and loss of earnings for many. These changes occurred in the relative absence of COVID-19 in  
3 the community. In considering future lockdowns, the implications for the population's mental well-being  
4 needs to be seriously weighed against the benefits of elimination of virus transmission within the community.  
5 Ambulances services need to be prepared for an increased caseload of mental ill-health, should further  
6 lockdowns occur.  
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13 Figure 1: Changes in absolute event rates per week during the Lockdown compared to Pre-lockdown period.

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15 Figure 2: Changes in Mechanism of Injury during the Lockdown compared to Pre-lockdown period.  
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## 18 **Footnotes**

### 19 **Contributors**

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21  
22 BD contributed to the study design, contributed to the literature review, conducted the analysis and was  
23 primarily responsible for the article preparation. GH contributed to the literature review and to the  
24 interpretation of data and preparation of the paper. AS contributed to the study design, provided oversight  
25 of the project, interpretation of results and article preparation. VT, BT, EM, HD, MB and DS contributed to  
26 the study design, the literature review and to the interpretation of data and preparation of the paper.  
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35  
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37 other financial support to declare.  
38  
39  
40

### 41 **Competing interests**

42  
43 None declared.  
44  
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### 46 **Patient consent for publication**

47  
48 Not required.  
49  
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### 51 **Ethics**

52  
53 Ethical approval for this study was provided by the Auckland University of Technology Ethics Committee (No.  
54 20/151).  
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## Provenance and peer review

Not commissioned, externally peer reviewed.

## Data availability statement

Data are not available in accordance with the ethics committee approval.

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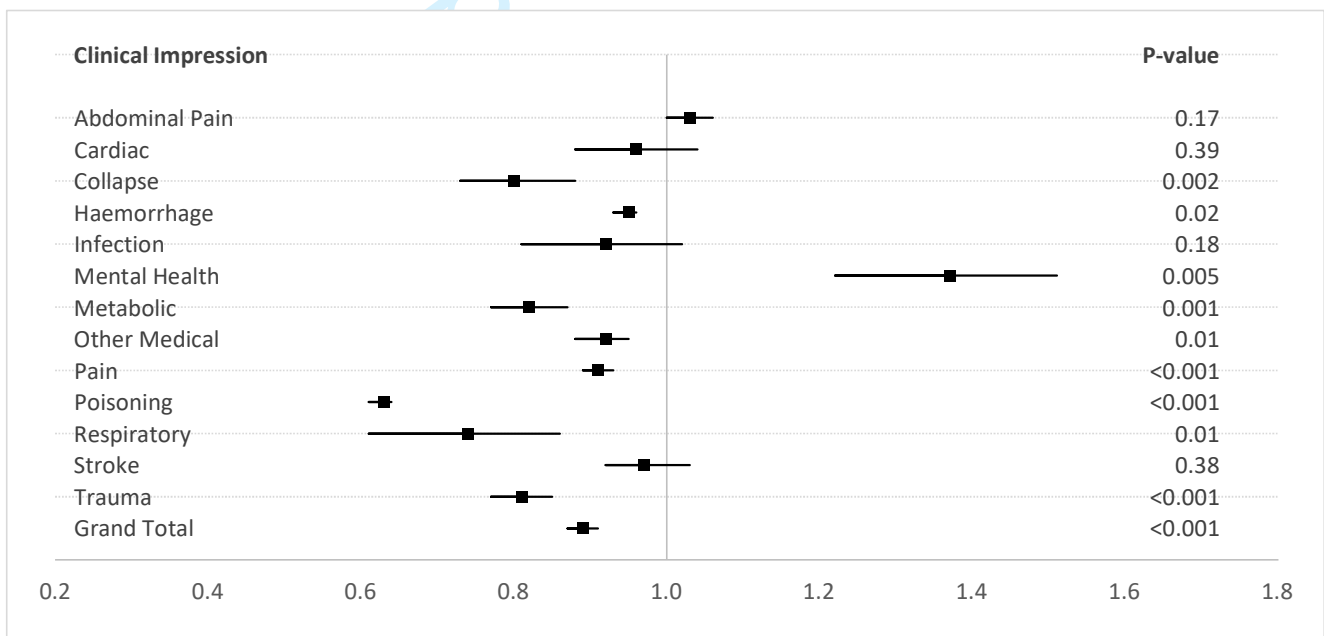
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Figure 1. Changes in absolute event rates per week during the Lockdown compared to Pre-lockdown period.



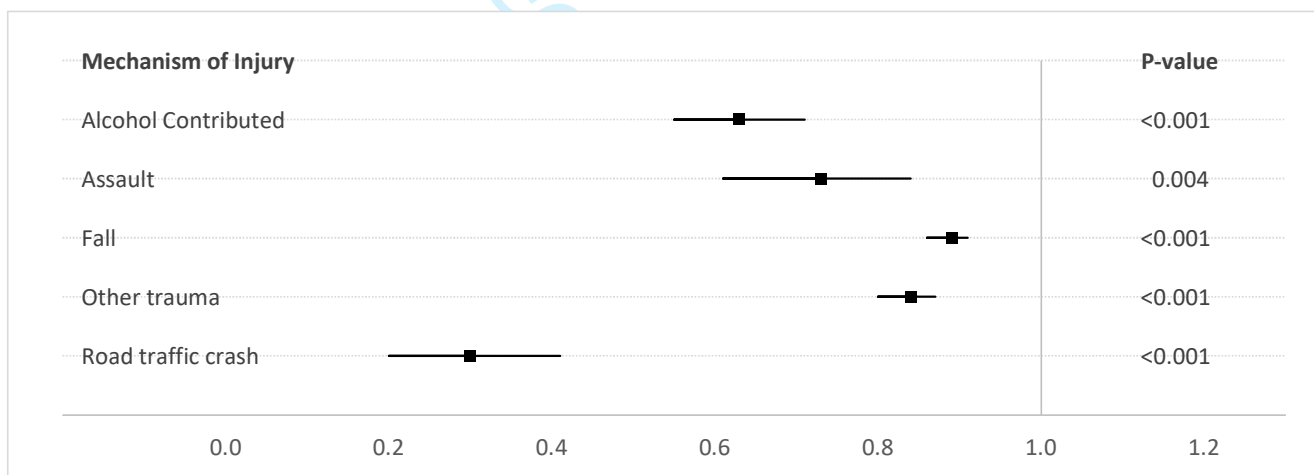
\*P<0.05 is significant; Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding.



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For peer review only

Figure 2. Changes in Mechanism of Injury during the Lockdown compared to Pre-lockdown period.



\*P<0.05 is significant; Independent t-test for continuous values. Missing values were Mechanism of Injury (15.1%, of Trauma cases) and whether Alcohol Contributed (27.1%). Missing data for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding.

**Table S1. List of Clinical Impressions and their generic categories**

Row Labels	Higher grouping
Abdominal aortic aneurysm	Abdominal Pain
Abdominal distension	Abdominal Pain
Abdominal mass	Abdominal Pain
Abdominal pain - cause unknown	Abdominal Pain
Abdominal pain (ACC & MED)	Abdominal Pain
Appendicitis	Abdominal Pain
Biliary colic	Abdominal Pain
Bowel obstruction	Abdominal Pain
Chronic constipation	Abdominal Pain
Constipation	Abdominal Pain
Cramp	Abdominal Pain
Epigastric pain	Abdominal Pain
Hernia	Abdominal Pain
Hernia of abdominal wall	Abdominal Pain
Incisional hernia	Abdominal Pain
Inguinal hernia	Abdominal Pain
Kidney stone	Abdominal Pain
Leaking abdominal aortic aneurysm	Abdominal Pain
Left flank pain	Abdominal Pain
Left iliac fossa pain	Abdominal Pain
Left lower quadrant pain	Abdominal Pain
Left sided abdominal pain	Abdominal Pain
Left upper quadrant pain	Abdominal Pain
Reflux	Abdominal Pain
Renal Colic	Abdominal Pain
Right flank pain	Abdominal Pain
Right iliac fossa pain	Abdominal Pain
Right lower quadrant pain	Abdominal Pain
Right sided abdominal pain	Abdominal Pain
Right upper quadrant pain	Abdominal Pain
Rupture of abdominal aortic aneurysm	Abdominal Pain
Torsion of testis	Abdominal Pain
Torsion of testis (ACC & MED)	Abdominal Pain
Acute myocardial infarction of anterior wall	Cardiac
Acute myocardial infarction of anterolateral wall	Cardiac
Acute myocardial infarction of inferior wall	Cardiac
Acute myocardial infarction of inferolateral wall	Cardiac
Acute myocardial infarction of inferoposterior wall	Cardiac
Acute myocardial infarction of septum	Cardiac
Acute ST segment elevation myocardial infarction	Cardiac
Angina	Cardiac
Atrial fibrillation	Cardiac
Atrial flutter	Cardiac
Atrial tachycardia	Cardiac
Bradycardia	Cardiac
Cardiac arrest	Cardiac
Cardiac Chest Pain	Cardiac
Cardiac dysrhythmia	Cardiac
Cardiogenic pulmonary oedema	Cardiac
Cardiogenic Shock	Cardiac
Congestive heart failure	Cardiac
Deceased	Cardiac
Disorder of implantable defibrillator	Cardiac
Left bundle branch block	Cardiac
Mobitz type 1 heart block	Cardiac
Mobitz type 2 heart block	Cardiac
Myocardial ischaemia	Cardiac
Non-cardiac chest pain	Cardiac
Palpitations	Cardiac
Pericarditis	Cardiac
Right bundle branch block	Cardiac
Right Heart Failure	Cardiac
Sick sinus syndrome	Cardiac
ST elevation myocardial infarction	Cardiac
SUDI - Sudden unexpected death of an infant	Cardiac
Supraventricular tachycardia	Cardiac

1	Tachycardia	Cardiac
2	Third degree heart block	Cardiac
3	Ventricular fibrillation	Cardiac
4	Ventricular tachycardia	Cardiac
5	Brief loss of consciousness	Collapse
6	Collapse	Collapse
7	Collapse - cause unknown	Collapse
8	Syncope	Collapse
9	Bleeding	Haemorrhage
10	Epistaxis	Haemorrhage
11	Haematuria	Haemorrhage
12	Haematuria ; Blood in urine	Haemorrhage
13	Haemorrhage	Haemorrhage
14	PR bleeding	Haemorrhage
15	PR bleeding (ACC & MED)	Haemorrhage
16	PV bleeding/Vaginal Bleeding	Haemorrhage
17	Vaginal bleeding	Haemorrhage
18	Varicose veins of the leg with rupture (ACC & MED)	Haemorrhage
19	Abscess	Infection
20	Abscess of ankle	Infection
21	Abscess of back except buttock	Infection
22	Abscess of buttock	Infection
23	Abscess of chest wall	Infection
24	Abscess of ear	Infection
25	Abscess of elbow	Infection
26	Abscess of eye	Infection
27	Abscess of face	Infection
28	Abscess of finger(s)	Infection
29	Abscess of flank	Infection
30	Abscess of foot	Infection
31	Abscess of forearm	Infection
32	Abscess of groin	Infection
33	Abscess of hand	Infection
34	Abscess of hip	Infection
35	Abscess of jaw	Infection
36	Abscess of knee	Infection
37	Abscess of lip	Infection
38	Abscess of lower leg	Infection
39	Abscess of neck	Infection
40	Abscess of nose	Infection
41	Abscess of shoulder	Infection
42	Abscess of thigh	Infection
43	Abscess of toe	Infection
44	Abscess of tongue	Infection
45	Abscess of upper arm	Infection
46	Abscess of wrist	Infection
47	Cellulitis	Infection
48	Cellulitis (ACC & MED)	Infection
49	Chickenpox	Infection
50	Dermatitis	Infection
51	Epiglottitis	Infection
52	Eye infection	Infection
53	Fever	Infection
54	Gallstone	Infection
55	Gangrene of foot	Infection
56	Gangrene of hand	Infection
57	Infected face	Infection
58	Infected hand	Infection
59	Infected insect bite	Infection
60	Infected thumb	Infection
	Infection	Infection
	Infection after injection infusion transfusion or vaccination	Infection
	Infection of ear	Infection
	Infection of finger(s)	Infection
	Infection of foot	Infection
	Infection of nail(s)	Infection
	Infection of obstetric surgical wound	Infection

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Infection of peritoneal dialysis catheter	Infection
Infection of skin	Infection
Infection of toe(s)	Infection
Joint swelling (ACC & MED)	Infection
Kidney infection ; Pyelonephritis	Infection
Measles	Infection
Meningitis	Infection
Meningococcaemia	Infection
Meningococcal infectious disease	Infection
Mumps	Infection
Norovirus	Infection
Other abscess (describe in notes)	Infection
Other infection (describe in notes)	Infection
Other infectious disease (describe in notes)	Infection
Pharyngitis ; Sore throat	Infection
Phlebitis	Infection
Postoperative wound infection	Infection
Rigor(s)	Infection
Rotavirus	Infection
Sepsis (ACC & MED)	Infection
Septic shock	Infection
Shingles	Infection
Sinusitis	Infection
Sore Throat	Infection
Tonsillitis	Infection
Tuberculosis	Infection
Urinary Tract Infection	Infection
Whooping Cough	Infection
Wound Infection	Infection
Anxiety	Mental Health
At risk for suicide	Mental Health
Chronic depression	Mental Health
Delirium	Mental Health
Dementia	Mental Health
Mental Health Problem	Mental Health
Suicidal	Mental Health
Abnormal behaviour	Metabolic
Agitated state	Metabolic
Confusion	Metabolic
DKA - Diabetic ketoacidosis	Metabolic
Epilepsy	Metabolic
Febrile convulsion	Metabolic
Hyperglycaemia	Metabolic
Hyperkalaemia	Metabolic
Hypoglycaemia	Metabolic
Post-ictal state	Metabolic
Seizure	Metabolic
Status Epilepticus	Metabolic
Abdominal pain in pregnancy	Other Medical
Abnormal gait	Other Medical
Abnormal involuntary movement	Other Medical
Abnormal vision	Other Medical
Accidental removal of catheter	Other Medical
Acute confusion	Other Medical
Allergic contact dermatitis	Other Medical
Allergic reaction to drug (ACC)	Other Medical
Allergic reaction to food (ACC)	Other Medical
Allergy	Other Medical
Altered sensation	Other Medical
Amnesia	Other Medical
Anaphylaxis	Other Medical
Anaphylaxis (ACC)	Other Medical
Angio-oedema	Other Medical
Antepartum haemorrhage	Other Medical
Aphasia	Other Medical
Birth	Other Medical
Bladder pain	Other Medical

1	Blocked catheter	Other Medical
2	Blurred vision	Other Medical
3	Breech presentation	Other Medical
4	Child at risk (ACC)	Other Medical
5	Complication occurring during labour and delivery	Other Medical
6	Complication of catheter	Other Medical
7	Complication of haemodialysis	Other Medical
8	Complication of urinary catheter	Other Medical
9	Decreased mobility	Other Medical
10	Dehydration	Other Medical
11	Diarrhoea	Other Medical
12	Diarrhoea and vomiting	Other Medical
13	Difficulty passing urine	Other Medical
14	Difficulty swallowing	Other Medical
15	Dizziness	Other Medical
16	Drug withdrawal	Other Medical
17	Dysarthria	Other Medical
18	Dysphasia	Other Medical
19	Dysuria	Other Medical
20	Ear problem	Other Medical
21	Ectopic pregnancy	Other Medical
22	End of Life Care	Other Medical
23	Food poisoning	Other Medical
24	Gastrointestinal bleeding	Other Medical
25	Generalised aches and pains (ACC & MED)	Other Medical
26	Generally unwell	Other Medical
27	Haematemesis	Other Medical
28	Haematemesis/ Vomiting Blood	Other Medical
29	Hallucinations	Other Medical
30	Hearing problem	Other Medical
31	Heat stroke (ACC & MED)	Other Medical
32	Hyperemesis of pregnancy	Other Medical
33	Hypertension	Other Medical
34	Hyperthermia	Other Medical
35	Hypotension	Other Medical
36	Hypothermia	Other Medical
37	Hypothermia (ACC & MED)	Other Medical
38	Hypovolaemia	Other Medical
39	Hypovolaemic shock (ACC & MED)	Other Medical
40	Illness of unknown cause	Other Medical
41	Labour	Other Medical
42	Lethargy	Other Medical
43	Lightheadedness	Other Medical
44	LOC - Loss of consciousness	Other Medical
45	Loss of consciousness	Other Medical
46	Malaise	Other Medical
47	Melaena	Other Medical
48	Miscarriage	Other Medical
49	Multiple birth	Other Medical
50	NAD - No abnormality detected (ACC & MED)	Other Medical
51	Nausea	Other Medical
52	Nausea and vomiting	Other Medical
53	No abnormality detected	Other Medical
54	Other illness or medical condition (describe in notes)	Other Medical
55	Palliative care	Other Medical
56	Peripheral ischaemia	Other Medical
57	Peripheral oedema	Other Medical
58	Photophobia	Other Medical
59	Postpartum haemorrhage	Other Medical
60	Pregnancy problem	Other Medical
	Premature delivery	Other Medical
	Premature labour	Other Medical
	Presentation for social reasons	Other Medical
	Pressure ulcer	Other Medical
	Pre-term Labour	Other Medical
	Priapism	Other Medical
	Referral for Social reason	Other Medical

1	Retained placenta	Other Medical
2	Skin problem	Other Medical
3	Skin Ulcer	Other Medical
4	Skin ulcer(s)	Other Medical
5	Undifferentiated illness	Other Medical
6	Urticaria	Other Medical
7	Vertigo	Other Medical
8	Visual difficulty	Other Medical
9	Vomiting	Other Medical
10	Weakness present	Other Medical
11	Acute back pain	Pain
12	Acute low back pain	Pain
13	Acute Pain	Pain
14	Acute pelvic pain (ACC and MED)	Pain
15	Anterior chest wall pain (ACC & MED)	Pain
16	Arthritis	Pain
17	Atypical chest pain	Pain
18	Chest pain - atypical	Pain
19	Chronic arthritis	Pain
20	Chronic back pain	Pain
21	Chronic low back pain	Pain
22	Chronic pain	Pain
23	Deep venous thrombosis	Pain
24	Flank pain	Pain
25	Gout	Pain
26	Headache	Pain
27	Hip pain	Pain
28	Hip pain (ACC & MED)	Pain
29	Joint pain	Pain
30	Low back pain	Pain
31	Migraine	Pain
32	Muscle pain (ACC & MED)	Pain
33	Musculoskeletal pain	Pain
34	Musculoskeletal pain (ACC)	Pain
35	Neck pain	Pain
36	Pain	Pain
37	Sciatica	Pain
38	Sprain of lumbar back (ACC)	Pain
39	Thoracic back pain	Pain
40	Toothache	Pain
41	Accidental poisoning by drug (ACC)	Poisoning
42	Accidental poisoning by substance other than drug (ACC)	Poisoning
43	Acute Drug Intoxication	Poisoning
44	Acute drug intoxication (ACC)	Poisoning
45	Adverse reaction to drug	Poisoning
46	Adverse reaction to drug (ACC & MED)	Poisoning
47	Alcohol abuse	Poisoning
48	Alcohol intoxication	Poisoning
49	Intentional Poisoning	Poisoning
50	Intentional poisoning by drug (ACC)	Poisoning
51	Intentional poisoning by substance other than drug (ACC)	Poisoning
52	Poisoning of unknown intent	Poisoning
53	Substance abuse (ACC)	Poisoning
54	Unintentional Poisoning	Poisoning
55	Abnormal breathing (ACC & MED)	Respiratory
56	Apnoea	Respiratory
57	Asphyxiation	Respiratory
58	Asphyxiation (ACC)	Respiratory
59	Aspiration of food (ACC)	Respiratory
60	Aspiration pneumonia (ACC & MED)	Respiratory
	Asthma	Respiratory
	Breathing painful	Respiratory
	Breathing problem of unknown cause	Respiratory
	Bronchiectasis	Respiratory
	Bronchiolitis	Respiratory
	Bronchitis	Respiratory
	Choking	Respiratory

1	Choking (ACC & MED)	Respiratory
2	Chronic obstructive pulmonary disease	Respiratory
3	Common cold	Respiratory
4	Cough	Respiratory
5	Croup	Respiratory
6	Exacerbation of CORD	Respiratory
7	Haemoptysis	Respiratory
8	Hyperventilation	Respiratory
9	Hypoxia	Respiratory
10	ILI - Influenza-like illness	Respiratory
11	Influenza-like illness	Respiratory
12	Left pneumothorax	Respiratory
13	Pleuritic pain	Respiratory
14	Pneumonia	Respiratory
15	Pneumothorax	Respiratory
16	Pneumothorax (ACC & MED)	Respiratory
17	Pulmonary embolism	Respiratory
18	Respiratory arrest	Respiratory
19	Respiratory tract infection	Respiratory
20	Right pneumothorax	Respiratory
21	Shortness of breath	Respiratory
22	Smoke Inhalation	Respiratory
23	Smoke Inhalation (ACC)	Respiratory
24	Stridor	Respiratory
25	Tachypnoea	Respiratory
26	Traumatic pneumothorax (ACC)	Respiratory
27	Stroke	Stroke
28	Transient ischaemic attack	Stroke
29	Transient ischaemic attack (TIA)	Stroke
30	Abrasion	Trauma
31	Abrasion of abdominal wall (ACC)	Trauma
32	Abrasion of ankle (ACC)	Trauma
33	Abrasion of back (ACC)	Trauma
34	Abrasion of buttock (ACC)	Trauma
35	Abrasion of chest wall (ACC)	Trauma
36	Abrasion of face (ACC)	Trauma
37	Abrasion of finger (ACC)	Trauma
38	Abrasion of flank (ACC)	Trauma
39	Abrasion of foot (ACC)	Trauma
40	Abrasion of forearm area (ACC)	Trauma
41	Abrasion of hand (ACC)	Trauma
42	Abrasion of head &or neck (ACC)	Trauma
43	Abrasion of hip (ACC)	Trauma
44	Abrasion of knee (ACC)	Trauma
45	Abrasion of lower leg (ACC)	Trauma
46	Abrasion of multiple fingers (ACC)	Trauma
47	Abrasion of scalp (ACC)	Trauma
48	Abrasion of shoulder (ACC)	Trauma
49	Abrasion of thigh (ACC)	Trauma
50	Abrasion of toe(s) (ACC)	Trauma
51	Abrasion of trunk (ACC)	Trauma
52	Abrasion of upper arm (ACC)	Trauma
53	Amputation	Trauma
54	Amputation of ear (ACC)	Trauma
55	Amputation of finger (ACC)	Trauma
56	Amputation of foot (ACC)	Trauma
57	Amputation of hand (ACC)	Trauma
58	Amputation of limb (ACC)	Trauma
59	Amputation of thumb (ACC)	Trauma
60	Amputation of toe (ACC)	Trauma
	Animal bite	Trauma
	Animal bite (ACC)	Trauma
	Assault (ACC)	Trauma
	At risk for falls	Trauma
	Avulsion	Trauma
	Avulsion of eye (ACC)	Trauma
	Avulsion of scalp (ACC)	Trauma

1	Bends (ACC)	Trauma
2	Broken teeth	Trauma
3	Burn	Trauma
4	Burn <10% (ACC)	Trauma
5	Burn >90% (ACC)	Trauma
6	Burn 10-19% (ACC)	Trauma
7	Burn 20-29% (ACC)	Trauma
8	Burn 30-39% (ACC)	Trauma
9	Burn 40-49% (ACC)	Trauma
10	Burn 50-59% (ACC)	Trauma
11	Burn 60-69% (ACC)	Trauma
12	Burn 70-79% (ACC)	Trauma
13	Burn 80-89% (ACC)	Trauma
14	Concussion	Trauma
15	Concussion (ACC)	Trauma
16	Contusion	Trauma
17	Contusion of abdominal wall (ACC)	Trauma
18	Contusion of ankle (ACC)	Trauma
19	Contusion of back (ACC)	Trauma
20	Contusion of breast (ACC)	Trauma
21	Contusion of buttock (ACC)	Trauma
22	Contusion of cheek (ACC)	Trauma
23	Contusion of chest (ACC)	Trauma
24	Contusion of chin (ACC)	Trauma
25	Contusion of clavicular area (ACC)	Trauma
26	Contusion of coccyx (ACC)	Trauma
27	Contusion of ear (ACC)	Trauma
28	Contusion of elbow &or forearm (ACC)	Trauma
29	Contusion of elbow (ACC)	Trauma
30	Contusion of eye socket (black eye) (ACC)	Trauma
31	Contusion of face (ACC)	Trauma
32	Contusion of finger (ACC)	Trauma
33	Contusion of flank (ACC)	Trauma
34	Contusion of foot (ACC)	Trauma
35	Contusion of forearm (ACC)	Trauma
36	Contusion of forehead (ACC)	Trauma
37	Contusion of genitals (ACC)	Trauma
38	Contusion of groin (ACC)	Trauma
39	Contusion of heel (ACC)	Trauma
40	Contusion of hip (ACC)	Trauma
41	Contusion of jaw (ACC)	Trauma
42	Contusion of knee (ACC)	Trauma
43	Contusion of lip (ACC)	Trauma
44	Contusion of lower back (ACC)	Trauma
45	Contusion of lower leg (ACC)	Trauma
46	Contusion of mouth (ACC)	Trauma
47	Contusion of multiple fingers (ACC)	Trauma
48	Contusion of multiple sites (ACC - describe in notes)	Trauma
49	Contusion of neck (ACC)	Trauma
50	Contusion of nose (ACC)	Trauma
51	Contusion of pelvic region (ACC)	Trauma
52	Contusion of scalp (ACC)	Trauma
53	Contusion of shoulder region (ACC)	Trauma
54	Contusion of thigh (ACC)	Trauma
55	Contusion of throat (ACC)	Trauma
56	Contusion of toe(s) (ACC)	Trauma
57	Contusion of upper arm (ACC)	Trauma
58	Contusion of wrist &or hand (ACC)	Trauma
59	Contusion of wrist (ACC)	Trauma
60	Crush injury	Trauma
	Crush injury of ankle &or foot excluding toe(s) (ACC)	Trauma
	Crush injury of elbow &or forearm (ACC)	Trauma
	Crush injury of hand excluding finger(s) (ACC)	Trauma
	Crush injury of head &or neck (ACC)	Trauma
	Crush injury of hip &or thigh (ACC)	Trauma
	Crush injury of knee &or lower leg (ACC)	Trauma
	Crush injury of shoulder &or upper arm (ACC)	Trauma



1	Crush injury of toe(s) (ACC)	Trauma
2	Crush injury of trunk (ACC)	Trauma
3	Crush injury of wrist &or hand (ACC)	Trauma
4	Decompression Sickness	Trauma
5	Degloving injury of finger (ACC)	Trauma
6	Degloving injury of hand (ACC)	Trauma
7	Degloving injury of multiple fingers (ACC)	Trauma
8	Dislocated ankle (ACC)	Trauma
9	Dislocated elbow (ACC)	Trauma
10	Dislocated finger or thumb (ACC)	Trauma
11	Dislocated hip (ACC)	Trauma
12	Dislocated patella (ACC)	Trauma
13	Dislocated shoulder (ACC)	Trauma
14	Dislocated wrist (ACC)	Trauma
15	Dislocation	Trauma
16	Dislocations sprains and strains involving head with r	Trauma
17	Dog bite	Trauma
18	Dog bite (ACC)	Trauma
19	Drowning	Trauma
20	Drowning (ACC)	Trauma
21	Electrocution	Trauma
22	Electrocution (ACC)	Trauma
23	Explosion (ACC)	Trauma
24	Eye Injury	Trauma
25	Eye symptom	Trauma
26	Fall (ACC)	Trauma
27	Fall minor injury	Trauma
28	Fall without injury	Trauma
29	Foreign body	Trauma
30	Foreign body in anus &or rectum (ACC)	Trauma
31	Foreign body in bladder &or urethra (ACC)	Trauma
32	Foreign body in ear (ACC)	Trauma
33	Foreign body in mouth &or oesophagus &or stomach	Trauma
34	Foreign body in nose (ACC)	Trauma
35	Foreign body in pharynx &or larynx (ACC)	Trauma
36	Foreign body in vulva &or vagina (ACC)	Trauma
37	Foreign body on external eye (ACC)	Trauma
38	Fracture	Trauma
39	Fracture of ankle (ACC)	Trauma
40	Fracture of clavicle (ACC)	Trauma
41	Fracture of face bones (ACC)	Trauma
42	Fracture of finger(s) (ACC)	Trauma
43	Fracture of foot (ACC)	Trauma
44	Fracture of humerus (ACC)	Trauma
45	Fracture of knee (ACC)	Trauma
46	Fracture of neck of femur (ACC)	Trauma
47	Fracture of patella (ACC)	Trauma
48	Fracture of pelvis (ACC)	Trauma
49	Fracture of radius &or ulna (ACC)	Trauma
50	Fracture of ribs (ACC)	Trauma
51	Fracture of scapula (ACC)	Trauma
52	Fracture of shaft of femur (ACC)	Trauma
53	Fracture of skull (ACC)	Trauma
54	Fracture of sternum (ACC)	Trauma
55	Fracture of tibia &or fibula (ACC)	Trauma
56	Fracture of toe(s) (ACC)	Trauma
57	Fracture of wrist &or hand (ACC)	Trauma
58	Fractures involving multiple body regions (ACC)	Trauma
59	Fractures of multiple limbs (ACC)	Trauma
60	Frostbite of face (ACC)	Trauma
	Frostbite of foot (ACC)	Trauma
	Frostbite of hand (ACC)	Trauma
	Gun shot	Trauma
	Gun shot (ACC)	Trauma
	Haematoma (ACC)	Trauma
	Haemothorax	Trauma
	Hanging	Trauma

1	Hanging strangulation or suffocation of unknown int	Trauma
2	Insect sting (ACC)	Trauma
3	Insect sting/bite	Trauma
4	Intentional hanging (ACC)	Trauma
5	Laceration	Trauma
6	Laceration of abdomen (ACC)	Trauma
7	Laceration of ankle (ACC)	Trauma
8	Laceration of back (ACC)	Trauma
9	Laceration of breast (ACC)	Trauma
10	Laceration of buttock (ACC)	Trauma
11	Laceration of calf (ACC)	Trauma
12	Laceration of cheek (ACC)	Trauma
13	Laceration of chest wall (ACC)	Trauma
14	Laceration of ear region (ACC)	Trauma
15	Laceration of elbow (ACC)	Trauma
16	Laceration of eye (ACC)	Trauma
17	Laceration of eye region (ACC)	Trauma
18	Laceration of eyebrow (ACC)	Trauma
19	Laceration of eyelid (ACC)	Trauma
20	Laceration of finger (ACC)	Trauma
21	Laceration of foot (ACC)	Trauma
22	Laceration of forearm (ACC)	Trauma
23	Laceration of forehead (ACC)	Trauma
24	Laceration of genitalia (ACC)	Trauma
25	Laceration of hand (ACC)	Trauma
26	Laceration of head (ACC)	Trauma
27	Laceration of head and neck (ACC)	Trauma
28	Laceration of hip (ACC)	Trauma
29	Laceration of knee (ACC)	Trauma
30	Laceration of lip (ACC)	Trauma
31	Laceration of lower leg (ACC)	Trauma
32	Laceration of neck (ACC)	Trauma
33	Laceration of nose (ACC)	Trauma
34	Laceration of shin (ACC)	Trauma
35	Laceration of shoulder (ACC)	Trauma
36	Laceration of thigh (ACC)	Trauma
37	Laceration of thumb (ACC)	Trauma
38	Laceration of toe (ACC)	Trauma
39	Laceration of upper arm (ACC)	Trauma
40	Laceration of upper limb (ACC)	Trauma
41	Laceration of wrist (ACC)	Trauma
42	Left hemiparesis	Trauma
43	Loss of teeth due to an accident (ACC)	Trauma
44	Major trauma of multiple regions	Trauma
45	Multi-system trauma (ACC)	Trauma
46	NAI - Non-accidental injury (ACC)	Trauma
47	Other injury (ACC - describe in notes)	Trauma
48	Other abrasion &or friction burn (ACC - describe in n	Trauma
49	Other contusion (ACC - describe in notes)	Trauma
50	Other crush injury (ACC - describe in notes)	Trauma
51	Paralysis (ACC)	Trauma
52	Paraplegia	Trauma
53	Quadriplegia	Trauma
54	Right hemiparesis	Trauma
55	Rupture of achilles tendon (ACC)	Trauma
56	Self inflicted lacerations to wrist	Trauma
57	Sexual abuse (ACC)	Trauma
58	Sexual assault (ACC)	Trauma
59	Shock (ACC & MED)	Trauma
60	Skin tear	Trauma
	Skin tear (ACC)	Trauma
	Soft tissue injury	Trauma
	Spinal cord injury	Trauma
	Sprain of ankle &or foot (ACC)	Trauma
	Sprain of elbow &or forearm (ACC)	Trauma
	Sprain of finger (ACC)	Trauma
	Sprain of hip (ACC)	Trauma

1	Sprain of knee (ACC)	Trauma
2	Sprain of shoulder (ACC)	Trauma
3	Sprain of thumb	Trauma
4	Sprain of wrist &or hand (ACC)	Trauma
5	Stab wound	Trauma
6	Stab wound (ACC)	Trauma
7	Sunburn (ACC)	Trauma
8	Superficial abrasion (ACC)	Trauma
9	Superficial bruising (ACC)	Trauma
10	Suspected victim of child abuse	Trauma
11	Swollen eye(s) (ACC)	Trauma
12	Traumatic brain injury	Trauma
13	Traumatic brain injury (ACC)	Trauma
14	Traumatic cervical spine pain (ACC)	Trauma
15	Traumatic haemothorax (ACC)	Trauma
16	Wound of ankle (ACC)	Trauma
17	Wound of buttock (ACC)	Trauma
18	Wound of chest (ACC)	Trauma
19	Wound of ear (ACC)	Trauma
20	Wound of face (ACC)	Trauma
21	Wound of finger(s) (ACC)	Trauma
22	Wound of forearm (ACC)	Trauma
23	Wound of hand (ACC)	Trauma
24	Wound of hip &or thigh (ACC)	Trauma
25	Wound of knee (ACC)	Trauma
26	Wound of lip (ACC)	Trauma
27	Wound of lower abdomen (ACC)	Trauma
28	Wound of mouth (ACC)	Trauma
29	Wound of neck (ACC)	Trauma
30	Wound of nose (ACC)	Trauma
31	Wound of scalp (ACC)	Trauma
32	Wound of upper abdomen (ACC)	Trauma
33	Wound of upper arm (ACC)	Trauma
34	Wounds of multiple areas (ACC)	Trauma

Table S2. Descriptive analysis, demographics (n=624,928). Changes in distribution.

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	Δ % = LD – PL	P-value
<b>Sex</b>				
<b>Female</b>	309991a (52.7%)	19326b (53.4%)	0.7%	0.01
<b>Male</b>	278232a (47.3%)	16854b (46.6%)	-0.7%	
<b>Age</b>				<0.001
<b>0-5</b>	27258a (4.6%)	1326b (3.7%)	-1.0%	
<b>6-15</b>	21401a (3.6%)	934b (2.6%)	-1.1%	
<b>16-25</b>	57119a (9.7%)	2875b (7.9%)	-1.8%	
<b>26-45</b>	92530a (15.7%)	6201b (17.1%)	1.4%	
<b>46-65</b>	122699a (20.8%)	7948b (22%)	1.1%	
<b>&gt;65</b>	267540a (45.5%)	16917b (46.7%)	1.3%	
<b>Ethnicity</b>				0.07
<b>European/Other</b>	424918a (82.6%)	25998b (83.1%)	0.5%	
<b>Māori</b>	61858a (12%)	3664a (11.7%)	-0.3%	
<b>Pacific Peoples</b>	27709a (5.4%)	1623a (5.2%)	-0.2%	
<b>Rurality</b>				0.25
<b>Rural</b>	129002a (22.5%)	7948a (22.2%)	-0.3%	
<b>Urban</b>	444054a (77.5%)	27774a (77.8%)	0.3%	
<b>Location</b>				<0.001
<b>Aged Care Facility</b>	33334a (5.7%)	1689b (4.7%)	-1.0%	
<b>Healthcare Facility†</b>	51831a (8.8%)	1404b (3.9%)	-4.9%	
<b>Public / other</b>	111771a (19%)	2930b (8.1%)	-10.9%	
<b>Home</b>	390934a (66.5%)	30166b (83.4%)	16.9%	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent T-test for continuous values. Missing values were <3% for all variables except Ethnicity (14.6%), the proportion of missing values for this variable was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding. †Healthcare Facility refers to non-hospital treatment localities such as a general practice clinic. The results from the z-test are depicted by each subscript letter. With each letter denoting a subset of final categories whose column proportions do not differ significantly from each other at the 0.05 level.

Table S3. Descriptive analysis, Clinical impression (n=624,928). Changes in distribution.

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	$\Delta$ % = LD – PL	P-value
<b>Clinical Impression</b>				<0.001
<b>Abdominal Pain</b>	45479a (7.8%)	3240b (9.1%)	1.3%	
<b>Cardiac</b>	61083a (10.4%)	4082b (11.4%)	1.0%	
<b>Collapse</b>	27296a (4.7%)	1516b (4.2%)	-0.4%	
<b>Haemorrhage</b>	10932a (1.9%)	717a (2%)	0.1%	
<b>Infection</b>	37374a (6.4%)	2369a (6.6%)	0.3%	
<b>Mental Health</b>	13966a (2.4%)	1318b (3.7%)	1.3%	
<b>Metabolic</b>	28580a (4.9%)	1616b (4.5%)	-0.4%	
<b>Other Medical</b>	76741a (13.1%)	4875b (13.6%)	0.5%	
<b>Pain</b>	68678a (11.7%)	4333b (12.1%)	0.4%	
<b>Poisoning</b>	18519a (3.2%)	802b (2.2%)	-0.9%	
<b>Respiratory</b>	67144a (11.4%)	3449b (9.6%)	-1.8%	
<b>Stroke</b>	13652a (2.3%)	916b (2.6%)	0.2%	
<b>Trauma</b>	117127a (20%)	6535b (18.3%)	-1.7%	
<b>Did alcohol contribute?</b>				<0.001
<b>No</b>	417011a (93.3%)	25493b (95.1%)	1.9%	
<b>Yes</b>	30076a (6.7%)	1300b (4.9%)	-1.9%	
<b>Mechanism of injury</b>				<0.001
<b>Assault</b>	8924a (6%)	445a (5.7%)	-0.3%	
<b>Fall</b>	75225a (50.8%)	4603b (58.9%)	8.0%	
<b>Other trauma</b>	39278a (26.5%)	2254b (28.8%)	2.3%	
<b>Road traffic crash</b>	24534a (16.6%)	518b (6.6%)	-10.0%	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables except Did alcohol contribute? (27.1%) and Mechanism of Injury (15.1%, across all Trauma cases), the proportion of missing values for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding. The results from the z-test are depicted by each subscript letter. With each letter denoting a subset of final categories whose column proportions do not differ significantly from each other at the 0.05 level.

**Table S4. Descriptive analysis, patient disposition and acuity. Changes in distribution.**

	Pre-Lockdown (PL) n=588,690	Lockdown (LD) n=36,238	$\Delta$ % = LD – PL	P-value
<b>Disposition</b>				<0.001
<b>Transport</b>	465237a (79.1%)	25112b (69.5%)	-9.6%	
<b>Non-Transport</b>	122975a (20.9%)	11022b (30.5%)	9.6%	
<b>Non-transport reason</b>				<0.001
<b>Ambulance staff decision not to transport</b>	105236a (85.6%)	9804b (88.9%)	3.4%	
<b>Patient declined transport</b>	17740a (14.4%)	1218b (11.1%)	-3.4%	
<b>Final status</b>				<0.001
<b>Status 0</b>	6692a (1.1%)	418a (1.2%)	0.0%	
<b>Status 1 &amp; Status 2</b>	75940a (12.9%)	4110b (11.4%)	-1.5%	
<b>Status 3 &amp; Status 4</b>	504533a (85.9%)	31550b (87.4%)	1.5%	

\*P<0.05 is significant;  $\chi^2$  test for nominal values. Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding. The results from the z-test are depicted by each subscript letter. With each letter denoting a subset of final categories whose column proportions do not differ significantly from each other at the 0.05 level.

**Table S5. Changes in absolute event rates per week during the Lockdown compared to Pre-Lockdown period.**

	Pre-Lockdown	Lockdown			
	Mean $\pm$ SD/week	Mean $\pm$ SD/week	Ratio (95% CI)	P-value	Cohens d Effect size
<b>Abdominal Pain</b>	629 $\pm$ 37	648 $\pm$ 25	1.03 (1.00 - 1.06)	0.17	n/s
<b>Cardiac</b>	846 $\pm$ 67	816 $\pm$ 67	0.96 (0.88 - 1.04)	0.39	n/s
<b>Collapse</b>	377 $\pm$ 25	303 $\pm$ 26	0.80 (0.73 - 0.88)	0.002	-2.4
<b>Haemorrhage</b>	151 $\pm$ 18	143 $\pm$ 5	0.95 (0.93 - 0.96)	0.02	-0.5
<b>Infection</b>	515 $\pm$ 66	474 $\pm$ 56	0.92 (0.81 - 1.02)	0.18	n/s
<b>Mental Health</b>	193 $\pm$ 27	264 $\pm$ 30	1.37 (1.22 - 1.51)	0.005	2.2
<b>Metabolic</b>	395 $\pm$ 29	323 $\pm$ 21	0.82 (0.77 - 0.87)	0.001	-2.1
<b>Other Medical</b>	1062 $\pm$ 73	975 $\pm$ 41	0.92 (0.88 - 0.95)	0.01	-1.2
<b>Pain</b>	949 $\pm$ 94	867 $\pm$ 32	0.91 (0.89 - 0.93)	<0.001	-0.9
<b>Poisoning</b>	255 $\pm$ 21	160 $\pm$ 6	0.63 (0.61 - 0.64)	<0.001	-3.0
<b>Respiratory</b>	932 $\pm$ 191	690 $\pm$ 119	0.74 (0.61 - 0.86)	0.01	-1.2
<b>Stroke</b>	188 $\pm$ 16	183 $\pm$ 11	0.97 (0.92 - 1.03)	0.38	n/s
<b>Trauma</b>	1616 $\pm$ 129	1307 $\pm$ 73	0.81 (0.77 - 0.85)	<0.001	-2.1
<b>Grand Total</b>	8139 $\pm$ 253	7248 $\pm$ 188	0.89 (0.87 - 0.91)	<0.001	-2.7

\*P<0.05 is significant; Independent t-test for continuous values. Missing values were <3% for all variables. Percentages may not add to 100% due to rounding. Cohen's *d* effect size, Small 0.2 – 0.4, Medium 0.5 to 0.7, Large  $\geq$ 0.8

**Table S6. Changes in Mechanism of Injury during the Lockdown compared to Pre-lockdown period.**

	<b>Pre- Lockdown</b>	<b>Lockdown</b>			
	Mean ± SD/week	Mean ± SD/week	Ratio (95% CI)	P-value	Cohens d Effect size
<b>Alcohol Contributed - Yes</b>	411 ± 35	260 ± 31	0.63 (0.55 - 0.71)	<0.001	-2.9
<b>Assault</b>	122 ± 15	89 ± 13	0.73 (0.61 - 0.84)	0.004	-1.9
<b>Fall</b>	1039 ± 50	921 ± 27	0.89 (0.86 - 0.91)	<0.001	-2.1
<b>Other</b>	539 ± 44	451 ± 21	0.84 (0.80 - 0.87)	<0.001	-1.8
<b>Road traffic crash</b>	340 ± 39	104 ± 31	0.30 (0.20 - 0.41)	<0.001	-3.3

\*P<0.05 is significant; Independent t-test for continuous values. Missing values were Mechanism of Injury (15.1%, of Trauma cases) and whether Alcohol Contributed (27.1%). The proportion of missing values for these variables was similar across both Pre-Lockdown and Lockdown periods. Percentages may not add to 100% due to rounding. Cohen's *d* effect size, Small 0.2 – 0.4, Medium 0.5 to 0.7, Large ≥0.8

**Table S7. Seasonal and population adjustment factors**

<b>Month</b>	<b>Season</b>	<b>Seasonal adjustment</b>
<b>Dec</b>	Summer	0.99
<b>Jan</b>	Summer	0.93
<b>Feb</b>	Summer	1.01
<b>Mar</b>	Autumn (Lockdown)	1.00
<b>Apr</b>	Autumn (Lockdown)	0.95
<b>May</b>	Autumn	0.97
<b>Jun</b>	Winter	1.00
<b>Jul</b>	Winter	1.04
<b>Aug</b>	Winter	1.07
<b>Sep</b>	Spring	1.03
<b>Oct</b>	Spring	1.00
<b>Nov</b>	Spring	1.01

Cyclic average was derived from overall ambulance incidents from May 2010 to Oct 2020.

At year end 2019 the population growth rate was 2% per annum (<https://www.stats.govt.nz/topics/population> )

**STROBE Statement**

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1 - 2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1 - 2
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Study design	4	Present key elements of study design early in the paper	4 - 5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up and data collection	4 - 5
Participants	6	<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	4 - 5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	4 - 5
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4 - 5
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	n/a
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	
		(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	Proportion of missing data are listed as relevant under each table.
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	
Statistical methods	12	<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	n/a
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	n/a



Section/Topic	Item No	Recommendation	Reported on Page No
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6 - 7
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6 - 7
		(b) Indicate number of participants with missing data for each variable of interest	Included below the data tables.
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	n/a
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	n/a
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	n/a
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	6 - 8
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a
		(b) Report category boundaries when continuous variables were categorized	6 - 8
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Supplementary data
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	9 - 11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11 - 12
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9 - 11
Generalisability	21	Discuss the generalisability (external validity) of the study results	9 - 11
<b>Other Information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

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