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RESEARCH ARTICLE

Knowledge, attitude and practices of pregnant women related to COVID-19 infection: A cross-sectional survey in seven countries from the Global Network for Women's and Children's Health

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Abstract

Objective: We sought to understand knowledge, attitudes and practices (KAP) regarding COVID-19 in pregnant women in seven low and middle-income countries (LMIC).

Design: Population-based prospective, observational study.

Settings: Study sites in DRC, Kenya, Zambia, Bangladesh, India (two sites), Pakistan and Guatemala.

Population and sample: Pregnant women in the Global Network's Maternal and Neonatal Health Registry (MNHR).

Methods: A KAP questionnaire was administered in face-to-face interviews with pregnant women from September 2020 through October 2021 in the MNHR.

Main outcome measures: KAP regarding COVID-19 during pregnancy.

Results: In all, 25 260 women completed the survey. Overall, 56.8% of women named ≥3 COVID-19 symptoms, 34.3% knew ≥2 transmission modes, 51.3% knew ≥3 preventive measures and 79.7% named at least one high-risk condition. Due to COVID-19 exposure concerns, 23.8% had avoided prenatal care and 7.5% planned to avoid hospital delivery. Over half the women in the Guatemalan site and 40% in the Pakistan site reduced care seeking due to COVID-19 exposure concerns. Of the women, 24.0% were afraid of getting COVID-19 from healthcare providers. Overall, 63.3% reported wearing a mask and 29.1% planned to stay at home to reduce COVID-19 exposure risk.

Conclusions: We found a decrease in planned antenatal and delivery care use due to COVID-19 concerns. The clinical implications of potential decreases in care are unclear, but decline in essential healthcare utilisation during pregnancy and delivery could pose challenges for maternal and newborn health. More research is needed to address the impact of COVID-19 on routine pregnancy and delivery care.

Tweetable abstract: Pregnant women in 7 low and middle income sites often had incomplete knowledge related to COVID-19 and practices to prevent COVID-19 during pregnancy varied.

1 | BACKGROUND

Since early 2020, the COVID-19 pandemic has had an important impact on global health.[1] COVID-19 has affected high-income as well as low- and middle-income countries (LMICs) in Asia, Europe, North and South America, Australia, and Africa.[2] On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak as a global pandemic with exponential spread worldwide.[1] Although COVID-19 was initially considered a respiratory disease that in some cases caused severe pneumonia, it is now known as a complex multisystem disease ranging in severity from asymptomatic to fatal.[3,4]

Since the emergence of the disease, COVID-19 has been accompanied by fear, lack of information and unpreparedness.[5] Because of the rapid spread of COVID-19 and its significant negative impact on the health and the socioeconomic status of communities, the WHO has recommended several precautionary measures against the spread of COVID-19 which have been adopted by the governments of many countries. The success of these initiatives depends largely on people having accurate information about the disease. Pregnant women and those with co-morbidities are at increased risk of developing complications due to severity of COVID-19 infection and due to physiological changes.[4,6] Limited knowledge related to COVID-19 symptoms, modes of transmission, risk status, and measures to prevent the spread of COVID-19 infection in pregnancy can increase the risk of contracting COVID-19 infection.

A recent meta-analysis by Allotey et al.[3] suggested that the cumulative effect of this disease on a woman and her growing fetus is detrimental. Most pregnant women remain asymptomatic and are less likely to manifest COVID-19 related symptoms than are non-pregnant women.[4] Pre-existing medical conditions along with pregnancy-specific conditions such as gestational diabetes and pre-eclampsia are additional risk factors that may increase the risk of adverse outcomes in COVID-19-positive pregnant women as compared with women without the disease.[3,7]

The WHO and others have emphasised the need to improve COVID-19 related health information in the population.[8] By understanding the knowledge, attitudes and preventive practices of the target community, informational materials can be tailored to pregnant women and incorporated as part of the antenatal care (ANC) package related to COVID-19 symptoms, modes of transmission, knowledge of high-risk groups and measures to prevent contracting COVID-19 in pregnancy. Understanding how women will approach care seeking is crucial since one potential pathway relating the COVID-19 pandemic to adverse pregnancy outcomes is through a decrease in pregnancy related care.

The aim of the present study was to determine the knowledge, attitudes, and preventive practices of pregnant women

related to COVID-19 in LMICs. The findings from the current study should help inform policies and guidelines for the prevention of COVID-19 among similar obstetric populations living in LMICs. Since the maternal and neonatal health indicators are already compromised in many LMICs, this study may encourage government officials to focus on areas for raising awareness for prevention of COVID-19 among pregnant women.

2 | METHODS

This study was undertaken as part of the Global Network for Women and Children's Health Research (Global Network), a multi-country research network funded through peer-reviewed research grants by the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD).[9] The KAP sub-study was nested within the Global Network's Maternal and Neonatal Health Registry (MNHR). The MNHR is a prospective, population-based observational study that includes all pregnant women and their outcomes in defined geographic communities (clusters).[10,11] Each of these mostly rural communities (clusters) includes approximately 300–500 births annually, with between 6 and 10 clusters at each of the study sites in western Kenya, Zambia (Kafue and Chongwe), the Democratic Republic of the Congo (DRC) (North and South Ubangi Province), Pakistan (Thatta in Sindh Provence), India (Belagavi and Nagpur), Guatemala (Chimaltenango) and Bangladesh (District Tangail). The MNHR was initiated at each of the study sites between 2008 and 2009, except for the DRC, which rejoined the Global Network in 2014 after a 5-year hiatus, and Bangladesh which joined the Global Network in 2018.

The KAP survey was initiated as part of the MNHR in September 2020 and is planned to be continued until the end of the pandemic. This analysis used data collected from September 2020 through October 2021 (exact start date varied by site). For the COVID-19 KAP study, once approved at a site, all the women enrolled within the MNHR sampling frame – those who consented and intended to deliver within the MNHR clusters – were approached to participate in the KAP survey.

The information about knowledge, attitudes and practices of pregnant women related to COVID-19 was obtained through face-to-face interviews with the women at the time of enrollment in the MNHR. To determine the level of knowledge related to COVID-19, women were asked to identify nine possible symptoms, four ways of transmission, six steps to prevent the spread and knowledge of the two highest risk groups. The questionnaire was intended to prompt the women's responses to the statements posed in the questionnaire. In this section, each question was asked as an open-ended question without reading the potential list of responses to assess the woman's understanding. For any of the woman's correct responses, the appropriate response was checked on the form. In the practices section, the staff prompted the mother or asked clarifying questions, as needed. COVID-19 symptoms of interest included: fever, cough, difficulty breathing, sore throat, runny or stuffy nose, tiredness, aches and pains, diarrhea, and loss of taste or smell. Transmission modes of interest included respiratory droplets from a sick person, respiratory droplets from an asymptomatic person, touching contaminated objects and shaking hands. Preventative measures of interest included handwashing or using a hand sanitiser, keeping distance from others, avoiding shaking hands, avoiding touching face, wearing a mask, and staying home. High risk populations of greatest interest included the elderly and those who have other comorbidities.

2.1 | Statistical analyses

The analysis population included women screened for the MNHR who were eligible and who had consented and completed the KAP interview. Data analysis was done using SAS Enterprise Guide version 7.1 (SAS Institute Inc.). For each of the knowledge components, valid responses were summed into four individual component scores. These scores were then dichotomised according to whether the participant met what our team felt was a minimum threshold of valid responses to be considered having sufficient knowledge. Questions were first coded for correctness. The correct answers were summed to determine the score for items of knowledge of symptoms, transmission, preventive practices and high-risk status. Categorical variables were created from the summed scores for cut points at which the participant would be considered to have knowledge of the items as follows, identified at least three symptoms, identified at least two transmission modes, identified at least three prevention measures, and identified at least one group at greatest risk. Maternal demographic characteristics and distributions of their COVID-19 knowledge, attitudes and practices were presented in frequencies and percentages.

2.2 | Ethical approvals

This study was reviewed and approved by ethics review committees of participating sites at INCAP, Guatemala; University of Zambia, Zambia; Moi University, Kenya; Aga Khan University, Pakistan; KLE University's Jawaharlal Nehru Medical College, Belagavi, India; Lata Medical Research Foundation, Nagpur, India, and the Kinshasa School of Public Health, Democratic Republic of the Congo, and International Centre for Diarrhoeal Disease Research, Bangladesh. The institutional review boards at each US partner university and the Data Coordinating Center (RTI International) also approved the protocol. All women provided informed consent for participation in the study and data collection.

3 | RESULTS

From September 2020 through October 2021, COVID-19 KAP questionnaires were collected for 25 260 women

TABLE 1 Characteristics of women completing the knowledge, attitudes and practices survey by study site. Amounts in *n* (%) unless marked otherwise

	Overall	DRC	Zambia	Kenya	Guatemala	India	Pakistan	Bangladesh
Women, *n*	25 260	3397	2843	4444	2376	3992	5066	3142
Age (years)								
<20	4080 (16.2)	832 (24.5)	621 (21.9)	924 (20.8)	431 (18.1)	292 (7.3)	175 (3.5)	805 (25.6)
20–35	19 691 (78.0)	2261 (66.6)	1983 (69.8)	3269 (73.6)	1743 (73.4)	3670 (91.9)	4558 (90.0)	2207 (70.3)
≥36	1482 (5.9)	303 (8.9)	237 (8.3)	249 (5.6)	202 (8.5)	30 (0.8)	332 (6.6)	129 (4.1)
Maternal level of education								
No formal schooling, illiterate	5871 (23.2)	1000 (29.4)	218 (7.7)	41 (0.9)	175 (7.4)	128 (3.2)	4081 (80.6)	228 (7.3)
Primary/ secondary	17 630 (69.8)	2382 (70.1)	2540 (89.4)	3965 (89.3)	1994 (83.9)	3149 (78.9)	907 (17.9)	2693 (85.7)
University+	1752 (6.9)	15 (0.4)	82 (2.9)	435 (9.8)	207 (8.7)	715 (17.9)	78 (1.5)	220 (7.0)
GA at enrolment (weeks)								
0–13	9613 (38.9)	809 (24.0)	423 (15.1)	997 (24.2)	1125 (47.8)	2981 (74.9)	2382 (47.3)	896 (29.2)
14–28	10 724 (43.4)	2247 (66.7)	1416 (50.4)	2352 (57.1)	890 (37.8)	423 (10.6)	1734 (34.4)	1662 (54.2)
≥29	4397 (17.8)	314 (9.3)	971 (34.6)	770 (18.7)	339 (14.4)	575 (14.5)	922 (18.3)	506 (16.5)
Parity								
0	8021 (31.8)	765 (22.5)	894 (31.5)	1535 (34.5)	863 (36.3)	1632 (40.9)	1088 (21.5)	1244 (39.6)
1–2	10 818 (42.8)	1032 (30.4)	1227 (43.2)	1786 (40.2)	1040 (43.8)	2175 (54.5)	1842 (36.4)	1716 (54.6)
≥3	6418 (25.4)	1600 (47.1)	720 (25.3)	1123 (25.3)	473 (19.9)	185 (4.6)	2136 (42.2)	181 (5.8)

Note: The sites began collecting COVID Knowledge, Attitudes and Practices data, as follows: Pakistan—17 Sept 20, DRC—16 Oct 20, Guatemala—12 Nov 20, India—26 Nov 20, Kenya—15 Dec 20, Bangladesh—15 Dec 20, Zambia–9 Feb 21.

enrolled in the MNHR ranging from 2376 in the Guatemala site to 5066 in the Pakistan site (Table 1).

Table 1 presents the number and percentages of maternal characteristics by site among the included women. The majority of participants were 20–35 years of age (78.0%). Almost 70% of women had a primary or secondary education, although the proportion of women with no formal schooling was substantially higher in Pakistan (80.6%) than in the other participating sites. Thirty-nine percent of women (38.9%) were enrolled in their first trimester, 43.4% in their second trimester, and 17.8% during the third trimester. Across all sites, 31.8% of women were nulliparous, 42.8% had a parity of 1–2 and around 25.4% had a parity of ≥3.

In the questions related to knowledge, across all the sites, 56.8% of women named ≥3 COVID-19 symptoms, 34.3% knew ≥2 transmission modes, 51.3% knew ≥3 preventive measures and 79.7% named at least one high-risk condition. We also assessed and present women's knowledge of COVID-19 symptoms, transmission, prevention, and highest risk groups by site. Figure 1 describes the percentages of women who could name at least three symptoms, two or more modes of transmission, three or more measures of prevention, and at least one high-risk group. More than 65% of women in the sites in Zambia, Kenya, India and Bangladesh were aware of three or more symptoms in comparison with only 4.5% of women in DRC. The sites with the lowest reported knowledge of COVID-19 transmission modes were DRC (10.2%), Pakistan (15.9%) and Bangladesh (17.4%), whereas more than half of the women in Kenya (62.9%) and Zambia (59.2%) had knowledge of at least two modes of transmission. We also assessed each participant's knowledge of six potential prevention measures for COVID-19 spread. More than 65% of women in Zambia, Kenya and India correctly named at least three measures of prevention. In the Kenyan, Guatemalan and Bangladeshi sites, at least 90% of respondents correctly identified at least one high-risk group, compared with 33.3% of women in the DRC site.

Women were also asked whether they had or planned to change their prenatal care and/or delivery location because of COVID-19. (Figure 2). A higher percentage of women in Guatemala (50.6%), Pakistan (39.6%), India (28.6%) and Kenya (21.0%) planned to avoid antenatal care, such as attending ANC visits at their clinic, compared with DRC, Zambia, and Bangladesh, where percentages ranged from 5.4% to 10.0% Furthermore, a much higher percentage of women in the Guatemalan site (33.7%) were planning to avoid delivering at a hospital or health facility compared with the other sites, where between 0.8% and 10.6% of women planned to avoid a facility delivery (Figure 2).

Women were also asked about measures they took to avoid contracting COVID-19 (Figure 3). Overall, 75% of women practised hand hygiene, 63.3% reported wearing a mask and 29.1% planned to stay at home to reduce COVID-19 exposure risk. Sites with the lowest reported hand hygiene behaviour were the DRC (57.8%) and Pakistan (59.9%). The second most common behaviour to prevent COVID-19 infection overall

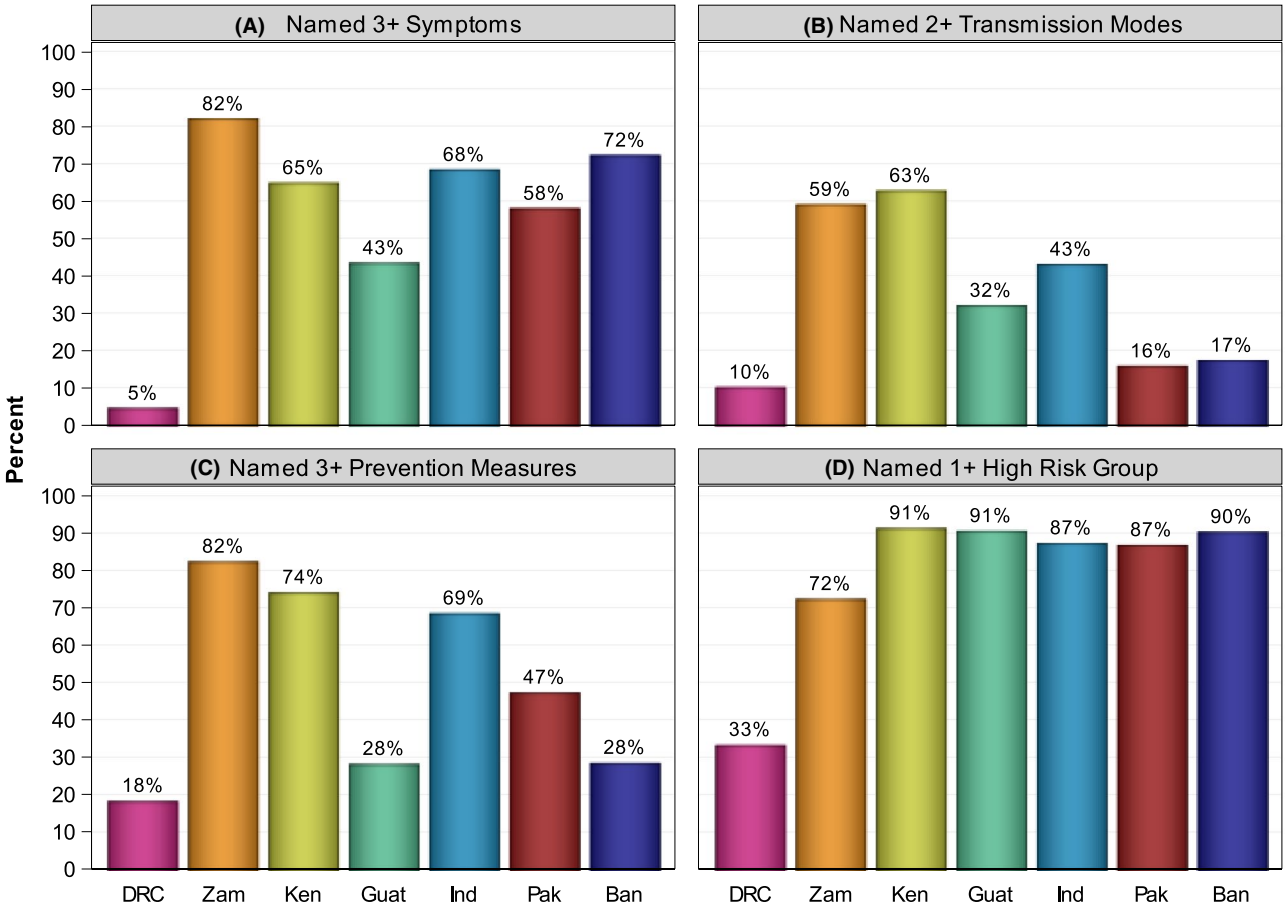

FIGURE 1 Knowledge of COVID-19 symptoms (A),[1] modes of transmission (B),[2] measures to prevent the spread of COVID-19 (C)[3] and high-risk groups for COVID-19 (D)[4] by site. [1]Symptoms of interest included fever, cough, difficulty breathing, sore throat, runny or stuffy nose, tiredness, aches and pains, diarrhoea, and loss of taste and smell. [2]Transmission modes of interest included respiratory droplets from a sick person, respiratory droplets from an asymptomatic person, touching contaminated objects and shaking hands. [3]Preventative measures of interest included handwashing or using gel, keeping distance, avoiding shaking hands, avoiding touching face, wearing a mask and staying home. [4]Those at greatest risk of interest included elderly and those who have another illness

was wearing a mask (63.3%), although women in the DRC site (27.1%) and the Pakistan site (38.9%) reported doing this less often than the other sites. The least common behaviour to prevent COVID-19 was avoiding touching the face, ranging from 6.2% in Bangladesh to 38.1% from the Kenyan site.

Participants were assessed about possible obstacles to receiving COVID-19-related care (Figure 4). When we assessed women's fears of getting COVID-19 from their provider, the Pakistan site reported the highest percentage (48.6%) compared with 4.2% in the DRC site. Additionally, 1.7% of the women in Bangladesh to 54.7% in Guatemala reported concerns regarding hospitals' capacity to provide care.

4 | DISCUSSION

4.1 | Main findings

To the best of our knowledge, this study is the first comprehensive analytical COVID-19 KAP survey on pregnant women conducted in multiple LMIC countries. Our survey found significant differences among the sites in the knowledge, attitudes and practices regarding COVID-19 among pregnant women. Limitations in knowledge were observed in all seven study sites. This is especially true as we focused on a minimal threshold of knowledge. We believe the gaps would be much larger had we focused on knowledge of all symptoms, modes of transmission and preventive practices.

In summary, our COVID-19 KAP survey documented that the pregnant women across seven countries had variable knowledge related to COVID-19. Nearly one-quarter of women avoided or reduced prenatal care visits, and 8% mentioned avoiding hospital deliveries due to fear of COVID-19 exposure. An important minority of women were afraid of contracting COVID-19 from their provider. Although variable among the sites, many women planned to stay at home and/or wear a mask to protect themselves against COVID-19.

4.2 | Strengths and limitations

Our paper has some limitations and strengths. Among the strengths are the large sample size, population-based

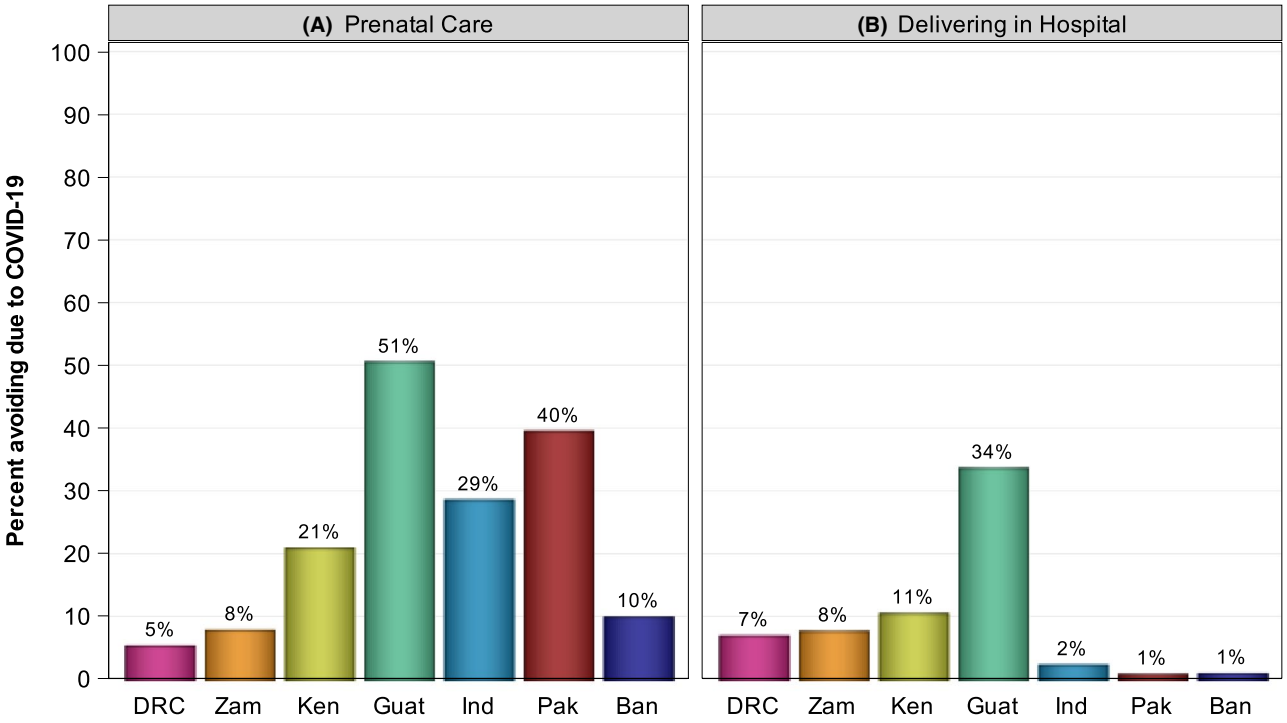

FIGURE 2 Health care avoidance due to COVID-19 by site (A) Avoidance of prenatal care (B) Avoidance of delivering in a hospital

data from three regions (Africa, Asia and Central America [Guatemala]) and prospective data collection using the same standardised data collection tool that allowed comparisons among the sites. There may have been a small decrease in the MNHR enrollment during the COVID-19 pandemic; however, we were able to capture nearly all the deliveries compared with prior years. Other limitations include that we had no validated tool for the assessments and the cut-offs for adequate knowledge as well as utilisation of the preventative practices. We acknowledge that the cut-offs were arbitrary and other cut-offs could have been used. Because of the rapidly evolving pandemic, we did not pilot the questionnaire beyond having multiple staff members review and evaluate the content. We also did not link our results to the prevalence of disease in the communities in which the women resided. Data on the prevalence of COVID-19, as determined by antibody positivity, appear to be increasing in each site, but reliable population-based data about disease prevalence is not consistently available. If there was no real or perceived disease in the community, KAP related to COVID-19 would likely have been less. Although there was similar training on the use of the questionnaire in each site, we also acknowledge that given face-to-face interviews involving multiple staff and investigators, there is the potential for bias with respect to the views of the questioner.

4.3 | Interpretation

A number of small, single-site studies have evaluated KAP among pregnant women.[12–16] Compared with the Global Network study, a prior KAP survey from Bangladesh, a negligible percentage (0.3%) of women were able to identify possible modes of transmission of COVID-19.[13] This difference could be attributed to the time when the studies were conducted, as the Bangladeshi study was conducted in March 2020, shortly after WHO declared COVID-19 a global pandemic, whereas the Global Network study was initiated in September 2020 and presented data through October 2021, during which time public knowledge of the disease had been increasing. However, the overall knowledge of our study participants about COVID-19 was still significantly lower than that seen from KAP studies conducted in Northern Ghana and Iran, where most of the participants (70%) had a high level of knowledge about COVID-19.[14,15]

Our study also suggested potential indirect effects of the COVID-19 pandemic on pregnancy and delivery care. In our study, a large proportion of women in Guatemala, Pakistan and the Indian sites planned to avoid prenatal care. The finding is consistent with studies conducted in southwest Iran and India, where more than 70% and nearly 32% of pregnant women avoided routine antenatal care visits, respectively.[16,17] In our study, nearly one-third of women in Guatemala planned to avoid delivering at a hospital. The finding is also consistent with studies conducted in India, Nepal and Ghana, where significant reductions in institutional deliveries have been reported during the COVID-19 panedemic.[16,17] Given the importance of prenatal care, there are potential concerns about longer-term impact on health outcomes.[18,19] However, overall, it seems as if disruptions in care were higher in the early days of the pandemic, when lockdowns were more frequent and less was known about the disease.

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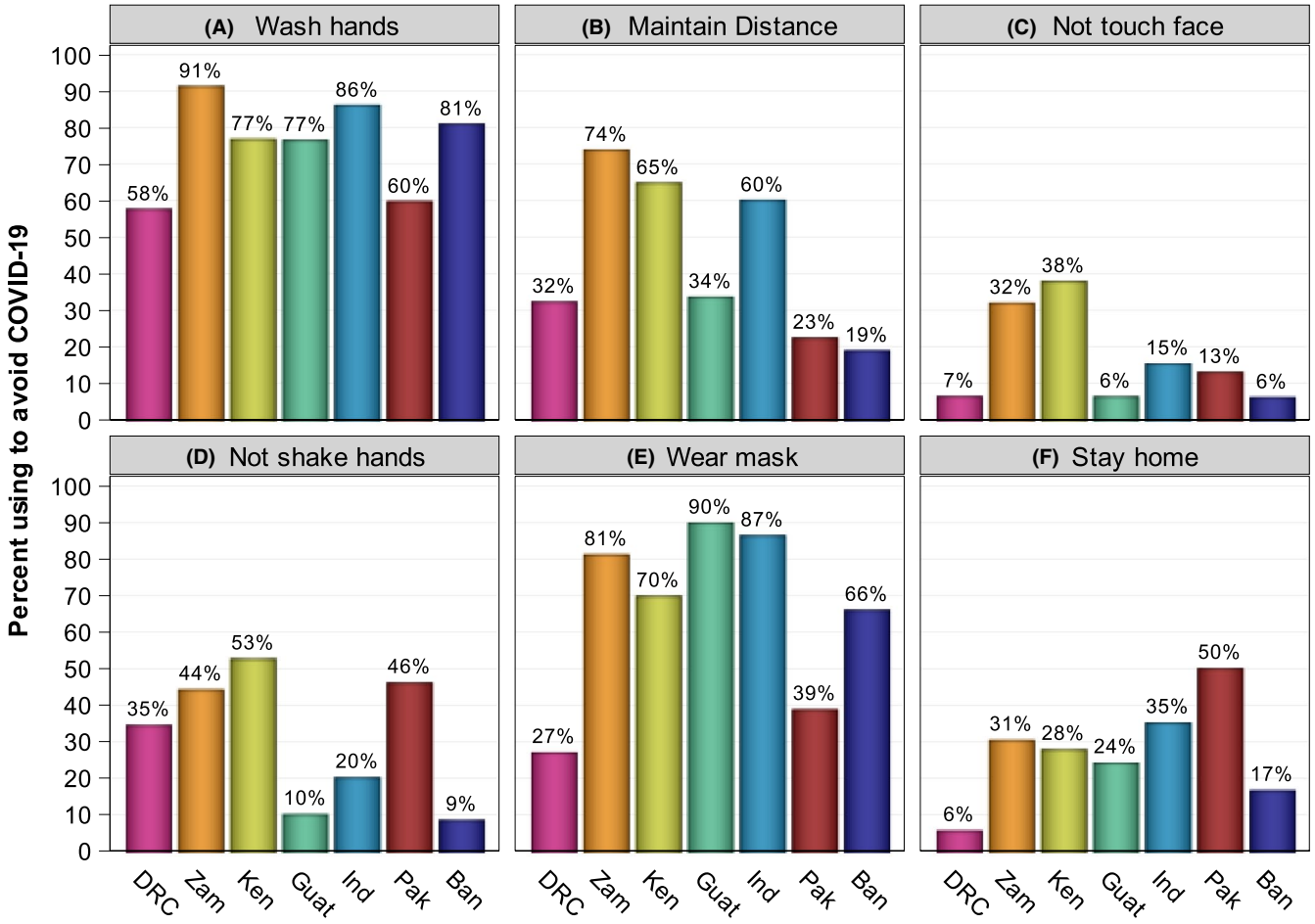

FIGURE 3 Preventive practices taken to avoid COVID-19 by site (A) Indicate handwashing (B) Maintain social distance from others (C) Avoid touching face (D) Avoid shaking hands (E) Routinely wear a face mask (F) Generally stay at home

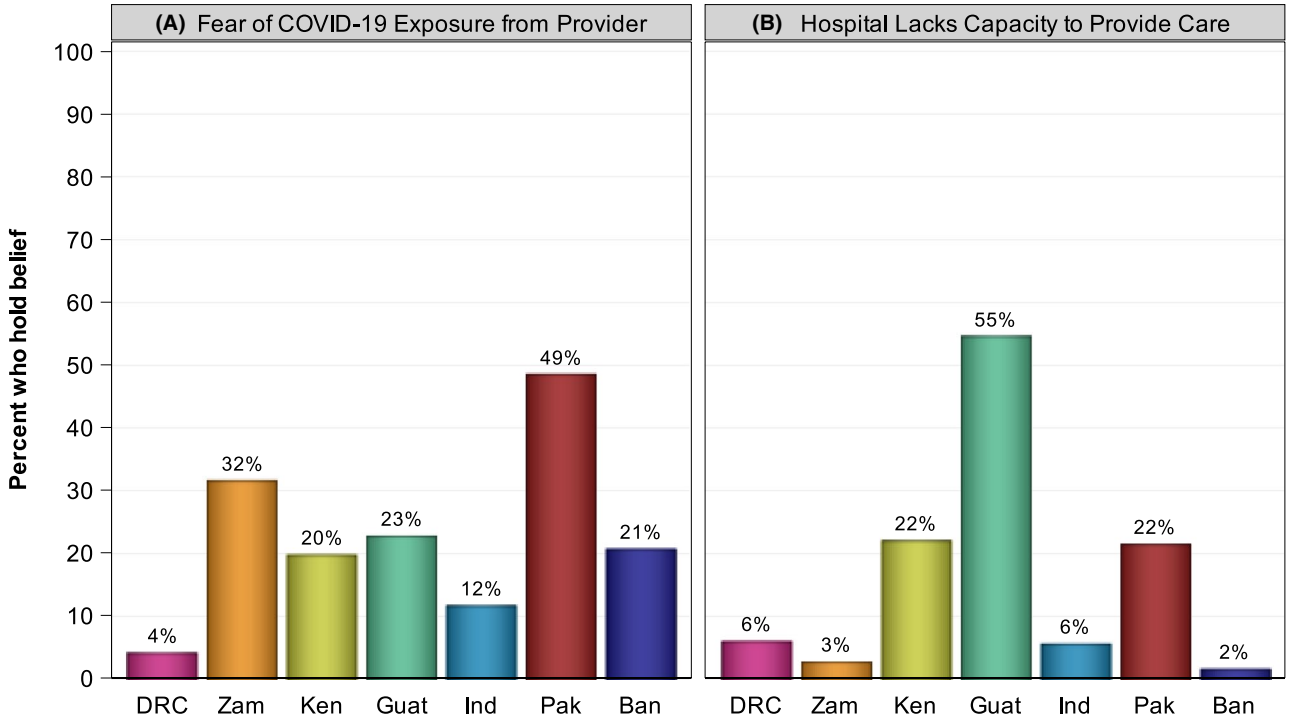

FIGURE 4 Attitudes around COVID-19 and barriers to care by site (A) Fear of receiving COVID-19 exposure from health care provider (B) Concern that hospital lacks capacity to provide adequate care

5 | CONCLUSION

Currently, the level of pregnant women's knowledge about COVID-19 is evolving. We expect the knowledge and practices to evolve further as the pandemic spreads and COVID-19 becomes even more of a real threat. To curtail the pandemic, a reduction in transmission of infection by implementing effective containment measures is needed. To help achieve this, improved knowledge and COVID-19 prevention practices among pregnant women are necessary, especially in resource-challenged countries where specialised care is often out of reach of most of the population.[7] In our Global Network sites, overall we found limited knowledge and use of preventive practices by pregnant women regarding COVID-19. More research is required to address women's fears of accessing appropriate healthcare services and ultimately improving health delivery for pregnant women and their children.

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DISCLOSURE OF INTERESTS

None declared. Completed disclosure of interest forms are available to view online as supporting information.

AUTHOR CONTRIBUTIONS

FN, SN, SS, and RLG wrote the first draft of the paper. FN, SN, Sk MB, SS, ALG, NP-S and EMM developed the protocol. EF and CMB conducted study analyses. FN, SN, Sk MB, SS, NP-S, LF, MM, ALG, AP, PD, AK, SSG, FE, EC, AL, AT, RH, SSi, SY, MB, EAL, NFK, RJD, WAC, WAP, PLH, MK-T, EMM and RLG oversaw study implementation and monitoring. All authors reviewed and approved the manuscript.

ETHICS APPROVAL

This study was approved by ethical review committees and institutional review boards at the participating institutions as follows: University of North Carolina at Chapel Hill (FWA 00004801) 7 January 2020; Kinshasa School of Public Health, Kinshasa DRC (FWA 00003581); 5 August 2020; University of Alabama at Birmingham, US (FWA 00005960) 16 June 2020; University of Colorado Health Sciences Center (FWA 00005070) 18 May 2020; Institute for Nutrition in Center America and Panama (INCAP), Guatemala City, Guatemala (FWA 00000742) 11 August 2020; University of Virginia (FWA 00014631) 12 September 2019; ICDDR,B (Bangladesh) (FWA 00001468) 23 January 2020; Thomas Jefferson University (FWA 00002109) 10 March 2020; JN Medical College, Belagavi India (FWA 00024127) 15 January 2020; Columbia University School of Medicine (FWA 00000636) 2 May 2020; Aga Khan University, Karachi, Pakistan (FWA 00001177) 1 July 2020; Boston University School of Medicine (FWA IORG0000222) 20 July 2021; Lata Medical Research Foundation, Nagpur, India (FWA 00012971) 12 December 2019; Indiana University School of Medicine, Indianapolis, Indiana (FWA 00003544) 1 November 2019; Moi University, Eldoret, Kenya (FWA 000031280) 22 January 2020.

DATA AVAILABILITY STATEMENT

Data from this study will be available through the NICHD Data and Specimen Hub (N-DASH).

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SUPPORTING INFORMATION

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