


BMJ Open Knowledge and attitudes among Lebanese pregnant women and women seeking fertility treatment during the COVID-19 outbreak: a cross-sectional survey

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ABSTRACT

Objectives COVID-19 has been recognised as a global health emergency necessitating collaborative efforts to halt further disease spread. The success of public health interventions and vaccination campaigns is contingent on the knowledge and awareness level of the public. We aim to assess COVID-19 knowledge and attitudes among Lebanese pregnant women and women seeking fertility treatment.

Design Cross-sectional study using telehealth administered survey.

Setting University-affiliated tertiary care centre.

Participants The data of 402-Lebanese women pregnant or seeking fertility treatment aged 20–45 years were analysed.

Outcome measures Extent of COVID-19 general knowledge, pregnancy-specific knowledge and attitudes toward COVID-19 practices.

Results All participants reported being knowledgeable about COVID-19, 70% of which rated their knowledge as 7 or more on a numerical scale of 0–10. The mean general COVID-19 knowledge was 22.15 (SD 2.44, range 14–27) indicating a high level of knowledge. The mean pregnancy-specific COVID-19 knowledge 6.84 (SD 2.061, range 0–10) indicated poorer pregnancy-specific knowledge compared with general COVID-19 knowledge. A trend towards higher knowledge was noted with higher income status. Reproductive age women with higher pregnancy-specific knowledge had more positive attitudes toward COVID-19 pregnancy practices.

Conclusion Our findings suggest a deficiency in pregnancy-specific COVID-19 knowledge stressing the necessity for targeted public health education interventions. It highlights the need for enhancing COVID-19 pregnancy-specific awareness which can serve as a stepping stone in the success of COVID-19 vaccination campaigns and in halting further disease spread.

INTRODUCTION

Throughout history, the human race has fought and conquered innumerable epidemics. In December 2019, the story of yet another outbreak with the highly infectious

Strengths and limitations of this study

- First study to explore knowledge and attitudes toward COVID-19 among reproductive age women pregnant or seeking fertility treatments.
- The survey responses may have been susceptible to reporting bias, in the form of participant self-reporting and social-desirability bias.
- Cross-sectional study design precludes establishing a causal association.
- Under-representation of women from rural areas and lower educational attainments.
- Knowledge and attitudes toward COVID-19 are provisional and may change over time.

new coronavirus disease began to unravel starting from Wuhan, China. While initial epidemiological investigations suspected zoonotic origins associating the outbreak to a Chinese seafood market, as the outbreak progressed, person-to-person dissemination became the main mode of transmission. In February 2020, the WHO designated this novel coronavirus disease COVID-19.¹ Soon after, the WHO declared COVID-19 a pandemic on 12 March 2020.² COVID-19 became the emerging disease of the 21st century and a global health emergency of international concern demanding collaborative efforts to halt its further spread.³

The disease is caused by SARS-CoV-2. SARS-CoV-2 is a single-stranded RNA virus belonging to the large family of coronavirus leading to a spectrum of illnesses ranging from the common cold to more morbid presentations such as the SARS and Middle East respiratory syndrome.^{4 5} The most common symptoms of COVID-19 include fever, cough, myalgias, fatigue and shortness of breath.^{6 7} As the scope of disease spread increased, more knowledge was gained via



experience with COVID-19. Spread was initially believed to occur mainly via respiratory droplets. Viruses released in the respiratory secretions of an infected person while coughing, sneezing or even talking have the potential of infecting others when in immediate contact with mucus membranes. Though droplets typically do not travel more than 2 m, infection can still occur if contact is made with an infected surface questioning the time frame sustainability of the virus through different media and on different surfaces.⁸ Today, COVID-19 is known to have contact, droplet and airborne transmission. The possibility of additional transmission routes could not, however, be overlooked especially considering the detection of 'coronavirus-like particles' by electron microscopy in stool samples reported in earlier studies which suggested additional fecal-oral viral transmission mode.⁹ This was supported by the detection of live virus cultured from stool of some patients with COVID-19.^{10 11} Yet, according to the joint WHO-China report, droplet transmission remains the main mode, whereby fecal-oral transmission did not appear to be a significant contributor to the spread of infection.¹² The detection of SARS-CoV-2 RNA in blood samples¹³ implied additional major concerns regarding the possibility of sexual transmission of the virus or even vertical transmission during pregnancy. These concerns were amplified by the dilemma imposed not only by who can transmit the novel coronavirus but also for how long they can transmit it, the role of asymptomatic and presymptomatic viral shedding of infected individuals¹⁴ and the prognosed morbidity for infected individuals.

As details on COVID-19 evolved, the devastating impact of its high transmission capability and associated morbidity and mortality became apparent, particularly in vulnerable groups. In response, countries around the world including Lebanon intensified their efforts to spread awareness and control the spread of this disease which has disrupted social harmony. Various countries including China,¹⁵ Kingdom of Saudi Arabia¹⁶ and Egypt¹⁷ have looked at their populations' knowledge and attitudes regarding COVID-19 to evaluate initiatives in raising awareness and limiting disease spread. However, none evaluated COVID-19 knowledge among expectant mothers where anxieties are intensified by potential maternal and fetal morbidities.

To the best of our knowledge, this is the first study to assess the knowledge and attitudes of Lebanese pregnant women and women seeking fertility treatment regarding COVID-19 infection. These data are much needed whereby the success of public health interventions and vaccination campaigns is contingent on the knowledge and awareness level of the public. Findings may aid policy-makers in the formulation of recommendations tailored for this specific population, improve awareness to best tackle the COVID-19 pandemic and facilitate the realisation of vaccination campaigns.

MATERIALS AND METHODS

Study design and population

This cross-sectional study was conducted over a 2-month period, June and July 2020, at the American University of Beirut Medical Centre (AUBMC), a large tertiary care academic hospital well-recognised in Lebanon and the Middle East. Lebanese women of reproductive age group, between 20 and 45 years of age, followed at AUBMC Women's Health Center or Haifa Idriss Fertility unit for antenatal care or seeking fertility treatment were eligible for recruitment.

All participants were identified using the hospital's EPIC Electronic Health Care System. Given the widespread imposed quarantine, lockdown and social distancing measures, eligible participants were contacted, by our research assistant, over the phone in the listed order generated from EPIC until the targeted sample size was achieved. Our choice of recruitment method was to best accommodate the current COVID-19 health situation while still obtaining a representative sample. Given the noticeable decline in the number of patients physically presenting to clinics, we anticipated a major selection bias in administering our questionnaire in paper form instead. In addition, it would have limited the representativeness of our targeted population apart from violating recommended healthcare measures designed to limit COVID-19 disease spread. Similarly, choosing an online survey format would have failed to include women of low socioeconomic status and lower educational background who have limited online network access especially with Lebanon's economic crisis.^{18 19} The study was designed to maximise reach and amass the perspective of as many respondents as possible. Therefore, it was devised using telehealth to minimise in-person interactions. This is in accordance with the American Society for Reproductive Medicine (ASRM) Patient Management and Clinical Recommendations during the COVID-19 pandemic published on 17 March 2020.

Study tool and validation

A questionnaire was developed for this current study to assess our target population's knowledge and attitudes towards COVID-19 (online supplemental file). Items of the questionnaire were developed based on previous knowledge and attitude questionnaires on ZIKA²⁰ and SARS virus²¹ and according to guidelines published for the community on COVID-19 by the major scientific societies during the study period: Centers for Disease Control and Prevention (CDC),²² ASRM,²³ European Society of Human Reproduction and Embryology²³ and Royal College of Obstetrics and Gynecology.²⁴

The questionnaire was divided into four main portions. The first section of the questionnaire gathered information on the woman's sociodemographic characteristics including age, area of residence, socioeconomic status/income level, educational attainment, parity, fertility status (pregnant with corresponding gestational age at the time of recruitment vs seeking fertility treatment for

primary or secondary infertility). The second section included the respondent's self-rated perceived level of COVID-19 knowledge scored from 0 (not knowledgeable) to 10 (extremely knowledgeable) and primary source of attained knowledge (social media/community including family and friends or governmental and scientific authorities). This section also assessed participant's knowledge of COVID-19 using 28 items on clinical symptoms, mode of transmission, diagnosis, control and prevention. The third section consisted of 10 items assessing the participant's pregnancy-specific COVID-19 knowledge (maternal morbidity, neonatal morbidity, delivery modes and breast feeding). The fourth section assessed the participant's attitudes towards COVID-19 infection during pregnancy using a 5-point Likert scale. Respondents indicated their level of agreement on each of six statements using '1 strongly disagree', '2 disagree', '3 neutral/undecided', '4 agree' or '5 strongly agree'. Participants who answered 4 or 5 were categorised as agreeing for subsequent correlation of attitudes with the level of knowledge.

The questionnaire was initially drafted in English, then translated into Arabic and back to English by different authors to ensure the meaning of the content is comprehended. We then conducted a preliminary phase of testing our questionnaire for validity and reliability on a pilot of 15 participants who were excluded from the final analysis. The results showed adequate internal consistency reliability with a Cronbach's alpha of 0.71.

Ethical approval

This study was designed and coordinated in accordance with ethical principles regarding research involving human participants. Therefore, ethical approval of American University of Beirut Institutional Review Board approval was secured prior to conducting the study including a waiver for written informed consent amended by oral/telephone consent. All participants' responses were anonymous with no identifiable data collected.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans for this research.

Sampling

There are currently no registries in Lebanon estimating the number of reproductive age women whether pregnant or seeking fertility treatment. Also, in the absence of similar studies related to coronavirus disease in women of the reproductive age group, our calculations of the sample size assumed that the probability of good knowledge on COVID-19 is 50%.²⁵ As such, a minimum of 384 participants are needed to have a representative sample. This is calculated using a margin of error of 5% and an assumed probability of 0.5 designed to obtain the maximum sample size. Accordingly, recruitment was halted after a total of 402 respondents.

Statistical analysis

Descriptive statistical analyses were performed to summarise data on sociodemographic factors reported for categorical variables as frequency (n) and percentage (%).

Two composite COVID-19 knowledge scores were calculated, general and pregnancy-specific COVID-19 knowledge scores. The COVID-19 general knowledge score was calculated for each participant based on 28 general COVID-19 knowledge items on the questionnaire. Similarly, a pregnancy-specific knowledge score was calculated based on 10 items regarding COVID-19 infection during pregnancy. Knowledge questions were given one point for each correct response and zero points for each incorrect response. The median values for the cumulative general knowledge score and pregnancy-specific knowledge score were used as a cut-off to assess the difference in the extent of knowledge (poor vs good knowledge) and correlate it with sociodemographic characteristics, self-rated perception and attitudes using Pearson χ^2 test or Fisher's exact test. A participant's self-rated extent of knowledge was dichotomised to low perception (values of 0–6 inclusive) versus high perception (values 7–10 inclusive) to facilitate analysis.

All data analyses were performed using SPSS 26 statistical software package (IBM, USA). A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 402 women completed the questionnaire with an average of 30.69±4.88 years of age, 46% of which lived in the capital Beirut. The sociodemographic characteristics of the participants are summarised in [table 1](#). Almost two-thirds of our sample were pregnant women with a comparable representation for each trimester of pregnancy. The majority of the sample (91.8%) had a college degree or higher educational attainment. The respondents were grouped according to their reported household's monthly income in US dollars, converted from Lebanese pounds based on Lebanon's official exchange rate for uniformity in light of Lebanon's economic crisis and the labile market exchange rates. Almost a third of the sample earned approximately the minimum monthly wage, a third had a monthly household income between US\$1000 and US\$2000, while remaining participants reported income above US\$2000.

All participants reported being knowledgeable about COVID-19, 70% of which rated their knowledge as 7 or more on a numerical scale of 0–10, 0 representing no knowledge at all. General COVID-19 knowledge score ranged between a minimum of 14 and a maximum of 27, with an average score of 22.15 (SD 2.44) and a median score of 22. [Table 2](#) shows responses to the general COVID-19 knowledge questions. The most frequently identified symptom of COVID-19 infection was fever (99.5%) followed by shortness of breath (96.5%) and cough (95%). Sputum production and rhinorrhoea were

Table 1 Sociodemographic characteristics of participants

Sociodemographic characteristic	No of women	Percentage
Age, years		
20–30	210	52.2
31–39	169	42
≥40	23	5.7
Participant		
Pregnant	263	65.4
Seeking pregnancy	139	34.6
Parity		
Nulliparous	245	60.9
Parous	151	37.6
Trimester of pregnancy		
First trimester	77	29.3
Second trimester	89	33.8
Third trimester	97	36.9
Education		
High school or below	31	7.7
College/university degree	222	55.2
Postgraduate degree	147	36.6
Monthly income		
Less than US\$1000	117	29.1
Between US\$1000 and US\$2000	130	32.3
Between US\$2000 and US\$3000	50	12.4
More than US\$3000	77	19.2
Primary source of knowledge		
Media/social media/internet	193	48.0
MoPH/WHO/CDC/hospital	194	48.3

CDC, Centers for Disease Control and Prevention; MoPH, Ministry of Public Health.

erroneously missed as possible symptoms by 71.1% and 57.5% of the respondents. The majority of participants correctly identified COVID-19 mode of transmission, prevention and availability of approved treatment and vaccination at the time of questionnaire administration. All participants deemed personal hygiene, social distancing and the use of face masks as ideal measurements to limit disease spread reinforcing their knowledge of COVID-19 epidemiology.

Tables 3 and 4 summarise responses to pregnancy-specific knowledge questions and attitudes regarding management strategies of COVID-19 infection during pregnancy and postpartum. Pregnancy-specific knowledge ranged from a minimum of 0 to a maximum of 10

Table 2 Responses to general knowledge questions about COVID-19 among participants

Knowledge items	Correct response, n (%)	Incorrect response, n (%)
Symptoms include		
Fever	400 (99.5)	2 (0.5)
Dry cough	382 (95)	20 (5)
Wet cough/sputum production	112 (27.9)	286 (71.1)
Shortness of breath/difficulty breathing	388 (96.5)	14 (3.5)
Fatigue	356 (88.6)	46 (11.4)
Myalgia	257 (63.9)	143 (35.6)
Rhinorrhoea	167 (41.5)	231 (57.5)
Sore throat	298 (74.1)	102 (25.4)
Chest pain	293 (72.9)	103 (25.6)
Loss of taste/decreased appetite	217 (54)	179 (44.5)
Primary COVID-19 transmission mode is contact with infected surfaces	112 (27.9)	284 (70.6)
Primary COVID-19 transmission mode is respiratory droplets	378 (94)	21 (5.2)
All positive COVID-19 patients are symptomatic	377 (93.8)	23 (5.7)
All COVID-19 patients have upper respiratory symptoms	323 (80.3)	76 (18.9)
COVID-19 is preventable	380 (94.5)	20(5)
COVID-19 is highly infectious	387 (96.3)	14 (3.5)
COVID-19 is less infectious/contagious than influenza	341 (84.8)	56 (13.9)
COVID-19 has high mortality than influenza	196 (48.8)	191 (47.5)
There is no need to repeat COVID-19 testing if negative in symptomatic patients	340 (84.6)	58 (14.4)
COVID-19 infection spread can be reduced by education/spreading awareness	402 (100)	0
COVID-19 can spread by close person-to-person contact	399 (99.3)	3 (0.7)
COVID-19 can be cured	383 (95.3)	19 (4.7)
Approved treatment for COVID-19 is available	389 (96.8)	12 (3)
Approved vaccination against COVID-19 virus is available	397 (98.8)	1 (0.2)
Best approach to decrease viral spread is personal hygiene, social distancing and use of face mask	402 (100)	0
Incubation period/period between infection and onset of symptoms	341 (84.8)	61 (15.2)

Continued

Table 2 Continued

Knowledge items	Correct response, n (%)	Incorrect response, n (%)
Duration of viral shedding	117 (29.1)	266 (66.2)
Symptomatic patients with negative COVID-19 testing should self-quarantine for 14 days	370 (92)	27 (6.7)
General knowledge score		
Min–max	14–27	
Mean±SD	22.15±2.44	
Median–IQR	22–3	
Poor general knowledge score	195 (48.5)	
Good general knowledge score	207 (51.5)	

with an average score of 6.84 (SD 2.061) and a median score of 7. The percentage of correct responses on each of the pregnancy-specific items of COVID-19 in relation to pregnancy varied between 39.9 and 89.8. About a third of the participants agreed that caesarean delivery should be performed to avoid vertical transmission of the virus and 40% to avoid exposure of healthcare workers to the virus. The majority showed positive attitudes to breast feeding if there is no risk of viral transmission through breast milk (78.3%) and negative attitudes towards breast feeding in light of possible respiratory transmission during lactation. Women of about 75.1% agreed on the importance of telehealth for follow-up during the COVID-19 pandemic. All respondents agreed that they needed more information specifically on COVID-19 infection during pregnancy.

Although there was no significant difference in the extent of general COVID-19 knowledge among pregnant women vs women seeking pregnancy, pregnant women had a greater extent of knowledge regarding COVID-19 infection during pregnancy (table 5). The extent of general and pregnancy-specific COVID-19 knowledge was noted to be higher among women with higher reported monthly income. In addition, women with good pregnancy-specific knowledge had significantly higher positive attitudes towards measures related to COVID-19 infection during pregnancy and lactation (table 6).

DISCUSSION

The novel coronavirus disease has become a global health emergency threatening not only healthcare systems but also the political, economic and social stability of countries globally. It is noteworthy that none of the respondents in our study reported total ignorance about COVID-19. All our sample conveyed being knowledgeable about COVID-19 with an average accuracy rate of general COVID-19 knowledge about 79% (22/28*100). These results are not surprising given the majority had high educational attainments. Moreover,

this serves as an attestation of the collaborative governmental and communal efforts to spread awareness and control the spread of the disease. Since the confirmation of the first COVID-19 case in Lebanon on 21 February 2020, extraordinary measures have been put in action to control the spread of the disease. Campaigns were intensified to promote awareness on the transmission, symptoms, diagnosis and prevention of this emerging illness whether through social media platforms, television ads, documentaries, brochures or flyers posted in public. The Ministry of Health prudently monitored disease spread and updated their recommendations in accordance with WHO guidelines to deal with this outbreak.²⁶ These measures included reinforcement of lockdown practices including suspension of internal and external flights, withholding gatherings, emphasising online teaching in schools and universities and abiding by strict nationwide curfews.

Available evidence stresses the importance of knowledge as a key element in tackling disease outbreaks.^{27 28} Despite data from our sample indicative of a high degree of COVID-19 general knowledge, the rise in the number of COVID-19 cases in Lebanon²⁹ might deceptively undermine the power of this knowledge and efficiency of public health measures in dictating the public behavioural practices. Yet, special circumstances in Lebanon should be contemplated as contributory to the spread of COVID-19 despite the extent of general COVID-19 knowledge. Lebanon has been a crisis-stricken nation before the first confirmed COVID-19 case in the country. The economic crisis which preceded COVID-19 has led to mass business closures and a drastic drop in gross domestic product with a substantial increase in poverty.^{30 31} This headed the premature uplifting of the lockdown measures with the subsequent increase in COVID-19 spread. Add to that the crowded refugee conditions with already deranged limited health capacity³² and of course the capital's port blast which only added insult to injury.^{33 34}

General COVID-19 knowledge scores were more impressive in our population compared with the pregnancy-specific COVID-19 knowledge. The least general knowledge score was 50% of correct responses compared with 0% least pregnancy-specific knowledge score. This is also manifested in a lower pregnancy-specific average and median knowledge score (table 3). Such findings are partly a reflection of the role of information technology and the data made available during COVID-19 awareness campaigns. While efforts focused on spreading awareness among the general population regarding COVID-19 transmission, symptoms and preventive measures, governmental and public health measures had only modest emphasis on vulnerable populations particularly pregnant women and women desirous of conception. Therefore, we can fairly presume that accessibility to data on COVID-19 infection during pregnancy was mainly through scientific platforms. As such, restricting this peculiar knowledge mainly to women of higher educational background and socioeconomic

Table 3 Responses to pregnancy-specific knowledge questions about COVID-19 among participants

Knowledge items	Correct response, n (%)	Incorrect response, n (%)
Pregnant women have similar risk of being infected like non-pregnant women.	292 (72.6)	108 (26.9)
Pregnant COVID-19-positive women have increased maternal morbidity.	160 (39.8)	231 (57.5)
COVID-19-infected mothers are at higher risk of miscarriage.	250 (62.2)	142 (35.3)
COVID-19-infected mothers are at higher risk of preterm delivery.	186 (46.3)	200 (49.8)
Pregnant women infected with COVID-19 late in pregnancy have been shown to transmit the virus to the fetus through the placenta.	303 (75.4)	82 (20.4)
Pregnant women infected with COVID-19 late in pregnancy have been shown to transmit the virus to the fetus during delivery.	265 (65.9)	118 (29.4)
Only delivery mode for COVID-19 women is via caesarean delivery.	256 (63.7)	131 (32.6)
Virus was shown to transmit through breast milk.	324 (80.6)	62 (15.4)
COVID-19 infection during pregnancy was shown to cause congenital birth defects.	361 (89.8)	31 (7.7)
Maternal and neonatal risks of COVID-19 infection during pregnancy are not completely known.	353 (87.8)	40 (10)
Pregnancy-specific knowledge score		
Min-max	0-10	
Mean±SD	6.84±2.061	
Median-IQR	7-2	
Poor pregnancy-specific knowledge score	242 (60.2)	
Good pregnancy-specific knowledge score	160 (39.8)	

status (table 5). Moreover, acquisition of such knowledge is tricky being highly contingent on regularly updated scientific resources. This is especially challenging given the uncertainty of the impact of COVID-19 during pregnancy with more data unravelling with the spread of the disease.

Based on the available evidence on COVID-19 infection during pregnancy and lactation, our data demonstrated more positive attitudes among women with higher pregnancy-specific knowledge. This essentially stresses

the importance of spreading awareness and evidence-based knowledge adapted to the needs of the masses. This is particularly crucial as part of vaccine campaigns. Our data point the importance of tailoring platforms to educate reproductive age women on the essence and safety of available COVID-19 vaccines.

To the researcher's knowledge, this is the first study to explore knowledge and attitudes toward COVID-19 among the Lebanese population, particularly reproductive age women pregnant or seeking fertility treatments.

Table 4 Responses to attitude statements regarding pregnancy measures during COVID-19 pandemic

	Strongly disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly agree, n (%)
Do you think a pregnant woman with positive COVID-19 infection should undergo caesarean section to prevent fetal intrauterine infection?	35 (8.7)	152 (37.8)	80 (19.9)	97 (24.1)	36 (9)
Do you think a pregnant woman with positive COVID-19 infection should undergo caesarean section to decrease exposure of healthcare workers to the virus?	28 (7)	140 (34.8)	68 (16.9)	127 (31.6)	36 (9)
Do you think you need routine COVID-19 screening during pregnancy?	35 (8.7)	161 (40)	51 (12.7)	112 (27.9)	41 (10.2)
If you were told the virus does not spread to the infant through breast milk of an infected COVID-19-positive mother, would you breast feed?	13 (3.2)	53 (13.2)	19 (4.7)	138 (34.3)	177 (44)
If you were told the virus can spread while breast feeding through respiratory droplets and contact with COVID-19-infected mother, would you breast feed?	110 (27.4)	139 (34.6)	30 (7.5)	82 (20.4)	37 (9.2)
Telehealth is essential due to the current situation.	7 (1.7)	46 (11.4)	40 (10)	169 (42)	133 (33.1)

Table 5 Association between COVID-19 general knowledge score versus pregnancy-specific COVID-19 knowledge and sociodemographic characteristics

	Knowledge score		P-value	Pregnancy-specific knowledge score		P-value
	Poor general COVID-19 knowledge, n=195	Good general COVID-19 knowledge, n=207		Poor pregnancy-specific COVID-19 knowledge, n=242	Good pregnancy-specific COVID-19 knowledge, n=160	
Age, years						
20–30	114 (55.1)	96 (49.2)	0.358	128 (52.9)	82 (51.3)	0.539
31–39	80 (38.6)	89 (45.6)		98 (40.5)	71 (44.4)	
40–45	13 (6.3)	10 (5.1)		16 (6.6)	7 (4.4)	
Gestational age						
First trimester	32 (24.8)	45 (33.6)	0.127	39 (27.3)	38 (31.7)	0.338
Second trimester	42 (32.6)	47 (35.1)		54 (37.8)	35 (29.2)	
Third trimester	55 (42.6)	42 (31.3)		50 (35)	47 (39.2)	
Parity						
Nulliparous	129 (63.2)	116 (60.4)	0.564	154 (64.4)	91 (58)	0.195
Parous	75 (36.8)	76 (39.6)		85 (35.6)	66 (42)	
Participant						
Pregnant	130 (62.8)	133 (68.2)	0.255	144 (59.5)	119 (74.4)	0.002*
Seeking pregnancy	77 (37.2)	62 (31.8)		98 (40.5)	41 (25.6)	
Education						
Primary/high school	15 (7.3%)	16 (8.2)	0.887	23 (9.5)	8 (5)	0.026*
College	116 (56.6)	106 (54.4)		141 (58.5)	81 (50.9)	
Higher education	74 (36.1)	73 (37.4)		77 (32)	70 (44)	
Monthly income						
Less than \$1000	71 (36.2)	46 (25.8)	0.008*	83 (36.6)	34 (23.1)	0.025*
Between \$1000 and \$2000	70 (35.7)	60 (33.7)		72 (31.7)	58 (39.5)	
Between \$2000 and \$3000	16 (8.2)	34 (19.1)		32 (14.1)	18 (12.2)	
More than \$3000	39 (19.9)	38 (21.3)		40 (17.6)	37 (25.2)	
Type of infertility						
Primary	49 (79)	35 (76.1)	0.716	56 (72.7)	28 (90.3)	0.047*
Secondary	13 (21)	11 (23.9)		21 (27.3)	3 (9.7)	
Self-rated level of knowledge						
Low perception	53 (26.1)	60 (31.4)	0.245	65 (27.7)	48 (30.2)	0.586
High perception	150 (73.9)	131 (68.6)		170 (72.3)	111 (69.8)	
Source of knowledge						
Community/media	106 (52.7)	87 (46.8)	0.241	115 (49.8)	78 (50)	0.967
MoPH/WHO/CDC/hospital	95 (47.3)	99 (53.2)		116 (50.2)	78 (50)	

Data presented as n (%).

*Significant p-value <0.05.

One limitation of our study is that the data used are self-reported with inherent reporting bias. Furthermore, the identification of patients via the hospital's electronic healthcare system restricted the sampled population to women who have presented for care at least once during the COVID-19 pandemic which is limited by convenience during lockdown measures. This is essentially reflected

by a larger representation of women from Beirut Governorate, over 90% of which had a college degree or higher educational attainment, limiting the generalisability of our results. However, the nature of this study in light of COVID-19 social constraints precludes acquisition of such data otherwise. Moreover, the value of our findings to promote COVID-19 awareness among reproductive

Table 6 Association between pregnancy-specific COVID-19 knowledge score and positive attitudes towards COVID-19 dilemmas

	Pregnancy-specific knowledge score		P-value
	Poor pregnancy-specific COVID-19 knowledge, n=242	Good pregnancy-specific COVID-19 knowledge, n=160	
Pregnant woman with positive COVID-19 infection should undergo caesarean section to prevent fetal intrauterine infection.	102 (42.1)	31 (19.4)	<0.001*
Pregnant woman with positive COVID-19 infection should undergo caesarean section to decrease exposure of healthcare workers to the virus.	108 (45.2)	55 (34.4)	0.031*
Routine COVID-19 screening during pregnancy is needed.	100 (41.7)	53 (33.1)	0.085
If you were told the virus does not spread to the infant through breast milk of an infected COVID-19-positive mother, would you breast feed?	178 (74.2)	137 (85.6)	0.006*
If you were told the virus can spread while breast feeding through respiratory droplets and contact with COVID-19-infected mother, would you breast feed?	67 (28.2)	52 (32.5)	0.353
Telehealth is essential due to the current situation.	100 (41.3)	130 (81.3)	<0.001*

Data presented as n (%).

*Significant p-value <0.05.

age women pregnant and/or desirous of conception is expected to be amplified among women of lower socio-economic status, educational background and/or from rural areas.

CONCLUSION

This study suggests a deficiency in pregnancy-specific COVID-19 knowledge indicating the need for targeted public health education interventions addressed to this vulnerable population. Though our data come almost a year since the first documented COVID-19 case in Lebanon and does not address causation, it aims through its findings to bridge deficiencies in public health interventions and promote awareness raising among reproductive age women pregnant and/or desirous of conception which might be instrumental to the success of COVID-19 vaccination and consequently the eradication of COVID-19 pandemic. Over a year has elapsed since the onset of the COVID-19 pandemic and we are not yet corona-free. As such, this paper stresses the importance of tailoring our health education programmes to promote knowledge needed to best overcome what we hope will 1 day become a part of our history. If we want to reach a solution, the public knowledge including that of vulnerable populations, attitudes and practices should be in alignment. This is best accomplished by raising awareness and being self-responsible.

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