RESEARCH
www.commprac.com
ISSN 1462 2815

OUTCOME OF TELEMONITORING OF COVID-19 CASES ENROLLED UNDER HOME ISOLATION OF A TERTIARY CARE CENTRE

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DOI: 10.5281/zenodo.13347975

Abstract

Introduction: Healthcare systems around the world were adopting models to manage patients infected with the SARS-CoV-2 virus. Telemedicine provides an approach for remote monitoring and management of patients infected with SARS- CoV2. Several telemedicine initiatives specific to COVID-19 have been successful, reporting low hospitalization rates and mortality. We created a telemedicine service, structured around frequent, virtual appointments with providers, to monitor and manage patients infected with SARS-CoV2 at an academic, tertiary care center. **Methods:** A Longitudinal study was conducted among 1135 patients from June 2020 to June 2021 for Asymptomatic/ Mild symptomatic patients enrolled in the Covid home care program at a Tertiary Care Hospital residing in Chennai, Kanchipuram, Tiruvallur, Chengalpattu districts. We created a novel telemedicine program to closely monitor patients infected with COVID-19 at home. Adult patients with COVID-19 were enrolled in the program at the time of documented infection. Patients were followed by a team of providers via telephone or video visits at frequent intervals until the resolution of their acute illness. **Results:** A total of 1135 patients were monitored, out of which wave 1 comprised 688 patients (60.6%) and wave 2 comprised 447 patients (39.4%). In wave 1, 354 patients were symptomatic in which majority of them 41.2% had a fever. In wave 2, 366 patients were symptomatic, which majority of them 48.4% had a fever. Comparing Wave 1 and Wave 2, patients in wave 2 were more symptomatic than in wave 1. The majority of them had a fever (48.4%), cough (33.1%), and body aches (26.2%) in wave 2 and in wave 1, the majority of them had loss of smell (27.4%), sore throat (13.6%) of which, patients with sore throats in wave 1 and wave 2 were statistically significant. **Conclusion:** Enrollment in a home monitoring program appears to be an effective and sustainable modality for the ambulatory management of COVID-19.

Keywords: Home Telecare, Telemedicine, Self-Care, COVID-19, Telemonitoring.

INTRODUCTION

COVID-19 disease caused by the SARS-CoV-2 is characterized by its sudden and widespread dissemination, accelerated clinical progression, and tragic consequences [1]. As of 4 January 2021, India reported 10,340,469 - confirmed cases, 149,649 - Total Deaths, and globally, 83,326,479 - Confirmed Cases 1,831,703 - Deaths. A decline had then been witnessed. In India highest number of cases in a day was 4,14,188 reported on 7 May 2021; since then, there has been a continuous decline in daily cases. As of 1 June 2022, India reported a total of 43,847,065 confirmed cases, with 525,930 deaths [2]. Globally, 564,126,546 -Confirmed Cases, 6,371,354 – Deaths [3]. The pace with which COVID-19 spread during India's two pandemic waves put a great deal of strain on the country's healthcare infrastructure. Around the world, steps were taken to slow the spread of the virus, including the isolation of confirmed COVID-19 patients and the quarantine of suspected [4]. The concept of home isolation (HI) or institutional isolation (non-hospital setting), for asymptomatic or mildly symptomatic patients, has been advocated [5]. The Ministry of Health and

Family Welfare, Government of India, released guidelines for HI of pre-symptomatic and mildly symptomatic patients in April 2020 with a further revision in July 2020 [6]. But by April 2021, the majority of public and private hospitals in India were overwhelmed by the pandemic's second wave. A mismatch in the availability and demand for hospital beds and oxygen caused problems for the health system. As a result, several organizations—including ours—improved their HI programs to handle milder patients at home. Telemedicine services, defined by the use of information communication technology to deliver healthcare services over a distance, are growing at a rapid pace, and a variety of telemedicine services are penetrating contemporary healthcare [7]. Based on Government of India guidelines, on June 15th 2020 Tertiary Care Hospital, initiated telemonitoring and teleconsultation services for mild cases of COVID-19 who were under home isolation to enhance their access to medical services. Telemedicine has demonstrated its use in developing secure procedures for close at- home observation, identifying symptom patterns, or forecasting hospitalization risk in COVID-19 patients [8].

Identifying patients at an early stage of illness development is critical to alleviate pressure on healthcare systems and improve the overall prognosis for COVID-19 patients, allowing for quick hospital admission. Constant vital parameter monitoring in residential isolation would provide an objective assessment of the patient's state in high-risk cases [9]. One significant gap in the care of COVID-19 patients may be filled by an accessible, low-cost home monitoring device [10]. During the time of the pandemic, when there is a shortage of beds, and manpower, isolation of these patients will help in reducing the burden of the healthcare system. WHO announced the end of the emergency phase of COVID-19 in May 2023 [11]. The purpose of this study was to characterize the features of COVID-19 patients who were managed at home and to compare the results of patients receiving home care in Waves 1 and 2. We reasoned that in this particular setting, a well-managed health improvement program under constant observation via teleconsultation would lessen the strain on the healthcare system by lowering the number of hospitalized patients.

METHODOLOGY

A Longitudinal study was conducted from June 2020 to June 2021 for Asymptomatic/ Mild symptomatic patients enrolled in the Covid home care program at Saveetha Medical College and Hospital. A total of 1135 patients were registered from June 15 2020 to June 2021, residing in Chennai, Kanchipuram, Thiruvallur, and Chengalpattu districts. This study aimed to compare the outcome of home isolation of patients enrolled in COVID-19 home care in Wave 1 (June 2020 to February 2021) and Wave 2 (from March 2021 to June 2021). A communication link between the caregiver and the hospital for the entire duration of home isolation and patients who can monitor their health regularly and inform the doctor was a pre- requisite.

Inclusion criteria - patients who were Asymptomatic/ mild symptomatic, caregiver available 24x7, and patients who can be under home quarantine as advised by Govt. of India guidelines, directed by the Ministry of Health and Family Welfare), from the hospital admission desk and telephone inquiries. A landline number was used exclusively for COVID-19 home care inquiries. Exclusion criteria - extreme ages below 3 years and above 60 years, patients who had uncontrolled Diabetes, Hypertension, and also patients suffering from immunocompromised status (HIV, Transplant

recipients, on anti-cancer drugs). The collection of baseline details of the patients was done with a semi- structured questionnaire that included their socio-demographic details, symptoms at the time of enrollment, number of family members, and their comorbidities at the time of admission of the patient and filed in individual patient files. Individual case files of the patient also had daily monitoring charts and caregiver and physician monitoring charts. From March 2021, the vaccination status of the patient was also enquired and recorded in the patient file.

The same data were entered in the Excel sheet. Patients who enrolled in the home care program were provided with a Covid home care kit, which consisted of a Pulse oximeter, thermometer, masks, vitamin C and zinc supplements, and an instruction booklet about Covid home care isolation for the patient and the caregiver. Pediatric age group patients were given a separate kit where vitamin C and zinc tablets were replaced with syrup, and dose adjustment was made as advised by the pediatrician. Patients who enrolled were monitored daily twice a day, morning and evening, and their vitals (Pulse rate, SpO2, Temperature) were recorded.

Every 3rd,6th,9th, and 12th day there was physician monitoring, where the patients were addressed and reassured by the Doctors. In case of any necessity, opinion was sought from respective specialty departments, and the prescription was sent to the patient through WhatsApp on mobile. Vitals of the caregiver were also monitored daily and, in case they developed any symptoms, they were advised and treated accordingly.

Patients who developed severe symptoms like breathing difficulty, or those who had a drop in saturation levels below 94%, were advised for hospital admission for further management. Those patients who did not want further monitoring were labeled as lost to follow-up. Referred patients were followed up telephonically after 2 weeks to know about the progression of the disease and outcome. Patients who completed 15 days of monitoring were discharged from the program and were given a discharge summary after satisfying the discharge criteria.

Summarized data was presented for categorical variables as numbers and percentages. Statistical significance was defined as $p \leq 0.05$. All analyses were performed using Statistical Package for Social Sciences for Windows (SPSS) v25. This study was approved by the Institutional Review Board and Ethics Committee of the institution and the procedure was per the Helsinki Declaration of 1975 as revised in 2000. Informed consent was given by all participants.

RESULTS

A total of 1135 patients were monitored, out of which wave 1 comprised 688 patients (60.6%) and wave 2 comprised 447 patients (39.4%). In terms of gender, 2/3rd (70.2%) of the patients were male. The majority of the patients were in the age group 19-39 years with 56.1% in Wave 1 and 66.4% in Wave 2., there were fewer patients in the more than 40 years age group in Wave 2 as compared to Wave 1 and this difference was found to be statistically significant.

Number of household members were less than 4 (88%) in both the waves. 81.9% of patients in wave 2 had symptoms at the time of enrollment, whereas in wave 1 it was 51.5%, and the difference was statistically significant 16% of the patients in wave 1 and 9.8% of patients in wave 2, had comorbidities, and the difference was statistically significant.

Table 1: Socio-demographic variables of the study participants

Variables	Categories	Wave 1 N=688	Wave 2 N=447	Total N= 1135	p-value
Gender	Male	485 (70.5%)	312(69.8%)	797(70.2%)	0.858
	Female	203(29.5%)	135(30.2%)	338(29.8%)	
Age	<18	48(7%)	25(5.6%)	73(6.4%)	**0.002***
	19-39	386(56.1%)	297(66.4%)	683(60.2%)	
	40-59	222(32.3%)	117(26.2%)	339(29.9%)	
	>60	32(4.6%)	8(1.8%)	40(3.5%)	
No. Of household members	<4	608(88.4%)	391(87.5%)	999(88%)	0.648
	>4	80(11.6%)	56(12.5%)	136(12%)	
Symptoms at the time of enrollment	Yes	354(51.5%)	366(81.9%)	720(63.4%)	**0.000***
	No	334(48.5%)	81(18.1%)	415(36.6%)	
Comorbidities	Yes	110(16%)	44(9.8%)	154(13.6%)	**0.003***
	No	578(84%)	403(90.2%)	981(86.4%)	

*p≤0.05 is statistically significant

Table 2: Distribution of symptoms of the participants

Symptoms	Wave 1 (N=354)	Wave 2 (N=366)	p value
Fever	146(41.2%)	177(48.4%)	0.054
Cough	89(25.1%)	121(33.1%)	0.061
Cold	65(18.4%)	84(22.9%)	0.128
Sore throat	48(13.6%)	30(8.19%)	**0.020***
Loss of smell	97(27.4%)	87(23.8%)	0.264
Body ache	73(20.6%)	96(26.2%)	0.075
Nose block	7(1.98%)	4(1.1%)	0.319
Breathlessness	3(0.8%)	1(0.3%)	0.300
Headache	27(7.6%)	42(11.5%)	0.079
Diarrhoea	13(3.7%)	14(3.8%)	0.914

*p≤0.05 is statistically significant

In wave 1, out of 688 patients, 354 patients were symptomatic in which majority of them 41.2% had a fever, followed by loss of smell 27.4%, cough 25.1%, body ache 20.6%, cold 18.4%, sore throat 13.6%, headache 7.6%, diarrhea 3.7%, nose block 1.98% and breathlessness 0.8%. In wave 2, out of 447 patients, 366 patients were symptomatic, which majority of them 48.4% had a fever, followed by cough 33.1%, loss of smell 23.8%, body aches 26.2%, cold 22.9%, headache 11.5%, sore throat 8.19%, diarrhea 3.8%, and breathlessness 0.3%. Comparing Wave 1 and Wave 2, patients in wave 2 were more symptomatic than in wave 1. The majority of them had fever (48.4%), cough (33.1%), body aches (26.2%), cold (22.9%), headache (11.5%), and diarrhea (3.8%) in wave 2 and in wave 1, majority of them had loss of smell (27.4%), sore throat (13.6%), nose block (1.98%). of which, patients with sore throats in wave 1 and wave 2 were statistically significant.

Table 3: Distribution of comorbidities of the study participants

Co-morbidities	Wave1 (N=110)	Wave 2 (N=44)	p-value
Diabetes mellitus	61(55.5%)	26(59.1%)	0.680
Hypertension	46(41.8%)	16(36.4%)	0.532
Asthma	2(1.81%)	2(4.55%)	0.336
Chronic kidney disease	1(0.9%)	0	

*p≤0.05 is statistically significant

In Wave 1, out of 688patients, 110(16%) patients had comorbidities, in which the majority of them had diabetes mellitus 61(55.5%), followed by hypertension, 46(41.8%), two patients were asthmatic and 1 patient had chronic kidney disease. In Wave 2, out of 447 patients, 44(12%) patients had comorbidities, in which the majority of them had diabetes mellitus26(59.1%), followed by hypertension 16(36.4%), and 2 patients were asthmatic. 1135 patients were enrolled, 688 and 447 in wasve1 and 2 respectively. In wave 1, 672 patients completed monitoring and were discharged, 13 were lost to follow-up. In wave 2, 428 patients had completed monitoring and were discharged, and 8 were lost to follow-up.

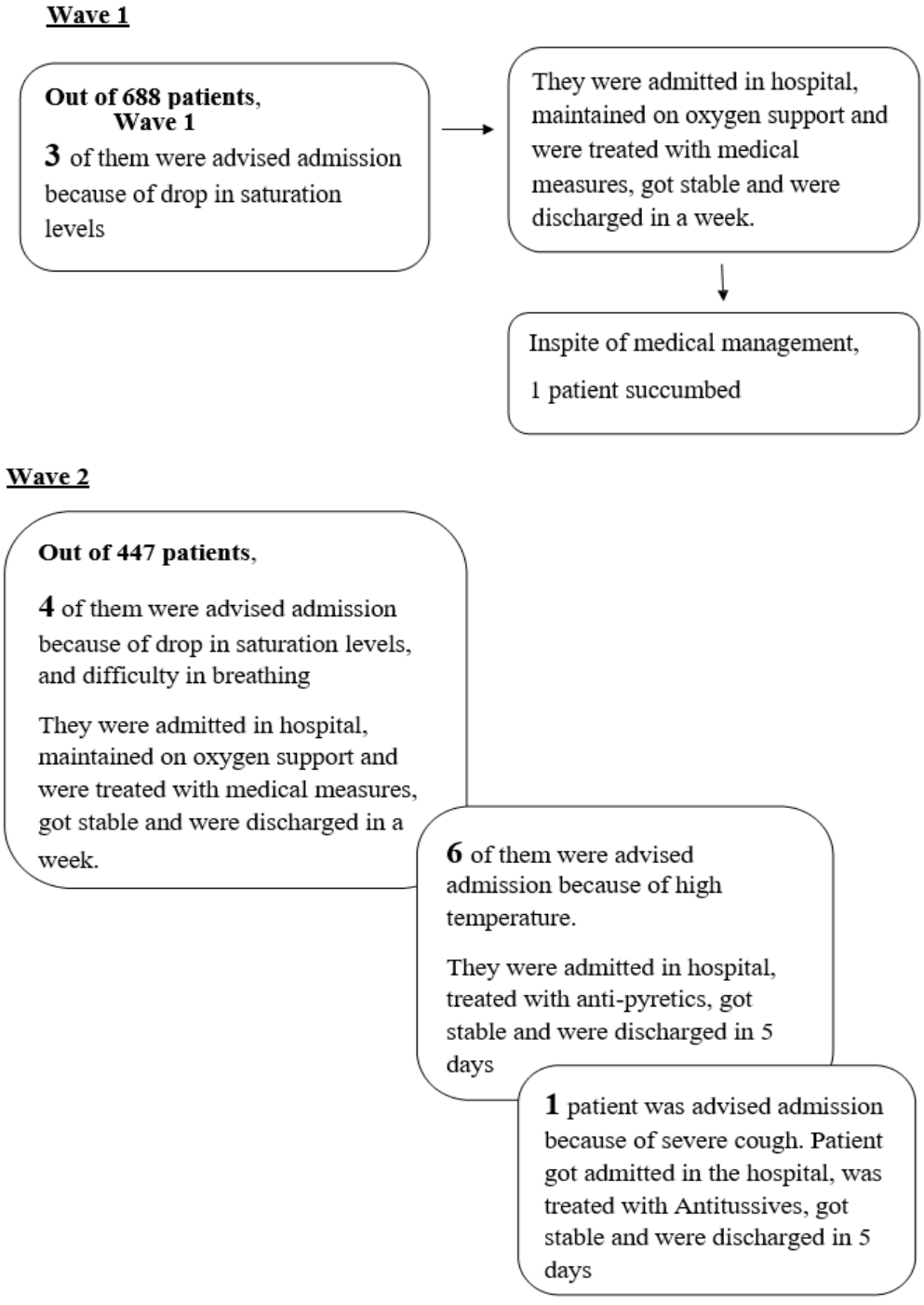
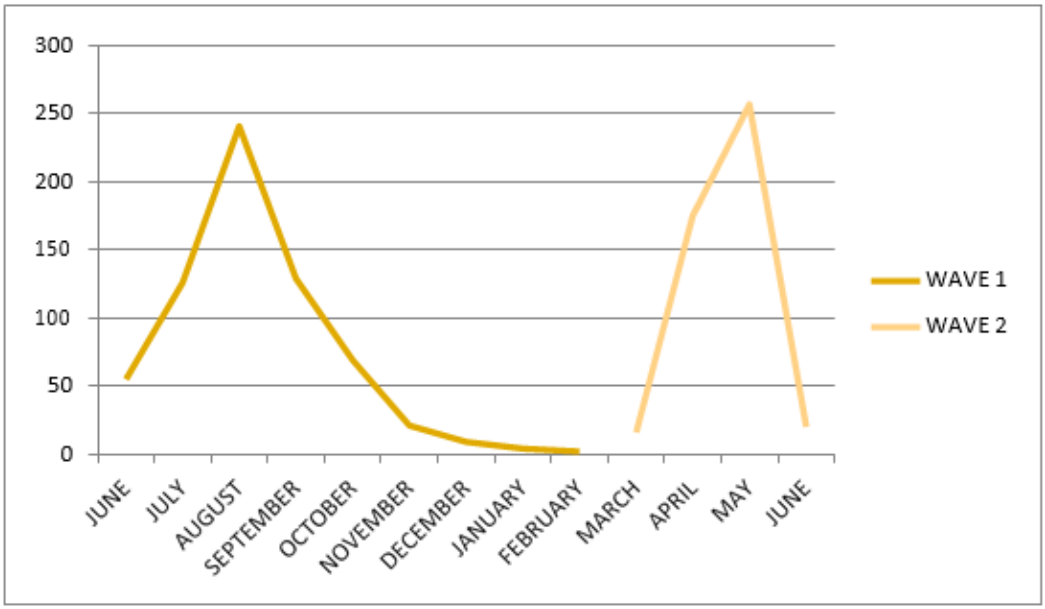
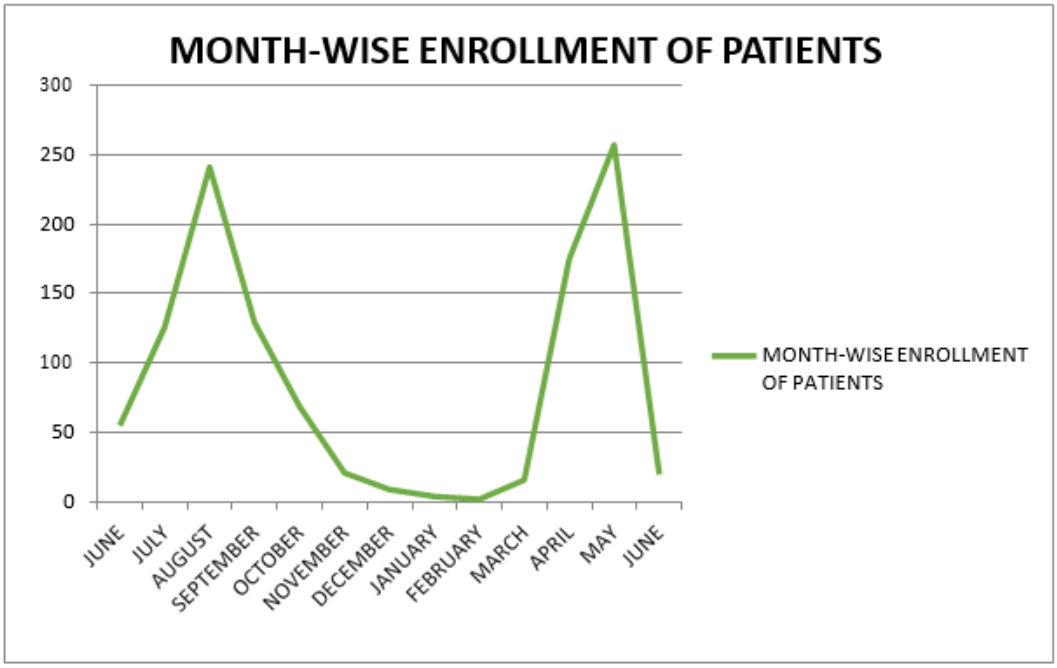


Fig 2: Reasons for referral





DISCUSSION

This study showed that the integration of telemedicine with telemonitoring used for patients with COVID-19 detected at the time of diagnosis and quarantined at home was associated with a frank decrease in hospitalizations, mean length of hospital stays, and mortality. Our data reinforced the idea that telemedicine with telemonitoring tools integrated into habitual care was well-accepted in the home setting. This allows for effective at-home surveillance and a safe hospital referral for the most severe cases, which helps to optimize the care model as a whole. This study showed that during both of the pandemic's waves, mild COVID- 19 patients could be effectively monitored and cared for at home with the help of the home isolation program. A group of specialists in infectious diseases and the administration created the home isolation program, which was then put into practice at the hospital's home isolation clinic. As

per the government guidelines, telemonitoring was advised for asymptomatic patients/ mild symptomatic patients in wave 1 and was later extended to monitor moderate cases as well in wave 2, which shows the severity of the disease in wave 2, when compared to wave 1 [12]. Though telemedicine has been widely used in monitoring acute infectious diseases [13], majority of the studies have been done on patients with chronic diseases [14], [15], [16] and there are limited studies regarding the role of telemedicine in managing and controlling the COVID-19 pandemic.

Our study was done to compare wave 1 and wave 2 and to determine the outcome of mild covid 19 home isolated patients. The average days of the home monitoring program were 10 days and in community management of COVID-19, the length of stay was 8 days in a study from Australia by O.R. Hutchings et al [17]. In our study, the participants were monitored for 15 days. A total of 1165 patients have enrolled altogether whereas in a study conducted in Vellore, Tamil Nadu by Kundavaram Paul Prabhakar Abhilash et al., a cohort of 1957 patients of wave 2, 93.3% were successfully managed at home [18] and an even higher no.of participants were enrolled in a study in Saudi Arabia by Jaffar A. Al-Tawfiq et al., there was a total of 5368 COVID-19 positive cases who were referred to the home isolation/monitoring program, 43.2% required oxygen therapy and 17.4% needed ICU admission [19], whereas in our study, in wave 1, 97% of the patients were completely monitored and were discharged in wave 1 and only 3 patients were advised admission because of a drop in saturation, in which 2 patients got stable, and 1 patient expired. 13 patients were lost to follow-up, as they did not want to monitor and got admitted in hospital themselves. (5%) required hospital admission, 45 (1%) were admitted to zone 2, and the majority 5028 (94%) continued home monitoring till clearance of infection in a study done during wave 1 in Saudi Arabia [20]. In wave 2, 95% of the patients were monitored completely and discharged in which 11 patients were advised admission because of breathlessness, high fever, and cough and all the 11 patients got stable after a week of hospital admission and were discharged [21]. In a smaller study of 173 patients in Australia who were monitored remotely, only 3 (1.9%) required hospitalization, O.R. Hutchings et al., [17]. 8 patients were lost to follow-up, due to the immense fear and anxiety which led them to get admitted in hospitals. In a study done by David Wurzur et al., A total of 20 patients (13%) were referred to the hospital by the Telecovid team. Seven patients required intensive medical treatment, and three of them were temporarily on invasive ventilation [10]. A fourth patient died after 25 days of invasive ventilation. The overall mortality in the HI cohort was 0.4% (7/1957) which is slightly higher than our study in which one patient succumbed despite medical management.

In contrast to our study, which found that sore throats were the most common symptom reported, a study by Kundavaram Paul Prabhakar Abhilash et al. on adjusted analysis found that factors associated with HI failure were age ≥60 years, male gender, subjective reporting of breathing difficulty, and history of cough [4]. In those symptomatic patients, fever was known to be the predominant symptom in both waves, which was similar to a study conducted in Spain by Simona Iftimie et al [22]. Among the other symptoms, sore throat and loss of smell were the most common presentation in wave 1 and wave 2, the second most common presentation was cough contrary to a study done in Munich by [10], they more commonly displayed fever and dyspnea as symptoms (2). 59% of the patients included in the home monitoring program were asymptomatic in a study in Saudi Arabia [21].

In wave 2, the majority of the patients had symptoms at the time of enrollment, when compared to wave 1 contrary to a study by Hodcroft EB et al., in which the majority of the patients who had co-morbidities were affected in wave 1 than in wave 2, and it was statistically significant [23].

Among those Patients who had co- morbidities, the majority of them had Diabetes Mellitus in both waves which was similar to the study done in Vellore [24]. In a study done by Jaffar A. Al-Tawfiq et al., in Saudi Arabia, a logistic regression analysis showed that only age and the presence of diabetes mellitus were associated with the presence of symptoms [25].

The first wave which was from June 2020 to February 2021 and the second wave from March 2021 to June 2021 reported that the majority of the patients who enrolled were male similar to a study done in Saudi Arabia and belonged to the age group of 19-39 years both in wave 1 and wave 2 similar to Jaffar A. Al-Tawfiq et al [25]., the majority of cases were between 21 and 60 years of age with 20% being 31 to 40 years and 17% being 20-31 years of age.

Whereas according to David Wurzur et al [10]., in a study done in Munich, with an interquartile range (IQR) of 42–68 years, the median age was 59 years. In the age group of 40-60 years, the percentage of patients affected with COVID-19 was more in wave 1 when compared to wave 2. The difference might be because of the initiation of COVID-19 vaccination, which led to a decrease in the rate of infection in the age group of 40-60 years. In a study done among patients in the wave in Saudi Arabia, the mean age (±SD) was 37.7 ± 19.4 years [21].

As quoted by Kundavaram Paul Prabhakar Abhilash et al., The program's effectiveness stemmed from closely monitoring patients via teleconsultations and providing them with the option to report to the emergency department in the event of any alarming symptoms [18].

Telemonitoring along with telemedicine when done proactively is a better approach to managing home isolation patients, as it reciprocates a positive response from them. In addition, since the patient's clinical progress is being closely watched, there's a good probability that their odds of survival will improve. Furthermore, because vital indicators that are essentially clinically significant (SpO2, respiratory rate, heart rate, and temperature) are recorded, the system may be applied to various health conditions.

One of this study's limitations is that it is a feasibility study, which must be stressed. It is not feasible to make claims regarding the effectiveness of avoiding severe disease courses or lowering mortality rates. Strength of the study, we do believe that the patient will have a better chance of surviving since an early detection of a worsening may shorten the hospital stay and maybe even lower death. To demonstrate this advantage, a comprehensive comparison between traditional treatment and telemedical monitoring is needed.

Additionally, we anticipate that the utilization of remote patient monitoring will result in immediate cost savings for the health department and physician offices, as well as long-term cost savings through shortened hospital stays and avoided intrusive ventilation.

CONCLUSION

Supported self-monitoring of patients with COVID-19 at home is reassuring to patients, is acceptable to clinicians, and can detect important signs of deterioration. Worryingly, some patients, because they felt well, occasionally ignored important signs of deterioration. It is important, therefore, to emphasize the importance of the early investigation and treatment of asymptomatic hypoxia at the time when patients are initiated and in the warning messages that are sent to patients. We are convinced that we have made an important step towards future clinical care options with our Tele covid study.

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