A cross-sectional study of knowledge, attitude, behaviour and preventive measures for COVID-19 infection in Lebanon

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Abstract

Background: The World Health Organization has often reiterated its recommendations for the prevention of COVID-19, however, the success of these measures largely depends on public knowledge and attitudes.

Aims: This study assessed the relationship between knowledge, attitude, behaviour and preventive measures for COVID-19 infection in a Lebanese population.

Methods: This cross-sectional study was conducted between September and October 2020 using the snowball sampling technique and an online self-administered questionnaire. The questionnaire had 4 parts targeting sociodemographic characteristics; medical history; knowledge, attitude and practices (preventive measures and behaviours related to COVID-19); and mental health variables such as psychological distress. Two models were derived using multivariable binomial logistic regression to optimize the picture of COVID-19 correlates.

Results: Our sample comprised 1119 adults. Being older, female, a regular alcohol consumer, waterpipe smoker, having low level of education, low family income, and having contact with a COVID-19 patient correlated with increased odds of ever having been diagnosed with COVID-19. Participants who had ever been diagnosed with COVID-19 had a significantly better knowledge and a higher risky practice scale [adjusted odds ratio (ORa) = 1.49; 95% CI 1.27–1.74; $P < 0.001$; and ORa = 1.04; 95% CI 1.01–1.08; $P = 0.024$, respectively].

Conclusion: The most important predictors of COVID-19 infection appear to be generally well-known among the general population, however, their knowledge and adherence to preventive measures should be continuously re-evaluated. This study highlights the need for greater awareness to improve precautionary behaviours among the public.

Keywords: COVID-19, risky behaviours, knowledge, attitude, preventive measures, Lebanon

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Introduction

COVID-19 was first officially reported in Lebanon on 21 February 2020 (1). Since then, the Lebanese population has encountered significant disruptions to the diverse facets of life, as they were already experiencing serious political and financial difficulties (2). Awareness was raised by the Lebanese government and the Ministry of Public Health to minimize the number of cases, however the number of confirmed cases steadily increased, reaching 177 996 by the end of December 2020, with 1443 recorded deaths (3).

The World Health Organization (WHO) recently reinforced its recommendations to the public to continue observing the COVID-19 preventive measures (4). A number of studies have demonstrated that the success of preventive measures is largely dependent on public attitudes, knowledge, mental health and comorbidities. However, knowledge about health-related problems may vary within a population (5,6). This study aimed to assess the relationship between knowledge, attitude, risky behaviours and preventive measures and COVID-19 infection in the Lebanese population.

Methods

Study design and sampling

This cross-sectional study was conducted in all Lebanese regions between September and October 2020. A snowball sampling technique was used, utilizing an electronic questionnaire, to enrol all non-hospitalized COVID-19 patients aged 18 years and above. The sample representativeness was then optimized via a weighting procedure in line with figures from the Central Administration of Statistics (7). A gender-group structure was considered, and weighting coefficients were associated with participants to obtain a final sample with a structure similar to that of the Lebanese population.

The ethical committee of the Lebanese University approved the study protocol. As an observational study, participants' confidentiality was maintained and none of them was traceable.

Questionnaire and variables

A standardized questionnaire that required around 30 minutes to complete was sent to participants for self-

administration. The dependent variable was the answer to the question "Ever having been diagnosed with COVID-19?" The independent variables were divided into 4 parts. Part 1 covered sociodemographic characteristics (age, sex, socioeconomic status through household income, marital status, employment status, education level). Part 2 included personal medical history (diabetes, cardiovascular disease, cancer) and risk factors for chronic diseases (smoking, alcohol consumption, hypertension). Part 3 included questions related to knowledge, attitude and practice (preventive measures and risky behaviours) related to COVID-19 (8). The knowledge scale comprised 12 questions (Cronbach's alpha = 0.713); there were 4 questions on preventive measures (wearing a mask outside, washing hands frequently, avoiding touching the face and wearing a mask in crowded places; Cronbach's alpha = 0.650); there were 3 questions on risky behaviours (going to a crowded place, going to work and going to work during lockdown periods; Cronbach's alpha = 0.654). The attitude questions were measured on a scale of 1–10. Part 4 included assessment of mental health variables such as psychological distress using the BDS-22 scale (*9*), family related satisfaction through the APGAR scale (*10*) and overall well-being through the WHO-5 scale (*11*).

The BDS-22 is a scale validated in Lebanon, used to measure the level of stress in the general Lebanese adult population. It comprises 22 questions exploring 6 domains: depressive symptoms, demotivation, psychosomatic symptoms, mood deterioration, intellectual inhibition and anxiety. Cronbach's alpha for this scale was 0.962 in our sample. The family APGAR scale is a short, self-reported instrument evaluating satisfaction with global family function. It has 5 questions, each corresponding to a component of family function, i.e. adaptation, partnership, growth, affection and resolve (APGAR). The total score is obtained by summing the answers to all items, and ranges from 0 to 10. Higher scores indicate greater satisfaction with family function. Cronbach's alpha for this scale was 0.912 in our sample. The 5-item World Health Organization Well-Being Index (WHO-5) is among the most widely used questionnaires assessing subjective psychological well-being. This short self-reported tool is widely used in Lebanon and comprises 5 questions graded from 0 to 5 to evaluate mental well-being in the past month. The total score ranges from 0 to 25; higher scores indicate better mental well-being (Cronbach's alpha = 0.898).

Minimum sample size calculation

The minimum sample size was calculated using *G-Power*, version 3.0.10. The calculated effect size was 0.0526, expecting a squared multiple correlation of 0.05 (R^2 deviation from 0) related to the Omnibus test of multiple regression. The minimum required sample size was 454, considering an alpha error of 5%, a power of 80%, and allowing 25 predictors to be included in the model. The target sample size was doubled to allow for additional analyses to be conducted.

Statistical analysis

Data were analysed using *SPSS*, version 23.0. A descriptive analysis was first conducted to evaluate sample characteristics. Normal distribution of variables was evaluated using the Shapiro–Wilk test. Means were compared using the Student *t*-test and percentages using the chi-squared test.

A multivariable analysis was also conducted using binomial logistic regression; a backward stepwise likelihood ratio method was used. We derived 2 models to optimize the picture of COVID-19 correlates by including variables with *P*-values < 0.2 in the bivariate analyses. The first model presented baseline characteristics as independent variables and "ever been diagnosed with COVID-19" as the dependent variable. The second model included transmission-context and preventive measures-related variables in addition to all sociodemographic characteristics of the first model as independent variables, and "ever been diagnosed with COVID-19" as the dependent variable. Results were reported as adjusted odds ratio (ORa) with 95% confidence interval (CI), and *P*-value < 0.05 being considered statistically significant.

Results

Sample description

A total sample of 1119 adults participated in this study. After weighting, this included 50.0% female, 19.2% with a university education, 72.7% with some level of education, and 50.0% who were married. Mean age was 31.97 [standard deviation (SD) 11.81] years. Around 30% were not employed (housewives and retired, mainly), just over 20% were students, and just under 40% were employed. Among those employed at the time of the survey, 60 (5.3%) were healthcare workers. Around 20% of participants reported having no household income and just under half reported having a monthly household income of less than US$ 1000.

The mean BDS-22 score was 20.58 (SD = 18.44); the WHO-5 well-being score was 15.54 (SD = 6.46) and the family APGAR score satisfaction was 22.59 (SD = 6.81). Having at least one family member with a chronic disease was reported by 14.8% of households.

COVID-19 history and transmission context

One hundred and fifty-six participants (13.9%) declared having ever been diagnosed with COVID-19 and 268 (23.9%) had ever been in contact with a COVID-19 patient. The mean knowledge score was 8.15 (SD = 2.41), the mean preventive practice score was 28.24 (SD = 5.89), and the mean risky practice score 9.61 (SD = 7.90). The mean score for fear of COVID-19 was 17.58 (SD = 6.49).

Bivariate analysis for participants ever diagnosed with COVID-19

Older age, female sex, having a lower household income, lower education, currently employed, current waterpipe smoking, having lower physical activity, lower

family satisfaction and lower overall well-being were significantly associated with COVID-19 (Table 1). There was a clear gradient of coronavirus infections associated with the certainty of having had contact with a COVID-19 positive person, higher mean score for COVID-19 knowledge, lower mean score for risky practices, lower mean score for fear of COVID-19, and lower mean score for trust that COVID-19 would be controlled one day (Table 2).

Table 1 Bivariate analysis of sociodemographic and profile characteristics of non-hospitalized adults (*n* = 1119), Lebanon, 2020

Characteristic	Never had COVID-19 *n* = 963 (86.1%)	Ever had COVID-19 *n* = 156 (13.9%)	*P*-value
Mean (SD) age (years)	**31.66 (12.04)**	**33.84 (10.12)**	**0.023**
	No. (%)	**No. (%)**	
Sex			0.006
Male	497 (88.9)	62 (11.1)	
Female	466 (83.2)	94 (16.8)	
Monthly household income (US$)			< 0.001
None	193 (87.3)	28 (12.7)	
< 1000	419 (80.9)	99 (19.1)	
1000–2000	279 (91.2)	27 (8.8)	
> 2000	72 (97.3)	2 (2.7)	
Education level			< 0.001
No education	65 (72.2)	25 (27.8)	
Secondary	705 (86.6)	109 (13.4)	
University	193 (89.8)	22 (10.2)	
Employment status			< 0.001
Unemployed (e.g. housewife/retired)	291 (86.9)	44 (13.1)	
Student	227 (96.2)	9 (3.8)	
Licensed but currently unemployed	101 (85.6)	17 (14.4)	
Actively employed	345 (80.0)	86 (20.0)	
Regular alcohol consumption			0.033
No	939 (86.5)	147 (13.5)	
Yes (≥ 2 drinks per day)	23 (71.9)	9 (28.1)	
Cigarette smoking			0.602
Never	628 (86.7)	96 (13.3)	
Previous	15 (93.8)	1 (6.2)	
Occasional	44 (83.0)	9 (17.0)	
Regular	275 (84.9)	49 (15.1)	
Waterpipe smoking			< 0.001
Never	531 (89.8)	60 (10.2)	
Previous	45 (81.8)	10 (18.2)	
Occasional	124 (96.9)	4 (3.1)	
Regular	263 (76.2)	82 (23.8)	
Regular physical activity			0.005
No	636 (84.0)	121 (16.0)	
Yes	326 (90.3)	35 (9.7)	
Chronic disease			0.402
No	774 (86.5)	121 (13.5)	
Yes	188 (84.3)	35 (15.7)	
	Mean (SD)	**Mean (SD)**	
Family APGAR satisfaction score	22.77 (6.69)	21.47 (7.42)	0.042
WHO-5 well-being score	15.79 (6.60)	13.99 (5.29)	< 0.001
BDS-22 score	20.63 (19.38)	20.27 (18.84)	0.822

SD = standard deviation.

Multivariable analysis

Table 3 describes 2 models to identify the factors associated with COVID-19. The first model included baseline characteristics while the second included additional variables related to transmission and preventive measures. Older age, female sex, regular alcohol consumption, previous and current waterpipe smoking and low family income were associated with higher odds of COVID-19. However, higher level of education, higher income and having a chronic disease were associated with a lower odds of COVID-19 infection (Table 3, Model 1).

After adding variables related to the COVID-19 transmission context, knowledge, attitude and practices in Model 2, similar results were found except that sex was no longer associated with higher risk of infection. Ever having had contact with a COVID-19 patient was strongly associated with infection (ORa = 7.44). Every 1-point increase in the risky practice scale was significantly associated with a 4.0% increase in odds of infection. Those who had ever been diagnosed with COVID-19 were more likely to have a better knowledge of COVID-19 (ORa = 1.49) and a greater trust that COVID-19 would eventually be controlled (ORa = 1.11) (Table 3, Model 2).

Discussion

This was the first cross-sectional population-based study conducted in all Lebanese regions to assess the association between the risk of COVID-19 and participants' sociodemographic factors, comorbidities, mental health, knowledge, risky practices, preventive measures, and awareness of and fears in regard to COVID-19 infection. We found that ever having been diagnosed with COVID-19 was significantly associated with older age, waterpipe smoking, regular alcohol consumption, low educational level, low family income, not having chronic disease, reporting having been in contact with a COVID-19 patient, greater knowledge at the time of the study, higher risky practice score, and trust that the infection would be controlled.

This study demonstrated that older adults were at higher risk of COVID-19. Our results are consistent with other findings that determined higher rates of COVID-19 infection and mortality among older adults (*12*). This may be due to the natural changes of the lung anatomy at an advanced age, and consequently diminished airway clearance and lesser function of the defensive barriers (*13*). Older patients with comorbidities were more prone to severe complications including death. They are more likely to have weaker immunity and are vulnerable to secondary bacterial infections (*14*).

The WHO has warned that waterpipe use can increase the risk of COVID-19 (*15*). Our findings confirm this association as waterpipe users had significantly greater odds of being diagnosed with COVID-19. Waterpipe smoking is considered to be a social activity, and the waterpipe hose and mouthpiece are often shared between users in indoor areas (*16*).

A significant association was found between low family monthly income and COVID-19 infection. This may be in part explained by the type of face mask used. Individuals with higher income levels are reported to wear N95 and surgical masks that were found to be more efficient in preventing COVID-19 transmission than the cloth masks used by individuals who had a lower income (*17,18*).

Long-term use of alcohol is reportedly associated with immunosuppression and increased risk of various viral and bacterial infections (*19*). Our findings support this association: regular consumption of alcohol was associated with greater risk of having COVID-19. It appears that alcohol was consumed regularly during COVID-19, perhaps due to misconceptions that alcohol consumption could help prevent the disease (*20*).

A higher level of education was found to be inversely associated with the risk of ever having COVID-19, and this appears to be related to having better knowledge regarding COVID-19 among individuals with a higher education level (*21*). Having a chronic disease was associated with lower odds of COVID-19 infection. This

Table 2 Bivariate analysis of COVID-19-related characteristics and transmission context

Characteristic	Never had COVID-19 (*n* = 963; 86.1%)	Ever had COVID-19 (*n* = 156; 13.9%)	*P*-value
	No. (%)	No. (%)	
Ever had a contact with a COVID-19 patient			
No known contact	629 (65.32)	36 (23.08)	< 0.001
Maybe/probably	153 (15.89)	33 (21.15)	
Yes, known contact	181 (18.79)	87 (55.77)	
	Mean (SD)	**Mean (SD)**	
COVID-19 knowledge	8.01 (2.50)	9.02 (1.46)	< 0.001
Preventive behaviour	28.21 (5.93)	28.37 (5.67)	0.759
Risky behaviour	9.83 (8.29)	8.29 (7.87)	0.024
Fear of COVID-19	18.60 (6.59)	17.26 (5.74)	0.009
Trust that COVID-19 will be controlled one day	6.52 (2.91)	5.53 (2.94)	0.007

Table 3 Multivariable analysis for factors related to COVID-19 infection

Model	ORa	*P*-value	95% CI of ORa
Model 1: including baseline characteristics of participants ever diagnosed with COVID-19			
Older age (years)	1.04	< 0.001	1.02–1.06
Female sex	1.76	0.009	1.15–2.69
Regular alcohol consumption	13.43	< 0.001	4.90–36.82
Waterpipe smoking		< 0.001	
Previous versus never	4.55	0.001	1.93–10.74
Occasional versus never	0.42	0.115	0.15–1.23
Current versus never	5.37	< 0.001	3.30–8.75
Education		0.001	
No education versus low	0.28	< 0.001	0.14–0.57
University versus low	0.42	0.058	0.17–1.03
Monthly household income (US$)		< 0.001	
< 1000 versus none	2.19	0.007	1.24–3.88
1000–2000 versus none	0.76	0.486	0.35–1.64
> 2000 versus none	0.18	0.043	0.04–0.95
Having a chronic disease	0.31	< 0.001	0.17–0.58
Model 2: including baseline characteristics and COVID-19 transmission context variables			
Older age in years	1.05	< 0.001	1.03–1.08
Regular alcohol consumption	7.94	0.001	2.27–27.84
Waterpipe smoking		< 0.001	
Previous versus never	5.58	0.001	2.00–15.58
Occasional versus never	0.53	0.251	0.18–1.57
Current versus never	10.29	< 0.001	5.71–18.56
Education		< 0.001	
No education versus low	0.19	< 0.001	0.09–0.45
University versus low	0.20	0.003	0.07–0.57
Monthly household income (US$)		0.001	
< 1000 versus none	0.86	0.647	0.44–1.66
1000–2000 versus none	0.64	0.290	0.28–1.47
> 2000 versus none	0.03	< 0.001	0.01–0.20
Having a chronic disease	0.24	< 0.001	0.12–0.50
Ever had contact with COVID	7.44	< 0.001	4.38–12.63
Knowledge scale	1.49	< 0.001	1.27–1.74
Risky practice scale	1.04	0.024	1.01–1.08
Trust that COVID will be controlled	1.11	0.017	1.02–1.21

ORa = adjusted odds ratio.
CI = confidence interval.

may be because comorbid patients take extra precautions and preventive measures due to the fear of contracting the disease and requiring intensive care since many of the awareness campaigns in the mass media in Lebanon were addressed to this vulnerable population.

Individuals who had recovered from COVID-19 appear to adhere less to the preventive measures. In fact, research has shown that a history of COVID-19 infection protects against reinfection with the virus (*22*), however, some reports have suggested that previous exposure to SARS-CoV-2 does not necessarily guarantee total immunity (*23*). This may be due to genetic mutation of the virus and the emergence of new variants of SARS-CoV-2 (*24*).

The limitations of this study include selection bias due to the virtual snowball sampling. This technique may have directed the sample towards a subgroup of the population, leading to a homogenous group of participants. The study results are limited to the adult population only, hence, future research should be conducted among adolescents to evaluate similar outcomes in this sub-population.

Conclusions

More than 2 years after the onset of the COVID-19 pandemic, the most important predictors of infection

appear to be largely well-known, yet they should be continuously re-evaluated among the general population as long as the pandemic persists. Despite immunization and a reduction in the infection and mortality rates, the WHO continues to reinforce the importance of awareness and preventive measures for COVID-19. Our study highlights the need to raise awareness to boost precautionary behaviours among the public. The findings may help policymakers in making policies to continuously promote knowledge, attitude and behaviours that help prevent COVID-19 transmission among different groups.

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Étude transversale des connaissances, de l'attitude, du comportement et des mesures de prévention de l'infection par la COVID-19 au Liban

Résumé

Contexte : L'Organisation mondiale de la Santé a souvent réitéré ses recommandations pour la prévention de la COVID-19, mais le succès de ces mesures dépend en grande partie des connaissances et des attitudes du public.

Objectifs : La présente étude évaluait le lien entre les connaissances, l'attitude, le comportement et les mesures de prévention de l'infection par la COVID-19 au sein d'une population libanaise.

Méthodes : Cette étude transversale a été menée entre septembre et octobre 2020 à l'aide de la technique d'échantillonnage en boule de neige et d'un questionnaire auto-administré en ligne. Le questionnaire comprenait quatre parties ciblant les caractéristiques sociodémographiques, les antécédents médicaux, les connaissances, l'attitude et les pratiques (mesures de prévention et comportements liés à la COVID-19) ainsi que des variables de la santé mentale telles que la détresse psychologique. Deux modèles ont été dérivés à l'aide de la régression logistique multivariable binomiale afin d'optimiser le tableau des corrélats de la COVID-19.

Résultats : Notre échantillon comprenait 1119 adultes. Le fait d'être plus âgé, d'être une femme, un consommateur régulier d'alcool, un fumeur de pipe à eau, d'avoir un faible niveau d'éducation, un faible revenu familial et d'avoir un contact avec un patient atteint de COVID-19 était corrélé à une probabilité accrue d'avoir déjà reçu un diagnostic de COVID-19. Les participants ayant déjà reçu un diagnostic de COVID-19 avaient une connaissance significativement meilleure et une échelle de pratique à risque plus élevé [odds ratio ajusté (ORa) = 1,49 ; IC à 95 % 1,27-1,74 ; $p < 0,001$; et ORa = 1,04 ; IC à 95 % 1,01-1,08 ; $p = 0,024$, respectivement].

Conclusion : Les facteurs prédictifs les plus importants de l'infection COVID-19 semblent généralement bien connus par la population générale, mais leurs connaissances et leur respect des mesures de prévention devraient être réévalués en permanence. La présente étude souligne la nécessité d'une plus grande sensibilisation afin d'améliorer les comportements de précaution au sein du public.

دراسة مقطعية عن الاتجاهات والمعلومات والسلوكيات والتدابير الوقائية المتعلقة بعدوى كوفيد-19 في لبنان

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الخلاصة

الخلفية: كثيرًا ما كررت منظمة الصحة العالمية التأكيد على توصياتها للوقاية من كوفيد-19، غير أن نجاح هذه التدابير يعتمد اعتمادًاكبيرًا على معرفة عموم الناس ومواقفهم.

الأهداف: هدفت هذه الدراسة إلى تقييم العلاقة بين المعلومات والاتجاهات والسلوكيات والتدابير الوقائية المتعلقة بكوفيد-19 في أوساط السكان اللبنانيين.

طرق البحث: أُجريت هذه الدراسة المقطعية في المدة ما بين سبتمبر/ أيلول وأكتوبر/ تشرين الأول 2020 باستخدام أسلوب كرة الثلج لأخذ العينات، واستبيان يُكمله المشاركون عبر الإنترنت بأنفسهم. وتضمَّن الاستبيان 4 أجزاء تستهدف الخصائص الاجتماعية السكانية؛ والسوابق المرضية؛ المعلومات والاتجاهات، والممارسات (التدابير الوقائية والسلوكيات المتعلقة بكوفيد-19)؛ ومتغيرات الصحة النفسية مثل الضائقة النفسية. واستُخلص نموذجان باستخدام الانحدار اللوجستي المتعدد المتغيرات ذي الحدين، لتحسين صورة العوامل المرتبطة بكوفيد-19.

النتائج: تتكون العينة التي أُجريت عليها الدراسة من 1119 بالغًا. ويرتبط ما يلي باحتمالية مرتفعة لتشخيص الإصابة بكوفيد-19: كبر السن، وكون الشخص من الإناث، وتعاطي المُسكرات بانتظام، وتدخين النرجيلة، وتدنِّي مستوى التعليم، وانخفاض دخل الأسرة، ومخالطة المصابين بكوفيد-19. وكان المشاركون الذين سبق تشخيص إصابتهم بكوفيد-19 يتمتعون بمعلومات أفضل كثيرًا، ويتَّبعون ممارسات أكثر خطورة [نسبة الأرجحية المعدَّلة = 1.49؛ فاصل ثقة 95٪ 1.27–1.74؛ القيمة الاحتمالية < 0.001؛ ونسبة الأرجحية المعدَّلة = 1.04؛ فاصل ثقة 95٪ 1.01–1.08؛ القيمة الاحتمالية = 0.024، على التوالي].

الاستنتاجات: يبدو أن أهم مُنبئات الإصابة بكوفيد-19 معروفة عامةً في أوساط عموم السكان، إلا أنه ينبغي إعادة تقييم معلومات السكان والتزامهم بالتدابير الوقائية باستمرار. وتسلّط هذه الدراسة الضوء على الحاجة إلى إذكاء الوعي لتحسين السلوكيات الاحترازية في أوساط عموم الناس.

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