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Original Research Article

Home isolation deaths during the third wave of COVID-19 pandemic in Kerala: a descriptive study

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ABSTRACT

Background: The state government directed its efforts to mitigate transmission of new variant SARS-CoV-2 called Omicron. This study aimed to describe pathways and characteristics of home isolation (HI) deaths reported in Kerala during third wave of pandemic.
Methods: The study adopted retrospective cross sectional descriptive approach, conducted among HI patients who died from January 15th to February 15th 2022. The sociodemographic, clinical characteristics and the events that happened prior to deaths were collected through verbal autopsy. The state declared 106 HI deaths with case fatality rate of 2% (95% CI 1.5-2.50%). After screening, 70 HI deaths (54 home deaths and 16 in-transit deaths) were studied.
Results: Majority were home deaths (84.29%) followed by in-transit deaths (15.71%). Mortality was higher among older persons (94.28%), females (51.42%), unemployed (68.57%) and patients in rural community. Majority had comorbidities (80%) mainly diabetes mellitus (55.35%). The median interval from symptom onset to death was five days (IQR) 4-8) and that from diagnosis to death was four days (IQR 2-8). Majority reported red flag signs (83.07%) commonly breathlessness (83.34%). Most of the deceased (80%) did not monitor oxygen saturation. The study identified four patterns of HI deaths, primarily due to delay in identification of red flag signs and hospitalization.
Conclusions: Non-compliance to oxygen monitoring, slow response towards red flag signs and delay in hospitalization were the main reasons for HI deaths. Stringent monitoring mechanism for HI patients at primary health care and meteoric referral strategy can prevent fatalities in future.

Keywords: COVID-19, Home deaths, In-transit deaths, Mortality

INTRODUCTION

Globally, coronavirus disease 2019 (COVID-19) is one of the major causes of mortality in this century.[1] As of 3rd February 2022, COVID-19 accounted for 5.7 million deaths worldwide and 0.49 million deaths in India.[2] The State of Kerala which reported the first case of COVID 19 in India has recorded 56,100 deaths with a case fatality rate of 0.09%.[3] The highly transmissible Omicron (B.1.1.529), variant of SARS-CoV-2 resulted in sharp rise of cases globally with mild or no symptoms. In Kerala this marked the beginning of the third wave of the

pandemic by the end of November 2021, even before the second wave touched the base line. Anticipating a peak in the number of cases and to decongest the COVID-19 designated hospitals in order to provide appropriate intensive care services to patients who are in real need, Government of Kerala revised the home isolation (HI) guidelines with effect from 5th January 2022.

The state had been undertaking diverse measures to contain the transmission of COVID-19 since the commencement of the pandemic.[4,5] Isolation of the infected person, was one of the prominent strategies adopted, despite its challenges in terms of compliance, cost, productivity and quality.[6] A structured approach was adopted to ensure isolation at facility and home by developing guidelines and by establishing a monitoring mechanism. The medical officers (MOs) of the concerned primary health centre (PHC) through the concerned rapid response team (RRT) monitored the patients under HI and ensured safe practices. According to the revised criteria, the PHC MOs were authorized to permit patients with mild or no symptoms without any comorbidities, but with necessary facility for self-isolation at their residence to follow HI.[11]

However, it has been found that during the third wave, around 7% of deaths were reported among those who were under HI either at home or during transit to hospital.[12] This unforeseen situation elicited the need to examine HI deaths in-depth. Moreover, there was not much evidence in this regard from elsewhere. By analysing the patterns and pathways of COVID-19 deaths during HI, the need for revisiting the guidelines for HI or enhancing the monitoring mechanism for HI could be brought out thus providing insights to improve outcomes for persons undergoing HI. Such information might help state/district administrators to plan and implement other interventions to prevent fatalities in future. The objective of this study, therefore, was to describe the characteristics of COVID-19 HI deaths reported in Kerala for a period of one month from January 15th 2022 to February 15th 2022 and the circumstances that led to such deaths.

METHODS

The study adopted a retrospective cross sectional descriptive approach. The list of HI deaths reported in Kerala from 15th January to 15th February 2022 were extracted from "COVID-19 online death portal" (a common portal for reporting COVID-19 deaths), then the primary caregivers of 106 deceased persons were contacted via phone.

The sociodemographic and clinical characteristics of deceased persons and prior to deaths were collected through verbal autopsy. Those who died during HI but had a COVID related hospital admission during the isolation period were excluded from detailed analysis, however the flow of events prior to death were examined. Thus 70 HI deaths (54 home deaths and 16 in-transit deaths) were studied in detail. Ethical approval was obtained from Institutional Ethics Committee of Health Action by People (HAP).

Operational definitions

According to COVID-19 guidelines, a confirmed COVID-19 case is defined as a positive result by using real-time reverse transcription polymerase chain reaction (RT-PCR)/ molecular tests/rapid antigen test (RAT).

A home death is defined as the death at home during HI period in a patient with clinically confirmed COVID-19.

In-transit death is defined as the death of a confirmed COVID-19 patient on the way to hospital during the HI period.

Based on the delays to access medical care reported by COVID 19 patients HI deaths were classified into three types.

Type I delay: Delay of more than 30 minutes from identification of red flag signs to the decision to shift the patient to hospital;

Type II delay: Delay of more than 30 minutes from decision to shift to actual shifting of the patient from home to hospital;

Type III delay: Delay of more than 30 minutes from the actual start of shifting the patient from home to reaching the hospital.

The variables included in the analysis were sociodemographic characteristics, details of symptoms, comorbidities, interval between onset of symptoms to death, interval between confirmation of COVID to death, onset of red flag signs and responses towards red flag signs.

The data were entered in Microsoft Excel and analysed in SPSS version 28.0. The home and in transit deaths were analysed separately to make comparisons wherever appropriate. The data were summarized as mean, median with interquartile range (IQR) and proportions with 95% confidence intervals (CI).

RESULTS

From 15th January to 15th February 2022, the state declared 3523 COVID-19 confirmed deaths, out of which around 2% (95% CI 1.55-2.50%) were HI deaths. Among the deaths under HI, majority were home deaths (84.29%) (95% CI 65.55-86.33%) followed by in-transit deaths (15.71%) (95% CI 13.67-34.45%).

Table 1 provides the sociodemographic and clinical details of the deceased persons.

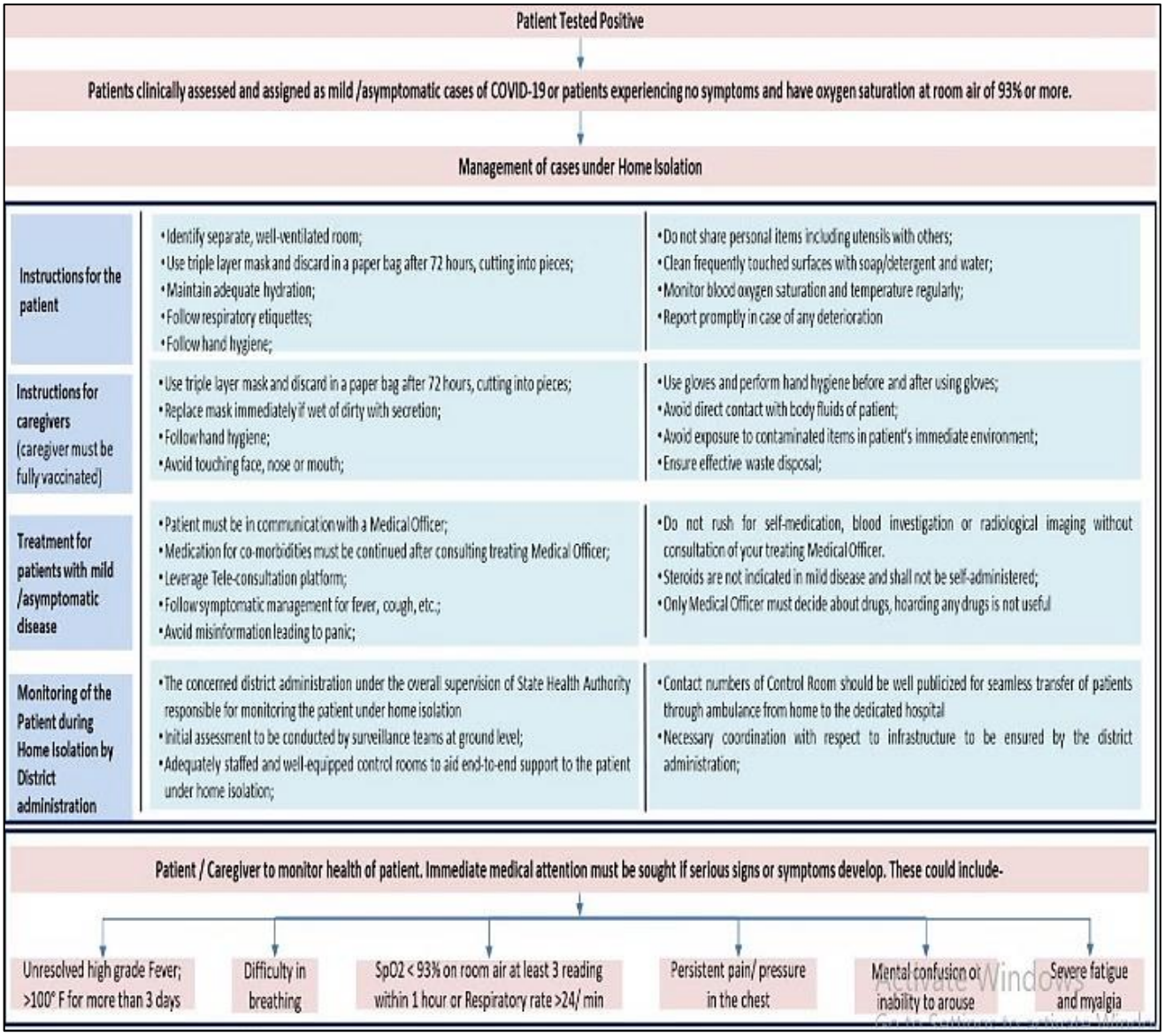

Figure 1: HI strategy adopted by the state.

Table 1: Characteristics of deceased persons.

Variables		Home deaths n=54 (%)	In transit deaths n=16 (%)	Total n=70 (%)
Sociodemographic characteristics				
Age (years)	Mean	80.55±12.60	66.93±12.89	
	≤40	0	1 (6.25)	1 (1.42)
	41-60	1 (1.85)	2 (12.5)	3 (4.28)
	61-80	20 (37)	10 (62.5)	30 (42.85)
	>80	33 (61.11)	3 (18.78)	36 (51.42)
Gender	Males	25 (46.29)	9 (56.25)	34 (48.57)
	Females	29 (54.71)	7 (43.75)	36 (51.43)
Occupation	Yes	18 (33.33)	8 (50)	26 (37.14)
	No	36 (66.66)	8 (50)	44 (62.85)
Residential type	Rural	45 (83.33)	12 (75)	57 (81.42)
	Urban	9 (16.66)	4 (25)	13 (18.58)
Clinical characteristics				
Presence of symptoms	Yes	46 (85.18)	8 (50)	54 (77.14)
	No	8 (14.81)	8 (50)	16 (22.85)

Continued.

Variables		Home deaths n=54 (%)	In transit deaths n=16 (%)	Total n=70 (%)
Comorbidity patterns				
Co-morbidity present	Yes	45 (83.33)	11 (68.75)	56 (80)
	No	9 (16.66)	5 (31.25)	14 (20)
Common co-morbidity	Diabetes mellitus	24 (53.33)	7 (63.64)	31 (44.28)
	Hypertension	26 (57.77)	4 (36.36)	30 (42.85)
	Cerebrovascular disease	6 (13.33)	1 (6.25)	7 (10)
	Coronary artery disease	6(13.33)	0 (0)	6 (8.57)
	Chronic kidney disease	2 (4.44)	1 (6.25)	3 (4.28)
	Cancer	2 (4.44)	0 (0)	2 (2.85)
	Respiratory disorders	4 (8.88)	2 (18.18)	6 (8.57)
	Neurodegenerative diseases	4 (8.88)	1 (6.25)	5 (7.14)
	Others	5 (11.11)	1 (6.25)	6 (8.57)
Course of COVID-19				
The duration between the onset of symptoms and death	≤7 days	27 (58.69)	5 (55.56)	32 (45.71)
	>7 days	19 (41.30)	4 (44.45)	22 (31.42)
	NA	8 (14.81)	7 (43.75)	
Duration between date of sample collection/start of home isolation and death	≤7 days	40 (74.07)	10 (62.5)	50 (71.42)
	>7 days	14 (25.92)	6 (37.5)	20 (28.88)
Self-monitoring during home isolation				
Frequency of use of pulse oximeter	Once-daily	4 (7.40)	2 (12.50)	6 (8.57)
	More than once daily	5 (9.25)	0 (0)	5 (7.14)
	Once in a while	3 (5.56)	0 (0)	3 (4.28)
	Not used oximeter	42 (77.78)	14 (87.5)	56 (80)
Saturation level maintained	<95%	6 (11.12)	2 (12.50)	8 (11.42)
	>95%	2 (3.70)	0 (0)	2 (2.85)
	Not recorded	4 (7.40)	0 (0)	4 (5.71)
	Not checked	42 (77.78)	14 (87.5)	56 (80)

Table 2: Patterns of red flag signs reported and responses towards red flag signs.

Variables		Home deaths (n=43) (%)	In transit deaths (n=11) (%)	Total (n=54) (%)
Type of red flag signs	Unresolved fever	3 (6.97)	0 (0)	3 (4.28)
	Breathlessness	36 (83.72)	9 (81.82)	45 (64.28)
	Chest pain	4 (9.30)	4 (36.36)	8 (11.42)
	Drowsiness	13 (30.23)	4 (36.36)	17 (24.28)
	Palpitation	1 (2.32)	1 (9.09)	2 (2.85)
	Reduced urine output	3 (6.97)	0 (0)	3 (4.28)
	Others	11 (20.37)	5 (31.25)	16 (22.85)
Shifted to hospital due to red flag signs	Yes	8 (18.60)	11 (100)	19 (35.18)
	No	35 (81.39)	0 (0)	35 (64.81)
Responses to red flag signs	Informed RRT	13 (30.23)	1 (9.09)	14 (25.92)
	Informed other relatives	5 (11.62)	6 (54.55)	11 (20.37)
	Waited for improvement	7 (16.27)	0 (0)	7 (12.96)
	Not informed	18 (41.86)	4 (36.36)	22 (40.74)
Actions taken after identification of red flag signs	Not informed and not shifted	25 (58.13)	0 (0)	25 (46.29)
	Not informed but shifted	6 (13.95)	10 (90.90)	16 (29.62)
	Informed but not shifted	4 (9.30)	0 (0)	0 (0)
	Informed and shifted	8 (18.60)	1 (9.09)	1 (1.85)

The mean age of the deceased was 77.4±12.80 years with highest proportion (94.28%) above 60 years of age. Majority (81.42%) of the deaths were reported in rural areas.

More than half of the deceased were females (51.42%). Most of the deceased (68.57%) were unemployed. However, and among those who were employed, around 40% were from informal sector. Among those who died

at home, 66.70% were unemployed. Among the persons who died in-transit, the proportion of employed and unemployed were equal.

More than three fourth of the deceased (77.14%) had symptoms, the commonest being influenza-like symptoms (ILI) including fever (41.42%), cough (38.57%), dyspnoea (11.42%) and sore throat (18.57%). Other symptoms were vomiting (7.14%), reduced food intake (5.71%), myalgia/joint pain (3.85%), diarrhoea (2.87%) and headache (2.87%). Four-fifth of the deceased (80%) had at least one comorbidity while more than half (57%) had multiple comorbidities. The major co-morbidities reported were diabetes mellitus (55.35%) followed by hypertension (53.57%). Though the guidelines mandate seeking permission from the local MO to opt HI, we found that over half of the deceased with co-morbidities (61.3%) opted HI without consulting the MO. Though the guidelines mandated the availability of a care taker at home during HI, 81.82% of those with comorbidities did not have a care taker. The whole family being concurrently infected with COVID-19 was found to be the main reason for this. The median interval from the onset of symptoms to death was five days [interquartile range (IQR) 4-8] and that between COVID-19 confirmation/date of HI and death was four days (IQR 2-8). To check whether there was any delay in diagnosis, we calculated the median interval from the date of onset of symptoms to the date of diagnosis as two days (IQR 0-3). We found that more than 60% of the deceased (64.28%) were vaccinated, out of which, majority (91.11%) had received two doses of viral vector vaccine. The mean duration from the date of first dose of vaccination to the date of death was 243±88.61 days.

Deaths reported in special groups

We found that a staff nurse aged 45 years, with hypothyroidism on irregular medication, who was tested positive three days after developing severe symptoms, denied to respond to red flag signs thus delaying seeking care, and died during transit to hospital. No COVID-19 deaths were reported among antenatals, postnatals, and infants. Three of the deceased (4%) aged 29, 67 and 78 years were cases of reinfection with comorbidities who were hospitalized during the first infection. The 29 year old was discharged from hospital only ten days prior to the diagnosis of reinfection.

Events reported prior to deaths

Majority of the deceased (86.31%) (87.03% home and 83.33% in-transit) had communicated their COVID-19 positive status to the concerned RRT. Among them 78.94% reported that the concerned RRT gave directions regarding monitoring during HI, identification of red flag signs and precautions to be taken to avoid negative outcomes. However, in spite of the mention in the guidelines, majority (80%) did not monitor oxygen saturation nor maintained SPO_2 monitoring chart (Table 2). Among those who checked, more than half (57.14%) had saturation levels less than 95%. More than four-fifth of the deceased (83.07%) had red flag signs (Table 2) including breathlessness (83.34%) and drowsiness (31.48%). Half the cases (51.16%) did not report the red flag signs to RRT nor shifted the patient to hospital anticipating natural improvement. Among those who informed, more than 60% were transported to hospitals, 22% were visited by the medical team to provide supportive management and 14% were advised shifting to hospitals. Patients were shifted mostly in their own cars (50%), followed by ambulance (45.46%) and rickshaws (tuk-tuk) (4.54%).

Patterns of HI deaths

The study found mainly four patterns of HI deaths: i) home deaths with red flag signs ii) home deaths without red flag signs (ii) in-transit deaths with red flag signs (iv) home deaths immediately after COVID-19 related hospital discharge (Figure 2).

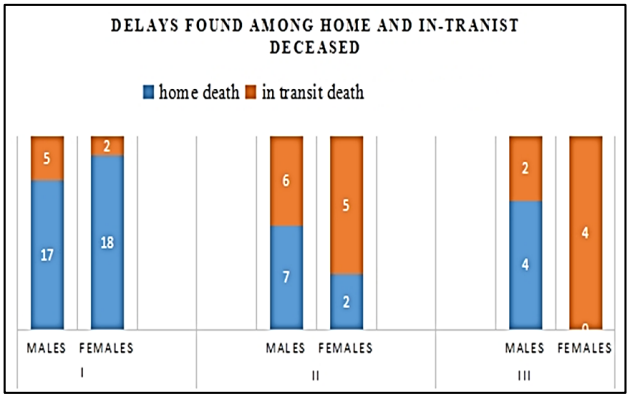

Figure 2: Type of delays found among home isolated deceased.

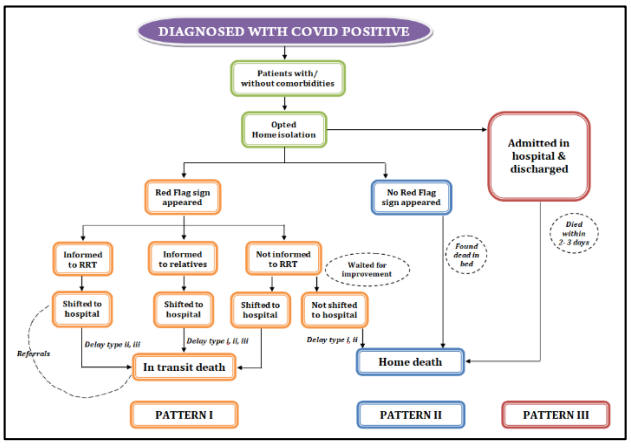

Figure 3: Patterns of home isolation deaths.

Most of the deaths were associated with delay in response towards red flag signs. Type I delay was prominent (71.18%) followed by type II (33%) and type III delays (15.71%) (Figure 3). Type I delay was common (81.39%)

among home deaths and type II in (68.75%) in-transit deaths, out of which more than half (54.55%) were due to the delay in obtaining vehicle for transportation. Few were found dead, therefore the information regarding their red flag signs were missing. Some reported that (28.35%) the information on red flag signs were not communicated to RRT and few died (10%) two to three days following discharge from hospital after an episode of admission for covid related issues.

DISCUSSION

This study attempted to compare the profile of home and in-transit deaths reported during the initial days of third wave of pandemic in Kerala and the findings are being discussed in terms of sociodemographic, clinical, and system-related aspects. This study was undertaken to examine the factors related to the estimated 2% fatality among HI patients, to execute safe HI practices. Reports showed that HI may be one reason safe and useful for COVID-19 patients with no symptoms/mild symptoms and those at low risk of complication. HI concept was appreciated by the public as well as HCWs as it was more culturally acceptable when compared to isolation at a facility.[6] We estimated the aggregate case fatality as nearly 2% but case based mortality rates could not be calculated due to paucity of data. Most of the home deaths were reported by older patients while younger patients reported in-transit deaths.[14-16] Earlier studies reported that older persons preferred home care rather than hospital care.[16] This might be one reason for high death counts in older patients but the reasons for in-transit deaths in younger age group require further exploration.[13] Men are considered more vulnerable than women but our study could not find any gender difference.[17]

During the lock down declared by the Government of India in connection with the pandemic, many people lost jobs and were forced to face financial crisis. This is one way for increased HI practice to avoid hospital expenses. Most of the deceased were unemployed and among employed, majority worked in informal sector. More deaths during HI were reported from rural areas. One of the reasons for this finding could be the location of COVID-19 designated hospitals (both secondary and tertiary hospitals) mostly in urban areas. Timely referral and availability of transportation are crucial in a rural setup to access higher level of health care in institutions mostly situated in urban areas.

Consistent to other studies, ILI symptoms were predominantly reported.[20] COVID-19 patients with comorbidities were more likely to develop critical illness progressing to death.[21] The prevalence of NCDs especially diabetes is high in Kerala which was reflected in this study too.[22] However, HI deaths were reported by patients without co-morbidities. It is likely that a higher proportion of patients with co-morbidities were admitted in designated facilities as per protocol. Young patients and patients without comorbidities tend to take the situation lightly by not complying to the guidelines of HI and by ignoring red flag signs.

The time interval between the diagnosis/start of HI to death was found to be too short in our study unlike earlier reports.[21] Non-compliance to HI protocols, delay in identification of red flag signs, delay in responding/ reporting the red flag signs to the authorities and delay in accessing higher level of care could be some of the reasons for this short interval. The findings call for modification of HI guidelines to factor in severity of symptoms at least in cases with comorbidities.

No HI deaths were reported from among some special groups such as antenatal, postnatal, neonates, and infants. Also, there were no HI deaths among patients with terminal diseases like cancer and renal diseases. These indicate the presence of optimal management strategies adopted by the state for vulnerable groups as these groups were not allowed home isolation as per the guidelines. It is a matter of concern that more than a quarter of the deceased had no comorbidities especially among those who died in transit. As autopsy results are not available, the reasons for this have to be explored further for policy decision.

Reports from All India Institute of Medical Sciences (AIIMS) shows that silent depletion of oxygen levels among asymptomatic or mildly symptomatic COVID-19 patients (silent hypoxia) might lead to cardiac arrest.[23] This reaffirms the importance of regular monitoring and follow up of patients under HI. Individual cases have to be investigated further to develop the guidelines for HI and hospital admission. Most of the deceased in our study did not monitor oxygen saturation levels during HI. Earlier studies found that staying at home and observing "self-care behaviours" are the best strategies for COVID-19 control and prevention and isolation is an important type of self-care behavior.[24] Monitoring of blood oxygen levels using pulse oximeter during HI is one of the mandates to be observed as part of self-care behaviour. This is useful for detecting disease progression and is a criterion for taking decisions regarding hospitalization.[25] Lack of awareness, non-availability of pulse oximeter, negligence towards self-care behaviour and optimism bias were the reasons for identified poor compliance in monitoring of oxygen level. Reinfection of COVID-19 is a major concern worldwide.[26,27] We found that a few deceased with comorbidities had reinfection, signifying the importance of monitoring high-risk groups during home isolation.

Majority of the deceased reported red flag signs however many of them failed to respond to it.[28] Breathlessness was the major red flag sign reported in our study, some studies reported fever and headache, while breathlessness was the most frequent and distressing symptom in some other studies.[29,30] Red flag signs have a role in decision-making and serve as a precursor to upcoming dangerous or life-threatening events, making early detection and

management of these signs essential for home-bound patients.[31] The findings highlight the need for creating awareness among the public regarding the significance of identification of red flag signs to prevent delays in shifting the patients to hospitals and to implement a HI monitoring mechanism (technology based).

The study found delays at different levels starting from the identification of red flag signs to hospital admission. In those cases where the red flag signs were identified, there was a delay in reporting to the concerned, delays for RRT/PI to respond, delay in decision making and then the delay in shifting the patient to an appropriate centre. In those cases where the red flag signs were identified, but not reported there was a delay in decision making and then a delay in shifting the patient to an appropriate centre. The in-transit deaths mostly happened in those situations where the patient was shifted directly from home in a rural setting to a tertiary care centre or referred from a peripheral institution to a tertiary care centre. It is important to examine the relationship between transportation barriers and health outcomes among the rural population who are mostly poor and vulnerable to inform future pandemics. The most commonly used mode of transport by the in-transit deceased was ambulance and the main delays found among them were type II and type III- related to the accessibility of transportation facilities. This suggests that interventions to provide easy access to transportation facilities and avoid delays is essential. The occurrence of home deaths soon after hospital admission warranted the need for reviewing the discharge guidelines and it requires further explorations. The information regarding events that happened prior to deaths were provided by the care givers and some patients were found dead on bed during early morning. The reasons for such deaths were not explored. which was the main limitation of the study.

Impact

The most important impact of the study was that the findings of the study were used even while they were coming in, to take measures to rectify the gaps and bottle necks identified. Steps were taken to ensure availability of pulse oximeters for all patients in home isolation, activating the RRTs in areas where insufficiencies were noticed and to ensure that patients with comorbidities received special attention. The major gaps identified were communicated on a real time basis to the Principal secretary (health), Government of Kerala and the Ministry of Health to initiate corrective actions. Overall, the study findings were helpful to identify the inadequacies related to home isolation practices as in an interim analysis which would prevent home isolation deaths in the State.

CONCLUSION

This study attempted a descriptive approach to explain the HI deaths reported during the initial part of the third wave of COVID-19 pandemic in Kerala. The importance of surveillance by RRT in preventing deaths of home isolated patients for covid. is the key finding of this study. A designated team to carry out strict surveillance of the patients is a requisite for managing patients under home isolation. The study questions the safety of home isolation for older COVID-19 patients and patients with comorbidities especially diabetes mellitus and reiterates the need for enforcement of guidelines. Poor compliance to HI guidelines including irregular monitoring of oxygen level and blood glucose level and delayed responses towards red flag signs could be some of the important reasons that resulted in these HI deaths. Inability to identify the red flag signs/denial in accepting and reporting them caused delay in accessing care at an appropriate centre that worsened the patient's condition and progressed to death. The reasons for deaths reported immediately after discharge from hospital requires further exploration. Interventions to ensure strict monitoring of HI practices and prudent referral mechanism to curb HI deaths in future is the need of the hour. This study helped to initiate policy decisions for course correction on a real time basis.

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REFERENCES

1. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. Int J Antimicrob Agents. 2020;55(3):105924.
2. WHO Coronavirus (COVID-19) Dashboard. Available at: https://covid19.who.int. Accessed on 3 June 2022.
3. GoK Dashboard. Official Kerala COVID-19 Statistics. Available at: https://dashboard.kerala.gov.in/covid/. Accessed on 3 June 2022.
4. Responding to COVID-19- Learnings from Kerala. Available at: https://www.who.int/india/news/feature-stories/detail/responding-to-covid-19---learnings-from-kerala. Accessed on 3 June 2022.
5. Chathukulam J, Tharamangalam J. The Kerala model in the time of COVID-19: rethinking state, society and democracy. World Dev. 2021;137:105207.

6. Bhardwaj P, Joshi NK, Gupta MK, Goel AD, Saurabh S, Charan J, et al. Analysis of facility and home isolation strategies in COVID-19 pandemic: evidences from Jodhpur, India. Infect Drug Resist. 2021;14:2233-9.
7. Guidelines-Summary-Of-Covid-19-quarantine-and-isolation-.pdf Available at: https://arogyakeralam.gov.in/wp-content/uploads/2020/03/guidelines-Summary-Of-Covid-19-quarantine-and-isolation-.pdf. Accessed on 3 June 2022.
8. Directorate of Health Services; Advisory DHS. Available at: https://dhs.kerala.gov.in. Accessed on 3 June 2022.
9. New Covid variant- Omicron - spells bad news for Kerala: Experts- The New Indian Express. Available at: https://www.newindianexpress.com/states/kerala/2021/nov/27/new-covid-variant-omicron-spells-bad-news-for-kerala-experts-2388621.html. Accessed on 3 June 2022.
10. Islam MR. The SARS-CoV-2 Omicron (B.1.1.529) variant and the re-emergence of COVID-19 in Europe: An alarm for Bangladesh. Health Sci Rep. 2022;5(2):e545.
11. Guidelines for home isolation and discharge criteria from home isolation of SARS-cov-2. Advisory-DHS. Available at: https://dhs.kerala.gov.in/wp-content/uploads/2022/01/Guidelines-Home-Isolation-and-Discharge.pdf. Accessed on 3 June 2022.
12. Directorate of Health Services. Government of Kerala. Available at: https://dhs.kerala.gov.in/dailybulletin. Accessed on 3 June 2022.
13. Fried TR, van Doorn C, O'Leary JR, Tinetti ME, Drickamer MA. Older persons' preferences for home vs hospital care in the treatment of acute illness. Arch Intern Med. 2000;160(10):1501-6.
14. Mat Din H, Adnan RNE, Nor Akahbar SA, Ahmad SA. Characteristics of COVID-19 related deaths among older adults in Malaysia. Malays J Med Sci. 2021;28(4):138-45.
15. Damayanthi HDWT, Prabani KIP, Weerasekara I. Factors associated for mortality of older people with COVID-19: a systematic review and meta-analysis. Gerontol Geriatr Med. 2021;7:23337214211057392.
16. Yanez ND, Weiss NS, Romand JA, Treggiari MM. COVID-19 mortality risk for older men and women. BMC public health. 2020 Dec;20(1):1-7.
17. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, et al. Gender differences in patients with COVID-19: focus on severity and mortality. Front Public Health. 2020;8.
18. Beaney T, Clarke J, Jain V. Measuring the toll of the COVID-19 pandemic in rural Bangladesh. JAMA Netw Open. 2021;4(11):e2133167.
19. Syed ST, Gerber BS, Sharp LK. Traveling towards disease: transportation barriers to health care access. J Community Health. 2013;38(5):976-93.
20. Zhang B, Zhou X, Qiu Y, Song Y, Feng F, Feng J, et al. Clinical characteristics of 82 cases of death from COVID-19. PloS One. 2020;15(7):e0235458.
21. Elezkurtaj S, Greuel S, Ihlow J, Michaelis EG, Bischoff P, Kunze CA, et al. Causes of death and comorbidities in hospitalized patients with COVID-19. Sci Rep. 2021;11(1):4263.
22. Webber M, Joubert J, Fendt-Newlin M, Madavanakadu Devassy S, Scaria L, Benny AM, et al. Towards the development of an intervention to address social determinants of non-communicable disease in Kerala, India: a mixed methods study. Int J Environ Res Public Health. 2020;17(22):8636.
23. Hypoxia: All India Institute of Medical Sciences (AIIMS) turns its focus on silent hypoxia now. The Economic Times. Available at: https://economictimes.indiatimes.com/industry/healthcare/biotech/healthcare/all-india-institute-of-medical-sciences-aiims-focus-is-on-silent-hypoxia-now/articleshow/77898122.cms?from=mdr. Accessed on 22 June 2022.
24. Foroozanfar Z, Zamanian M, Moradzadeh R, Hajiabadi F, Ahmadzadeh J, Hosseinkhani Z. Isolation compliance and associated factors among COVID-19 patients in North-West Iran: a cross-sectional study. Int J Gen Med. 2020;13:1697-703.
25. Luks AM, Swenson ER. Pulse oximetry for monitoring patients with COVID-19 at home. Potential pitfalls and practical guidance. Ann Am Thorac Soc. 2020;17(9):1040-6.
26. Dhillon RA, Qamar MA, Gilani JA, Irfan O, Waqar U, Sajid MI, et al. The mystery of COVID-19 reinfections: A global systematic review and meta-analysis. Ann Med Surg. 2021;72:103130.
27. Wang J, Kaperak C, Sato T, Sakuraba A. COVID-19 reinfection: a rapid systematic review of case reports and case series. J Investig Med. 2021;69(6):1253-5.
28. García-Azorín D, Trigo J, Talavera B, Martínez-Pías E, Sierra A, Porta-Etessam J, et al. Frequency and type of red flags in patients with Covid-19 and headache: a series of 104 hospitalized patients. Headache J Head Face Pain. 2020;60(8):1664-72.
29. Baker Rogers J, Modi P, Minteer JF. Dyspnea in Palliative Care. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022 Jan.
30. Hentsch L, Cocetta S, Allali G, Santana I, Eason R, Adam E, et al. Breathlessness and COVID-19: A Call for Research. Respiration. 2021;100(10):1016-26.
31. Ramanayake RPJC, Basnayake BMTK. Evaluation of red flags minimizes missing serious diseases in primary care. J Fam Med Prim Care. 2018;7(2):315-8.

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