Original Article

Study Factors Involved in Maternal Deaths Attributed to COVID-19 in a Disadvantaged Area in Southeast of Iran

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Abstract

Objective: It is a fact that coronavirus disease of 2019 (COVID-19) infection mortality rate is high, but the question is "what is the role of other factors in maternal death with COVID-19?" The present study aimed to understand the factors that prevent women from timely use of healthcare services and also the potential weaknesses of the healthcare system that cause the lack of quality healthcare services for women.

Materials and methods: This case-series study was performed in the southeast of Iran. In total, 12 cases of maternal deaths attributed to COVID-19 were identified through the Iranian Maternal Mortality Surveillance System. The required information was collected through existing verbal autopsy data sets. In some cases, the family members had to be re-contacted and healthcare workers were asked to supply the missing information. The root cause analysis method was employed for data analysis.

Results: From March 2020 to March 2021, the deaths of 12 women were attributed to COVID-19. The majority of these women lived in rural areas (58%) and had a secondary school education level or less (83.3%). The contributing factors were divided into three categories: barriers at the community level (no prenatal care, lack of trust, lack of recognition of the severity of disease, and attribution of symptoms to something else), at the primary health system level, and at the hospital level (fear of staff of being infected, non-compliance with guidelines, lack of team working, and problem with telehealth).

Conclusion: The socio-cultural context and unmet healthcare needs hinder the utilization of available services. Moreover, factors at the level of the healthcare system prevent the timely detection and referral of women with COVID-19 to receive quality healthcare services. Using telehealth also did not help to appropriately triage pregnant women.

Keywords: COVID-19; Health Services; Maternal Mortality

Introduction

Since the first report of COVID-19 on December 31, 2019, it has extensively spread all around the world (1). On March 11, 2020, the World Health Organization declared COVID-19 as a global pandemic (2). Iran is one of the countries that have been suffered from the widespread prevalence of

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COVID-19 (3).

Presentations of COVID-19 range from asymptomatic carriers of the virus, mild influenza-like illness to moderate and severe illness that requires hospitalization and intensive therapy. Recent studies have shown that pregnant women are more vulnerable to severe COVID-19 infection and maternal and neonatal morbidity (e.g., preeclampsia, preterm birth, cesarean delivery) (4, 5). Furthermore, a high maternal mortality rate due to COVID-19 (Relative Risk, 22.3) is reported for pregnant women (6).

Additionally, it has also been reported that maternal deaths due to COVID-19 are disproportionately high in low- and middle-income countries (LMICs) such as Iran (7, 8). In these countries, pregnant women might be more vulnerable (due to insufficient resources for early molecular testing and detection of COVID-19, poor access to ventilators and intensive care, and low-quality healthcare) (7, 9). Moreover, nationwide lockdown, physical distance protocols to control COVID-19, and fears of referral to healthcare facilities lead to challenges in healthcare-seeking behaviors and indirectly reduce access to healthcare among women during pregnancy and postpartum period (10). Therefore, outbreaks, such as COVID-19 can increase maternal mortality, not only through infection itself but also through indirect effects which can be much more likely to cause maternal death, especially in low- and middle-income countries (11, 12).

Review of all maternal death attributed to COVID-19 using root cause analysis (RCA) help to understand the underlying factors contributing to such deaths (13-15). It helps provide insight into quality evidence for context-appropriate responses at the local level and prevent future deaths (11, 16).

With this background in mind, the present study aimed to investigate the root causes of maternal deaths attributed to COVID-19 in a disadvantaged area in the southeast of Iran. The final objective was to understand the contributing factors that prevent women from timely use of healthcare services and also the potential weaknesses of the healthcare system that cause the lack of quality healthcare services for women.

Iranian health system strategies to care for pregnant women during COVID-19 pandemic

The Iranian health system has taken some important steps (e.g. protection strategies, screening programs, and a referral system) to prevent the spread of the virus and identify pregnant women with COVID-19. First, general tips and information were provided for community members, including pregnant women, to protect them against COVID-19.

Second, at service delivery for low-risk women, the number of prenatal care visits decreased from eight to four. Text messages and phone calls (where available) were taken into account to report the results of tests to healthcare personnel and ask their questions (this service is known with its phone number which is 4030). It was also emphasized that the appointments requiring face-to-face contact should be held with respect to social distancing and reduction of overcrowding in healthcare facilities.

Third, healthcare providers working in rural and urban health centers called pregnant women every week to ask about 1. New onset of fever and/or respiratory tract symptoms, such as cough, and loss of sense of taste or smell (anosmia); 2. Sudden onset of at least three or more symptoms, such as fever, cough, general weakness/extreme tiredness, headache, myalgia, sore throat, shortness of breath, anorexia/nausea, vomiting, diarrhea, and loss of consciousness; 3. Whether in the past 14 days she stayed at home, worked, or traveled to areas (e.g., crowded places, weddings, and funerals) where the virus was most likely to be present ad also whether anyone in her family had a fever, cough, shortness of breath, and chills; and 4. Their history of contacting people with suspected or confirmed COVID-19 (17, 18).

Forth, suspected COVID-19 cases are referred to selected healthcare centers that work from 7 am to 8 pm. In these selected health centers, the doctor decides whether to refer the person to the hospital or advise them to isolate themselves at home based on the "Instructions for Care and Diagnosis of COVID-19". In addition, polymerase chain reaction (PCR) testing is performed for both groups. Individuals in both groups will also be followed up by health personnel according to national instructions (18). Some women go directly to the selected health centers or hospitals without going to a health center.
5. After major signal about safety of COVID_19 vaccination during pregnancy (19) the Ministry of Health and Medical Education of Iran approved the use of China's Sinopharm COVID-19 vaccine for pregnant women after the 12th week of pregnancy on 7 August 2021.

Materials and methods

This case series study was conducted to assess maternal deaths which were attributed to COVID-19

during 12 months from March 20th, 2020, to March 21st, 2021. During this time, 30 maternal deaths occurred in population covered by ZUMS, 12 of which were attributed to COVID-19 according to PCR test and maternal mortality committee. This study was approved by the Ethics Committee of Zahedan University of Medical Sciences, Zahedan, Iran (April 14, 2021; IR.ZAUMS.REC.1400.008).

Setting: Sistan and Baluchestan Province is located in the southeast of Iran, bordering Pakistan and Afghanistan, and its capital is Zahedan. It has a population of about 2.775 million people, and about 50.5% of the population lives in rural areas. Moreover, it has been reported that this province has the worst condition in terms of poverty index which represents the level of deprivation in three aspects of life span, education level, and revenue (20). As well, this province has the worst social health index, such as low insurance coverage, the prevalence of women within the age range of 15-54 years old with one chronic disease (21). The population of this province is covered by three medical universities (e.g. Zabol, Iranshar and Zahedan). Zahedan University of Medical Sciences (ZUMS) is in charge of providing services for more than half (1,600,000) of the population of this province.

Data collection: In the present study, the cases of maternal deaths (n=12) were identified through the Iranian Maternal Mortality Surveillance System. Maternal death refers to the death of a woman during pregnancy or within 42 days of the termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (22). In Iran, all maternal deaths inside and outside hospitals and health centers are reported to the District, then Province Health Center, and then Maternal Health Unit in the Ministry of Health and Medical Education.

All maternal deaths should be investigated by maternal death inquiry team members within two weeks. Verbal autopsy interviews are conducted with family members, healthcare providers who provide prenatal and postnatal care in health centers, and healthcare providers who provide care during terminal events (in public or private hospitals and maternity facilities or clinics). It should be mentioned that these interviews were conducted using a structured information questionnaire. In addition, interviews were conducted with healthcare providers who worked in the selected health center, where primary diagnostic and treatment services are provided for pregnant women suspected of COVID-19.

During the study year, to protect the personnel from COVID-19, members of maternal death inquiry teams completed the questionnaire through telephone interviews and did not visit the home of the deceased women. The questionnaire contains questions about general health, pregnancy history, risk factors, use of prenatal and postnatal care, place of delivery, medications, and referrals. It also includes a detailed narrative about the terminal events and healthcare received during the terminal event. The required data were collected by maternal death inquiry teams at district and provincial levels. It is noteworthy that the maternal death records were also reviewed by first and third authors. In some cases, it was necessary to re-contact family members and healthcare workers to collect the missing information.

Root cause analysis: A Root cause analysis technique with its descriptive and explanatory elements (15, 23) was employed to interpret raw data and explore the underlying reasons for maternal deaths attributed to COVID-19. The focus was on factors that prevent women from timely use of health care services and potential weaknesses of a healthcare system that cause the lack of quality healthcare services for women.

For this purpose, first, a team was organized to conduct RCA. This team included a maternal health expert who is responsible for handling cases of maternal death, the director of Family; Population and Health Department, Zahedan University of Medical Sciences, Zahedan, Iran; Vice Chancellor for Health in Zahedan University of Medical Sciences; and a Ph.D. in reproductive health who had experience in maternal mortality review.

The maternal health expert and Ph.D. in reproductive health classified the data of each file along a timeline of events to establish a sequence of events until the maternal death. Meanwhile, we always ask “why” to think more deeply about the factors associated with each step in the path towards the defined problem. Therefore, sometimes it was needed to call the healthcare providers, family members, or healthcare providers to understand the root cause of the problem.

The collected data were entered into a data entry form (Table 1). On January 10, 2021, we were informed that five cases of maternal death with COVID-19 were reviewed by the National Maternal Mortality Committee (NMMC) in Iran.

Table 1: Data entry instrument; timeline and fall-out tool to find factors contributing to the death of women with COVID-19

Row	Date	Time/when	Where/setting	Event	Who	Findings	Measures	Unsafe act	Why
1			Urban Health centers	Pregnancy of a woman under the care of the health center	Health-care provider	No prenatal care	-	Failure to identify a pregnant women	
In the electronic medical record system, it was falsely recorded that the woman was not married and lived in her father's house. Why? 1- High volume of care/lack of supervision and false completion of the information. Next, we ask them why not the woman herself went to the health center to receive prenatal care. 2- "During pregnancy, due to family disputes, the woman was not allowed to visit her family, travel in the city, and attend health centers." (case no. 11)									
2									

The results announced by the National Committee were in line with those of the present study. In the next step, contributory factors of all the cases were reviewed and categorized by the panel of team members.

Results

From March 20, 2020 to March 21, 2021, the deaths of 12 women due to COVID-19 were reported (Table 2).

Table 2: Characteristics of women whose deaths were attributed to COVID-19 (n=12)

Characteristics	n	%
Women's age (years)		
<18	2	16.67
19-30	2	16.67
>30	8	66.66
Women's education		
Illiterate	2	16.67
Primary	5	41.66
Second	3	25.00
university	2	16.67
Women's job		
Housewife	2	16.67
employee	10	83.33
Residency		
Urban	5	41.67
rural	7	58.33
Man's education		
Illiterate	3	25.00
Primary	5	41.67
High school	3	25.00
University	1	8.33
Man's job		
Unemployed*	1	8.33
Employed**	2	16.67
Seasonal worker	6	50.00
Driver	2	16.67
Shopkeeper	1	8.33

* Prisoner, but sometimes he could take leave and stay at home **one was army, and one was teacher

The majority of these women (58%) lived in rural areas and had a secondary school education level or less (83.3%). Table 2 summarizes their other characteristics and the education level and job of their husbands. The data also showed that 2 (2/12, about 16.7%) of maternal deaths (cases no. 4 and 6) occurred at home. Obstetric profile and perinatal outcome of women are shown in Table 3. The root cause of maternal death files showed that barriers to accessing services can be divided into three main categories: community level, health system/pre-hospital setting, and hospital setting.

1. Community level

Lack of seeking prenatal care: The relative of one of two women who did not seek prenatal care (2/12, 16.66%) said: *"During pregnancy, due to family disputes, she was not allowed to visit her family, travel in the city, and attend health centers." Case no. 11*

It is important to mention that two women (2/12, 16.66%) refused to refer to the hospital after being identified as suspected cases of COVID-19. Despite their deteriorating conditions, they were cared for at home by family members. Their reasons are explained in the following.

Lack of trust in the available hospital care services: The father of one of the women explained his reason for not admitting woman to the hospital as follows:

"The last time she was hospitalized, nothing was done for her. I quarantined her at home and treated her with herbal medicine." Cases no. 4

Lack of recognition of symptoms/severity of the disease: One of the women had said her reasons for not going to the hospital to one of the health care providers:

"My little brother had the same symptoms, we did not take him anywhere (to the hospital) for treatment, and he recovered on his own." Case no.6

Table 3: Obstetric profile and perinatal outcome of women whose deaths were attributed to COVID-19 (n=12)

Obstetric profile	n	%
History of disease		
No	4	33.34
Addiction	1	8,33
β-thalassemia minor	2	16.67
Kidney disease	1	8.33
Hypothyroidism	4	33.33
Gravida		
1	3	25.00
>1	9	75.00
Weeks of pregnancy at first antenatal care		
no prenatal care	2	16.66
between 7 and 13	5	41.67
between 16 and 18	5	41.67
No. of antenatal care visits		
No visit	2	16.66
<5	5	41.67
≥5	5	41.67
Type of delivery		
No childbirth	4	33.33
Normal vaginal delivery	3	25.00
Cesarean section	5	41.67
Place of childbirth		
No childbirth	4	33.33
Home	2	16.67
Hospital	6	50.00
Moment of death		
During pregnancy	4	33.33
At delivery	2	16.67
postpartum	6	50.00
Place of death		
At home	2	16.67
on the way to provincial referral hospital	1	8.33
at tertiary care hospitals	9	75.00
neonatal outcome		
Death	9	75.00
alive	3	25.00
Gestational age (weeks)		
16-33	7	58.33
35-40	5	41.66
Use of intensive care		
Yes	4	33.33
No	8	66.66

Attribution of COVID-19 symptoms to something els: In response to the question of why they did not come to the hospital earlier despite the symptoms, one of health personnel explained that the woman had told them:

"I always have such symptoms; these are related to camel milk." Case no.4

Eight women (8/12, 66.7%) arrived at the hospital so late that they died within a week of being admitted to the hospital (min=1 day, max=7 days). Five out of these eight women (5/8, 62.5%) died within days of hospitalization, and three of them (3/12, 37.5%) died up to seven days after hospitalization. A review of maternal death files showed that barriers to accessing services were not only related to the factors influencing demand at the community level but also to the factors involved in service delivery (supply factors). Maternal characteristics and healthcare services provided for pregnant women whose deaths were attributed to COVID-19 are summarized in Table 4.

Supply-related factors were divided into two main categories, namely the pre-hospital (barriers for COVID-19 case finding and timely referral of infected women to the hospital), and hospital (barriers for COVID-19 triage and case finding in hospitalized women) factors.

2. Health system/pre-hospital setting

2.1. In health centers

Fear of healthcare workers of being exposed to COVID-19: In the village, the doctor and the midwife went to the houses of women. They took a photo of the woman and reported that she did not have a fever and is in good health. While that night, the woman suffered from respiratory distress and loss of consciousness and died the next day (case no. 10). When asked why a clinical examination was not performed and vital signs were not measured. They (the doctor and midwife) replied: "We have recently recovered from COVID-19 infection."

Doctors do not obey the guidelines: According to the national guidelines, all pregnant women with COVID-19 symptoms should have a PCR test. In the present study, only four (4/12, 33.3%) women at the health center level had a PCR test.

Non-compliance with guidelines in following the progress of illness in outpatient care: During the outpatient care, regardless of the guidelines, the healthcare providers did not visit the patient in her house to check her health status (e.g., fever and shortness of breath) (case no. 4).

Lack of good communication with family members: In response to the question of why you did not take her to the hospital, her father said:

"The healthcare providers at the hospital did not tell us anything at all. So I got angry and took my daughter home." Case no.6

Table 4: Maternal characteristic and health care services provided to pregnant women whose death attributed to COVID-19

Cases	Contact with suspicious or definite cases	Measures at health centers				How refer to hospital@	Disagree with hospitalization	Po2 at hospital admission	Place/or moment for PCR	family members developed COVID-19
		Symptoms	Pulse oximetry	PCR	Management after onset of symptoms					
1	husband	1, 2,3	-	+	Referral to expert	Private sector	-	86%	Private sector/before hospitalization	-
2	sister in law	1, 10	-	-	No prenatal care	HS	-	-	After death†	-
3	mother	1, 3, 4,11	-	-	No detected	Self-referral	-	-	Hospital	-
4	?	1, 2, 5, 6	-	+	Out patient	HS	+	-	Health Center	Sister who was pregnant, recovered
5	?	1, 7, 8,12	-	-	Referral to expert	Self-referral	-	93%	Hospital**	-
6	sister	1, 3,12	-	- ‡‡	No detected	HS	+	-	After death†	Aunt and brother's wife, recovered
7	?	1, 3	-	-	No detected	Self-referral	-	75%	Hospital	-
8	contaminated village*	3,9	-	-	No detected	Self-referral	-	65%	Hospital	-
9	contaminated villager*	1, 2, 3	_	+	Referral to selected health center	HS	+	-	Health Center	-
10	mother‡	1, 2, 3	-	+	No detected	Self-referral	-	40%	Health Center	-
11	?	1, 2, 3	-	-	No prenatal care	Self-referral	-	73%	Hospital	Mother who died
12	hospital personnel††	3,12	-	_	No detected	Self-referral	-	-	After death	Father in law, recovered

Symptoms: 1. Fever, 2. Cough, 3. Dyspnea, 4. Diarrhea, 5. Chill, 6. sore throat, 7. nausea, 8. vomiting, 9. Muscle aches/ myalgia , 10. Be extremely sick, 11. Palpitation, 12. Epigastric/abdomen pain @ Health System (HS)

‡‡ COVID was diagnosed using CT scan results at the time of admission to the hospital, † a PCR test was performed after the woman died (postmortem) to confirm infection with COVID-19, * In this village a large number of people were diagnosed with COVID-19, ‡ mother of women had been recently died with COVID-19, ** A test was taken for this woman with a delay of 20 days of hospitalization, and a positive test result was received three days before her death. †† The woman had undergone a cesarean section at the hospital, where a large number of staff were later diagnosed with COVID-19 and some died.

In another case, the father of the women said:

"There were many patients in the hospital and they did not take care of her. I quarantined her at home and treated her with herbal medicine." Case no. 9

Lack of team working with the private sector: Some women received their first care from the private sector. There was no connection between the private sector and governmental health system to inform the health system about COVID-19 suspected/confirmed cases (cases 2 and 10).

2.2. Problem with telehealth as case-finding/or follow-up tools

Detection of the symptoms of COVID-19 over phone calls was not timely, and women with COVID-19 were diagnosed too late to do anything (cases no. 3, 6, 7, 8, and 11). A woman was detected with severe symptoms (dyspnea) and Po2=75% of COVID-19, while she had symptoms from a week before the phone call (case no.8).

In another case, when healthcare personnel called a woman to come to a health center for a flu shot, the healthcare provider was told that 11 days ago the woman had tested positive for COVID-19 (case no. 6).

2.3. In selected health centers as the first level of referral

After the woman was referred to the selected health centers, despite the shortness of breath, the doctor disregarded her history (e.g., death of close family members due to COVID-19)/vital signs (fever and diarrhea). Moreover, the doctor did not comply with the national guidelines to refer the mother to the hospital after performing a PCR test (while waiting for PCR test result) (cases no. 9, 10).

3. In hospital setting

3.1. In hospital triage

Non-compliance with guidelines and outpatient versus inpatient care: One of the women was referred to the hospital triage with a history of her mother's death due to COVID-19, and complaints of shortness of breath, fever, and cough. She was discharged from the hospital after symptomatic treatment/supportive care but she died the next day (case no. 10).

Lack of team working with out of hospital units (health centers): In case of hospital discharge with personal consent, not informing the midwife in charge of high-risk women in the hospital to make the necessary arrangements with the health personnel for follow up care (cases no. 4, 6, and 10).

3.2. In hospital wards: Lack of team working/ or* uncoordinated *care

Case no. 5 (1/12, 8.3%) died 24 days after being identified by the health system. This woman was hospitalized due to suspected pancreatitis, and her pregnancy was terminated one day after admission. Moreover, consult with an infectious disease specialist for advice about diagnosis and management of COVID-19 (due to Po2=97%, T-37.9) was considered, but this counseling was not followed up. Finally, the PCR test was performed with a delay of 13 days due to shortness of breath and Po2 of 83%. The PCR positive lab result was received within three days. Factors contributing to maternal death due to COVID-19 are shown in Table 5.

Table 5: Classification of contributory factors of maternal death attributed to COVID-19

Community Level	Did not seek prenatal care	Cases no. 2, 11
	Lack of trust in the available hospital care services	Cases no. 4, 6, 9
	Lack of recognition of symptoms/ or severity of disease	Case no.1,3,6,7
	Attribute COVID_19 symptoms to something else	Case no. 4, 8
Primary Health System/ Pre-hospital setting	**Barriers for COVID-19 case investigation and timely referral of infected women to the hospital**	
	health workers fears of being exposed COVID-19	Cases10
	Health care providers did not know about /obey the protocols	Cases no. 1,4,9,10
	Non-compliance with guidelines in following the progress of illness in outpatients care	cases no.3, 7,8, 11
	Lack of team working with private sector	case no. 4
	Lack of good communication with family members	Cases no. 6, 9
	problem with telehealth as a case-finding/ or follow up tools	Cases2, 10
	In selected health centers 1- Non-compliance with guidelines	Cases no.9, 10
Hospitals setting	**In hospital triage:** Non-compliance with protocols, and outpatient versus inpatient care	Cases no.10
	Lack of team working with out of hospital units (health centers)	Case 4, 6, 10
	In hospital setting: Lack of team working/ or uncoordinated care	Case no.5

Discussion

Based on the results of the present study, apart from COVID-19 itself, other contributing factors prevented women from timely healthcare seeking at the community level. Furthermore, there were some barriers to timely detecting and responding to suspected or confirmed cases of COVID-19 by the healthcare system.

In line with a previous study performed in Brazil (24), nearly half of the women (41.7%) died within a day of hospitalization, and more than half of them (66%) were not admitted to the intensive care unit. This indicates that the majority of women are faced with some barriers to using available services. This can be explained by two reasons, including utilization of available healthcare services and provision of effective healthcare services.

Sistan and Baluchestan province has the worst condition in terms of poverty index (e.g. education level and revenue) in Iran. Previous studies have shown that factors, such as low level of education, are among the reasons for the delay in seeking healthcare (25). Abdelhafiz et al. have reported that higher educational levels are associated with higher perceived severity of illness and that such people are also more concerned about the potential risk of COVID-19 infection among members of their families (26).

In such situations, lack of experience of severe cases and death due to COVID-19 infection among relatives/or close friends can be accompanied by a lack of perception of COVID-19 seriousness (27). In the present study, it was found that the probability of using the available healthcare services increased with the deterioration of the health of women. In case no. 4, the data showed that after her death due to COVID-19 infection and refusal of her hospitalization, one of her family members was immediately hospitalized with a positive PCR test. As a result, simple provision of information for people without considering socio-cultural context does not guarantee an increase in the utilization of the available services (28).

Moreover, like previous studies, the failure of the healthcare system to meet the expectations of women and their families (e.g. to share relevant information with women or their relatives) is one of the effective factors for non-use of the available services (29). In such situations, effective communication is one of the measures that not only help meet communication needs but also explains which complications could be managed at which level of available healthcare services (30, 31).

The findings of this set of RCA showed that shortage of resources (e.g. personal protective equipment [PPE], pulse oximeter, and PCR kit test for COVID-19 infection), suboptimal adherence to guidelines (for timely referral and outpatient care, lack of teamwork), and problems with current telehealth are contributed to maternal death. These findings can be explained as follows: First, the capacity of Iran to effectively respond to the COVID-19 outbreak was impeded by US sanctions, and the government faced difficulty in the preparation and provision of PPE, diagnostic tests, and medications (32).

Second, consistent with a previous study performed in Pakistan (33), it was found that fear of infection and transmission of COVID-19 and limited access to PPE among healthcare providers who are in direct contact with people suspected of COVID-19 might have affected the performance of healthcare providers. Consequently, they might have refused to fully comply with guidelines and have direct physical contact with a suspected COVID-19 case to assess her health situation. Based on the findings of the present study, this situation was worsened by a shortage of PCR kit tests, especially in rural areas, which made it difficult to detect cases of COVID-19 as soon as possible. In addition, the shortage of pulse oximeters made it difficult to measure the oxygen saturation and identify the severity of the situation in a suspected case of COVID-19 infection in rural outpatient settings, and take all measures to hospitalize women who refused to refer to a hospital.

The Iranian health system also initiated a telehealth system (it is known by its phone number 4030) for the provision of maternal healthcare and triage of patients with COVID-19 (34). However, according to the findings of the present study, in line with those of previous studies (35), in settings, such as Iran that telehealth is new, this system might not be able to reach high-risk pregnant women (e.g. the women whose pregnancies are not recognized by healthcare services), and triage of pregnant women.

After reviewing some maternal death files provided by NMMC, it was suggested that the number of telephone consultations should be reduced, and the quality of telephone care should be monitored and evaluated. At the district level, the healthcare providers were asked to call and speak directly with the pregnant woman, record all the conversations, and send reports to the district health centers managers every week. However, there are two problems; first,

in many cases, the phone number given to the healthcare providers belongs to the husband. Second, especially on the outskirts of the city, sometimes false statements are made in response to COVID-19 screening questions. These people believe that if they are diagnosed with COVID-19, they will be referred to the hospital which will eventually result in death.

Similar to previous research on maternal death due to other reasons other than COVID-19 (36, 37), the present study showed that about half of maternal deaths were associated with negligence of healthcare providers in using national protocols and guidelines for the management of women in primary healthcare and hospital settings. To ensure that a guideline has an actual impact on the process and outcomes of care, the managers need to make sure that (general) practitioners optimally adhere to guidelines in practice (38). Therefore, Iranian NMMC after reviewing 5 out of 12 maternal deaths attributed to COVID-19 has recommended that the optimal compliance with guidelines and protocols for the management of women with COVID-19 should be evaluated by the Health and Treatment Deputy.

In the present study, we only had access to those maternal deaths due to COVID-19 at the hospitals and health centers affiliated with Zahedan University of Medical Sciences. We did not have access to maternal deaths due to COVID-19 in other parts of the province or country; therefore, caution should be exercised in generalizing the results of the present study.

Conclusion

The results of the present research highlighted the importance of the regular assessment of the performance of the healthcare system in primary healthcare centers (e.g. compliance with guidelines and protocols, case-findings, outpatients care, and timely referral) and hospitals (e.g. compliance with guidelines and protocols, case findings at triage level and among hospitalized patients, provision of coordinate care and teamwork). The socio-cultural context and expectations of people from the health system should be considered in the delivery of services. Moreover, the needs of frontline health workers and bottlenecks should be met to help them provide quality healthcare services.

Conflict of Interests

Authors have no conflict of interests.

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