

COVID-19 and Management of Severe Acute Respiratory Infection (SARI): A Questionnaire-Based Study Among Indian Healthcare Professionals

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ABSTRACT: Background: COVID-19 presenting as SARI (severe acute respiratory syndrome) mandates the need for ICU (intensive care unit) hospitalization, increasing healthcare burden. This study aims to determine knowledge of healthcare professionals towards management of SARI in COVID-19 suspected cases. Methods: A total of 313 healthcare professionals from the state of Maharashtra, India completed a questionnaire-based survey study adapted from the WHO interim guidance for management of SARI in COVID-19 suspected cases. Convenience sampling method was used and the distribution of responses was presented as frequencies and percentages. Sub-groups were classified on the basis of gender, age, profession and ICU vs. Non-ICU setting. Descriptive statistics were performed for all groups based on percentage of correct responses and individual pairwise comparisons were done using the Chi-Square test. Results: The median and mean percentage of correct responses for all sub groups was only 66.80% and 58.62% respectively. A higher percentage of total correct responses were those from the ICU setting with a higher overall performance from medical postgraduates. The nursing and allied healthcare professionals had a poor overall performance. Conclusions: The findings indicate lacunae in several aspects of SARI management which calls for nationwide studies and implementation of comprehensive training programmes. A uniform structured training program with team-oriented crisis resource management suitable for all healthcare professionals irrespective of prior training in COVID-19 management must be implemented. Furthermore, the findings of this study can serve as a baseline to develop training resources for healthcare professionals for COVID-19 management.

KEYWORDS: COVID-19, SARI, COVID-19 India, WHO guidelines for COVID-19 related SARI, Severe Acute Respiratory Infection.

Introduction

COVID-19 frequently presents as mild or uncomplicated illness. About 14% develop severe disease and 5% require intensive care [1].

COVID-19 can be complicated by the severe acute respiratory infection (SARI) and often multisystem involvement is encountered [2].

SARI is defined as “an acute respiratory illness with a history of fever or measured fever of $\geq 38^{\circ}\text{C}$ and cough, with onset within the past 10 days, requiring hospitalization” [3].

SARI increases morbidity and mortality associated with COVID-19.

This potentiates the need to review the clinical management of SARI in detail and determine the existing knowledge of healthcare professions currently working in various hospital settings related to COVID-19 treatment.

In a survey conducted among patients in India with SARI, a total of 104 (1.8%) of the 5,911 SARI patients tested were positive for COVID-19 and the number of patients is still on the rise [4].

COVID-19 presenting as SARI mandates the need for ICU (Intensive Care Unit)

hospitalization and mechanical ventilation which increases cost of healthcare [5,6].

The sudden rise of the pandemic has placed tremendous demands on both public health and healthcare systems, and also on providers of essential community services [7].

Thus, appropriate knowledge of SARI and its management protocols will help in reducing the burden of healthcare.

The interim guidelines developed by a multidisciplinary panel of experienced healthcare providers who have laid the foundation for management of previous similar viral epidemics such as MERS (Middle Eastern Respiratory Syndrome), SARS (Severe Acute Respiratory Syndrome) and ARDS (Acute Respiratory Distress Syndrome) should serve to provide best possible supportive care which may increase the odds of survival [8,9].

The questionnaire was derived from the current interim guidance and information for healthcare professionals published by the WHO on 13th March 2020 [10].

It is of utmost importance that the interim guidelines are formed regionally and must be uniformly structured to suit all healthcare

professionals working in various hospital settings with or without prior COVID-19 training.

To the best of our knowledge, this particular area of COVID-19 management has not been well studied or reported so far.

The need for such studies helps in assessment of knowledge of treatment guidelines for management of SARI in COVID-19 suspected cases, identify areas of deficiencies and help in reinforcing the present knowledge with the apt resources and guidance [11,12].

Methods

The study was a questionnaire based cross-sectional survey conducted at a university affiliated tertiary-care hospital in Navi Mumbai, India.

An online survey link was sent to 1250 healthcare professionals including doctors

and nursing staff at various healthcare institutions in the state of Maharashtra, India.

The period of the survey was from 22 April, 2020 to 1 May, 2020 and a total of 313 responders completed the survey with a response rate of 25.04%.

The self-administered questionnaire was adapted from the WHO interim guidance for clinical management of SARI when COVID-19 is suspected, updated on March 13, 2020 [10].

The questionnaire was reviewed by an internal expert panel on COVID-19 and modifications were made according to discussions.

The questionnaire was distributed with a link to the survey through various social media platforms concerning healthcare professionals and the participation was purely voluntary.

The questions covering various aspects of management of SARI in COVID-19 and appropriate abbreviation for each question is presented in Table 1.

Table 1. Survey sections.

Q3	The correct sequence of donning of a mask/respirator.
Q5	Diagnostic criteria for COVID-19.
Q6	Most common clinical syndrome in COVID-19.
Q7	The use of SOFA (Sequential Organ Failure Assessment) scoring system.
Q8	IPC (Infection Prevention and Control) measures for aerosol generating procedures in suspected or confirmed COVID-19 patients.
Q9	Method of sample collection for COVID-19 suspected patients.
Q10	Management of mild COVID-19.
Q11	Management of severe COVID-19.
Q12	Management of acute respiratory distress syndrome (ARDS) in mechanically ventilated COVID-19 patients.
Q13	Interventions reduce incidence of ventilator associated pneumonia in COVID-19 patients.
Q14	Septic shock in COVID-19 suspected or confirmed adult patients.
Q15	Management of septic shock in COVID-19 suspected or confirmed adult patients.
Q17	Caring for pregnant women with COVID-19.
Q18	Caring for infants and mothers with COVID-19.
Q19	Use of corticosteroids in COVID-19 suspected or confirmed patients that develop pneumonia.

The questionnaire included open as well as closed ended questions with the initial part of the survey (questions 1 and 2) focusing on socio-demographic information, and the remainder of the survey focused on the management guidelines for SARI based on the WHO interim guidance.

Question 4 was a polar question (yes-no question) regarding formal training in hand hygiene which is indirectly related to SARI management and is discussed separately.

Question 16 was an open-ended question seeking the participants opinion regarding their barriers in COVID-19 management.

As inclusion criteria for participants, we considered healthcare professionals from various medical and paramedical fields involved directly in management of COVID-19 cases.

This included the medical graduates and postgraduates, super-specialists, nurses and allied healthcare workers in the ICU as well as Non-ICU settings.

Professionals not involved in direct COVID-19 management were excluded.

A written consent was obtained for all participants in the beginning of the study.

The Institutional Ethics Committee (IEC) reviewed and approved the study-related documentation (DYP/IECBH/2020/02).

Convenience sampling method was used for data collection.

The distribution of responses has been presented as frequency and percentages.

Sub-groups were further classified on the basis of gender (male vs. female), age (18-30 years, 31-45 years, more than 45 years), profession (medical professional, nursing and allied healthcare) and job profile (ICU vs. Non-ICU setting).

Data were tabulated in excel, and descriptive statistics was performed using SPSS 17.

Overall percentages of correct responses were assessed for all subgroups by the median test. Individual pairwise comparisons were done for categorical data using the Chi-Square test.

Results

A total of 313 healthcare professionals from the state of Maharashtra responded to the survey and the maximum responses were from the Mumbai Metropolitan Region (88.5%).

Of the total responders 48.2% were males and 51.8% were females.

The distribution of the participants in the various subgroups of age, profession, qualification and job profile is provided in Table 2.

More participants in the survey were from Non-ICU setup (hospital wards, outpatient department), as compared to the ICU setting.

Data for participants in the ICU setup mainly included medical professionals from the fields of critical care, internal medicine, pulmonary medicine, emergency medicine and anesthesia.

Table 2. Responder profile (n=313).

	No.	%		No.	%
Age			Qualification		
18 to 30 years	198	63.3	Medical graduate	73	23.3
31 to 45 years	73	23.3	Nursing & allied	77	24.6
46 to 75 years	41	13.1	Medical post-graduation	155	49.5
76+years	1	0.3	Super-specialty	8	2.6
Healthcare Setting			Profession		
ICU	107	34.2	Medical professionals	235	75.1
Non-ICU	206	65.8	Nursing & allied staff	78	24.9

The median and mean values for the overall percentage of correct responses for all subgroups were 66.8 and 58.62% respectively (Figures 1-2).

Areas where all subgroups had a low total percentage of correct responses were related to sequence of donning and doffing PPE (Personal Protective Equipment), IPC measures for aerosol generating procedures, identification of COVID-19 related clinical syndromes and management of severe COVID-19 disease and interventions to reduce ventilator associated pneumonia.

Lower percentage of correct responses was observed with respect to caring for infants and mothers with COVID-19 disease.

It was observed from comparisons of individual subgroups that the total percentage

of correct responses from the medical professionals was significantly higher as compared to nursing and allied healthcare professionals ($P < 0.05$) (Figure 2).

It was observed that 80% of the responders had received training in hand hygiene practices in the last three years (Figure 3).

Total percentage of correct responses was higher from those working in the ICU setting as compared to those working in the Non-ICU setting ($P > 0.05$) (Figure 4). Overall correct responses were higher from males as compared to females and higher from those in the age group of 31-45 years ($P > 0.05$) (Figure 5). Among the medical professionals, it was observed that a significantly higher total percentage of correct responses were obtained from postgraduates ($P < 0.05$).

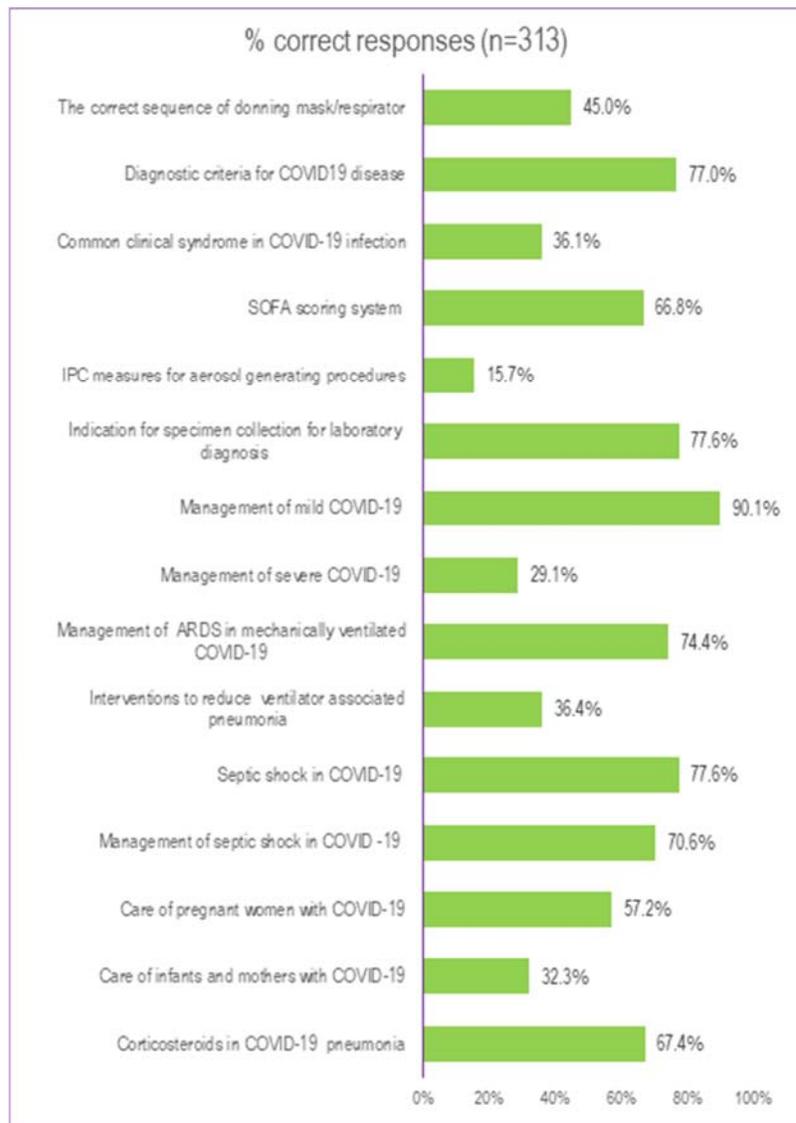


Figure 1. Overall percentage correct responses (median) among all subgroups.

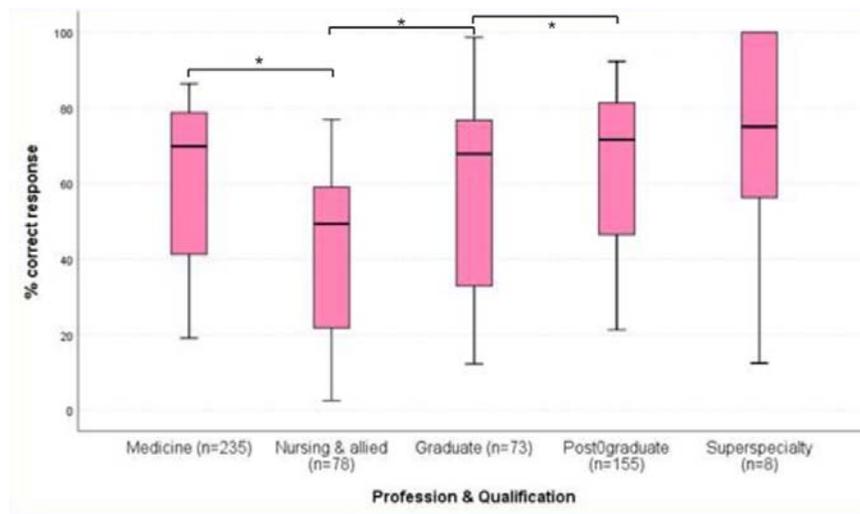


Figure 2. Correct responses (median and quartiles) for profession and qualification (*, P<0.05).

More than 78% of the responders had a COVID-19 ICU protocol in their hospital but only about 44% received special training related to management of COVID-19 patients.

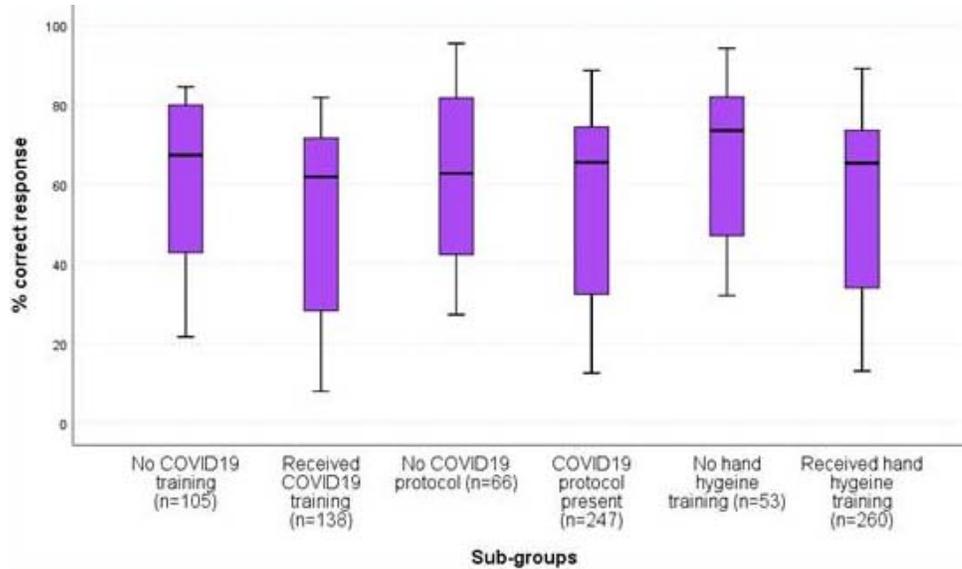


Figure 3. Correct responses (median and quartiles) for subgroups based on COVID-19 training, COVID-19 protocols and hand hygiene training in the last 3 years ($P>0.05$).

Knowledge of surveillance case definitions for COVID-19 plays a vital role in appropriate screening and triage and it was observed that medical professionals with a graduate degree performed better as compared to nursing and allied healthcare professionals ($P<0.05$)

More number of medical professionals, especially in the ICU setting, from the age group of 18-30 and with a graduate degree were able to identify mild illness as the most common clinical

syndrome associated with COVID-19 as compared to other subgroups ($P<0.05$)

In case of management of sepsis in COVID-19 suspected cases, the SOFA scoring system is used to predict outcomes and mortality.

While responding to the use of SOFA score, professionals working in the ICU setting did better than the Non-ICU setting; whereas nursing and allied healthcare professionals performed poorly as compared to the medical professionals ($P<0.05$).

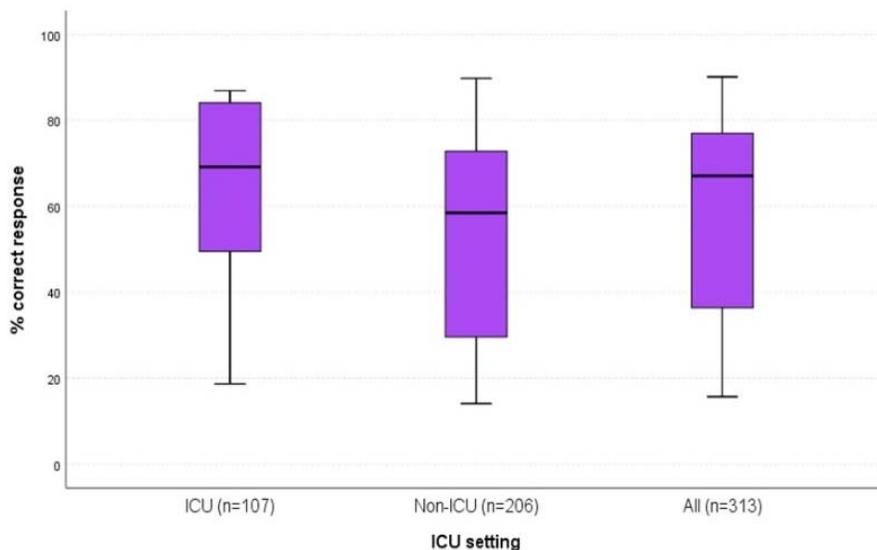


Figure 4. Correct responses (median and quartiles) for ICU vs. Non-ICU setting ($P>0.05$).

Those in the ICU setting, medical professionals and graduates could answer about the parameters that indicate septic shock in COVID-19 suspected or confirmed adult patients better as compared to other groups ($P<0.05$).

The younger individuals (age 18-30 years) performed better with respect to fluid resuscitation for septic shock in COVID-19 suspected or confirmed adults ($P<0.05$).

The interventions involved in the management of ARDS in mechanically ventilated COVID-19 patients along with the interventions to reduce incidence of ventilator associated pneumonia in COVID-19 were best answered by those in ICU setting.

Medical professionals performed better than nursing and allied professionals and those with a graduate degree did better than the rest ($P<0.05$).

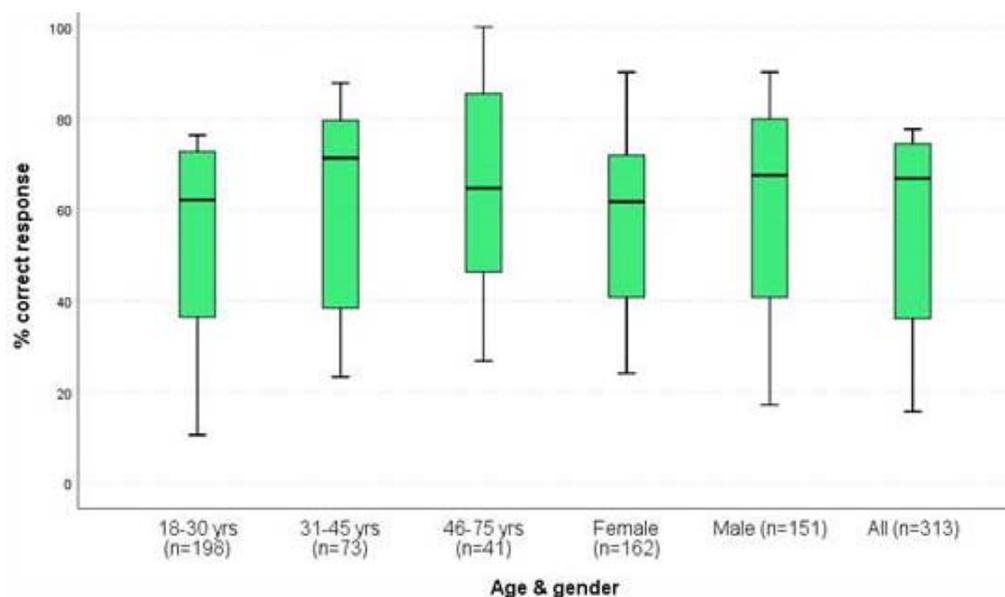


Figure 5. Correct responses (median and quartiles) for various age groups and gender ($P<0.05$).

Another key concept is the care of pregnant women with COVID-19 and younger individuals (age 18-30 years), medical professionals comparatively performed better in this area ($P<0.05$).

As per the WHO interim guidance, routine use of corticosteroids is not recommended for COVID-19 suspected or confirmed patients that develop pneumonia [10].

Those from the medical profession and the graduates performed better while answering this question than other subgroups ($P<0.05$).

Knowledge of IPC measures for aerosol generating procedures in suspected or confirmed COVID-19 patients is crucial to check the spread of disease.

Those from nursing and allied professions did poorly than others with respect to the correct

sequence of donning and doffing of PPE and appropriate IPC measures for sampling and aerosol generating procedures as compared to other sub groups ($P<0.05$).

Those from ICU settings answered better than others.

Oddly, those who previously received training for COVID-19 and had management protocols in their hospitals did poorly with respect to describing the most common symptoms of mild illness as seen in most cases of COVID-19 and about the IPC measures.

It was observed that a number of those who received special training for COVID-19 also did poorly in questions regarding symptoms, IPC, sample collection, management of COVID-19, ARDS, VAP and use of corticosteroids (Table 3).

Table 3. Item wise correct responses for subgroups based on healthcare setting, profession type, qualification and correct responses for subgroups based on training for COVID-19, presence of COVID-19 ICU management protocol and hand hygiene training.

Item wise correct responses for subgroups based on healthcare setting																
N	Healthcare Setting				Age in years								Gender			
	ICU		Non-ICU		18 to 30		31 to 45		46 to 75		>76		Female	Male		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
	107		206		198		73		41		1		162	151		
Q3	46	43.00%	95	46.10%	86	43.40%	35	47.90%	19	46.30%	1	100.00%	71	43.80%	70	46.40%
Q5	87	81.30%	154	74.80%	141	71.20%	63	86.30%	37	90.20%	0	0.00%	116*	71.60%	125	82.80%
Q6	62*	57.90%	51	24.80%	52*	26.30%	39	53.40%	22	53.70%	0	0.00%	39*	24.10%	74	49.00%
Q7	93*	86.90%	116	56.30%	123	62.10%	53	72.60%	33	80.50%	0	0.00%	107	66.00%	102	67.50%
Q8	20	18.70%	29	14.10%	21*	10.60%	17	23.30%	11	26.80%	0	0.00%	23	14.20%	26	17.20%
Q9	93*	86.90%	150	72.80%	144	72.70%	62	84.90%	36	87.80%	1	100.00%	117*	72.20%	126	83.40%
Q10	97	90.70%	185	89.80%	177	89.40%	64	87.70%	41	100.00%	0	0.00%	146	90.10%	136	90.10%
Q11	40*	37.40%	51	24.80%	53	26.80%	25	34.20%	13	31.70%	0	0.00%	42	25.90%	49	32.50%
Q12	90*	84.10%	143	69.40%	144	72.70%	54	74.00%	35	85.40%	0	0.00%	116	71.60%	117	77.50%
Q13	53*	49.50%	61	29.60%	72	36.40%	28	38.40%	14	34.10%	0	0.00%	61	37.70%	53	35.10%
Q14	92*	86.00%	151	73.30%	151	76.30%	58	79.50%	34	82.90%	0	0.00%	120	74.10%	123	81.50%
Q15	74	69.20%	147	71.40%	145*	73.20%	55	75.30%	20	48.80%	1	100.00%	115	71.00%	106	70.20%
Q17	62	57.90%	117	56.80%	115*	58.10%	43	58.90%	21	51.20%	0	0.00%	93	57.40%	86	57.00%
Q18	28	26.20%	73	35.40%	63	31.80%	27	37.00%	10	24.40%	1	100.00%	51	31.50%	50	33.10%
Q19	87	81.30%	124	60.20%	129	65.20%	51	69.90%	31	75.60%	0	0.00%	93*	57.40%	118	78.10%

Item wise correct responses for profession type and qualification																
N	Profession type				Qualification						Training for COVID-19 care					
	Medicine		Nursing & allied		Graduate		Nursing and Allied		Post-graduation		Super-specialty	No	Yes			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
	235		78		73		77		155		8		175	138		
Q3	95*	40.40%	46	59.00%	24*	32.90%	46	59.70%	67	43.20%	4	50.00%	73	41.70%	68	49.30%
Q5	197*	83.80%	44	56.40%	57*	78.10%	45	58.40%	133	85.80%	6	75.00%	140	80.00%	101	73.20%
Q6	111*	47.20%	2	2.60%	20*	27.40%	2	2.60%	85	54.80%	6	75.00%	80	45.70%	33*	23.90%
Q7	164*	69.80%	45	57.70%	42	57.50%	46	59.70%	113	72.90%	8	100.00%	118	67.40%	91	65.90%
Q8	45*	19.10%	4	5.10%	9*	12.30%	4	5.20%	33	21.30%	3	37.50%	38	21.70%	11*	8.00%
Q9	197*	83.80%	46	59.00%	58	79.50%	45	58.40%	133	85.80%	7	87.50%	144	82.30%	99*	71.70%
Q10	222*	94.50%	60	76.90%	72*	98.60%	59	76.60%	143	92.30%	8	100.00%	169	96.60%	113*	81.90%
Q11	77	32.80%	14	17.90%	18*	24.70%	16	20.80%	56	36.10%	1	12.50%	56	32.00%	35	25.40%
Q12	185*	78.70%	48	61.50%	55*	75.30%	48	62.30%	122	78.70%	8	100.00%	142	81.10%	91*	65.90%
Q13	97*	41.30%	17	21.80%	25*	34.20%	16	20.80%	72	46.50%	1	12.50%	75	42.90%	39*	28.30%
Q14	203*	86.40%	40	51.30%	56*	76.70%	41	53.20%	138	89.00%	8	100.00%	148	84.60%	95	68.80%
Q15	171	72.80%	50	64.10%	54	74.00%	51	66.20%	111	71.60%	5	62.50%	120	68.60%	101	73.20%
Q17	142*	60.40%	37	47.40%	46	63.00%	35	45.50%	93	60.00%	5	62.50%	105	60.00%	74	53.60%
Q18	79	33.60%	22	28.20%	29	39.70%	21	27.30%	47	30.30%	4	50.00%	62	35.40%	39	28.30%
Q19	185*	78.70%	26	33.30%	53*	72.60%	27	35.10%	126	81.30%	5	62.50%	131	74.90%	80*	58.00%

Item wise correct responses for subgroups based on training for COVID-19, presence of COVID-19 ICU management protocol and hand hygiene training														
N	Training for COVID-19 care				COVID-19 ICU management protocol				Hand hygiene training				Total	
	No		Yes		No		Yes		No		Yes			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
	175		138		66		247		53		260		313	
Q3	73	41.70%	68	49.30%	28	42.40%	113	45.70%	20	37.70%	121	46.50%	141	45.00%
Q5	140	80.00%	101	73.20%	55	83.30%	186	75.30%	49	92.50%	192*	73.80%	241	77.00%
Q6	80	45.70%	33*	23.90%	35	53.00%	78*	31.60%	29	54.70%	84*	32.30%	113	36.10%
Q7	118	67.40%	91	65.90%	42	63.60%	167	67.60%	39	73.60%	170	65.40%	209	66.80%
Q8	38	21.70%	11*	8.00%	18	27.30%	31*	12.60%	15	28.30%	34*	13.10%	49	15.70%
Q9	144	82.30%	99*	71.70%	54	81.80%	189	76.50%	44	83.00%	199	76.50%	243	77.60%
Q10	169	96.60%	113*	81.90%	63	95.50%	219	88.70%	50	94.30%	232	89.20%	282	90.10%
Q11	56	32.00%	35	25.40%	18	27.30%	73	29.60%	17	32.10%	74	28.50%	91	29.10%
Q12	142	81.10%	91*	65.90%	49	74.20%	184	74.20%	42	79.20%	191	73.50%	233	74.40%
Q13	75	42.90%	39*	28.30%	23	34.80%	91	36.80%	21	39.60%	95	35.80%	114	36.40%
Q14	148	84.60%	95	68.80%	55	83.30%	188	76.10%	43	81.10%	200	76.90%	243	77.60%
Q15	120	68.60%	101	73.20%	41	62.10%	180	72.90%	34	64.20%	187	71.90%	221	70.60%
Q17	105	60.00%	74	53.60%	35	53.00%	144	58.30%	33	62.30%	146	56.20%	179	57.20%
Q18	62	35.40%	39	28.30%	21	31.80%	80	32.40%	20	37.70%	81	31.20%	101	32.30%
Q19	131	74.90%	80*	58.00%	49	74.20%	162	65.60%	39	73.60%	172	66.20%	211	67.40%

An additional question regarding barriers for providing patient care was included in the survey.

It has been established in this study that the major barrier in caring for patients with COVID-19 was the lack of appropriate PPE (Figure 6).

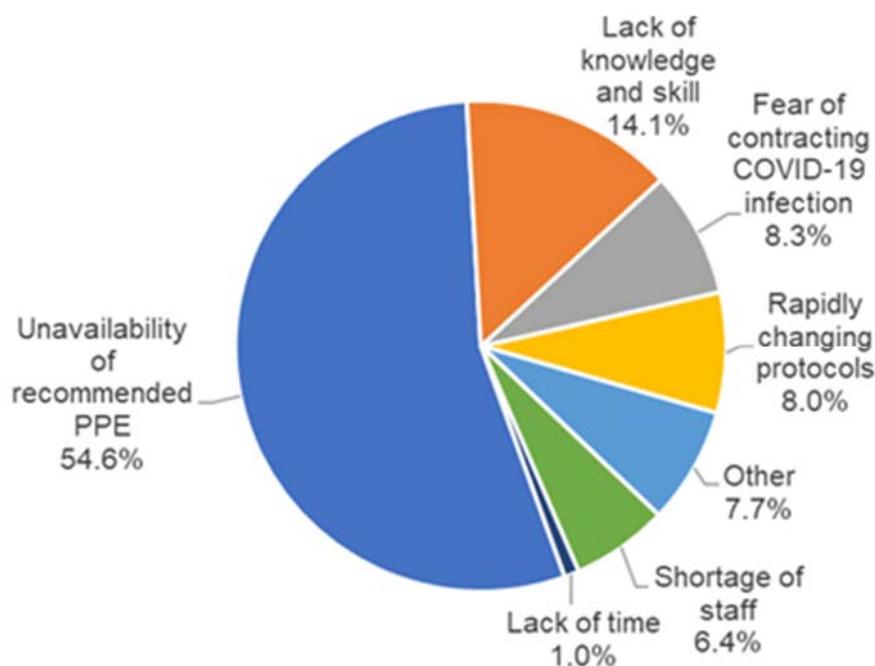


Figure 6. Barriers in caring for patients with COVID-19.

Discussion

To the best of our knowledge, this is one of the first surveys of this kind addressing the key areas of management of SARI in COVID-19 suspected cases and our findings from this study showed multiple areas of deficit in knowledge.

The median and mean percentage of correct responses for all sub groups was only 66.80% and 58.62% respectively.

Overall a deficit in knowledge about sequence of donning and doffing PPE, IPC measures for aerosol generating procedures, identification of COVID-19 related clinical syndromes, interventions to reduce ventilator associated pneumonia and with respect to caring for infants and mothers with COVID-19 disease.

Previous studies based on practices towards MERS showed low adherence to PPE, IPC and poor knowledge about ventilator associated pneumonia (VAP) [11-13].

Resident doctors all over the world are struggling with fear, fatigue and burnout [14].

However, along with the intense training curriculum, most of the current frontline medical services during this pandemic are being provided by resident doctors worldwide.

It is not surprising that the majority of those who answered correctly during the study were postgraduates ($P < 0.05$).

In a similar study about COVID-19 awareness among medical students and professionals, the highest responses were obtained from undergraduates [15].

It was observed that the medical professionals answered more correctly than the nursing and allied professionals; a similar outcome was achieved in a previous study done for MERS [13].

Among the various outcomes of our study, healthcare professionals from the age group of 18-30 years were more aware about SARI management ($P > 0.05$).

This was contrary to the previous studies with other pandemics in which older healthcare professionals showed higher rates of knowledge and awareness [16,17].

However, with respect to care for pregnant women with COVID-19, the younger age group was more aware.

This might be due to greater access to evidence-based practices and online updates as observed in this study [18].

In our study those in the ICU setting answered more correctly than those from Non-ICU ($P>0.05$).

Similar outcome was seen in an older study by Ahmed Asaad Donea among healthcare workers in Saudi Arabia during the MERS outbreak where those who worked in areas where preventive programmes and infection control policies had better knowledge [16].

Though a slight deviation from the topic of SARI, it is of utmost importance to carry out donning and doffing of PPE as healthcare professionals are at maximum risk of exposure, especially in the ICU setting and hence knowledge of the order of donning appropriate PPE must be imbibed in depth.

However, in our study we found poor knowledge among all subgroups with the lowest in nursing and allied subgroups with respect to following the correct sequence of donning a mask or respirator.

This could be due to lack of adequate training practices to nursing and allied healthcare professionals.

IPC measures and correct collection methods including avoiding inducing sputum or aerosol generation, contribute a long way in preventing the spread of disease to non-infected areas and to others.

The IPC measures for aerosol generating procedures in suspected or confirmed COVID-19 patients were most appropriately answered by the younger age group (18-30 years).

Ideally, aerosol generating procedures in COVID-19 patients both suspected and confirmed must be done in negative pressure rooms which was incorrectly answered by most responders.

The medical professionals seemed to be better trained than rest, with those from super specialty answering about negative pressure rooms more appropriately.

Knowledge regarding case definitions for suspected or confirmed patients was found to be inadequate overall.

However, medical graduates answered correctly that a person with laboratory confirmation of COVID-19 infection is known as a confirmed case, irrespective of clinical signs and symptoms.

This is probably due to a good amount of work exposure in the current scenario.

Those in ICU answered questions about COVID-19 case definitions better than the other groups, as similarly seen in published

literature based on intensive care management of COVID-19 [19].

Lack of knowledge about key areas was seen even in those who had received special training in COVID-19.

This corresponds to the need of repeated knowledge imparting and training programmes to increase awareness among healthcare professionals.

Early recognition of SARI starts with screening and triage with appropriate knowledge of disease classification.

Mild illness is commonly seen in most COVID suspected individuals which includes non-specific symptoms like fever, cough, fatigue and rarely diarrhea.

Patients may also present with severe conditions like ARDS diagnosed by a P/F ($\text{PaO}_2/\text{FiO}_2$) ratio ≤ 300 , sepsis and septic shock and better knowledge about it was seen in medical professionals as compared the nursing and allied health staff, probably due to the lack of these topics in their curriculum as demonstrated in a study conducted in São Paulo by Santos JFD [20].

The Sequential Organ Failure Assessment (SOFA) score is a predictor of ICU mortality. Sepsis can be defined as an increase in the sepsis-related SOFA score of ≥ 2 points.

It includes scores, one each system such as the respiratory, hepatic, cardiovascular, coagulation, renal and neurological systems.

Septic shock in COVID-19 patients is defined as serum lactate $\geq 2\text{mmol/L}$ and requirement of vasopressors to maintain MAP (Mean arterial pressure) $\geq 65\text{mmHg}$ [10].

A higher percentage of correct responses with respect to septic shock and SOFA scoring were from medical graduates, probably due to an increased emphasis on management of sepsis in teaching programmes as demonstrated in a study by H.M Ziglam [21].

Moreover, questions were aptly answered in the ICU settings.

Management of SARI requires the use of a ventilator, often for prolonged time.

In such scenarios the incidence of ventilator associated pneumonias (VAP) is high. WHO recommends various guidelines to prevent VAP.

Use of recumbent position and change of ventilator circuits with appropriate replacements in case of damage must be done [10].

This was correctly answered mostly by medical graduates, especially those in ICU settings.

The nursing and allied professionals were deficit in knowledge of this.

Another important patient category is the pediatric and neonatal population.

The preferred method of oxygen delivery in case of severe respiratory infection among infants was via nasal prongs.

Children with severe respiratory distress need oxygen therapy during resuscitation.

The ideal method of oxygen delivery is by the use of nasal prongs or nasal cannula in young children, as it may be better tolerated [10].

It has been established in this study that the major barrier as perceived by healthcare professionals in caring for patients with COVID-19 was the lack of appropriate PPE, while the lack of time was least of the concerns.

The lack of PPE has been observed, debated and is of alarming concern worldwide [22].

Although a previous study with respect to MERS suggested that anxiety about the disease was a major barrier which was one of the barriers observed in our study but wasn't seen in a considerably large group of healthcare professionals [23].

There are several limitations of this study.

Responses were mainly obtained from teaching hospitals in and around Mumbai and Navi Mumbai metropolitan region and hence the finding may not be generalizable to other settings.

Thereafter nationwide studies with a larger sample size need to be carried out especially in remote areas where management of COVID-19 and its related complications could be a major concern.

Another drawback of the study is the low response rate, probably due to the COVID-19 related healthcare crisis. In this study, responses of the participants may differ since the participants worked in different areas of the hospital and could have varying levels of training and pre-existing knowledge of COVID-19.

However, the COVID-19 pandemic is rapidly evolving and there is a need for development of universal measurement tools that can be used in all healthcare settings to evaluate training and formulate strategies for COVID-19 management and make comparisons between different groups.

Conclusion

With the COVID-19 situation yet to reach its peak in India and many parts of the world, outcomes from the current study have important implications for future interventions with management of patients with COVID-19 related SARI.

The present study was able to identify lacunae in knowledge with several aspects of SARI which calls for major awareness and implementation programs that need emphasis among all groups of healthcare professionals besides those in the ICU setting.

A uniform and well-structured training program must be implemented at local and national level that targets physicians, nursing and allied healthcare professionals with varying levels of COVID-19 training.

Also, team-oriented crisis resource management would also help in effectively managing the COVID-19 crisis.

The findings of this study can be used as a baseline for further development of training resources for healthcare professionals.

Conflict of interests

None to declare.

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