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Descriptive Analysis of a Telephone Based Community Monitoring Service for COVID-19

A. C. Clarke[1] · S. Hull[1] · A. I. Semciw[2,3] · R. L. Jessup[2,3,4] · D. Campbell[1] · A. M. Fabri[1] · N. Tully[1] · C. Bramston[1] · J. Hayes[1]

Abstract

The coronavirus disease (COVID-19) pandemic has required health services to rapidly respond to the needs of people diagnosed with the virus. Over 80% of people diagnosed with COVID-19 experience a mild illness and there is a need for community management to support these people in their home. In this paper we present, a telephone based COVID-19 community monitoring service developed in an Australian public health network, and we describe the rapid implementation of the service and the demographic and clinical characteristics of those enrolled. A retrospective mixed methods evaluation of the COVID-19 community monitoring service using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework. Eight hundred and fifty COVID-19 positive patients were enrolled, 54% female, 45% male, mean age 34 years SD 17. Four hundred and nine (48%) patients were born outside Australia. Among the 850 patients, 305 (36%) were classified as having a high risk of serious illness from COVID-19. The most prevalent risk factors were cardiovascular disease (37%), lung disease (30%) and age over 60 years (26%). The most common reported ongoing symptoms were fatigue (55%), breathing issues (26%) and mental health issues such as low mood (19%). There were no deaths in patients that participated in the service. The process of risk stratification undertaken with telephone triage was effective in determining risk of prolonged illness from COVID-19. Telephone monitoring by trained health professionals has a strong potential in the effective management of patients with a mild COVID-19 illness.

Keywords Telemedicine · Community medicine · Community health services

Introduction

The coronavirus disease (COVID-19) pandemic has required health services to rapidly respond to the needs of people diagnosed with the virus. The spectrum of disease has been categorised as mild, severe or critical [1]. Early findings from China established that 81% of people with COVID-19 had mild disease, 14% had severe disease and 5% had critical disease; fatality rates were reported to be 49% in those with critical disease [2]. Individuals that are older or have co-morbidities such as cardiovascular disease, chronic lung disease, diabetes and obesity are at high risk of critical illness from COVID-19 [1].

Over 80% of people with COVID-19 are likely to experience a mild illness [1]. There is a need for community management of those with mild illness to reduce the strain on hospital resources and healthcare worker exposure [3, 4]. Community management involves monitoring symptoms while individuals remain at home, while also allowing for timely identification of deteriorating symptoms which usually occurs around one week after illness onset [3, 5].

Due to the novel nature of this coronavirus, there is limited evidence on the most successful healthcare model for community management of COVID-19 patients. Community management models described in the literature to date generally utilised a combination of monitoring technology and telephone support from health professionals. Kricke et al.

✉ A. C. Clarke
  Andrea.clarke4@nh.org.au

1 Hospital Without Walls Directorate, Northern Health, 1231 Plenty Road, Bundoora, Melbourne, VIC 3083, Australia

2 Allied Health Research, Northern Health, Melbourne, Australia

3 School of Allied Health, Human Services and Sport, La Trobe University, Melbourne, Australia

4 School of Rural Health, Monash University, Warragul, Australia

[6]; Morgan et al. [7] and Medina et al. [8] all described the implementation of an electronic Short Message Service (SMS) monitoring system that relied on patient response of self-reported symptoms, with phone calls made by health professionals only to those patients with self-reported symptoms that were of concern. Silven et al. [3] described a model that combined monitoring of vital signs with video consultations. There appears to be an absence of research on lower technology models of care.

In this study, we describe the development and outcomes of a telephone based community monitoring service for patients with COVID-19. The aim of this study was to describe the rapid implementation of a telephone based COVID-19 community monitoring service and the demographic and clinical characteristics of those enrolled.

Methods

Design

This study was a retrospective mixed methods evaluation of the COVID-19 community monitoring service using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework [9].

Setting

The World Health Organization (WHO) declared a international public health emergency on the 30th January 2020, around the same time Australia recorded its first confirmed case of COVID-19. Australia's largest COVID-19 outbreak was in Melbourne, Victoria, with 72% (20,345 on 1st December 2020) [10] of the nation's cases recorded in Victoria and 67% (n = 18,965 on 1st December 2020) [11] in metropolitan Melbourne. The new daily cases in Victoria began to rise in late June 2020 and peaked on 5th August 2020 with 725 new cases reported in a 24 h period [12].

Northern Health is the key provider of public health care in Melbourne's northern suburbs. Residents in the Northern Health catchment are culturally and linguistically diverse, born in over 170 countries, speaking over 100 different languages and following 75 religions or beliefs [13]. Northern Health's catchment accounts for approximately 10% of Victoria's population, however at the peak of the pandemic, one third of Victoria's COVID-19 cases resided in the catchment.

Participants

All patients that consented to participate in the COVID-19 community monitoring service (the service) were included in the evaluation. Patients were enrolled in the service if they were diagnosed with COVID-19 and were a patient of Northern Health and/or lived in the Northern Health catchment area. Patients referred were contacted by the service, after the patient had been notified of a positive COVID-19 result.

Procedure

The service was established to ensure that people who were COVID-19 positive living in Melbourne's northern region were provided with health advice and support during the acute phase of their infection. The service also aimed to provide timely identification of worsening symptoms and prevent unnecessary hospital admissions.

A low technology model was rapidly developed that relied on telephone contact by trained health professionals. The development of the service was first discussed on 15th July 2020 and the service went live on 21st July 2020. Nursing staff furloughed due to medical risk issues and allied health staff from community programs were engaged to work in the service. The service was suspended on the 12th November 2020 due to there no longer being any active cases in the state.

Patients were monitored by the service during the acute phase of their illness which was typically up to 14 days. All patients received an initial call within 24–48 h of receipt of referral. At the initial call, consent was gained for the patient to be monitored by the service, and a clinical assessment incorporating risk stratification and a social and welfare needs assessment were undertaken. Education was provided on how to isolate at home and how to identify symptoms of deterioration.

A telephone call script was used during the initial and subsequent calls. The initial call script included a checklist of risk factors and both the initial and subsequent call scripts included a checklist of symptoms. The telephone scripts were refined through iterative processes during the first four weeks of the service. The risk factor checklist supported the assessment of risk of serious illness from COVID-19, and risk stratified the patient as high or low risk (see Table 1). The symptom checklist identified if patient symptoms were worsening. Patient symptoms were categorised as stable or deteriorating. For patients with deteriorating symptoms, escalation of care involved either consultation with a Northern Health medical officer, referral to the general practitioner or hospital emergency department (ED), or calling an ambulance. High risk patients received daily monitoring calls and low risk patients received second daily contact. (See Fig. 1 for more information).

Patients were discharged from the service when cleared from isolation by the Victorian Department of Health and Human Services (DHHS). At the time the service was active, the DHHS were responsible for contact tracing and release from isolation. All patients received a post discharge follow

Table 1 Risk factor stratification criteria

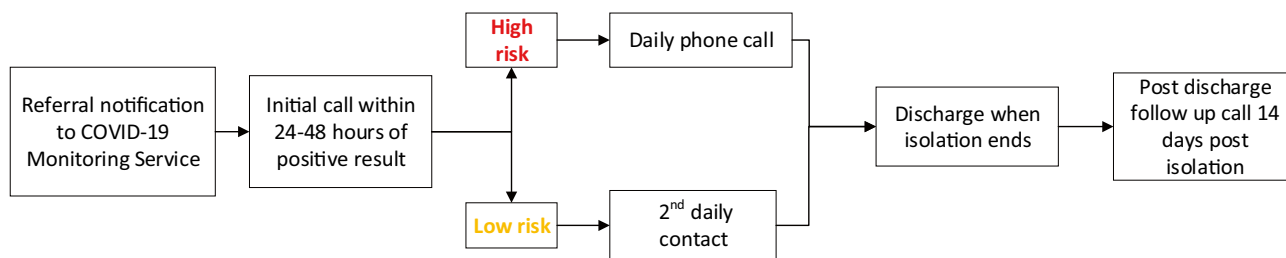|	
High risk	Any of
	• Age 60 or over
	• Presence of one or more co-morbidities associated with increased mortality (cardio-vascular disease, respiratory disease, hypertension, diabetes mellitus, cancer, chronic kidney disease, obesity)
	• Immunosuppression
	• Aboriginal and/or Torres Strait Islander
	• Pregnant
	• Socially isolated/vulnerable
	• Frailty
	• Disability
	• Mental health issues
	• A person discharged after an acute inpatient admission
	• A person who has had a 000 call due to COVID-19 symptoms
	• Moderate to severe COVID-19 symptoms
	• A person whom clinical judgement/clinician worry identifies them at being at higher risk
Low risk	All of the following
	• Under 60 years of age
	• No co-morbidities
	• Nil known immunosuppression
	• Mild COVID-19 symptoms

Fig. 1 Patient flow

up call two weeks after discharge to check on their recovery, self-reported ongoing symptoms and if they had returned to their usual daily activities.

Evaluation Procedure

Patient data (demographic) was extracted from the Northern Health data warehouse. Socio-economic Indexes for Areas (SEIFA) 2016, ranking data was obtained from the Australian Bureau of Statistics (ABS) and the residential suburb data was used to determine decile rankings for the state of Victoria. Deciles are ordered from lowest to highest with decile 1 being the most disadvantaged and 10 being the least.

Data on patient demographics, risk level, self-reported symptoms and issues during acute illness, clinical recommendations and symptoms or issues beyond 30 days after symptom onset was gathered from an audit of the clinical progress notes.

Data Analysis

Descriptive Analysis of Service Utilization

Demographics were described based on age, country of birth, preferred language, SEIFA ranking and gender. SEIFA was dichotomized into high, low, with those ≤ being classified as low. Gender has been reported as male, female and other. Due to the low reporting of 'other' within our sample, any further analyses including gender as a variable have been conducted with male and female levels of sex only (see Fig. 2 for patient age and gender distribution). The proportion of people who satisfied each risk category was also described.
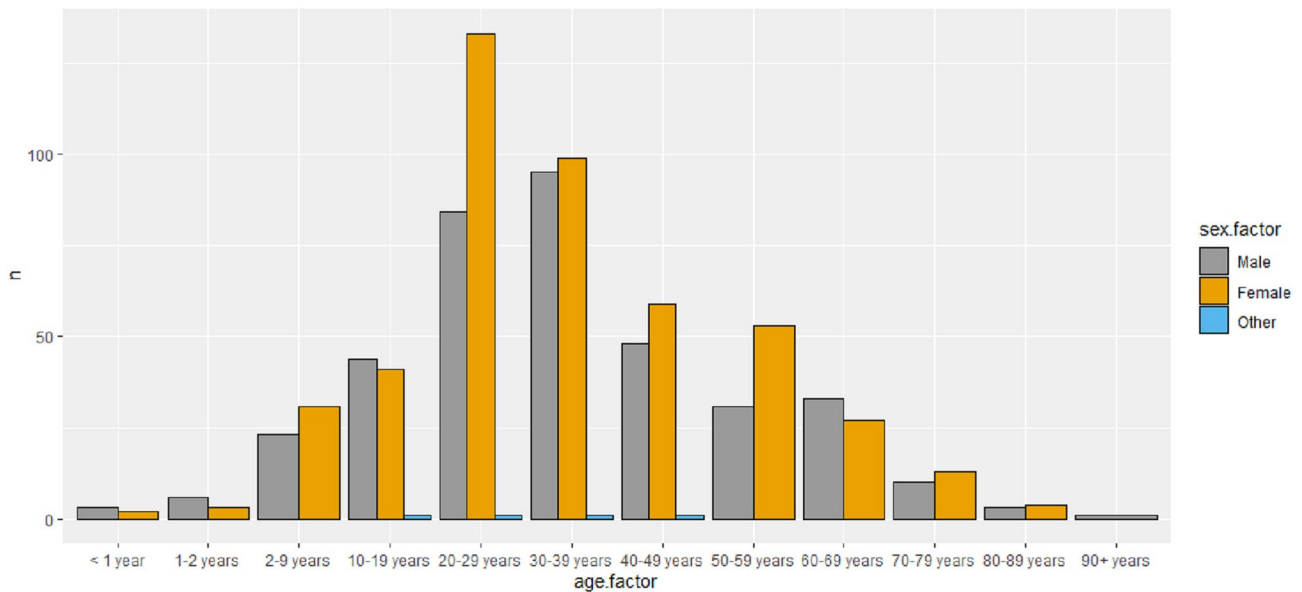
Fig. 2 Patient age and gender distribution

Factors Associated with Ongoing Symptoms

Only those who agreed to receive post discharge follow-up calls, or who responded to follow-up calls were included in this analysis. Factors associated with ongoing symptoms were investigated using multivariable logistic regression. The outcome variable was 'ongoing symptoms' (yes/no), and the independent variables were 'risk category' (high/low), gender (male/female), SEIFA (high/low). Language/use of interpreter services and country of birth were not included due to their potential relationship with SEIFA (collinearity). Age was not included, as it was a variable used to determine risk category. Results are presented as crude and adjusted odds ratios (95% CI). All analyses were performed using R statistical software (https://www.r-project.org/, version 4.0.2).

Results

Characteristics of the Patients

Between 21st July and 12th November 2020, 850 COVID-19 positive patients were enrolled, 54% female, 45% male, mean age (SD) 34 (17) years. Four hundred and nine (48%) patients were born outside Australia. Three hundred and five (36%) were classified as high risk of serious illness from COVID-19. The most prevalent risk factors were cardiovascular disease (n = 112, 37%), lung disease (n = 92, 30%), aged over 60 years (n = 80, 26%) and diabetes (n = 60, 20%). There were no deaths in patients that participated in

the service. Thirty (3.5%) patients had deteriorating symptoms and were escalated for urgent medical care. Forty-one patients presented to the emergency department, 22 patients were admitted to hospital and one required an ICU admission. Characteristics of the patients are shown in Table 2.

Prolonged Illness

Prolonged illness data is available from the 646 patients that responded to or accepted follow-up calls, representing 76% of the total sample. Of those that responded to the follow up calls 415 were categorized as low risk and 231 high risk. Of the 646 patients, 16% (n = 105) patients reported ongoing symptoms 20 days post illness onset. The most common reported ongoing symptoms were fatigue (n = 58; 55%), breathing issues (n = 27; 26%) and mental health issues such as low mood (n = 20; 19%) (see Fig. 3).

Crude analyses suggested that those deemed high risk had 2.18 (1.42, 3.33, p < 0.001) times greater odds of prolonged symptoms than those deemed low risk. Sex [odds ratio (OR) = 1.52 (0.98, 2.34), p = 0.073] or SEIFA category [OR = 1.12 (0.71, 1.77), p = 0.753] were not associated with prolonged symptoms. Figure 4 illustrates a forest plot of the relationship between risk category and the odds of prolonged symptoms, after adjusting for sex and SEIFA category. Adjustments did not change the meaning of the outcome. Adjusted probabilities of prolonged symptoms in those deemed high and low risk were 23% (18%, 29%) and 12% (9%, 16%) respectively. There were no interactions between risk category and sex (p = 0.98), or risk and SEIFA category (p = 0.48) (see Fig. 4).

Table 2 Characteristics of enrolled patients

Total, n	850
Age, mean (SD)	34 (17)
Female, n (%)	460 (54.1)
Male, n (%)	384 (45.1)
Other, n (%)	6 (0.7)
Country of birth (top 8), n (%)	
Australia	436 (51.2)
India	109 (12.8)
Iraq	59 (6.9)
Nepal	40 (4.7)
New Zealand	16 (1.8)
Philippines	24 (2.8)
Samoa	17 (2)
Sri lanka	13 (1.5)
Preferred language (top 4), n (%)	
English	628 (73.8)
Arabic	27 (3.1)
Assyrian	15 (1.7)
Chaldean	9 (1)
SEIFA ranking within state, decile, n (%)	
1	177 (20)
2	69 (8)
3	292 (34)
4	8 (0.9)
5	35 (4)
6	80 (9)
7	49 (6)
8	99 (11)
9	31(3)
10	10 (1)
High risk, n (%)	302 (35)
Risk factors, n (%)[a]	
Patients with > 1 risk factor	192 (64)
Aged 60 or over	80 (26)
Aboriginal and/or Torres Strait Islander	6 (2)
Lung disease	92 (30)
Cardiovascular disease	112 (37)
Diabetes	60 (20)
Pregnancy	17 (6)
Socially isolated/vulnerable	13
Disability	24 (8)
Frailty	12 (4)
Cancer	12 (4)
Chronic renal disease	15 (5)
Obesity	52 (17)
Immunosuppressed	22 (7)
Inpatient admission for COVID-19	64 (21)
000 call due to COVID	11 (4)
Moderate to severe symptoms	9 (3)
Clinician worry	4 (1)
Escalation of medical care, n (%)	30 (3.5)
Hospital admission, n (%)	22 (3.7)
Length of hospital admission stay, mean days, SD[b]	4.8 (4.7)
ED presentation	41 (4.8)
ICU admission, n (%)	1 (0.1)

Table 2 (continued)

[a]Proportion of the high risk patients

[b]Applies only to those patients that were admitted to hospital

Discussion

This study examined the demographic and clinical characteristics of patients enrolled in a COVID-19 community monitoring service. One in five people who were categorised as high risk at the time of diagnosis went on to develop prolonged symptoms. Those at high risk were also twice as likely to experience prolonged symptoms than those categorised as low risk. Escalations for medical care, emergency department presentations and hospital admissions were low and there were no deaths in patients enrolled in the service. There was a high proportion of enrolled patients from lower socioeconomic and migrant backgrounds.

We found that 16% of enrolled patients who responded to follow up calls self-reported symptoms beyond 30 days from illness onset. This is consistent with findings reported in the literature. Greenhalgh et al. [14] reported approximately 10% of patients are likely to experience symptoms beyond three weeks and Medina et al. [8] found 10% of patients required continued monitoring beyond 14 days due to persistent symptoms. Tenforde et al.'s [15] research reported that 65% of people had not returned to their usual state of health 14–21 days post illness onset.

This evaluation found that fatigue was the most common ongoing symptom affecting more than half of the patients with ongoing symptoms. This is less than reported in the studies by Eythorsson et al. [16], who reported ongoing lethargy in 74.7%, and Tenforde et al. [15], who reported ongoing fatigue in 71% of patients. This may be attributed to the differing time points used in reporting of prolonged symptoms. Similar studies reported symptoms between 14 and 21 days [15, 16], whereas our study reported prolonged symptoms at least 30 days post illness, providing a greater period of time within which symptoms may have resolved.

In this evaluation, we found that 35% of patients were at high risk, and of those, 64% had more than one risk factor. This is higher than reported in the study by Medina et al. [8], who found 55% of patients had greater than one risk factor. Health risk factors were comparable between the studies, however socioeconomic and migrant backgrounds were not reported in other studies and may account for the differences seen between studies [8]. Only 3.5% of patients were escalated for urgent medical care which is lower than the research by Morgan et al. [7] who reported 15.5% escalation for urgent assessment. This evaluation found that 41 patients presented to the ED and 22 were admitted. The proportion of hospitalised cases is well below Australia's national average of 13% (on 22 November 2020) [17]. The

Fig. 3 Symptom type in those that presented with prolonged symptoms (total sample = 105)
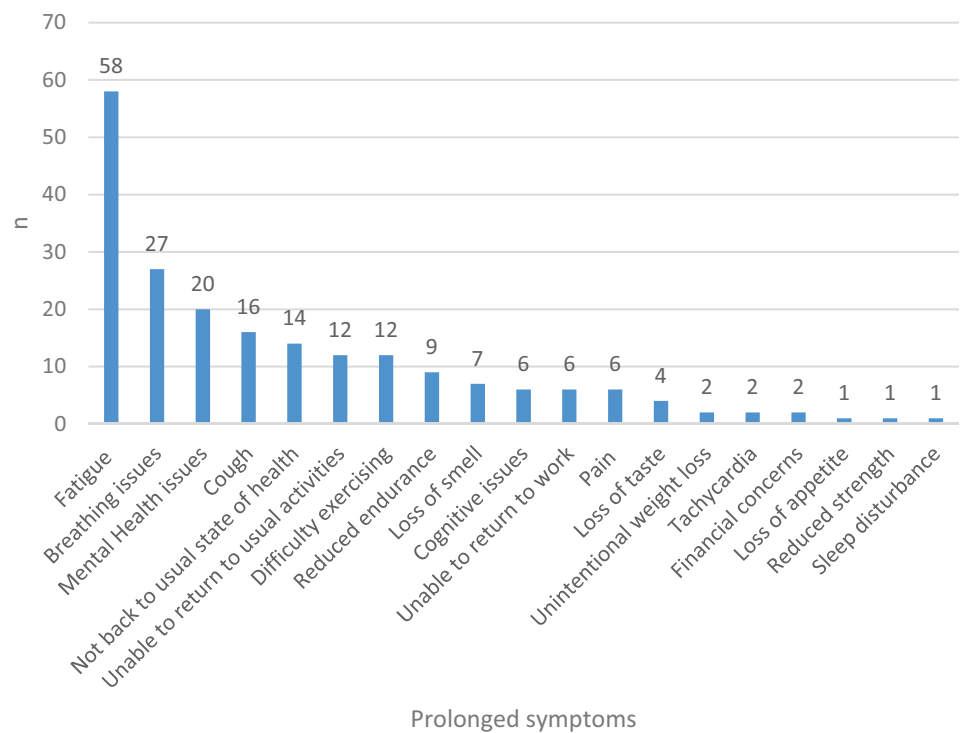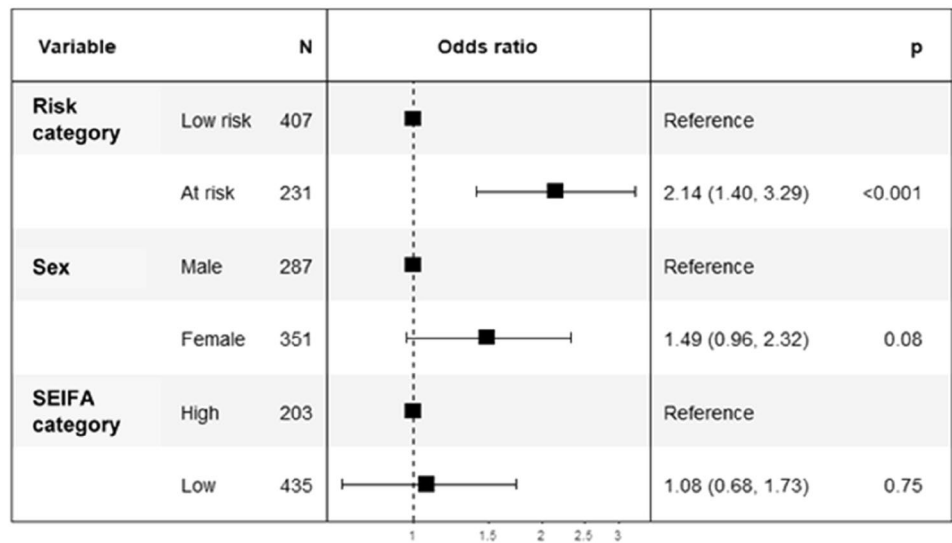

Fig. 4 Relationship between risk category, sex, Socio-economic Indexes for Australia (SEIFA) and prolonged illness

reason for this disparity is likely attributed to the low median age of enrolled patients and the exclusion of people living in residential aged care. The hospitalisation rate of 3.7% is similar to other community management programs [4] who reported a 3% hospitalisation rate. Of those admitted to hospital, 59% were from migrant backgrounds. Around the world, COVID-19 cases have been more prevalent in people from culturally and linguistically diverse and lower socio-economic backgrounds [18]. The Northern Health service was a low technology model that relied on telephone contact from trained health professionals. The participation rate was

97% which was higher than reported by the other studies [ranging from 33% (6) to 78% (7)]. This may be attributed to the telephone only modality which has the benefit of being highly accessible.

Telephone triage of risk and telephone support was feasible in supporting individuals during the acute phase of their illness. Risk stratification criteria was associated with likelihood of identification of prolonged symptoms. This is likely attributable to using trained health professionals. The telephone monitoring model provided support to individuals at home without the reliance on technology. This evaluation

suggests that this low technology model is capable of monitoring and supporting people during the acute phase of COVID-19. Further research is required to determine if this model of care could also be suitable for monitoring people at home with other infectious diseases.

A limitation of the study is that findings are from a single health network and there was no comparator group so the findings may not be generalisable. There was also a need to commence the program rapidly which limited our ability to create a comparator group. As the program was rapidly developed, the evaluation was completed in retrospect and patient related outcome measures were unable to be included. Further research is required to determine the impact of community management on patient related outcomes such as quality of life.

Conclusion

This study described a telephone monitoring service for patients in the community with COVID-19. The service approach was a low technology model that relied on telephone monitoring from trained health professionals. One in five people identified as being high risk developed prolonged symptoms, and this was two times greater odds than those at low risk. The study showed that the telephone triage of risk stratification was effective in determining risk of prolonged illness from COVID-19. Telephone monitoring by trained health professionals has a strong potential in the effective management of patients with mild COVID-19 illness.

Declarations

Conflict of interest Authors have no conflicts of interest to declare.

Ethical Approval Northern Health Human Research Low Risk Ethics Committee (Reference 68253).

Consent to Participate Verbal consent was obtained from patients to participate in the service.

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