ORIGINAL RESEARCH

Epidemiology and clinical features of emergency department patients with suspected and confirmed COVID-19: A multisite report from the COVID-19 Emergency Department Quality Improvement Project for July 2020 (COVED-3)

Gerard M O'REILLY [1,2,3] Rob D MITCHELL [1,2] Biswadev MITRA [1,2,3] Hamed AKHLAGHI [4]
Viet TRAN [5,6] Jeremy S FURYK [7,8] Paul BUNTINE,[9,10] Holly BANNON-MURPHY [1]
Timothy AMOS [1] Maushmi UDAYA KUMAR,[10] Emma PERKINS,[10] Alexandra PRENTICE,[4]
Olivia SZWARCBERG,[4] Ashley LOUGHMAN,[5,11] Nicole LOWRY,[7] Steven COLWELL,[9]
Michael P NOONAN,[1,3,12] Ryan HILLER,[1] Andrew PATON,[1,13] De Villiers SMIT[1,2,3] and
Peter A CAMERON [1,2] on behalf of the COVED Project Team

[1]Emergency and Trauma Centre, Alfred Health, Melbourne, Victoria, Australia, [2]School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia, [3]National Trauma Research Institute, Alfred Health, Melbourne, Victoria, Australia, [4]Emergency Department, St Vincent's Hospital, Melbourne, Victoria, Australia, [5]Emergency Department, Royal Hobart Hospital, Tasmanian Health Services, Hobart, Tasmania, Australia, [6]Tasmanian School of Medicine, University of Tasmania, Hobart, Tasmania, Australia, [7]Emergency Department, Barwon Health, Geelong, Victoria, Australia, [8]School of Medicine, Deakin University, Melbourne, Victoria, Australia, [9]Emergency Department, Eastern Health, Melbourne, Victoria, Australia, [10]School of Medicine, Monash University, Melbourne, Victoria, Australia, [11]Ambulance Tasmania, Hobart, Tasmania, Australia, [12]Trauma Service, Alfred Health, Melbourne, Victoria, Australia, and [13]Adult Retrieval Victoria, Ambulance Victoria, Melbourne, Victoria, Australia

Correspondence: Adjunct Clinical Associate Professor Gerard M O'Reilly, Emergency and Trauma Centre, Alfred Health, 55 Commercial Road, Melbourne, VIC 3004, Australia. Email: gerard.oreilly@monash.edu

Gerard M O'Reilly, MBBS, MPH, MBiostat, AStat, PhD, FACEM, Emergency Physician, Adjunct Clinical Associate Professor, Head of Epidemiology and Biostatistics, NHMRC Research Fellow; Rob D Mitchell, MBBS (Hons), BMedSc (Hons), MPH&TM, GradCertDisRefHlth, FACEM, Emergency Physician, PhD Scholar; Biswadev Mitra, MBBS, MHSM, PhD, FACEM, Director of Emergency Medicine Research, Professor, Head of Clinical Research; Hamed Akhlaghi, MD, PhD, FACEM, Director of Emergency Medicine Research; Viet Tran, MBBS, FACEM, Director of Emergency Medicine Research, Senior Lecturer; Jeremy S Furyk, MBBS, MPH&TM, MSc, PhD, FACEM, Emergency Physician, Senior Lecturer; Paul Buntine, MBBS (Hons), FACEM, Director of Emergency Medicine Research, Adjunct Senior Lecturer; Holly Bannon-Murphy, MBBS, Emergency Registrar; Timothy Amos, MBBS, Emergency Registrar; Maushmi Udaya Kumar, BBiomedSc, Medical Student; Emma Perkins, BBiomedSc, Medical Student; Alexandra Prentice, MD, BSc, Medical Intern; Olivia Szwarcberg, MD, House Medical Officer; Ashley Loughman, MBBS, MPH, FACEM, Emergency Physician, Retrieval Consultant; Nicole Lowry, BN (Hons), GradDipNurs (Emerg), MAdvNursPrac (NP), Research Assistant; Steven Colwell, MBBS, BSc (Hons), House Medical Officer; Michael P Noonan, MBChB (Hons), BPhty (Hons), MMEd, FACEM, Emergency Physician, Honorary Consultant, Trauma Consultant; Ryan Hiller, MBBS, BMedSc (Hons), Emergency Registrar; Andrew Paton, MBChB, FACEM, CHIA, Emergency Registrar, Retrieval Consultant; De Villiers Smit, MBChB, FACEM, Emergency Physician, Director, Adjunct Associate Professor, Head of Emergency Medicine Program; Peter A Cameron, MBBS, MD, FACEM, Emergency Physician, Adjunct Professor.

Accepted 17 September 2020

Key findings

- A substantial proportion of patients presenting to Australian EDs in July 2020 underwent SARS-CoV-2 testing and required enhanced IPC precautions, but only a small proportion returned a positive result.
- In this sample, the presence of SARS-CoV-2 on nasopharyngeal testing was not associated with mechanical ventilation or death in hospital.

Abstract

Objective: The aim of the present study was to describe the epidemiology and clinical features of patients presenting to the ED with suspected and confirmed COVID-19.
Methods: The COVID-19 ED (COVED) Project is an ongoing prospective cohort study in Australian

EDs. This analysis presents data from eight sites across Victoria and Tasmania for July 2020 (during Australia's 'second wave'). All adult patients who met criteria for 'suspected COVID-19' and underwent testing for SARS-CoV-2 in the ED were eligible for inclusion. Study outcomes included a positive SARS-CoV-2 test result and mechanical ventilation.

Results: In the period 1 July to 31 July 2020, there were 30 378 presentations to the participating EDs and 2917 (9.6%; 95% confidence interval 9.3–9.9) underwent testing for SARS-CoV-2. Of these, 50 (2%) patients returned a positive result. Among positive cases, two (4%) received mechanical ventilation during their hospital admission compared to 45 (2%) of the SARS-CoV-2 negative patients (odds ratio 1.7, 95% confidence interval 0.4–7.3; $P = 0.47$). Two (4%) SARS-CoV-2 positive patients died in hospital compared to 46 (2%) of the SARS-CoV-2 negative patients (odds ratio 1.7, 95% confidence interval 0.4–7.1; $P = 0.49$). Strong clinical predictors of a positive SARS-CoV-2 result included self-reported fever, non-smoking status, bilateral infiltrates on chest X-ray and absence of a leucocytosis on first ED blood tests ($P < 0.05$).

Conclusion: In this prospective multi-site study from July 2020, a substantial proportion of ED patients required SARS-CoV-2 testing, isolation and enhanced infection prevention and control precautions. Presence of SARS-CoV-2 on nasopharyngeal swab was not associated with death or mechanical ventilation.

Key words: *COVID-19, emergency, isolation, quality improvement, registry.*

Introduction

The COVID-19 pandemic continues to have a significant impact on Australian EDs.[1–6] Although the overall number of ED presentations has decreased,[5,6] substantial reforms have been required to optimise infection prevention and control (IPC) processes.[7] COVID-19 case numbers remain low, but Victoria's 'second wave' has demonstrated the need for vigilance.[8]

EDs, by their nature, deal with acute and undifferentiated illness. In the current environment, a large proportion of emergency patients meet criteria for 'suspected COVID-19' and require isolation.[2,3,9,10] This has created a 'triple challenge' for Australian EDs: maintaining 'business as usual', providing care for patients with confirmed COVID-19 and minimising transmission through effective IPC for suspected cases.[4] Australia's liberal approach to testing, and the associated requirement for patient isolation, has added to this burden.[9,10]

Given the evolving nature of the pandemic, it is important that ED clinicians have access to contemporary data and evidence-based tools to guide clinical decisions, policy making and system improvements. Although the clinical features of COVID-19 are well described, relatively little has been published about the characteristics of ED patients who undergo testing for SARS-CoV-2. For this reason, there are limited data on the accuracy of COVID-19 diagnostic and clearance strategies in the ED.[11]

In this context, the COVID-19 ED (COVED) Quality Improvement Project was instigated to monitor the clinical features and outcomes of ED patients with suspected and confirmed COVID-19. COVED-1, which coincided with Australia's 'first wave', demonstrated a low positive test rate, with no SARS-CoV-2 positive patients receiving mechanical ventilation or dying in the ED.[2] COVED-2, reporting data from the whole of April 2020, identified an increasing number of patients meeting case definition criteria and highlighted the potential negative effects for patient flow.[3]

The objectives of this analysis (COVED-3), undertaken during the 'second wave', were to explore the association between SARS-CoV-2 test result and mechanical ventilation and death in hospital and to identify clinical and epidemiological variables predictive of SARS-CoV-2 positivity. This is the first multi-site report from the Project.

Methods

COVED is an ongoing prospective cohort study that commenced on 1 April 2020. The study protocol has been published previously.[12] The study includes adult patients who had a SARS-CoV-2 polymerase chain reaction (PCR) test requested in the ED and were managed with IPC precautions for 'suspected COVID-19'. Testing criteria are guided by the various health jurisdictions and have evolved throughout the Project.[9,10] The criteria that were applicable during the present study period are listed in Box 1. Patients who underwent testing for surveillance purposes were excluded.

This analysis (COVED-3) describes study findings for all eligible patients who presented to the eight participating EDs (The Alfred Hospital, St Vincent's Hospital Melbourne, Box Hill Hospital, University Hospital Geelong, Royal Hobart Hospital, Launceston General Hospital, North-West Regional Hospital and Mersey Community Hospital) over the period 1 July to 31 July 2020. These sites represent a mixture of urban and regional EDs across Victoria and Tasmania (Table 1). In all of these locations, screening (testing) clinics were in operation. Patients who only presented to the screening clinics were not included in the present study.

COVED Project outcome measures include a positive SARS-CoV-2 PCR test result and the requirement for mechanical ventilation. A complete list of additional variables has previously been published in the study protocol.[12] These include history (age, sex, symptoms and duration of presenting complaint, epidemiological features, comorbidities), findings on clinical examination, radiological and blood investigations, care provided in the ED and hospital (including commencement of invasive mechanical ventilation and ED disposition destination) and patient outcomes (including survival to discharge). COVED Project variables and definitions have been harmonised with international COVID-19 research tools developed by the World Health Organization and International Severe Acute Respiratory and Emerging Infection Consortium.[13]

Administrative and clinical data for study participants are collected via hospital electronic medical record systems. Some variables are automatically extracted from data warehouses, but all sites rely on some degree of manual record review. Data are entered into a novel registry utilising Research Electronic Data Capture (REDCap) tools, hosted and managed by Helix (Monash University).[14,15] The current version of the data dictionary and case report form are available on The Alfred Hospital's academic programmes website at https://emergencyeducation.org.au/research/coved/.

For this analysis, summary descriptive statistics have been determined for each pre-specified variable. These data have been stratified by the test result for the SARS-CoV-2 PCR swab taken in the ED. Unlike previous COVED reports, there were sufficient positive cases in July 2020 to undertake inferential analyses (comparing predictors and outcomes by SARS-CoV-2 test result, with summary measures of association and 95% confidence intervals [CIs]). Symmetrical numerical data have been summarised using the mean and standard deviation; skewed and ordinal data have been summarised using the median and interquartile range; and categorical data have been summarised using the frequency and percentage.

The final prediction model was derived to avoid overfitting; that is, the maximum number of predictor variables included in the final (parsimonious) model was limited by the 'rule of thumb' whereby at least 10 observations of each outcome (SARS-CoV-2 positive and negative) are required per predictor variable.

Data were analysed using Stata statistical software (version 15.1; StataCorp, College Station, TX, USA). A *P*-value of <0.05 was defined to be statistically significant. Ethics approval was obtained from the Alfred Human Research Ethics Committee (project no: 188/20) on 26 March 2020, with subsequent amendment to a multi-site project (63444) on 9 April 2020.

Results

There were 30 378 presentations to the eight participating EDs during the period 1 July to 31 July 2020, and 2917 (9.6%, 95% CI 9.3–9.9) met inclusion criteria. Of these, 50 (2%) patients returned a positive SARS-CoV-2 test result and 2867 (98%) were negative. As described in Table 1, case detection rates varied between 0% in regional Tasmania and 9% in the designated ED area for suspected COVID-19 at St Vincent's Hospital Melbourne.

Table 2 summarises the baseline demographic and ED arrival characteristics of included patients. There were no differences in age or sex distribution. Patients who tested positive for SARS-CoV-2 were more likely to have arrived by ambulance (*P* < 0.001).

Patient outcomes are summarised in Table 3. Of the SARS-CoV-2 positive patients, two (4%) were admitted directly to the intensive care unit but none underwent intubation and mechanical ventilation in the ED. A total of 26 (52%) patients were admitted to hospital. Two (4%) received mechanical ventilation at any point during their admission compared to 45 (2%) of the SARS-CoV-2 negative patients (odds ratio 1.7, 95% CI 0.4–7.3; *P* = 0.47). Of the SARS-CoV-2 positive patients, two (4%) died in hospital compared to 46 (2%) of the SARS-CoV-2 negative patients (odds ratio 1.7, 95% CI 0.4–7.1; *P* = 0.49).

Table 4 describes the clinical and epidemiological features; subjective fever (78%), cough (68%) and fatigue (58%) were the commonest presenting complaints among SARS-CoV-2 positive patients. Half (50%)

TABLE 1. *Submitted cases for analysis and report by site*

Site	Total number of ED presentations†	Total adult cases tested for SARS-CoV-2, n (%)	SARS-CoV-2 positive, n (%)	SARS-CoV-2 negative, n (%)	Case data included in Tables 2 and 3	Case data included in Table 4
The Alfred Hospital	4420	1111 (25)	12 (1)	1099 (99)	All	All
University Hospital Geelong	5614	283 (5)	6 (2)	277 (98)	All	SARS-CoV-2 positive
Box Hill Hospital	4510	983 (22)‡	12 (1)§	971 (99)	SARS-CoV-2 positive	SARS-CoV-2 positive
Launceston General Hospital	3512	97 (3)	0 (0)	97 (100)	All	SARS-CoV-2 positive¶
Mersey Community Hospital	1504	23 (2)	0 (0)	23 (100)	All	SARS-CoV-2 positive¶
North West Regional Hospital	2264	33 (1)	0 (0)	33 (100)	All	SARS-CoV-2 positive¶
Royal Hobart Hospital	5309	183 (3)	1 (1)	182 (99)	All	SARS-CoV-2 positive
St Vincent's Hospital Melbourne	3245	204 (6)	19 (9)	185 (91)	All	All
Total	30 378	2917 (10)	50 (2)	2867 (98)		

†All ages. ‡Testing criteria as per Box 1, plus any patient transferred to a private hospital. §No patient who tested positive for SARS-CoV-2 at Box Hill Hospital was tested based on the expanded local criteria. ¶No SARS-CoV-2 positive cases in study period.

reported close contact with a positive case and 37% had bilateral infiltrates on chest X-ray (CXR).

Compared to SARS-CoV-2 negative patients, SARS-CoV-2 positive patients were more likely to identify cough, anosmia or dysgeusia, sore throat, fever, fatigue or myalgia among their symptoms on presentation to the ED. In terms of examination findings, SARS-CoV-2 positive patients had higher temperatures and lower oxygen saturations on ED arrival, but were not more likely to have a fever (temperature ≥38°C) or hypoxia (oxygen saturation <92%) when analysed using a dichotomous (categorical) approach. On investigation, SARS-CoV-2 positive patients were less likely to have a leucocytosis and more likely to have bilateral infiltrates on first CXR than SARS-CoV-2 negative patients. In terms of clinical and epidemiological risk factors, SARS-CoV-2 positive patients were more likely to report contact with a confirmed case of COVID-19 or a positive SARS-CoV-2 PCR swab result in the 14 days prior to their ED presentation. SARS-CoV-2 positive patients were less likely to be a smoker or have a diagnosis of hypertension.

For those variables with a univariable association with the SARS-CoV-2 test result, Table 4 also provides the corresponding positive and negative likelihood ratios and summarises the parameters of a parsimonious clinical prediction model. Variables with a positive likelihood ratio of relatively large magnitude included: contact with a confirmed SARS-CoV-2 positive case; a positive SARS-CoV-2 PCR swab in the previous 14 days; anosmia as a presenting complaint and the absence of leucocytosis on first ED blood tests. The final set of four clinical variables (applying the 'rule of thumb' outlined in the Methods section) in the clinical prediction model for having a positive SARS-CoV-2 test result included self-reported fever, bilateral infiltrates on CXR, being a non-smoker and not having a leucocytosis.

Discussion

This prospective, multi-site study is the largest analysis to date of patients presenting to Australian EDs who undergo testing for

TABLE 2. *Baseline demographic and ED arrival details by SARS-CoV-2 result from ED polymerase chain reaction*

Variable	SARS-CoV-2 test positive† (*n* = 50)	SARS-CoV-2 test negative† (*n* = 1896)	OR (95% CI)	*P*-value
Age (years), mean (SD)	53 (22)	56 (22)	1.0 (1.0–1.0)	0.38
Sex, *n* (%)				
Male	24 (48)	950 (50)	0.9 (0.5–1.6)	0.76
Mode of transport, *n* (%)				
Private transport/other	7 (14)	742 (39)	Reference group	
Ambulance – road	38 (76)	1042 (55)	3.9 (1.7–8.7)	0.001
Ambulance – helicopter	0 (0)	12 (1)	–	–
Public transport	5 (10)	97 (5)	5.5 (1.7–17.6)	0.004
Triage category, median (IQR)	3 (3,4)	3 (3,3)	NA	0.16
Triage category, *n* (%)				
1	0 (0)	45 (2)	Reference group	
2	6 (12)	400 (21)	0.4 (0.2–1.1)	0.09
3	30 (60)	983 (52)	0.9 (0.5–1.7)	0.72
4	14 (27)	408 (22)	–	–
5	0 (0)	57 (3)	–	–

†For Box Hill Hospital, only SARS-CoV-2 positive cases included. CI, confidence interval; IQR, interquartile range; NA, not applicable; OR, odds ratio; SD, standard deviation; – , category omitted from estimation because of perfect prediction (empty cell) or collinearity.

SARS-CoV-2 virus. A substantial proportion of ED patients met 'suspected COVID-19' criteria but only a small proportion returned a positive test result. Not surprisingly, testing and SARS-CoV-2 detection rates differed between sites, in keeping with the distribution of COVID-19 cases during Australia's 'second wave'.

In the present study, there was no difference in the outcomes of mechanical ventilation or death, neither in the ED nor during the patient's hospital admission, between those who tested positive or negative for the virus. Only two (4%) patients who tested positive required mechanical ventilation during their admission, equating to 8% of all COVID-19 patients admitted to hospital. This contrasts with data from overseas settings (where ventilation rates among inpatients of up to 33% have been reported[16]) but is broadly consistent with Australian experience. National data to 19 July 2020 report a mechanical ventilation rate of 8% among hospitalised patients.[17]

This early analysis suggests that the presence of SARS-CoV-2 is not associated with worse outcomes (relative to other ED patients, with similar presenting complaints, who return a negative SARS-CoV-2 result). Current standards of care therefore need to be continued to maintain such outcomes, but the requirement for novel therapeutic agents against SARS-CoV-2 appears less urgent.

The strongest clinical predictors of a positive SARS-CoV-2 test result included self-reported fever, being a non-smoker, the absence of a leucocytosis and having bilateral infiltrates on CXR. These results are broadly consistent with the findings of overseas studies.[11,18,19] A recent review of COVID-19 diagnostic features identified fever as the commonest historical feature, whereas hyposmia and hypogeusia were thought to have favourable performance characteristics for 'ruling in' disease.[11] Cough has been previously reported in less than 60% of symptomatic cases and was thought to have insufficient discriminatory

ability.[11,18,19] In a predictive model developed by Roland *et al*., smell or taste change, fever and body ache were associated with COVID-19 positivity but shortness of breath and sore throat were associated with a negative test result.[20]

Other results of the present study add to the understanding of clinical features of COVID-19 and may help identify cases. Myalgia and fatigue, both associated with SARS-CoV-2 positivity in the univariable analysis, are not currently included as indications for testing in Victoria and Tasmania (in the absence of epidemiological risk factors). As in other studies, bilateral infiltrates on CXR have been confirmed as a strong predictor of a positive test result.[21] It is not useful, however, for 'ruling out' COVID-19. In the present study, only 37% of SARS-CoV-2 patients had a CXR with bilateral infiltrates, broadly consistent with the reported sensitivity of between 21% and 75%.[21] The predictive value of a positive SARS-CoV-2 test result in the 2 weeks prior to the ED

TABLE 3. *Outcomes by result of ED SARS-CoV-2 test*

Variable	SARS-CoV-2 test positive† (*n* = 50)	SARS-CoV-2 test negative† (*n* = 1896)	OR (95% CI)	*P*-value
Invasive mechanical ventilation in ED, *n* (%)				
Yes	0 (0)	33 (2)	–	–
Disposition destination from ED, *n* (%)				
Home	22 (44)	636 (34)	Reference group	
Died in ED	0 (0)	2 (0)	–	–
ICU	2 (4)	63 (3)	0.9 (0.2–4.0)	0.91
OT	0 (0)	16 (1)	–	–
Ward (not ICU)	24 (48)	773 (41)	0.9 (0.5–1.6)	0.73
ED short stay unit	2 (4)	323 (17)	0.2 (0.0–0.8)	0.02
Transfer to other hospital	0 (0)	52 (3)	–	–
DAMA	0 (0)	20 (1)	–	–
Other	0 (0)	7 (0)	–	–
Invasive mechanical ventilation in hospital, *n* (%)				
Yes	2 (4)	45 (2)	1.7 (0.4–7.3)	0.47
Discharge destination from hospital, *n* (%)				
Home	41 (82)	1547 (82)	Reference group	–
Died in hospital	2 (4)	46 (2)	1.6 (0.4–7.0)	0.50
Residential aged care facility	2 (4)	57 (3)	1.3 (0.3–5.6)	0.70
Transfer to other hospital	2 (4)	149 (8)	0.5 (0.1–2.1)	0.35
Discharge against medical advice	0 (0)	54 (3)	–	–
Hospital in the home	0 (0)	8 (0)	–	–
Other (includes current inpatients)	3 (6)	27 (1)	4.2 (1.2–14.4)	0.02

†For Box Hill Hospital, only SARS-CoV-2 positive cases included. CI, confidence interval; ICU, intensive care unit; OR, odds ratio; OT, operating theatre; –, category omitted from estimation because of perfect prediction (empty cell).

presentation is an expected finding; however, poor access to outpatient SARS-CoV-2 test results and contact history (through a lack of integrated electronic medical record systems) remains an ongoing barrier for ED staff in their efforts to contain and diagnose COVID-19 in the ED. Internationally, several attempts have been made to use data of this nature to derive and validate severity prediction tools.[22,23] Current COVID-19 case numbers in the COVED registry prohibit this type of analysis, but it may be possible to use the dataset to externally validate these approaches.

Several other observations can be made based on the results of the present study. The burden of suspected COVID-19 cases is significant and is likely to contribute to prolonged ED length of stay.[1] This has the potential to precipitate overcrowding, exacerbate access block and delay definitive care.[1,24,25] Prolonged test turnaround times contribute to this burden because patients spend a longer period of time in isolation while awaiting test results. The incidence of critical illness among SARS-CoV-2 positive patients in this sample was low. Although criteria for ED short-stay unit admission may have varied between participating sites, almost half (46%) were admitted to the short stay unit or discharged directly from the ED. This finding was apparent despite widespread access to screening clinics for minimally symptomatic patients during the study period and may reflect a liberal approach to testing in the ED. High rates of intensive care unit admission and mechanical ventilation reported in other settings may reflect a restrictive approach to testing despite high rates of community transmission.[16,26,27] It is also representative of the selection bias in early COVID-19 studies, which tended to focus on hospitalised patients.

These findings will be useful to guide service planning. In the present study, almost half of the SARS-CoV-2 positive patients were suitable for discharge, reaffirming the need for

TABLE 4. *Results of analysis to determine univariable association and predictive performance of variables with being SARS-CoV-2 positive among patients tested for SARS-CoV-2 in the ED*

Variable	Subgroups	Missing >20% (yes/no)	SARS-CoV-2 test positive‡ (n = 50)	SARS-CoV-2 test negative‡ (n = 1284)	OR (95% CI), P-value	Positive likelihood ratio	Negative likelihood ratio	Parsimonious model OR (95% CI), P-value§
Presenting complaint, n (%)								
Shortness of breath¶	Yes	No	26 (57)	529 (47)	1.5 (0.8–2.6), 0.22	–	–	–
Cough¶	Yes	No	32 (68)	421 (38)	3.5 (1.9–6.6), <0.001	1.8	0.5	–
Anosmia or dysgeusia¶	Yes	Yes	10 (29)	32 (4)	11.4 (5.0–25.9), <0.001	8.4	0.7	–
Sore throat¶	Yes	No	15 (42)	270 (26)	2.1 (1.1–4.1), 0.03	1.6	0.8	–
Runny nose¶	Yes	No	12 (32)	276 (26)	1.3 (0.6–2.6), 0.48	–	–	–
Fever¶	Yes	No	39 (78)	383 (34)	6.8 (3.5–13.5), <0.001	2.3	0.3	14.5 (3.0–69.2), 0.001
Fatigue	Yes	Yes	22 (58)	271 (29)	3.4 (1.8–6.6), <0.001	2.0	0.6	–
Myalgia¶	Yes	Yes	13 (34)	139 (15)	3.0 (1.5–5.9), 0.002	2.3	0.8	–
Diarrhoea	Yes	No	5 (13)	99 (10)	1.3 (0.5–3.4), 0.59	–	–	–
Number of days since first symptom, median (IQR)		No	3 (2,5)	2 (1,5)	0.10			
Other relevant history, n (%)								
Overseas¶ in previous 28 days	Yes	Yes	0 (0)	1 (0)	–	–	–	–
Contact with a confirmed case¶	Yes	Yes	23 (50)	35 (4)	26.6 (13.6–52.0), <0.001	13.8	0.5	–
Residential aged care facility	Yes	No	4 (8)	98 (9)	0.9 (0.3–2.6), 0.87	–	–	–
Healthcare worker	Yes	No	2 (4)	52 (5)	0.8 (0.2–3.5), 0.80	–	–	–
Previous SARS-CoV-2 swab (within 14 days prior to the ED presentation)	SARS-CoV-2 negative	No	3 (7)	137 (11)	Reference	–	–	–
	SARS-CoV-2 positive		15 (36)	18 (1)	38.1 (10.0–144.4), <0.001	25.3	0.7	–
	Swab result unknown		3 (7)	34 (3)	4.0 (0.8–20.9), 0.10	–	–	–
	No prior swab		21 (50)	1087 (85)	0.9 (0.3–3.0), 0.84	–	–	–
Comorbidities, n (%)								

TABLE 4. *Continued*

Variable	Missing >20% (yes/no)	Subgroups	SARS-CoV-2 test positive†‡ (n = 50)	SARS-CoV-2 test negative‡ (n = 1284)	OR (95% CI), P-value	Positive likelihood ratio	Negative likelihood ratio	Parsimonious model OR (95% CI), P-value§
Chronic respiratory	No	Yes	12 (25)	292 (27)	0.9 (0.5–1.8), 0.77	–	–	–
Obesity	No	Yes	4 (9)	154 (17)	0.5 (0.2–1.4), 0.20	–	–	–
Smoker	Yes	Yes	4 (10)	376 (38)	0.2 (0.1–0.5), 0.002	0.3	1.5	0.1 (0.0–1.0), 0.05
Chronic cardiac	No	Yes	7 (15)	281 (26)	0.5 (0.2–1.1), 0.10	–	–	–
Hypertension	No	Yes	9 (19)	376 (35)	0.4 (0.2–0.9), 0.03	0.5	1.2	–
Diabetes mellitus	No	Yes	10 (21)	186 (17)	1.3 (0.6–2.6), 0.54	–	–	–
Malignant neoplasm	No	Yes	1 (2)	91 (9)	0.2 (0.0–1.7), 0.15	–	–	–
Immunosuppressive pharmacotherapy	No	Yes	2 (4)	104 (10)	0.4 (0.1–1.7), 0.23	–	–	–
Examination – first vital signs in ED								
Temperature‖ (°C), mean (SD)	No	NA	37.1 (0.9)	36.6 (0.9)	2.3 (1.6–3.2), <0.001	–	–	–
Fever recorded‖ (temperature ≥38°C), n (%)		Yes	6 (12)	58 (5)	2.8 (1.1–6.7), 0.03	2.5	0.9	–
SaO₂ (%), mean (SD)	No	NA	96 (5)	97 (3)	0.9 (0.9–1.0), 0.002	–	–	–
Hypoxia (SaO₂ <92%), n (%)		Yes	4 (8)	58 (5)	1.8 (0.6–5.2), 0.28	–	–	–
Systolic blood pressure (mmHg), mean (SD)	No	NA	130 (20)	137 (26)	1.0 (1.0–1.0), 0.07	–	–	–
Hypotension (SBP <100 mmHg), n (%)		Yes	2 (4)	59 (5)	0.9 (0.2–3.6), 0.84	–	–	–
Examination – other								
Abnormality on chest auscultation,†† n (%)	Yes	Yes	16 (35)	293 (29)	1.3 (0.7–2.4), 0.39	–	–	–

(*Continues*)

TABLE 4. *Continued*

Variable	Missing >20% (yes/no)	Subgroups	SARS-CoV-2 test positive‡ (n = 50)	SARS-CoV-2 test negative‡ (n = 1284)	OR (95% CI), P-value	Positive likelihood ratio	Negative likelihood ratio	Parsimonious model OR (95% CI), P-value§
Investigations – imaging††								
CXR report, n (%)	Yes	No	14 (37)	502 (60)	Reference			
		Yes – bilateral infiltrates	14 (37)	47 (6)	10.7 (4.8–23.7), <0.001	6.6	0.7	11.3 (2.7–47.7), <0.001
		Yes – other abnormality	10 (26)	295 (35)	1.2 (0.5–2.8), 0.64	–	–	–
Investigations – blood tests††								
WCC (×10⁹/L), mean (SD)	No	NA	6 (3)	10 (7)	0.7 (0.6–0.8), <0.001	–	–	–
Leucocytosis (WCC >11.0 (×10⁹/L)), n (%)		Yes	2 (4)	339 (29)	0.1 (0.0–0.5), 0.003	0.2	1.3	0.1 (0.0–0.8), 0.03
Platelet count (×10⁹/L), mean (SD)	No	NA	218 (94)	245 (91)	1.0 (1.0–1.0), 0.05	–	–	–
Thrombocytopenia (platelet count <150 × 10⁹/L), n (%)		Yes	6 (14)	141 (12)	1.1 (0.5–2.7), 0.78	–	–	–
							AIC	106
							AUROC	0.86 (0.78–0.95)

†SARS-CoV-2 positive cases are defined in this COVED report as having a SARS-CoV-2 test during their ED presentation for which the result is positive for SARS-CoV-2. ‡Includes only SARS-CoV-2-positive case data from Barwon Health, Box Hill Hospital and Tasmanian Health Services. §Clinical variables with a statistically significant univariable association with a SARS-CoV-2 positive test in ED (i.e. excluding patients with a positive SARS-CoV-2 test in the previous 14 days or contact with a person confirmed as SARS-CoV-2 positive). ¶One of the criteria for testing (i.e. inclusion in the present study). ††May not have been performed. AIC, Akaike information criteria; AUROC, area under the receiver operating characteristic curve; CI, confidence interval; IQR, interquartile range; NA, not applicable; OR, odds ratio; SBP, systolic blood pressure; WCC, white blood cell count; –, not meeting criteria for calculation of likelihood ratios (no statistically significant association with SARS-CoV-2 test result) and/or not included in final parsimonious prediction model.

integrated models of care that support outpatient management. In many cases, the discharge decision may have been made prior to the test result becoming available. A number of hospitals have invested in remote monitoring systems, and emerging data suggest it is feasible for EDs to enrol patients in these community-based care arrangements.[28] These types of models aim to detect patient deterioration and may have a role in mitigating the risk of adverse events among patients discharged from the ED.[28,29]

There are several limitations to the present study. First, data on SARS-CoV-2 negative patients were not available for all sites (Table 1). This limits the generalisability of the inferential analyses to the EDs that provided complete data. Second, there were a significant amount of missing clinical data, as summarised in Table 4. This reflects the challenges of systematic, prospective data collection in the dynamic environment of the ED. Third, the study used a PCR swab, ordered during the ED encounter, as the criterion for SARS-CoV-2 positivity. The sensitivity of this test is estimated to be 70–80%,[11,30] and certain patients in the present study may have had false negative results; a further analysis comparing test results during a patient's hospital admission will be informative. Finally, the study's inclusion criteria were SARS-CoV-2 testing in the ED. It is possible that some patients with confirmed COVID-19 who were diagnosed in the community were not re-tested on arrival in the ED. Anecdotal experience, and cross-referencing against other hospital datasets, suggests this number is likely to be low. Conversely, the outcomes of patients who were tested in residential aged-care facilities and did not present to an ED may have differed to the results reported in the present study.

Conclusion

A substantial proportion of patients presenting to Australian EDs in July 2020 underwent SARS-CoV-2 testing and required enhanced IPC precautions. Only a small proportion returned a positive result. In this sample, the presence of SARS-CoV-2 on nasopharyngeal testing was not associated with mechanical ventilation or death in hospital.

Author contributions

All authors have contributed to the concept and design of this Original Research, including its analysis plan, and have critically reviewed the Original Research for content.

Competing interests

GMOR, BM, VT, JSF and PAC are section editors for *Emergency Medicine Australasia*.

Data availability statement

Data that support the findings of this study may be available upon reasonable request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. O'Reilly GM, Mitchell RD, Mitra B *et al*. Impact of patient isolation on emergency department length of stay: a retrospective cohort study using the Registry for Emergency Care. *Emerg. Med. Australas.* 2020; **32**: 1034–9.
2. O'Reilly GM, Mitchell RD, Rajiv P *et al*. Epidemiology and clinical features of emergency department patients with suspected COVID-19: initial results from the COVID-19 Emergency Department Quality Improvement Project (COVED-1). *Emerg. Med. Australas.* 2020; **32**: 638–45.
3. O'Reilly GM, Mitchell RD, Wu J *et al*. Epidemiology and clinical features of emergency department patients with suspected COVID-19: results from the first month of the COVID-19 Emergency Department Quality Improvement Project (COVED-2). *Emerg. Med. Australas.* 2020; **32**: 814–22.
4. Staib A, Small N. Emergency medicine's COVID future: facing the triple challenge after flattening the curve. *Emerg. Med. Australas.* 2020; **32**: 880–2.
5. Cheek JA, Craig SS, West A, Lewena S, Hiscock H. Emergency department utilisation by vulnerable paediatric populations during the COVID-19 pandemic. *Emerg. Med. Australas.* 2020; **32**: 870–1.
6. Mitchell RD, O'Reilly GM, Mitra B, Smit DV, Miller JP, Cameron PA. Impact of COVID-19 State of Emergency restrictions on presentations to two Victorian emergency departments. *Emerg. Med. Australas.* 2020; **32**: 1027–33.

7. Australasian College for Emergency Medicine. Clinical Guidelines for the Management of COVID-19 in Australasian Emergency Departments, Melbourne, Australia, 2020.

8. Saul A, Scott N, Crabb BS, Majundar SS, Coghlan B, Hellard ME. Victoria's response to a resurgence of COVID-19 has averted 9,000–37,000 cases in July 2020. *Med J Aust*. Preprint.

9. Department of Health and Human Services. *Assessment and Testing Criteria for Coronavirus (COVID-19)*. [Cited 1 Aug 2020.] Available from URL: https://www.dhhs.vic.gov.au/assessment-and-testing-criteria-coronavirus-covid-19

10. Tasmanian Government. *Testing for COVID-19*. [Cited 1 Sep 2020.] Available from URL: https://coronavirus.tas.gov.au/keeping-yourself-safe/testing-for-covid19

11. Carpenter CR, Mudd PA, West CP, Wilber E, Wilber ST. Diagnosing COVID-19 in the emergency department: a scoping review of clinical examinations, laboratory tests, imaging accuracy, and biases. *Acad. Emerg. Med*. 2020; **27**: 653–70.

12. O'Reilly GM, Mitchell RD, Noonan MP *et al*. Informing emergency care for COVID-19 patients: the COVID-19 Emergency Department Quality Improvement Project protocol. *Emerg. Med. Australas*. 2020; **32**: 511–4.

13. International Severe Acute Respiratory and Emerging Infection Consortium. *COVID-19 Clinical Research Resources*. [Cited 29 Mar 2020.] Available from URL: https://isaric.tghn.org/covid-19-clinical-research-resources/

14. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – a metadata-driven methodology and workflow process for providing translational research informatics support. *J. Biomed. Inform*. 2009; **42**: 377–81.

15. Harris PA, Taylor R, Minor BL *et al*. The REDCap consortium: building an international community of software platform partners. *J. Biomed. Inform*. 2019; **95**: 103208.

16. Wunsch H. Mechanical ventilation in COVID-19: interpreting the current epidemiology. *Am. J. Respir. Crit. Care Med*. 2020; **202**: 1–4.

17. Petrie S. COVID-19, Australia: Epidemiology Report 21: fortnightly reporting period ending 19 July 2020. *Commun. Dis. Intell*. 2020; **44**: 1–28.

18. Rodriguez-Morales AJ, Cardona-Ospina JA, Gutiérrez-Ocampo E *et al*. Clinical, laboratory and imaging features of COVID-19: a systematic review and meta-analysis. *Travel Med. Infect. Dis*. 2020; **34**: 101623.

19. Cao Y, Liu X, Xiong L, Cai K. Imaging and clinical features of patients with 2019 novel coronavirus SARS-CoV-2: a systematic review and meta-analysis. *J. Med. Virol*. 2020; **92**: 1449–59.

20. Roland LT, Gurrola JG, Loftus PA, Cheung SW, Chang JL. Smell and taste symptom-based predictive model for COVID-19 diagnosis. *Int. Forum Allergy Rhinol*. 2020; **10**: 832–8.

21. Chen S-G, Chen J-Y, Yang Y-P, Chien C-S, Wang M-L, Lin L-T. Use of radiographic features in COVID-19 diagnosis. *J. Chin. Med. Assoc*. 2020; **83**: 644–7.

22. Liang W, Liang H, Ou L *et al*. Development and validation of a clinical risk score to predict the occurrence of critical illness in hospitalized patients with COVID-19. *JAMA Intern. Med*. 2020; **180**: 1081.

23. Haimovich A, Ravindra NG, Stoytchev S *et al*. Development and validation of the quick COVID-19 severity index (qCSI): a prognostic tool for early clinical decompensation. *Ann. Emerg. Med*. 2020; https://doi.org/10.1016/j.annemergmed.2020.07.022.

24. Boyle AA, Henderson K. COVID-19: resetting ED care. *Emerg. Med. J*. 2020; **37**: 458–9.

25. Mazurik L, Javidan AP, Higginson I *et al*. Early lessons from COVID-19 that may reduce future emergency department crowding. *Emerg. Med. Australas*. 2020; **32**: 1077–9.

26. Grasselli G, Pesenti A, Cecconi M. Critical care utilization for the COVID-19 outbreak in Lombardy, Italy. *JAMA* 2020; **323**: 1545–6.

27. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? *Lancet* 2020; **2**: 10–3.

28. Shah S, Majmudar K, Stein A *et al*. Novel use of home pulse oximetry monitoring in COVID-19 patients discharged from the emergency department identifies need for hospitalization. *Acad. Emerg. Med*. 2020; **27**: 681–92.

29. Kilaru AS, Lee K, Snider CK *et al*. Return hospital admissions among 1419 Covid-19 patients discharged from five US emergency departments. *Acad. Emerg. Med*. 2020; https://doi.org/10.1111/acem.14117.

30. Woloshin S, Patel N, Kesselheim A. False negative tests for SARS-CoV-2 infection — challenges and implications. *N. Engl. J. Med*. 2020; **38**: 1–3.