

ORIGINAL ARTICLE

Site of care and factors associated with mortality in unvaccinated Australian aged care residents during COVID-19 outbreaks

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Key words

COVID-19, residential aged care, frailty, Clinical Frailty Score, hospitalisation, mortality.

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Abstract

Background: Residential InReach presents an alternative to hospital admission for aged care residents swabbed for coronavirus disease 2019 (COVID-19), although relative outcomes remain unknown.

Aims: To compare rates and predictors of 28-day mortality for aged care residents seen by InReach with COVID-19, or 'suspected COVID-19' (sCOVID), including hospital versus InReach-based care.

Methods: Prospective observational study of consecutive patients referred to a Victorian InReach service meeting COVID-19 testing criteria between April and October 2020 (pre-vaccine availability). COVID-19 was determined by positive polymerase chain reaction testing on nasopharyngeal swab. sCOVID-19 was defined as meeting symptomatic Victorian Government testing criteria but persistently swab negative.

Results: There were no significant differences in age, sex, Clinical Frailty Score (CFS) or Charlson Comorbidity Index (CCI) between 152 patients with COVID-19 and 118 patients with sCOVID. Similar results were found for 28-day mortality between patients with COVID-19 (35/152, 23%) and sCOVID (32/118, 27%) ($P = 0.4$). For the combined cohort, 28-day mortality was associated with initial oxygen saturation ($P < 0.001$), delirium ($P < 0.001$), hospital transfer for acuity ($P = 0.02$; but not public health/facility reasons), CFS ($P = 0.04$), prior ischaemic heart disease ($P = 0.01$) and dementia ($P = 0.02$). For patients with COVID-19, 28-day mortality was associated with initial oxygen saturation ($P = 0.02$), delirium ($P < 0.001$) and hospital transfer for acuity ($P = 0.01$), but not public health/facility reasons.

Conclusion: Unvaccinated aged care residents meeting COVID-19 testing criteria seen by InReach during a pandemic experience high mortality rates, including with negative swab result. Residents remaining within-facility (with InReach) experienced similar adjusted mortality odds to residents transferred to hospital for public health/facility-based reasons, and lower than those transferred for clinical acuity.

Introduction

Aged care residents are at significant increased risk from respiratory viral outbreaks, including coronavirus disease 2019 (COVID-19),¹ with comorbidity, frailty, crowding and staffing pressures all potential contributors.² In some international settings, over half of the COVID-19-related

mortality has occurred within residential aged care facilities (RACFs).¹

Despite significant public interest, we are aware of only one other Australian study exploring mortality outcomes from COVID-19 in RACFs, limited to a single facility from the early pandemic.³ Larger studies in RACF patients with COVID-19 have reported age, multiple comorbidities^{4,5} and frailty (including Clinical Frailty Scale [CFS]⁶) to be associated with mortality.

Conflict of interest: None.

Charlson Comorbidity Index (CCI) has been associated in hospitalised populations with COVID-19,⁷ but not to our knowledge in RACFs.⁸ The FRAIL-NH (fatigue, resistance, ambulation, incontinence or illness, loss of weight, nutritional approach, and help with dressing) score uses data largely available from routine RACF documentation.⁹ Modified FRAIL-NH (FRAIL) may be associated with COVID-19 severity in hospital.¹⁰

Residential InReach presents an alternative to hospital admission, which may reduce emergency department presentations by providing specialist-level care within-facility.¹¹ InReach services continue to provide core medical and sometimes logistical support to RACFs during COVID-19 outbreaks.¹² The pandemic has prompted an international expansion of such geriatrician-led mobile units to support care facilities,^{13,14} with observational data suggesting lower mortality, improved symptom control and lower hospital transfers.¹⁵ The relative outcomes of hospital transfer versus InReach-based management for RACF residents swabbed for COVID-19 during the pandemic remains unknown. Mortality rates of RACF-acquired pneumonia may be similar between facility-based InReach management and hospital admission.¹⁶ A variety of factors may impact the decision to transfer patients swabbed for COVID-19 during a pandemic scenario, including patient frailty, severity, public health and staffing/logistical issues.¹¹

Overwhelming international evidence supports the role of vaccination in reduced transmission and mortality from common COVID-19 variants within RACFs,^{17,18} although effectiveness against future potential variants may differ.

We analysed data from routine clinical care of patients with either confirmed COVID-19 or suspected COVID-19 (sCOVID; met testing criteria but subsequently COVID-19 negative), collected by a Victorian metropolitan InReach service during the 2020 COVID-19 pandemic 'second wave'. This was at a time of great strain to the state's health system and well before the availability of COVID-19 vaccination or direct antiviral treatment in Australia. The InReach service covers 45 RACFs with approximately 3937 total beds. The primary aim of this study was to compare the rates and predictors of mortality in this group of entirely unvaccinated aged care residents with COVID-19 and/or sCOVID, including relative outcomes of either staying within-facility with InReach support or transfer to hospital. Secondly, we aimed to describe the presentation and management in these patients. The overall mortality of patients with COVID-19 in RACF was expected to be similar to the then-nationally reported rate of 33%.¹⁹

Methods

Study design and population

This study included RACF residents referred to a metropolitan tertiary hospital-based, geriatrician-led InReach team in Victoria, with either confirmed COVID-19 or sCOVID, with 28-day follow-up, between 29 March 2020 and 13 October 2020. This represented an unvaccinated population. COVID-19 infection was defined as a positive polymerase chain reaction (PCR) testing using nasopharyngeal swab. 'sCOVID' was defined as meeting initial screening criteria (from the Department of Health and Human Services Victoria at the time of assessment²⁰) but persistently PCR-negative despite a minimum of one adequately collected symptomatic swab. This sCOVID cohort then represented a range of non-COVID-19-related acute medical issues developed during the study period.

Due to the extraordinary circumstances of the early pandemic during which this study occurred, extremely close clinical and organisational support was provided by InReach to RACFs within catchment (including regular surveillance checks, infection tracing assistance, case management and family liaison). The authors are therefore confident we have included all swab-positive cases of COVID-19 within the catchment and time criteria, including those transferred directly to hospital prior to in-person InReach review. Cases of sCOVID reflect only those referred specifically to InReach, and some may have been managed by general practitioner alone or transferred to hospital without InReach becoming aware.

Data collection

Information was prospectively derived from medical records, including demographics, medical history, presenting symptoms and clinical status, frailty assessment, management, hospital transfers and 28-day mortality.

Disease severity was determined using Australian National Health and Medical Research Council (ANHMRC) criteria,²¹ incorporating signs and symptoms applied to both COVID-19 and sCOVID cohorts. 'Initial oxygen saturation' was defined as the first available oxygen saturation value following symptom onset or, in the case of asymptomatic status (COVID-19 only), after swab result. Hospital transfers were categorised as 'patient acuity' for medical, facility or patient/family concern about individual patient clinical illness, or 'public health/facility capacity' where the transfer occurred in an attempt to halt the local viral outbreak or due to overwhelmed facility resourcing (including staffing),

meaning that routine care was unable to be provided. Hospital transfer occurred on a case-by-case basis.

Frailty was defined at baseline using CFS category and FRAIL-NH.⁹ Multimorbidity was determined using CCI.^{7,8} Delirium was defined clinically, guided by the Confusion Assessment Method.²²

Data analysis

Statistical analysis was performed using IBM SPSS version 26.0. Between-group comparison was performed using Wilcoxon–Mann–Whitney test (non-normally distributed continuous variables, as indicated by Shapiro–Wilk test). Categorical variables were compared using chi-square test. Between COVID-19 and sCOVID cohorts, we compared baseline demographics, medical history, frailty, presenting symptom/sign type, onset date, severity score, ‘initial’ and ‘lowest’ recorded oxygen saturation, delirium, management, hospital admission and 28-day mortality. Similar comparison was performed between those with COVID-19 admitted to hospital and those remaining at their RACF. Patients admitted to a hospital other than that of the primary study site were excluded from the primary analysis of symptoms, severity and management (due to incomplete data), but included in the analysis of baseline and outcomes.

Univariate and multivariate logistic regressions were performed using the combined data set of patients with either COVID-19 or sCOVID for the primary outcome measure of 28-day mortality, and also for COVID-19 separately. Models included age, sex, CFS, FRAIL-NH, CCI, COVID-19 disease status, initial oxygen saturations, delirium and hospital admission status/reason. Several cardiac and respiratory conditions, chosen based on statistical difference or previous reported COVID-19 mortality association, were included for univariate but not multivariate analysis due to risk of collinearity. NHMRC severity and ‘lowest’ oxygen saturations were not included in this analysis because of the variability of timing and concern they may reflect surrogate markers of the dying process.

Patients with missing data were removed from that analysis. Sensitivity analysis was performed to compare patient groups with missing data to included data sets.

Ethics approval

This study was approved by the Austin Health Human Research Ethics Committee (reference H65479).

Results

Baseline characteristics

A total of 270 patients were included: 152 with COVID-19 across four RACF outbreaks (76, 46, 29 and 1 cases per facility, respectively) and 118 with sCOVID from 32 RACFs. sCOVID cases were generally sporadic/single cases per RACF. The median duration of follow-up for COVID-19 was 38 days (range, 28–81 days for survivors and 2–40 days for nonsurvivors) and 51 days for sCOVID. Cumulative case numbers per week are presented in Figure 1. Patient referrals, hospital admission status and mortality outcomes are shown in Figure 2.

Demographic data did not differ between the COVID-19 and sCOVID cohorts (Table 1). CCI was similar between the two groups, although there were significantly higher rates of several comorbidities (Table S1) within the sCOVID cohort, including ischaemic heart disease (IHD), heart failure, atrial fibrillation and dementia. CFS did not differ significantly ($P = 0.08$). 98% of patients with COVID-19 met CFS criteria for at least ‘mild’ frailty, but only 50% were frail using FRAIL-NH.

Clinical presentation, severity and management

Comparison of initial symptoms/signs, severity, management and outcomes between patients in COVID-19 and sCOVID patient cohorts, as well COVID-19-alone stratified by hospital admission status, are presented in Table 2 and described below. Similar comparison for those with sCOVID stratified by hospital admission status was not performed due to the relatively low admission rate (5 of 118 patients) in this group.

The median time from swab positivity to symptom onset in the COVID-19 cohort was 3 days. About 74% of patients were asymptomatic at the swab-positive date. The most common presentation for confirmed COVID-19 was respiratory (42%); several patients (16%) presented with other signs/symptoms alone (e.g. fatigue and gastrointestinal) and 12% were asymptomatic throughout the study. Patients with sCOVID had a higher prevalence of respiratory (with or without fever) symptoms (85%, $P < 0.001$). Patients with COVID-19 had higher ‘initial’ ($P = 0.009$) but lower ‘minimum’ oxygen saturations ($P = 0.01$) than patients with sCOVID. NHMRC severity ($P = 0.09$) and delirium prevalence ($P = 0.9$) was similar between groups. Hypoactive delirium was the most common subtype.

Patients admitted to hospital with COVID-19 were less likely to be asymptomatic and had higher NHMRC severity and delirium prevalence than those staying in-facility.

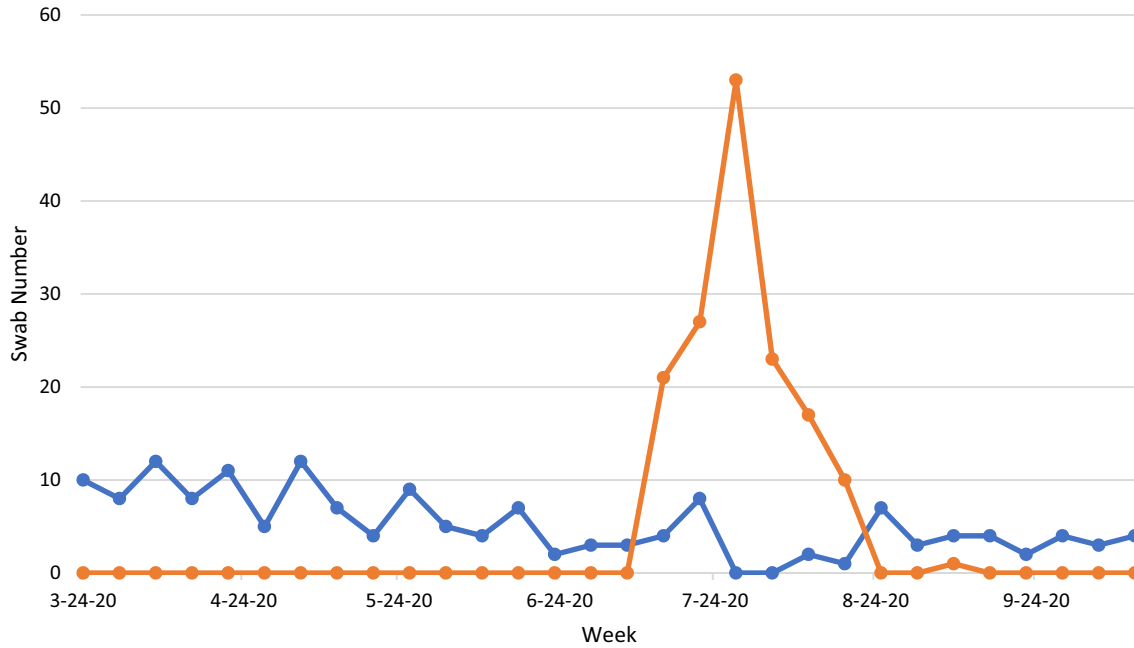


Figure 1 Patients swabbed for coronavirus disease 2019 (COVID-19) with positive result (COVID) versus negative result (suspected COVID-19 [sCOVID]). (—●—) sCOVID and (—●—) COVID.

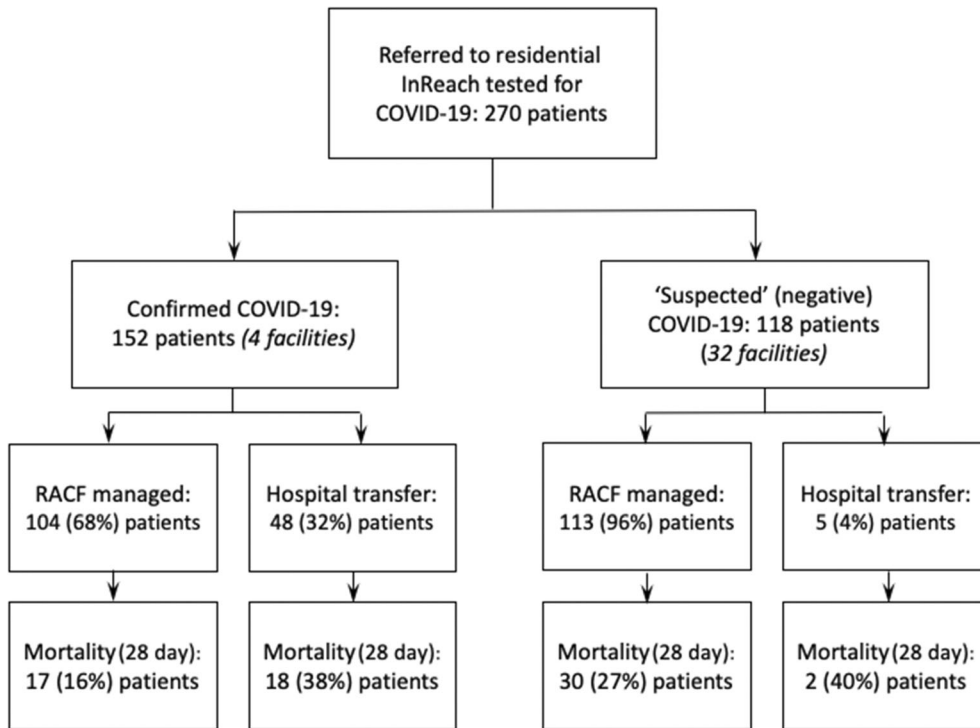


Figure 2 Study population flowchart. COVID-19, coronavirus 2019; RACF, residential aged care facility.

Table 1 Demographic characteristics of study participants by swab result

	Patient group		P value
	COVID-19 positive	Suspected (negative) COVID-19	
Number of patients	152	118	
Number of RACFs	4	32	
Age (years)			0.3
Median (IQR)	87 (80–91)	88 (83–92)	
Range	63–103	48–102	
Female sex, n (%)	89 (59)	67 (57)	0.8
Frailty category, n (%)			0.08
Fit to vulnerable (CFS 1–4)	2 (1)	0	
Mild–moderate frailty (CFS 5–6)	113 (74)	76 (65)	
Severely frail to terminally ill (CFS 7–9)	37 (24)	41 (35)	
Charlson Comorbidity Index			0.4
Median (IQR)	6 (5–8)	6 (5–9)	
Range	2–14	1–13	

CFS, Clinical Frailty Score; RACF, residential aged care facility. Continuous variables are reported as median (interquartile range [IQR]). Statistical comparison performed by Mann–Whitney or chi-square test.

About 38% of patients with COVID-19 received antibiotics versus 61% of patients with sCOVID ($P < 0.001$). Antibiotics and dexamethasone were more frequently prescribed for patients with COVID-19 admitted to hospital than in RACFs (67% vs 29% and 33% vs 8%, respectively; each $P < 0.001$). Supplemental oxygen prescription was similar between COVID-19 and sCOVID cohorts as well as admitted and nonadmitted COVID-19 cohorts.

Although similar rates of community palliative care service referral occurred between the sCOVID and COVID-19 groups ($P = 0.6$), the latter was more likely to have palliative medications prescribed ($P < 0.001$), including ‘anticipatory’ prescription. Palliative medication prescription was similar between patients with COVID-19 in hospital and RACFs.

Forty-eight patients with COVID-19 (32%) were transferred to hospital; 17 (35% of transfers) were for public health (e.g. to limit outbreak spread, inability to isolate due to behaviours) or facility care (e.g. inadequate staffing to provide routine care). A similar number of those with COVID-19 transferred for patient acuity had their transfer actively planned by InReach (16/48 transferred) versus unplanned (15/48, e.g. sudden acute deterioration). The majority of those with a planned transfer were sent directly to the ward instead of the emergency department (12 vs 4). The median duration between swab positivity and hospital admission was 1 day (interquartile range [IQR] 0–3.5).

Mortality rates and associations

Twenty-eight-day mortality was 23% (35/152) for patients with COVID-19 and 27% (32/118) for patients with sCOVID ($P = 0.4$). Ten additional patients with COVID-19 (7%) died during subsequent follow-up.

Mortality (28-day) in residents with COVID-19 hospitalised for public health/local resourcing issues occurred in 24% (4/17) of cases, versus 45% (14/31) hospitalised for acuity and 16% (17/104) who remained within-facility with InReach support. In comparison with those staying within-facility, the odds ratio for mortality was significantly higher for the group hospitalised for acuity ($P = 0.02$), but not statistically different than those transferred for public health/local resourcing issues, including on multivariate modelling (see Table 4). Of those with sCOVID transferred to hospital, 28-day mortality occurred in 30 of 113 residents, with no significant statistical difference than those transferred with COVID-19 ($P = 0.07$). In the adjusted logistic regression model including all COVID-19 and sCOVID patients (Table 3), COVID-19 status did not change the odds of mortality, even with adjustment for hospital admission status and other variables. A similar subanalysis was not performed for those with sCOVID alone stratified by hospital admission status because of the relatively low admission rate (only 5 of 118 patients) of patients with sCOVID.

Further variables associated with 28-day mortality in the combined COVID-19 and sCOVID cohorts are presented in Table 3. Similar analysis restricted to the COVID-19 cohort is presented in Table 4. Results are described below.

Initial oxygen saturation was strongly associated with odds of 28-day mortality across combined ($P < 0.001$) and COVID-19--only ($P = 0.02$) analysis, including multivariate analysis ($P < 0.001$ in both), as was delirium ($P < 0.001$ all analysis sets). The median delay from ‘initial’ oxygen saturation to the date of hospital admission was also 1 day (IQR, 0–2).

Higher frailty scores (CFS 7–9) were associated with greater 28-day mortality ($P = 0.04$) in univariate analysis of the combined cohorts, though nonsignificant in multivariate, and COVID-19--only analysis.

Neither CCI nor prespecified medical comorbidities were associated with mortality within the COVID-19 cohort, though the association with respiratory disease approached significance ($P = 0.06$). IHD ($P = 0.01$) and dementia (0.02) were the only individual medical comorbidities associated with mortality within the combined cohort analysis.

Data completeness and sensitivity analysis

All patients had complete 28-day mortality, basic demographics and medical history information.

Table 2 Initial symptoms/signs, severity, management and outcomes of specified patient cohorts

	Suspected COVID-19	Confirmed COVID-19	COVID-19 (no hospital admission)	COVID-19 (hospital admission)
Initial symptom/sign, n (%) ^{†‡}				
Asymptomatic throughout	0 (0)	16 (12)	15 (14)	1 (3)
Respiratory symptoms	81 (69)	57 (42)	46 (44)	11 (33)
Fever	14 (12)	19 (14)	17 (16)	2 (6)
Fever and respiratory symptoms	19 (16)	23 (17)	13 (13)	10 (30)
Other (including fatigue, gastrointestinal)	3 (3)	22 (16)	13 (13)	9 (27)
Symptom/sign onset, n (%)				
Asymptomatic on date swab positive ^{†‡}	0 (0)	87 (74)	69 (79)	18 (58)
Time from swab to symptoms (days) [‡]				
Median (IQR)	-1 (-2 to -1)	3 (0-6)	3 (1-6)	2 (0-5)
ANHMRC severity score, n (%) [†]				
Mild	57 (49)	60 (44)	55 (53)	5 (15)
Moderate	20 (17)	15 (11%)	13 (13)	2 (6%)
Severe	0 (0)	4 (3)	2 (2%)	2 (6%)
Critical	40 (34)	58 (42)	34 (33)	24 (73%)
Lowest oxygen saturation [‡]				
>92%	53 (56)	54 (39%)	41 (41)	13 (33)
89-92%	26 (28)	53 (38)	39 (39)	14 (35)
≤88%	15 (16)	32 (23)	19 (19)	13 (33)
Initial oxygen saturation, n (%) [‡]				
>92%	64 (68)	116 (84)	82 (83)	34 (85)
89-92%	16 (17)	8 (6%)	6 (6)	2 (5)
≤88%	14 (15)	15 (11%)	11 (11)	4 (10)
Delirium, n (%)				
Any [†]	33 (28)	38 (28)	22 (21%)	16 (49%)
Subtype, n (%) [†]				
Hypoactive	25 (21)	22 (16)	15 (14)	7 (21)
Hyperactive	3 (3)	4 (3)	1 (1)	3 (9)
Mixed or not specified	5 (4)	12 (9)	6 (6%)	6 (18)
Management (active), n (%)				
Antibiotics ^{†‡}	71 (61)	52 (38%)	30 (29)	22 (67%)
Oxygen (supplementary)	22 (19)	35 (26)	25 (24)	10 (30)
Subcutaneous fluids	6 (5)	8 (6)	8 (8%)	0 (0)
Dexamethasone ^{†‡}	0 (0)	19 (14)	8 (8)	11 (33)
Management (symptomatic), n (%)				
Community palliative care	20 (17)	27 (20)	23 (22%)	4 (12%)
Palliative care medication [‡]	38 (33)	96 (72)	70 (67%)	26 (79)
'Anticipatory' prescription [‡]	17 (15)	60 (44)	46 (44%)	14 (42%)
Hospital admission ^{†‡}	5 (4)	48 (32%)	0 (0%)	48 (100%)
Public health facility capacity (well) [§]	0 (0%)	17 (11%)	0 (0%)	17 (35%)
Planned transfer (direct to ward)	0 (0)	12 (8)	0 (0)	12 (25)
Planned transfer (via ED)	2 (2)	4 (3%)	0 (0%)	4 (8%)
Unplanned transfer	3 (3%)	15 (10)	0 (0)	15 (31%)
28-day mortality [†]	32 (27)	35 (23%)	17 (16)	18 (38)

[†] $P < 0.05$, coronavirus disease 2019 (COVID-19) (admission) versus COVID-19 (no admission).

[‡] $P < 0.05$, confirmed COVID-19 versus suspected COVID-19.

[§]Patients transferred not because of systemic unwellness but instead because of other factors limiting adequate patient care including facility factors (e.g. staffing availability) or patient factors (e.g. impractical to be isolated in facility environment due to behavioural factors). ANHMRC, Australian National Health and Medical Research Council; ED, emergency department; IQR, interquartile range.

Missing data are summarised in Table S2. Fifteen patients with COVID-19 and 1 patient with sCOVID were excluded from analysis of symptoms, severity and

management (Table 2) as admitted to a nonprimary study site hospital. FRAIL-NH was unavailable for 11 (7%) COVID-19 patients.

Table 3 Logistic regression model for 28-day mortality in patients with either COVID-19 or suspected COVID-19

Grouping variable	Univariate		Multivariate	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value
Age (years)	1.0 (0.98–1.1)	0.4	0.99 (0.94–1.0)	0.8
Sex (female)	1.1 (0.63–1.9)	0.7	0.90 (0.43–1.9)	0.8
Charlson Comorbidity Index	1.1 (0.97–1.2)	0.1	1.1 (0.93–1.3)	0.2
CFS category (reference = fit to moderate frail CFS 1–6)				
Severely frail to terminally ill (CFS 7–9)	1.8 (1.0–3.3)	0.04	1.3 (0.55–3.1)	0.5
Cardiac disease (any)	1.5 (0.74–3.2)	0.2	1.9 (0.67–5.3)	0.2
Hypertension	1.2 (0.66–2.1)	0.6		
Ischaemic heart disease	2.2 (1.2–4.3)	0.01		
Congestive cardiac failure	1.3 (0.69–2.6)	0.4		
Atrial fibrillation	1.2 (0.61–2.4)	0.6		
Respiratory disease (any)	1.3 (0.7–2.3)	0.4	1.6 (0.67–3.6)	0.3
Chronic obstructive pulmonary disease	1.4 (0.7–2.9)	0.3		
Dementia (any)	2.0 (1.1–3.7)	0.02	1.9 (0.85–4.0)	0.1
COVID-19 status	0.8 (0.5–1.4)	0.4	0.77 (0.35–1.7)	0.5
Delirium	5.3 (2.9–9.8)	<0.001	5.5 (2.6–11.7)	<0.001
Initial oxygen saturation (%)	0.87 (0.82–0.93)	<0.001	0.87 (0.81–0.94)	<0.001
Hospital admission status (reference = no admission)				
Facility care requirement/public health	1.1 (0.3–3.4)	0.9	2.5 (0.48–13.0)	0.3
Patient acuity	2.4 (1.1–5.2)	0.02	2.8 (1.1–7.3)	0.04

CFS, Clinical Frailty Score; CI, confidence interval; COVID-19, coronavirus disease 2019; OR, odds ratio.

Table 4 Logistic regression model for 28-day mortality in patients with COVID-19

Grouping variable	Univariate		Multivariate	
	OR (95% CI)	<i>P</i> value	OR (95% CI)	<i>P</i> value
Age (years)	1.0 (0.96–1.1)	0.8	0.98 (0.91–1.1)	0.7
Sex (female)	0.69 (0.32–1.5)	0.3	2.1 (0.69–6.2)	0.2
Charlson Comorbidity Index	1.1 (0.93–1.3)	0.3	1.2 (0.88–1.5)	0.3
CFS category (reference = fit to moderate frail CFS 1–6)				
Severely frail to terminally ill (CFS 7–9)	1.3 (0.57–3.1)	0.5	1.6 (0.46–5.5)	0.5
FRAIL-NH (frailty score)	1.1 (0.89–1.3)	0.5		
Faecal incontinence	0.88 (0.4–2.1)	0.8		
Wheelchair/bed bound	1.5 (0.64–3.4)	0.4		
Weight loss (% over last 3–6 months)	1.1 (0.95–1.2)	0.3		
Cardiac disease (any)	1.6 (0.6–4.2)	0.3	0.91 (0.22–3.8)	0.9
Hypertension	1.5 (0.68–3.3)	0.3		
Ischaemic heart disease	1.7 (0.63–4.6)	0.3		
Congestive cardiac failure	1.2 (0.44–3.4)	0.7		
Atrial fibrillation	0.5 (0.13–1.7)	0.3		
Respiratory disease (any)	2.2 (0.96–4.9)	0.06	2.5 (0.75–8.5)	0.1
Chronic obstructive pulmonary disease	2.4 (0.93–6.0)	0.07		
Dementia (any)	1.5 (0.7–3.2)	0.3	1.4 (0.47–4.3)	0.5
Delirium	4.2 (1.8–9.8)	<0.001	7.1 (2.2–22.7)	<0.001
Initial oxygen saturation (%)	0.93 (0.88–0.99)	0.02	0.82 (0.74–0.92)	<0.001
Hospital admission status (reference = no admission)				
Facility care requirement/public health	1.4 (0.4–4.8)	0.6	2.9 (0.53–15.9)	0.2
Patient acuity	3.2 (1.3–7.9)	0.01	3.4 (1.1–10.9)	0.04

CFS, Clinical Frailty Score; CI, confidence interval; COVID-19, coronavirus disease 2019; FRAIL-NH, fatigue, resistance, ambulation, incontinence or illness, loss of weight, nutritional approach, and help with dressing; OR, odds ratio.

Missing data for oxygen saturation (14%) and delirium (5%) resulted in 42 (16%) exclusions from the multivariate logistic regression in the combined COVID-19/sCOVID cohort and 17 (6.3%) for COVID-19 alone.

Sensitivity analysis (Tables S3–S5) did not reveal significant differences in age, sex, CCI or CFS category for those with missing or complete data on FRAIL-NH score (COVID-19 only), oxygenation or nonprimary site hospital admission.

Discussion

This report summarises detailed presentation, management and outcomes for a sizable sample (7.4%) of the 2049 RACF-based Australian cases of COVID-19 through 2020, as managed by a single InReach service during the peak of Victoria's 'second wave' 2020 pandemic. The observed mortality rate of 30% was similar to concurrent national¹⁹ and international²³ RACF-based reports.

Predictors of mortality

Although aged care residents meeting symptomatic testing criteria for COVID-19 demonstrated high mortality rates, COVID-19–positive status did not change the odds of mortality, in contrast with previous reports of hospitalised patients.²⁴ The reason for this may relate to differences in case-finding – the InReach service provided clinical oversight for all cases of COVID-19 within these outbreaks; by comparison, the described patients with sCOVID represented only those deemed by the referrer to be sufficiently severe to require InReach support. In support of this, we observed significantly higher rates of dementia, IHD, CCF and atrial fibrillation and lower initial oxygen saturations in the sCOVID cohort.

COVID-19–positive residents transferred to hospital for disease acuity (but not primary public health/facility factors) had higher odds of mortality than nontransfer patients, including with adjustment for other clinical variables. This may still reflect that those with more severe disease were prioritised for transfer, whereas those with mild–moderate disease were more frequently treated at the RACF.

Initial oxygen saturation and presence of delirium strongly increased the odds of 28-day mortality. Oxygen status on admission to hospital has been previously proposed as a mortality predictor.²⁵ One previous study of the aged care resident population has demonstrated good mortality rate discrimination using PROFUND or CURB-65 clinical risk scores,⁸ though the requirement for laboratory data means in RACF outbreaks may be limited.

Frailty by either CFS category or FRAIL-NH score was not associated with mortality in the COVID-19 cohort. This is in contrast to some international studies in RACFs.⁶ CFS was associated with odds of mortality in unadjusted modelling of the combined COVID-19 and sCOVID cohorts. One previous hospital-based study reported similar increased mortality with CFS in COVID-19–negative but not COVID-19–positive patients.²⁴ We recorded near-universal frailty by CFS, questioning the discriminatory utility of lower CFS categories within our population.

In our study, neither CCI or predetermined individual medical comorbidities had significantly higher odds of mortality after adjustment. Higher CCI has been associated with poor outcomes in COVID-19 in a meta-analysis of mostly hospital-based studies including younger patients.⁷ One study in an RACF did not demonstrate this association.⁸ Larger studies of patients with COVID-19 in RACFs have previously identified risk factors for mortality including male sex, age, diabetes, respiratory/cardiovascular disease, malignancy, chronic kidney disease, and dementia,⁵ though studies with less than 1000 patients have struggled to demonstrate many of these associations.²⁶

Clinical presentation and management

Around three of four RACF residents with COVID-19 were asymptomatic at the time of positive swab (higher than previously reported rates).²³ Many patients presented without classic features of fever or respiratory symptoms at onset, highlighting the importance of broad testing for atypical symptoms in RACFs during outbreaks or when community case numbers are high. Treatment received in hospital and RACFs differed in frequency, likely reflecting inherent differences in disease severity and goals of care. InReach was able to plan around half of the hospital admissions that occurred due to patient acuity and coordinated a direct ward transfer for the majority of those patients.

Residents with sCOVID usually presented with respiratory (with or without fever) symptoms (85%) and were treated with antibiotics for confirmed or suspected bacterial infection in most (61%) cases.

A notable difference in the care provided between the two cohorts was significantly lower palliative medication prescription for patients with sCOVID, despite similar observed mortality to those with COVID-19. This may suggest clinicians were more alert to the risk of deterioration within the COVID-19 cohort and emphasised the importance of routine palliative care consideration in this highly vulnerable population.

Strengths and limitations

The strengths of the current study include detailed functional, clinical and demographic information, hard end points, follow-up duration and lack of loss to follow-up. Use of a mixed cohort of patients with either COVID-19 or sCOVID provides a ‘real-world’ description of relative outcomes for patients managed and swabbed by an InReach service during a pandemic. Nevertheless, some residents with sCOVID would not have been included due to having been managed by a general practitioner alone or admitted directly to hospital without InReach input. Results of the sCOVID cohort should not therefore be interpreted to reflect all RACF residents presenting with a non-COVID-19 condition initially meeting testing criteria. This study also does not include asymptomatic residents with negative COVID-19 swabs collected in the setting of local facility outbreaks.

The limitations of the current study include the sample size, single InReach service inclusion (though multiple RACFs), the observational design and some missing data. Additional clinical data may have allowed for more thorough adjustment for disease severity. Empiric therapy was used frequently for the sCOVID cohort and a subdivision of exact underlying diagnoses for each patient was not able to be reported. This was due to a combination of factors including limited goals for intensive investigation, compounded by local RACF lockdowns limiting access to investigations such as mobile radiology, as well as lack of access to some records due to shared care with other community practitioners for this group. These data were collected during outbreaks that occurred prior to rollout of COVID-19 vaccination, direct antiviral treatments and novel strain outbreaks in Australian RACFs. Despite a

large proportion of RACF residents now having received vaccination, our study remains of relevance due to waning immunity and need for booster vaccinations in this population, as well as the potential emergence of new variants with lower vaccine efficacy. Further study is needed to assess the impact of vaccination and novel variants on COVID-19 RACF outbreaks.

Conclusion

Patients residing in RACFs referred to InReach with suspected COVID-19 represent a particularly frail and vulnerable cohort, irrespective of the outcome of PCR testing, highlighting the importance of advanced care planning and appropriate goals of careful consideration. Markers of early clinical status including delirium and initial oxygen saturation were significantly associated with mortality. Aged care residents with COVID-19 and/or sCOVID staying within-facility with InReach support and adequate local resources experienced unchanged adjusted odds of mortality compared with those transferred to hospital for public health or facility-resourcing issues and lower odds compared with those transferred for clinical concern.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Table S1. Baseline medical history for COVID-19 and sCOVID-19 patient cohorts

Table S2. Summary of missing data

Table S3. Sensitivity analysis for FRAIL-NH incomplete data amongst COVID-19

Table S4. Sensitivity analysis for incomplete oxygen saturation data amongst COVID-19 and suspected COVID-19 cohorts ('initial' and 'owest')

Table S5. Sensitivity analysis for patients admitted to a hospital other than that of the primary study site, and therefore potentially incomplete symptom, severity and management data (excluded from Table 2, main body)