COVID-19

Parents' knowledge, attitude, and practices towards COVID-19 in children: A Lebanese cross-sectional study

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Keywords

Knowledge • Attitude • Practices • COVID-19 • Children

Summary

Introduction. *The Coronavirus disease 2019 (COVID-19) pandemic, a serious public health crisis, can affect all ages, even children. This study aimed to investigate the knowledge, attitude, and practices of parents living in Lebanon towards the COVID-19 in children.*

Methods. *A cross-sectional online survey was conducted between June and July 2021, targeting parents living in Lebanon. The questionnaire was divided into 4 parts: socio-demographic, knowledge, attitude, and practices. A score was calculated to evaluate parents' knowledge towards COVID-19 in children. Descriptive and bivariate analyses were conducted. Then, determinants of COVID-19 knowledge were assessed using multivariable linear regression. P < 0.05 was considered statistically significant.*

Results. *A total of 429 parents were included. The mean knowledge score was 11.28 ± 2.19 out of 15. Knowledge was significantly lower among older (p = 0.022), and single parents (p = 0.035), who don't know if COVID-19 is a serious disease (p < 0.001) and if it will be successfully controlled (p = 0.007), and higher among female parents (p = 0.006). The majority of parents had a positive attitude and good practices towards COVID-19 in children, but 76.7% of them were worried about their child getting coronavirus. About 66.9% of parents expressed their willingness to vaccinate their kids when a vaccine would be available for them, and 66.2% answered that they are sending or willing to send their children to the school or the nursery.*

Conclusions. *Parents' knowledge about COVID-19 in children was good, but remains lower among older and single parents. Health authorities should conduct awareness campaigns to target specific groups of parents who lacked critical knowledge about COVID-19 in children.*

Introduction

Coronavirus disease 2019 (COVID-19) pandemic caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is a serious public health crisis threatening humanity since the middle of December 2019. This new form of coronavirus has emerged in Wuhan, China, and has quickly spread globally [1]. The World Health Organization (WHO) declared a public health emergency of worldwide significance by the end of January 2020, and urged all governments to work together to avoid its fast spread. COVID-19 was later named a "global pandemic" by the WHO [2].

The first confirmed case infected with SARS-CoV-2 was diagnosed in Lebanon on February 21, 2020 [3]. Up to February 7, 2022, there have been 978,125 confirmed cases of COVID-19 with 9,730 deaths. The COVID-19 incidence rate in the age group 0-9 was over 400 cases per 100,000 children, and over 800 cases per 100,000 children in the age group 10-19. The fatality rate was 0.06% in the age group 0-9, and 0.03% in the age group 10-19 [4].

Although a lower incidence of COVID-19 cases in children than adults has been demonstrated [5], investigating the burden in this special population is essential as a part of contact tracing.

As of February 7, 2022, over 12 million children have been tested positive for COVID-19 since the beginning of the pandemic in the United States, and this number represented 18.9% of all cases (16,000 cases per 100,000 children). Children accounted for 1.6 to 4.7% of total cumulative hospitalizations in the states, and 0.00-0.24% of all COVID-19 deaths [6]. Children aged 0-4 years had the highest percentage of hospitalizations and ICU admissions among children, adolescents, and young adults [7]. In this age group, immaturity of the respiratory tract and immune system is considered to have a role in severe viral respiratory disease [8].

The average incubation period for COVID-19 is 5.2 days [9]. COVID-19 infection in children appears to be primarily transmitted through the family cluster [10]. Because younger children cannot wear masks and have not taken particular preventive and control measures, the number of child infection cases has increased dramatically since then [11]. Unlike adults, most infected children are asymptomatic or have only minimal clinical symptoms [10]. The flu-like syndrome, fluctuating fever, pneumonia, upper respiratory signs (cough, sore

throat, stuffy nose, sneezing, and rhinorrhea), diarrhea, and abdominal pain are the main COVID-19 symptoms in children [11].

To add, children, particularly those from racial and ethnic minorities, as well as those with underlying medical conditions and disabilities, can become seriously ill. They could develop multisystem inflammatory syndrome in children (MIS-C), a life-threatening hyperinflammatory state 4-6 weeks after infection with primary COVID-19, with symptoms ranging from severe abdominal pain to organ damage [12]. Up to January 31, 2022, 6,851 cases of MIS-C and 59 MIS-C deaths were reported in the United States [13].

The majority of children who developed MIS-C were school-aged, and previously healthy. In these patients, the original COVID-19 infection is often mild or asymptomatic. They usually get a persistent fever, gastrointestinal symptoms (pain, vomiting, diarrhea), evidence of mucocutaneous inflammation (rash, conjunctivitis, oromucosal alterations), lymphopenia, and high circulating inflammation levels. A small proportion of MIS-C patients develops a severe disease, such as hypotension/shock, and evidence of cardiac involvement, including myocarditis, myocardial dysfunction, and alterations in coronary arteries. Immune modulation has been applied in conjunction with optimum supportive care to treat MIS-C, and in most cases, the inflammation has resolved quickly. Fatal cases are rare (2%) [14, 15].

COVID-19 in children poses a significant challenge due to the asymptomatic presentations and role in community transmission. The confirmed diagnosis is important, and cannot be without microbiologic testing. COVID-19 is primarily diagnosed through direct detection of SARS-CoV-2 RNA in the upper respiratory tract using nucleic acid amplification tests (NAATs), most commonly reverse-transcription polymerase chain reaction (RT-PCR) [16]. Also, tests that detect SARS-CoV-2 antigen can be performed quickly with rapid results, but are less sensitive than NAATs [17]. Serologic tests that detect antibodies to SARS-CoV-2 in the blood have insufficient utility for diagnosis in the first days to weeks of infection, but help identify patients who have previously had a SARS-CoV-2 infection, as well as, patients with current infection, who have had symptoms for 3 to 4 weeks [18]. Regarding the vaccine, the US Food and Drug Administration (FDA) on May 10, 2021, expanded the emergency use authorization for the Pfizer-BioNTech COVID-19 vaccine for the prevention of COVID-19 caused by SARS-CoV-2 to include adolescents aged 12 to 15 [19]. On 29 October 2021, the FDA authorized its emergency use to include children aged 5 to 11 [20]. As of February 4, 2022, 16.4 million children aged 12 to 17 in the United States have received at least one dose of the COVID-19 vaccine, with 13.9 million of these children fully vaccinated, representing 65 and 55% of 12-17 year old children, respectively. In addition, 8.6 million children aged 5 to 11 in the United States have received at least one dose of the COVID-19 vaccine, with 6.2 million of these children fully vaccinated, as of February 4, 2022, representing 30% and 22% of children at this age, respectively [21].

In Lebanon, approximately 30.40% of residents completed their vaccinations on February 8, 2022 [22]. There is no data regarding the number of vaccines administered for the age group 12-18 in Lebanon since the vaccine is still unavailable for the younger group.

While keeping the focus on continuing safety measures for the younger group, knowledge regarding the clinical characteristics and disease burden in children, positive attitudes and good practices among their parents are critical at this stage of the pandemic.

Parents must educate their children, and help them practice preventive measures and hygiene behaviors. Assessing the knowledge, attitude, and practices (KAP) related to COVID-19 in children among parents would be helpful to identify knowledge gaps, provide control of transmission and proper allocation of healthcare resources in this age group, and develop preventive strategies and programs for health promotion in children.

Few studies about KAP towards COVID-19 in children among parents and caregivers were conducted [23, 24]. In addition, to the best of our knowledge, there was no published study among the Lebanese parents towards COVID-19 in children. Thus, we aimed to investigate the KAP among parents towards COVID-19 in children.

Methods

STUDY DESIGN AND POPULATION

A cross-sectional anonymous survey was designed, targeting parents living in Lebanon to evaluate their KAP towards the COVID-19 pandemic in children between 17 June and 22 July 2021. Parents (having at least one child aged less than 18 years), that were over 18 years old and living in Lebanon were eligible to participate in the survey. This study was conducted through a link shared on social networking platforms using the Snowball sampling technique.

SURVEY INSTRUMENT

The structured questionnaire was developed based on the literature [23, 25, 26] and was designed in English and then translated to Arabic, the native language in Lebanon.

The online survey was divided into four parts that included 54 mandatory questions. The first one required the sociodemographic information of the participant (sex, age, nationality, marital status, number of children of all ages, level of education, occupation, family income, and place of current residence), his medical history, his experience with the COVID-19 pandemic, and his vaccination status. The second one, having 15 knowledge questions (K1 to K15) about COVID-19 symptoms, treatment, mode of transmission, MIS-C, and measures for prevention in children, required true/false/I don't know the answers. Each right answer was given

one point, and each wrong or I don't know the answer was given a zero. The total knowledge score ranged from 0 to 15, with a higher score denoting a better knowledge about COVID-19 in children. The Cronbach's alpha coefficient of the knowledge questionnaire was 0.613 in our sample, indicating acceptable internal consistency.

The third part included 6 questions reflecting the attitude of the respondents towards the disease and the vaccine, and the last part consisted of 6 questions about the practice of the parents towards COVID-19 in children, like social distancing, wearing a mask, washing hands, avoiding the touch of eyes, nose, and mouth, and willing to send children to the school or the nursery. Parents were asked to respond "yes" or "no" to the practice items. For the first five practice questions, a score of one was given to answers that reflected good practice, and a score of zero was given for answers that reflected bad practice. The total score ranged from zero to five, with high scores indicating better practices.

A preliminary phase was conducted to check the reliability and the validity of the questionnaire. Two experts in the pediatric medical field were asked to review the questions to make sure that it reflects the KAP of the Lebanese parents towards COVID-19 in children. The next step was pretesting of the questionnaire on 10 participants who were excluded later from the study sample. Accordingly, modifications have been applied to meet the aim required. The data generated from the initial pilot study was excluded from the final analysis.

DATA COLLECTION

On the first page of the online survey, respondents were informed about the background and objectives of the study. Participants were informed that they were free to withdraw at any time, and that all information and opinions provided would be anonymous and confidential. Online informed consent was obtained before proceeding with the questionnaire.

An online open-access google form survey was created and participants from all areas of Lebanon were invited via social media platforms (Facebook° and Instagram°) through the accounts of the members of the research team with all our contacts and friends. In addition, members of the research team shared the survey link through our contacts lists in the chatting group "WhatsApp°".

SAMPLE SIZE

The sample size was determined using the Epi Info™ software, version 7.2. As there were no similar studies related to COVID-19 in children, the calculations were based on the assumption that the probability of having good knowledge, positive attitude, and effective practices towards preventive measures against COVID-19 among parents was 50.0%, at a 95% confidence interval (CI), a margin of error of 5%, with a design effect of 1.0, the calculated sample size was 384 participants.

STATISTICAL ANALYSIS

The results were analyzed using Statistical Package for the Social Science (SPSS) software version 22 (IBM, New York-USA). No missing data were obtained. Categorical data were expressed as frequencies (percentages) while continuous data as means ± standard deviation (SD). The dependent variable is a continuous variable: knowledge score. Normality was checked for variables with n < 30 in one or more of the categories. Student's t and ANOVA tests were used to compare the mean knowledge score between different demographic groups for variables with adequate normal distribution. Mann - Whitney U or Kruskal - Wallis tests were used for non-normally distributed continuous variables. Multivariable linear regression analysis was performed to identify factors associated with the knowledge score. Only variables with p < 0.2 in the bivariate analysis were included in the multivariate linear regression, using the Enter method. All results were considered "statistically significant" when the p-value was < 0.05 with a CI of 95%.

Results

Out of 454 participants, 447 completed the survey, generating a response rate of 98.46%. Eighteen of them were excluded because they reported that they don't have children. So, a total of 429 parents were included in the study.

DESCRIPTIVE ANALYSIS

Table I details the socio-demographic characteristics of the studied participants. The majority of parents were females (n = 344, 80.2%), aged 30-39 years (n = 186, 43.4%), married (n = 412, 96%), Lebanese (n = 422, 98.4%), had a bachelor's degree (n = 173, 40.3%), and had a family income between 675,000 and 1,999,000 LBP (n = 132, 30.8%). In addition, 12.4% (n = 53) of parents were healthcare workers.

Additionally, 66.7% (n = 286) of the parents had 1-2 children, 52% (n = 223) had at least one child aged 4 or less, 55.9 % (n = 240) had at least one child aged between 5 and 11 years, and 37.3 % (n = 160) of them had at least one child aged between 12 and 18 years.

About 54.3% (n = 233) of the respondents were living in Mount-Lebanon.

Moreover, 22.8% (n = 98) of the parents were smokers, 16.3% (n = 70) of the parents and, 8.9% (n = 38) of the children had a history of one or more chronic diseases (Tab. II).

Concerning their experience with the COVID-19 pandemic, 55.5% (n = 238) of the parents reported that they were once in quarantine because of symptoms or because they were in close contact with someone tested positive for COVID-19 or because they returned from a country that had a large number of cases, 32.2% (n = 138) have tested positive with coronavirus using PCR or other tests, 24.7% (n = 106) of parents reported that at least one of their children experienced COVID-19 symptoms and 11.9% (n = 51) of them had at least one of their children tested positive with coronavirus using PCR or other tests.

Tab. I. Socio-demographic characteristics of parents.

Variable	Frequency (n = 429)	Percentage (%)
Sex		
Female	344	80.2
Male	85	19.8
Age		
18-29	72	16.8
30-39	186	43.4
40-49	118	27.5
≥ 50	53	12.4
Nationality		
Lebanese	422	98.4
Other nationalities	7	1.6
Marital status		
Married	412	96
Not married	17	4
Number of children		
1-2	286	66.7
3-4	129	30.1
≥ 5	14	3.3
At least one child aged 4 years or less	223	52
At least one child aged between 5 and 11 years	240	55.9
At least one child aged between 12 and 18 years	160	37.3
Level of education		
High school's degree and below	118	27.5
Bachelor's degree	173	40.3
Master's degree and above	138	32.2
Occupation		
Unemployed	147	34.3
Student	10	2.3
Healthcare worker	53	12.4
Other occupations	219	51
Family income		
No current income	58	13.5
< 675,000 LBP	22	5.1
675,000-1,999,000 LBP	132	30.8
2,000,000-3,999,000 LBP	123	28.7
≥ 4,000,000 LBP	94	21.9
Place of current residence		
Beirut governorate	35	8.2
Mount-Lebanon governorate	233	54.3
South-Lebanon governorate	41	9.6
Bekaa + Baalbeck - Hermel governorates	40	9.3
Nabatieh governorate	34	7.9
North + Akkar governorates	46	10.7

Regarding the vaccine, 33.8% (n = 145) of the parents have already received one of the available vaccines for COVID-19, 42% (n = 180) of those who had not been vaccinated were willing to receive it, 36.1% (n = 155) had a partner who received the vaccine and 42.2% (n = 181) of them had a partner who had not been vaccinated and was willing to receive it.

For their information on COVID-19, parents primarily relied on social media (n = 128, 29.8%) (Tab. III).

The total knowledge score ranged from 0 to 15, with a mean of 11.28 ± 2.19. Table IV below details the knowledge score, the attitude, and the practices of parents towards COVID-19 in children.

Participants gave the most correct answers when asked about the ways of the spread of the COVID-19 virus (K7-95.3%), the need for isolation (K13-94.9%), and some practices related to prevention and control of the infection (K10-95.1%, K11-95.6%, K12-93.9%) (Supplementary Tab. I).

The questions with the lowest rates of correct answers were those related to eating habits related to COVID-19 transmission (K5-24.2%) and the MIS-C (K15-29.1%) (Supplementary Tab. I).

Concerning the attitude of the parents towards COVID-19 in children, 85.3% (n = 366) agreed that COVID-19 is a serious disease, 76.7% (n = 329) of

Tab. II. Medical history of parents and children.

Variable	Frequency (n = 429)	Percentage (%)
Smoking status of parents		
No	331	77.2
Yes	98	22.8
Chronic diseases in parents		
No	359	83.7
Yes	70	16.3
Type of chronic diseases in parents		
No chronic diseases	338	78.8
Cardiac problems	13	3
Respiratory problems	3	0.7
Neurological problems	1	0.2
Diabetes	4	0.9
Allergies	23	5.4
Other diseases	22	5.1
More than 1 chronic disease	25	5.9
Chronic diseases in children		
No	391	91.1
Yes	38	8.9
Type of chronic diseases in children		
No chronic diseases	379	88.3
Cardiac problems	2	0.5
Respiratory problems	2	0.5
Neurological problems	0	0
Diabetes	2	0.5
Allergies	29	6.8
Other diseases	10	2.3
More than 1 chronic disease	5	1.1

Tab. III. Parents' experience with the COVID-19 pandemic and their vaccination status.

Variable	Frequency (n = 429)	Percentage (%)
Were you ever in quarantine because of symptoms or because you were in close contact with someone tested positive for COVID-19 or because you returned from a country that had a large number of cases?		
No	191	44.5
Yes	238	55.5
Have you tested positive with coronavirus using PCR or other tests?		
No	291	67.8
Yes	138	32.2
Did any of your children experience any COVID-19 symptoms?		
No	323	75.3
Yes	106	24.7
Have any of your children tested positive with coronavirus using PCR or other tests?		
No	378	88.1
Yes	51	11.9
Did you receive one of the available vaccines for COVID-19?		
No	284	66.2
Yes	145	33.8
Are you willing to receive one of the available vaccines for COVID-19?		
No	116	27
Yes	180	42
I already received my vaccine	133	31
Did your partner receive one of the available vaccines for COVID-19?		
No	263	61.3
Yes	155	36.1
I don't have a partner	11	2.6

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Tab. III. Parents' experience with the COVID-19 pandemic and their vaccination status.

Variable	Frequency (n=429)	Percentage (%)
Is your partner willing to receive one of the available vaccines for COVID-19?		
No	103	24
Yes	181	42.2
I don't have a partner	11	2.6
My partner has already received his vaccine	134	31.2
Most used source of information regarding COVID-19		
Social media	128	29.8
Google and search engines	48	11.2
Family, friends, neighbors	10	2.3
News channels	61	14.2
Ministry of health website	89	20.7
Scientific articles and research	93	21.7

Tab. IV. Knowledge, attitude and practices of parents towards COVID-19 in children.

Variable	Frequency (n = 429)	Percentage (%)
Knowledge score of the parents towards COVID-19 in children 11.28 ± 2.19 (mean ± standard deviation)		
Attitude of the parents towards COVID-19 in children		
Do you agree that COVID-19 is a serious disease?		
Agree	366	85.3
Disagree	47	11.0
I don't know	16	3.7
Are you worried about your child getting coronavirus?		
Yes	329	76.7
No	100	23.3
Do you agree that COVID-19 will finally be successfully controlled?		
Agree	299	69.7
Disagree	38	8.9
I don't know	92	21.4
Do you think that the pandemic will be controlled in Lebanon in the near future?		
Yes	257	59.9
No	172	40.1
Do you think authorities should close educational centers (kindergartens, schools, and universities) to limit the spread of the disease?		
Yes	220	51.3
No	209	48.7
Are you willing to vaccinate your kids when a vaccine will be available for them?		
Yes	287	66.9
No	142	33.1
Practices of the parents towards COVID-19 in children		
In recent days, have you taken your children to any crowded place (> 10 people indoor, > 25 people outdoor)?		
Yes	140	32.6
No	289	67.4
Have you asked your kids to wear a mask outside the house or when in presence with other people?		
Yes	338	78.8
No	91	21.2
Do you teach your children to wash their hands with soap and water for 20 seconds frequently?		
Yes	409	95.3
No	20	4.7
Do you teach your children to maintain an appropriate distance between them and other people?		
Yes	391	91.1
No	38	8.9
Do you teach your children to avoid touching their eyes, nose and mouth?		
Yes	397	92.5
No	32	7.5
Are you sending or willing to send your children to the school or to the nursery?		
Yes	284	66.2
No	145	33.8

Tab. V. Factors associated with COVID-19 knowledge score.

Variable	Knowledge score			
	Standardized β	Unstandardized β	95% CI	P-value
Sex - Female	0.137	0.751	0.213, 1.289	**0.006 ***
Age ≥ 50 years	-0.157	-1.045	-1.941, -0.149	**0.022 ***
Marital status - Single	-0.100	-1.123	-2.168, -0.078	**0.035 ***
Don't know if COVID-19 is a serious disease	-0.188	-2.168	-3.228, -1.108	**0.000 ***
Don't know if COVID-19 will finally be successfully controlled	-0.126	-0.672	-1.163, -0.181	**0.007 ***

CI: confidence interval; β: regression coefficient; *: p < 0.05 is considered significant.

them were worried about their child getting coronavirus, 69.7% (n = 299) agreed that COVID-19 will finally be successfully controlled and 59.9% (n = 257) thought that the pandemic will be controlled in Lebanon in the near future. For governmental measures, 51.3% (n = 220) of parents reported that authorities should close educational centers (kindergartens, schools, and universities) to limit the spread of the disease. Finally, 66.9% (n = 287) of parents expressed their willingness to vaccinate their kids when a vaccine would be available for them.

The mean practices score was 4.25 ± 1.03 out of 5. Many parents indicated that they avoided crowded places (67.4%) and taught their children to wear a mask (78.8%), wash their hands (95.3%), maintain an appropriate distance between them and other people (91.1%), and avoid touching their eyes, nose, and mouth (92.5%). Furthermore, 66.2% of parents answered that they are sending or willing to send their children to the school or the nursery.

CHARACTERISTICS OF PARTICIPANTS ACCORDING TO COVID-19 KNOWLEDGE

Regarding socio-demographic characteristics, parents' knowledge score significantly differed by sex (p = 0.001) and occupation (p = 0.002). The knowledge score was higher among female parents and those who were students. Participants' age, marital status, nationality, number of children of all ages, level of education, family income, and place of current residence were not related to the knowledge level of COVID-19 (Supplementary Tab. II).

Regarding parents' and children's medical history, smoking status of parents, chronic diseases in parents and children, and the type of chronic diseases in parents and children, were not related to the knowledge level of COVID-19 (Supplementary Tab. III).

Parents' knowledge score significantly increased by the experience of COVID-19 symptoms in children (p = 0.027) (Supplementary Tab. IV).

There was no significant association between the knowledge score and being in quarantine because of symptoms or because of close contact with someone tested positive or because of returning from a country that had a large number of cases (p = 0.097), positive diagnostic with COVID-19 using PCR or other tests in parents (p = 0.078), and in children (p = 0.317), and the most used source of information regarding COVID-19 (p = 0.061). Received the vaccine (p = 0.319), willing to receive the vaccine (p = 0.127), had a partner who received the vaccine (p = 0.515), or who is willing to

receive it (p = 0.332) were not significantly associated with the knowledge score (Supplementary Tab. IV).

Concerning parents' attitudes towards COVID-19 in children, parents' knowledge scores significantly increased if the parent agreed that COVID-19 is a serious disease (p = 0.014) and if he was worried about his child getting coronavirus (p = 0.022) (Supplementary Tab. V). Concerning parents' practices towards COVID-19 in children, parents' knowledge scores significantly increased if the parent had not taken his children to a crowded place in recent days (p = 0.043), and if the parent taught his children to avoid touching their eyes, nose, and mouth (p = 0.002) (Supplementary Tab. V).

In the multivariable linear regression model estimating factors associated with the COVID-19 knowledge score (Tab. V), we found that age ≥ 50 years (β = -1.045; p = 0.022; 95% CI: -1.941, -0.149), being single (β = -1.123; p = 0.035; 95% CI: -2.168, -0.078), don't know if COVID-19 is a serious disease (β = -2.168; p < 0.001; 95% CI: -3.228, -1.108) and don't know if COVID-19 will finally be successfully controlled (β = -0.672; p = 0.007; 95% CI: -1.163, -0.181) were inversely associated with COVID-19 knowledge score. Female sex (β = 0.751; p = 0.006; 95% CI: 0.213, 1.289) was positively associated with COVID-19 knowledge score.

Discussion

To the best of our knowledge, this is the first study in Lebanon that assesses the KAP towards COVID-19 in children among parents. In general, participants in our survey had good general knowledge about the disease, its ways of transmission, and measures for prevention in children. The mean knowledge score was 11.28 ± 2.19 over 15.

The results revealed that the mean knowledge score was significantly lower among older (≥ 50 years) and single parents, who don't know if COVID-19 is a serious disease and if it will be finally successfully controlled. The mean knowledge score was higher among female parents.

The majority of parents had a positive attitude and good practices towards COVID-19 in children. In details, 69.7% agreed that COVID-19 will finally be successfully controlled and 59.9% thought that the pandemic will be controlled in Lebanon shortly, but 76.7% of them were worried about their child getting coronavirus. About 66.9% of parents expressed their willingness to vaccinate their kids when a vaccine would be available

for them. Concerning their practices, many parents indicated that they avoided crowded places (67.4%) and taught their children to wear a mask (78.8%), wash their hands (95.3%), maintain an appropriate distance between them and other people (91.1%), and avoid touching their eyes, nose, and mouth (92.5%). Furthermore, 66.2% of parents answered that they are sending or willing to send their children to the school or the nursery. It can be considered that parents have more protective attitudes and adhere to more protective behaviors because, in addition to self-protection, they are responsible for their families.

The overall correct rate for the knowledge test was 75.2%, which can be attributed to the fact that nearly 73% of the parents had a university degree, and this was comparable to studies done elsewhere. For example, in the Arab countries, correct knowledge was found to be at 81.64% in Saudi Arabia [27], 74.5% in Egypt [28], 70.3% in Jordan, and 63.25% in Kuwait [29]. In addition, correct knowledge was found to be at 90% in China [25], 80.5% in Malaysia [30], and 70.16% in South Korea [31]. The difference in correct knowledge rate can be attributed to the absence of a question about the MIS-C in other countries' KAP questionnaires. Most parents (70.9%) were unaware of this rare and uncommon condition in children infected with COVID-19.

In our study, women showed more COVID-19 awareness than men, which is different from what was reported in a previous study in Saudi Arabia [32], but consistent with studies conducted in Palestine [33], Iran [34], China [25], South Korea [31], and the United States [35]. Similarly, for other diseases like cancer, women showed better knowledge about the different characteristics of the health condition than men [36].

Our data showed that older parents (≥ 50 years) had less knowledge about transmission and the symptoms of COVID-19 in children. This observation can be explained by the fact that the older population has limited use of various social media channels, which are the primary source of information about COVID-19 in our study. The results are consistent with previous studies done in Egypt [28], Palestine [33], China [37], and incompatible with others done in Lebanon [38], and Saudi Arabia [27].

In our participants, the mean knowledge score was significantly lower among single parents. These results were based on a small sample size (17 single parents), but were similar to the results of a study done in three Middle Eastern countries (Jordan, Saudi Arabia, and Kuwait) in which divorced individuals had a lower knowledge score [29]. Also, in a study realized in Iran, being single was associated with a lower knowledge score [34].

Furthermore, a lower COVID-19 knowledge score was found to be significantly associated with a lack of knowledge about whether COVID-19 is a serious disease, and whether it can be controlled. These are some basic facts about the disease, known in its early stages. This shows the importance of working on parents' knowledge towards COVID-19 in children by health strategies which in turn, would improve their attitude and practices regarding COVID-19.

Concerning parents' attitude towards COVID-19 in children, the majority of them had a positive attitude towards the disease and the vaccine. And this was comparable to studies done in Palestine [33], Egypt [28], Saudi Arabia [27], and Iran [34].

About 67% of parents expressed their willingness to vaccinate their kids when a vaccine would be available for them. Similarly, in a study done in Lebanon about the willingness to pay for a coronavirus vaccine, 68.2% of adults were ready to do the vaccine if available [39]. This acceptability rate of the COVID-19 vaccine in children is comparable to a study done in Korea where 64.2% of parents intended to have their children vaccinated against COVID-19 [40]. Also, as found in a study done in Turkey about the willingness to accept the COVID-19 vaccine by healthcare professionals, having children was associated with an increased acceptance of the vaccine [41].

In comparison, a cross-sectional study done in Italy, found that 36.1% of families would not vaccinate their children [42]. The results of this study were consistent with ours, where 33,1% of parents reported that they would not vaccinate their children.

The desire to return to a normal life, the trust in sciences, and the fear of new outbreaks were the main reasons behind parents' willing to vaccinate their children. But, the reasons for children's vaccine resistance were centered on side effects, safety, and lack of vaccine effectiveness [43].

Also, parents adopted safe and good practices to protect themselves and their children against COVID-19. The same findings were reported by most of the studies done in countries around the world, where the governments imposed strict measures to control the spread of the virus [44–47]attitudes and practices (KAP.

About 66% of parents answered that they are sending or willing to send their children to the school or the nursery. This is consistent with a study assessing school hesitancy among parents, 84% of them were planning to send their children to school in fall 2021 [48].

There are several limitations to this study that should be considered. The main limitation was the use of a convenience sample (Snowball technique). Also, the surveying process, which excluded those who can't read and have access to the internet, generates a sample that may not represent all parents in Lebanon and may overestimate their knowledge level. Furthermore, this study did not use a validated instrument to measure the KAP of parents towards COVID-19 in children because, since that time, there was no reliable and validated instrument. In addition, because of the COVID-19 awareness done at this time, parents may have given socially desirable responses that are inconsistent with their actual practices towards COVID-19 in their children. Moreover, recall bias can be a result of self-reported data. Finally, a misclassification bias is likely to have occurred, such as when reporting the family income by the parent.

Despite these limitations, this study is believed to be the first in Lebanon to assess parents' KAP towards COVID-19 in children. Additionally, this study was conducted during a critical period of COVID-19 in Lebanon, when the vaccine was still unavailable for children under the age of 12. Also, the distribution of participants according to governorates was similar to the actual distribution of the population in Lebanon, where all the governorates were targeted with an overrepresentation of the Mount Lebanon governorate.

The percentages of respondents' distribution were 10.7% in North Lebanon and Akkar governorates, 9.3% in Bekaa and Baalbeck-Hermel governorates, 7.9% in Nabatieh governorate, 9.6% in South Lebanon governorate, 54.3% in Mount Lebanon governorate, and 8.2% in Beirut governorate, in comparison with 22.07, 14.57, 7.9, 11.69, 34.50, and 9.27% respectively as mentioned in the statistical bulletin of the Ministry of Public Health 2019 [49].

Conclusions

To conclude, parents living in Lebanon participating in our study had good general knowledge, positive attitude, and effective practices towards COVID-19 in children. However, knowledge was lower among older and single parents, as well as those who lacked some basic facts about the disease's seriousness and control. More awareness should target those groups of parents, especially that the COVID-19 vaccine is still unavailable for use in children under 12 years in Lebanon, and that schools and nurseries reopened after a year and a half due to the pandemic. Nearly two-thirds of parents in our study reported their willingness to send their children to schools and nurseries, and to vaccinate them when a vaccine would be available. Schools and nurseries should take steps to slow the spread of COVID-19 among children and their families by maintaining good hygiene and ventilation in the classrooms, reducing the frequency of physical contact between students, and helping in their vaccination program.

Ethics approval

Participants' anonymity and autonomy were respected in the study. Ethical approval has been obtained from the Clinical and Epidemiological department. The participants had the option to participate and delay the submission of the completed form.

Consent to participate

Participants were informed that they were free to withdraw at any time, and that all information and opinions provided would be anonymous and confidential. Online informed consent was obtained before proceeding with the questionnaire.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

RS performed study, collected data, analyzed data and drafted the manuscript.
ZA, ME, NL reviewed the questionnaire, edited the manuscript and approved the final
version of the manuscript to be submitted.
RA designed study, analyzed data, reviewed and approved the final version of the manuscript to be submitted.

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Supplementary Tab. I. The correct answer rates of the COVID-19 knowledge questionnaire.

Variable	Frequency (n = 429)	%
K1. The main clinical symptoms of COVID-19 in children are fever, fatigue, dry cough, and myalgia		
Correct answer	298	69.5
Incorrect answer	131	30.5
K2. Unlike the common cold, stuffy nose, runny nose, and sneezing are less common in children infected with the COVID-19 virus		
Correct answer	231	53.8
Incorrect answer	198	46.2
K3. There currently is no effective cure for COVID-19, but early symptomatic and supportive treatment can help most children recover from the infection		
Correct answer	340	79.3
Incorrect answer	89	20.7
K4. Not all children with COVID-19 will develop to severe cases. Only those who have some medical conditions (asthma, diabetes, heart disease, obesity…) might be at increased risk of severe illness compared to other children		
Correct answer	342	79.7
Incorrect answer	87	20.3
K5. Eating or contacting wild animals (e.g., bats) would result in the infection by the COVID-19 virus in children		
Correct answer	104	24.2
Incorrect answer	325	75.8
K6. Persons with COVID-19 cannot infect the virus to others when a fever is not present		
Correct answer	350	81.6
Incorrect answer	79	18.4
K7. The COVID-19 virus spreads via respiratory droplets of infected individuals		
Correct answer	409	95.3
Incorrect answer	20	4.7
K8. Children aged 2 years and under should wear general medical masks to prevent the infection by the COVID-19 virus		
Correct answer	300	69.9
Incorrect answer	129	30.1
K9. Children aged 3-11 years should wear general medical masks to prevent the infection by the COVID-19 virus		
Correct answer	335	78.1
Incorrect answer	94	21.9
K10. Children aged 12 years and over should wear general medical masks to prevent the infection by the COVID-19 virus		
Correct answer	408	95.1
Incorrect answer	21	4.9
K11. It is not necessary for children and young adults to take measures to prevent the infection by the COVID-19 virus		
Correct answer	410	95.6
Incorrect answer	19	4.4
K12. To prevent the infection by COVID-19 in children, individuals should avoid going and taking their children to crowded places (> 10 people indoor, > 25 people outdoor) and avoid taking public transportations		
Correct answer	403	93.9
Incorrect answer	26	6.1
K13. Isolation and treatment of people (or children) who are infected with the COVID-19 virus are effective ways to reduce the spread of the virus		
Correct answer	407	94.9
Incorrect answer	22	5.1
K14. Children who have contact with someone infected with the COVID-19 virus should be immediately isolated in a proper place. In general, the observation period is 14 days		
Correct answer	377	87.9
Incorrect answer	52	12.1
K15. Multisystem inflammatory syndrome (MIS-C) is a rare but serious medical condition associated with COVID-19 in children		
Correct answer	125	29.1
Incorrect answer	304	70.9

Supplementary Tab. II. Socio-demographic characteristics of parents according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Socio-demographic characteristics			
Sex			
Male	85	10.59 ± 2.75	**0.001** †*
Female	344	11.45 ± 2.00	
Age			
18-29	72	11.54 ± 2.34	
30-39	186	11.06 ± 2.35	0.166 ‡
40-49	118	11.55 ± 1.85	
≥ 50	53	11.07 ± 2.07	
Marital status			
Married	412	11.32 ± 2.12	0.168 §
Not married	17	10.18 ± 3.47	
Nationality			
Lebanese	422	11.28 ± 2.20	0.461 §
Other nationalities	7	11.14 ± 1.68	
Number of children			
1-2 children	286	11.23 ± 2.30	
3-4 children	129	11.39 ± 1.87	0.923 ¶
≥ 5 children	14	11.36 ± 2.7	
Number of children aged 4 or less			
0	206	11.34 ± 1.95	0.556 †
At least one child	223	11.22 ± 2.39	
Number of children aged between 5 and 11 years			
0	189	11.46 ± 2.17	0.130 †
At least one child	240	11.14 ± 2.21	
Number of children aged between 12 and 18 years			
0	269	11.15 ± 2.25	0.119 †
At least one child	160	11.49 ± 2.08	
Level of education			
High school's degree and below	118	11.08 ± 2.21	
Bachelor's degree	173	11.48 ± 1.95	0.254 ‡
Master's degree and above	138	11.19 ± 2.45	
Occupation			
Unemployed	147	11.25 ± 2.25	
Student	10	12.1 ± 1.29	**0.002** ¶*
Healthcare worker	53	12.04 ± 2.03	
Other occupations	219	11.08 ± 2.19	
Family income			
No current income	58	10.79 ± 2.35	
< 675,000 LBP	22	11.82 ± 2.75	
675,000-1,999,000 LBP	132	11.36 ± 2.21	0.294 ‡
2,000,000-3,999,000 LBP	123	11.41 ± 1.91	
> 4,000,000 LBP	94	11.18 ± 2.26	
Place of current residence			
Beirut governorate	35	10.91 ± 2.76	
Mount-Lebanon governorate	233	11.35 ± 2.09	
South-Lebanon governorate	41	11.44 ± 2.05	
Bekaa + Baalbeck - Hermel governorates	40	11.10 ± 1.84	0.730 ‡
Nabatieh governorate	34	10.94 ± 3.03	
North-Lebanon + Akkar governorates	46	11.46 ± 1.94	

SD: standard deviation; *: p < 0.05 is considered significant; †: T-Test; ‡: ANOVA; §: Mann-Whitney Test; ¶: Kruskal-Wallis Test.

Supplementary Tab. III. Medical history of parents and children according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Medical history of parents and children			
Smoking status of parents			
No	331	11.35 ± 2.07	0.240 [†]
Yes	98	11.05 ± 2.57	
Chronic diseases in parents			
No	359	11.28 ± 2.26	0.972 [†]
Yes	70	11.27 ± 1.85	
Type of chronic diseases in parents			
No chronic diseases	338	11.26 ± 2.27	
Cardiac problems	13	11.54 ± 1.94	
Respiratory problems	3	12.33 ± 1.53	
Neurological problems	1	12 ± 0.00	0.762 [¶]
Diabetes	4	10.25 ± 1.26	
Allergies	23	11.09 ± 2.17	
Other diseases	22	11.73 ± 1.45	
More than 1 chronic disease	25	11.24 ± 2.03	
Chronic diseases in children			
No	391	11.28 ± 2.24	0.916 [†]
Yes	38	11.31 ± 1.71	
Type of chronic diseases in children			
No chronic diseases	379	11.27 ± 2.24	
Cardiac problems	2	13 ± 0.00	
Respiratory problems	2	10 ± 0.00	
Diabetes	2	7.5 ± 3.53	0.056 [¶]
Allergies	29	11.55 ± 1.59	
Other diseases	10	10.9 ± 1.45	
More than 1 chronic disease	5	12.6 ± 1.14	

SD: standard deviation; *: p < 0.05 is considered significant; [†]: T-Test; [‡]: ANOVA; [§]: Mann-Whitney Test; [¶]: Kruskal-Wallis Test.

Supplementary Tab. IV. Parents' experience with the COVID-19 pandemic, their vaccination status according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Parents' experience with the COVID-19 pandemic and their vaccination status			
Were you ever in quarantine because of symptoms or because you were in close contact with someone tested positive for COVID-19 or because you returned from a country that had a large number of cases?			
No	191	11.08 ± 2.29	0.097 [†]
Yes	238	11.44 ± 2.10	
Have you tested positive with coronavirus using PCR or other tests?			
No	291	11.15 ± 2.3	0.078 [†]
Yes	138	11.55 ± 1.92	
Did any of your children experience any COVID-19 symptoms?			
No	323	11.14 ± 2.26	**0.027** [†] [*]
Yes	106	11.69 ± 1.93	
Have any of your children tested positive with coronavirus using PCR or other tests?			
No	378	11.24 ± 2.22	0.317 [†]
Yes	51	11.57 ± 1.94	
Did you receive one of the available vaccines for COVID-19?			
No	284	11.20 ± 2.30	0.319 [†]
Yes	145	11.43 ± 1.97	
Are you willing to receive one of the available vaccines for COVID-19?			
No	116	10.95 ± 2.51	
Yes	180	11.33 ± 2.25	0.127 [‡]
I already received my vaccine	133	11.50 ± 1.75	

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Supplementary Tab. IV. Parents' experience with the COVID-19 pandemic, their vaccination status according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Did your partner receive one of the available vaccines for COVID-19?			
No	263	11.25 ± 2.09	
Yes	155	11.38 ± 2.22	0.515 ‡
I don't have a partner	11	10.64 ± 3.80	
Is your partner willing to receive one of the available vaccines for COVID-19?			
No	103	10.93 ± 2.45	
Yes	181	11.43 ± 1.97	0.332 ¶
I don't have a partner	11	10.64 ± 3.80	
My partner has already received his vaccine	134	11.39 ± 2.09	
Most used source of information regarding COVID-19			
Social media	128	11.05 ± 2.49	
Google and search engines	48	11.87 ± 1.42	
Family, friends, neighbors	10	10.6 ± 2.22	0.061 ‡
News channels	61	10.95 ± 2.46	
Ministry of health website	89	11.17 ± 2.16	
Scientific articles and research	93	11.68 ± 1.82	
SD: standard deviation; *: p < 0.05 is considered significant; †: T-Test; ‡: ANOVA; §: Mann-Whitney Test; ¶: Kruskal-Wallis Test.			

Supplementary Tab. V. Parents' attitude and practices towards COVID-19 in children according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Parents 'attitude towards COVID-19 in children			
Do you agree that COVID-19 is a serious disease?			
Agree	366	11.45 ± 1.93	
Disagree	47	10.70 ± 2.35	0.014 ¶*
I don't know	16	9 ± 4.76	
Are you worried about your child getting coronavirus?			
Yes	329	11.41 ± 2.08	0.022 †*
No	100	10.84 ± 2.50	
Do you agree that COVID-19 will finally be successfully controlled?			
Agree	299	11.41 ± 2.18	
Disagree	38	11.37 ± 2.12	0.063 ‡
I don't know	92	10.80 ± 2.22	
Do you think that the pandemic will be controlled in Lebanon in the near future?			
Yes	257	11.27 ± 2.26	0.933 †
No	172	11.29 ± 2.09	
Do you think authorities should close educational centers (kindergartens, schools, and universities) to limit the spread of the disease?			
Yes	220	11.28 ± 2.23	0.984 †
No	209	11.28 ± 2.16	
Are you willing to vaccinate your kids when a vaccine will be available for them?			
Yes	287	11.42 ± 2.10	0.063 †
No	142	11.00 ± 2.36	
Parents 'practices towards COVID-19 in children			
In recent days, have you taken your children to any crowded place (> 10 people indoor, > 25 people outdoor)?			
Yes	140	10.97 ± 2.24	0.043 †*
No	289	11.43 ± 2.16	
Have you asked your kids to wear a mask outside the house or when in presence with other people?			
Yes	338	11.36 ± 2.08	0.154 †
No	91	10.99 ± 2.54	

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►

Supplementary Tab. V. Parents' attitude and practices towards COVID-19 in children according to COVID-19 knowledge score.

	Knowledge score		
	N = 429	Mean ± SD	P-value
Do you teach your children to wash their hands with soap and water for 20 seconds frequently?			
Yes	409	11.27 ± 2.17	0.371 [§]
No	20	11.5 ± 2.66	
Do you teach your children to maintain an appropriate distance between them and other people?			
Yes	391	11.33 ± 2.09	0.094 [†]
No	38	10.71 ± 3.00	
Do you teach your children to avoid touching their eyes, nose and mouth?			
Yes	397	11.37 ± 2.13	**0.002** [†*]
No	32	10.12 ± 2.62	
Are you sending or willing to send your children to the school or to the nursery?			
Yes	284	11.29 ± 2.28	0.869 [†]
No	145	11.25 ± 2.02	

SD: standard deviation; *: p < 0.05 is considered significant; [†]: T-Test; [‡]: ANOVA; [§]: Mann-Whitney Test; [¶]: Kruskal-Wallis Test.