ORIGINAL ARTICLE

Knowledge, attitudes and practices during the second wave of COVID-19 outbreak: a cross-sectional study from various perspectives

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ABSTRACT

Aim To investigate knowledge, attitudes and practice towards COVID-19 among selected population.

Methods An anonymous online questionnaire based on a Chinese study was distributed via online social media platforms among general population of Bosnia and Herzegovina, Germany, India, Kosovo and Romania.

Results In total 1032 subjects, predominately females, 615 (59.6%) with a mean age of 31.23±12.94 years, single, 705 (68.3%), with high school degree or lower, 469 (45.4%), students, 528 (51.1%) and living in an urban environment, 824 (79.8%), have completed the survey. The median knowledge score was 10.0 (range 0-12). Being male (β: -0.437; p=0.003) and older (β: -0.028; p<0.001) were associated with lower knowledge scores, while being single (β: 1.026; p<0.001) and mental labour employee (β: 0.402; p=0.032) were associated with higher knowledge scores. The vast majority of subjects had not visited crowded places, 630 (61.0%) and wearing masks when they were going out, 928 (89.9%). Being female (OR=0.731; p=0.022), having higher knowledge scores (OR=0.929; p=0.017) and being a mental labour employee (OR=0.713; p=0.031) decreased the exposure to crowded places. High school or lower education level (OR=0.616; p=0.024) decreased the action of wearing a mask in public places, while higher knowledge scores (OR=1.112; p=0.013) increased it.

Conclusion Our study suggests that residents of the selected regions have had good knowledge, pessimistic attitudes and relatively appropriate practices towards COVID-19 during the second wave of the outbreak.

Key words: attitude, COVID-19, epidemiology, knowledge, public health

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by the highly contagious novel severe acute respiratory syndrome coronavirus 2 (Novel SARS-CoV-2) (1). Even though this infection may be asymptomatic, the disease usually presents with mild symptoms such as fever, dry cough, fatigue, myalgia, shortness of breath and loss of sense of smell and taste, but it can also progress to lethal forms with severe pneumonia, acute respiratory distress syndrome and even fatality (2). This emerging respiratory infection that was first discovered in December 2019 in Wuhan city has infected more than 25 602 665 patients and resulted in more than 852 758 deaths as of 2 September 2020 (3). During COVID-19 pandemic, government responses varied from doing little to nothing, laissez-faire strategy, to more aggressive measures which limited even population's liberty (4).

In the examined region of Bosnia and Herzegovina, Germany, India, Kosovo and Romania from the beginning of the pandemic to 2nd September 2020 there have been 4 194 095 reported cases with death ratio ranging from 2.0% to 4.1%: Bosnia and Herzegovina 20 234 (3.0%), Germany 246 808 (4.0%), India 3 823 449 (2.0%), Kosovo 13 713 (3.9%) and Romania 89 891 (4.1%) (5).

Pandemic spread of COVID-19 is an undefined medical challenge and unprecedented measures have been made worldwide. Being a novel infectious agent, healthcare professionals are constantly challenged in order to apply the most efficient prevention measures, treatment schemes and avoid the long-term complication of the disease. Knowledge, attitude and practices studies (KAP) find their unique importance in the selected topic (6).

KAP surveys usually apply in the first step of a clinical trial or research in order to collect data about a chosen topic from the general population. The investigation may be developed at any point during control activities, but it proves its maximum utility and efficiency in the early phases of a novel project. Therefore, the data obtained from a KAP survey are useful to orientate the resource allocation, to develop the project design itself or to obtain baseline information which will be used for comparison with post-interventional data (7).

KAP research is a powerful tool in order to evaluate the public awareness about spreading, symptomatology, treatment and outcome of infection with coronavirus. By evaluating the public knowledge, attitude and practices towards COVID-19, patterns of responsive behaviour and applying healthy practices may be studied. Moreover, lack of information and maximizing on-going prevention measures are possible (8,9).

Individual studies have been done in various populations, and in different geographical areas including Bosnia and Herzegovina (B&H) (9-11). This multicentre research was conducted in order to gather not only local (B&H) but global COVID-19 KAP data from various population and to compare them.

The aim of this study was to investigate knowledge, attitudes and practice towards COVID-19 among selected population from Bosnia and Herzegovina, Germany, India, Kosovo and Romania.

PARTICIPANTS AND METHODS

Participants and study design

This observational cross-sectional study conducted from 15th July to 2nd September 2020 was done in the form of an online questionnaire-based survey in order to respect the norms of social distancing and lockdown in various areas in the study setting. Subjects across Bosnia and Herzegovina, Germany, India, Kosovo and Romania were provided with a KAP questionnaire adapted from a similar Chinese study (9) via e-mail, WhatsApp, Facebook and other social networking media. The questionnaire informed the subjects about the objectives of the study, their voluntary and anonymous participation, including online informed consent and details of how to fill up the questionnaire. Exclusion criteria were being younger than 18 years, not being a resident of one of the countries and not completing the questionnaire. The study was approved by the Ethics Committee of the University of Sarajevo and all procedures were followed in accordance with the Helsinki Declaration and subsequent amendments.

Methods

The questionnaire consisted of two parts. The first part assessed demographic characteristics of subjects such as gender, age, marital status, education level, current occupational status and

living environment. The second part, KAP assessment, consisted of 16 questions, divided in 3 sections: knowledge test, attitudes towards COVID-19 and practices towards COVID-19.

Knowledge test had 12 questions with each question having as response 'True', 'False' and 'I don't know'. The questions primarily were regarding the main symptoms of COVID-19, the mode of transmission, treatment and prevention principles of the disease. Correct answers were given 1 point, while incorrect and unknown responses were assigned 0 points. A total of 12 score was attributed to the knowledge test of KAP with higher scores denoting better understanding of the disease by the subject.

Attitude aspect towards COVID-19 was assessed by 2 components, whether COVID-19 can be ultimately controlled or not; and whether they have the belief that their respective countries can achieve this goal.

The subject's practice in preventing disease transmission was assessed by whether they had gone to a crowded place recently and whether they had worn masks while going out.

Statistical analysis

Categorical variables were presented in frequencies and percentages, while numerical variables by arithmetic mean±standard deviation (SD) for normally distributed data, or by median (25^{th}; 75^{th} quartile) for not normally distributed data. Binary logistic regression was performed to assess predictors of knowledge test scores, attitudes and practices towards COVID-19. Hosmer-Lameshow goodness of fit test of binary logistic regression models were not significant ($p>0.05$) indicating good fit of the models, while the Nagelkerke R^2 variation showed effect size regarding our models.

RESULTS

A total of 1069 subjects have completed the survey. After excluding 37 subjects because of the exclusion criteria, the final sample consisted of 1032 subjects. The dominant characteristics of the sample were: 615 (59.6%) were females except India where the majority were males (93; 62.0%), a mean age of 31.23±12.94 years, 705 (68.3%) single, 469 (45.4%) had high school degree or lower education level expect in Kosovo, (106; 59.5%) where the majority held a bachelor's degree, 528 (51.1%) were students, and 824 (79.8%) lived in an urban environment (Table 1).

Table 1. Demographic characteristics of the subjects presented in five countries

Variable		No (%) of participants in the country				
		B&H (n=132)	India (n=150)	Romania (n=265)	Kosovo (n=178)	Germany (n=307)
Gender	Female	103 (78.0)	57 (38.0)	161 (60.7)	113 (63.5)	181 (58.9)
	Male	29 (22.0)	93 (62.0)	104 (39.3)	65 (36.5)	126 (41.1)
Age	18-29	128 (96.9)	24 (16.0)	191 (72.1)	138 (77.5)	175 (57.0)
	30-49	3 (2.3)	49 (32.7)	58 (21.9)	35 (19.6)	106 (34.5)
	50+	1 (0.8)	77 (51.3)	16 (6.0)	5 (2.9%)	26 (8.5)
Marital status	Single	120 (90.9)	24 (16.0)	221 (83.4)	133 (74.7)	207 (67.4)
	Married	12 (9.1)	126 (84.0)	44 (16.6)	45 (25.3)	100 (32.6)
Education level	High school or lower	55 (41.7)	87 (58.0)	94 (35.5)	34 (19.1)	199 (64.8)
	Bachelor's degree	44 (33.4)	16 (10.7)	92 (34.7)	106 (59.5)	67 (21.8)
	Master's degree	25 (18.9)	47 (31.3)	62 (23.4)	36 (20.2)	38 (12.3)
	PhD degree	8 (6.0)	0	17 (6.4)	2 (1.2)	3 (1.1)
Occupation	Student	103 (78.0)	27 (18.0)	157 (59.2)	106 (59.5)	135 (43.9)
	Mental labour	20 (15.1)	54 (36.0)	73 (27.5)	25 (14.0)	94 (30.6)
	Physical labour	2 (1.5)	53 (35.3)	17 (6.4)	14 (5.2)	48 (15.6)
	Unemployed	7 (5.4)	16 (10.7)	18 (6.9)	33 (21.3)	30 (9.9)
Living environment	Urban	118 (89.4)	123 (72.0)	232 (87.5)	142 (79.8)	209 (66.1)
	Rural	14 (10.6)	27 (18.0)	33 (12.5)	36 (20.2)	98 (33.9)

B&H, Bosnia and Herzegovina;

The correct answer rates on questions 1 to 12 of the COVID-19 knowledge test were between 60.6% and 91.8%: 89.8%, 61.1%, 75.9%, 76.4%, 60.6%, 77.1%, 87.1%, 64.9%, 82.9%, 86.8%, 88.1% and 91.8%, respectively, with a median score of 10.0 (8.0, 11.0). Overall knowledge test scores varied across different countries ranging from lowest knowledge test scores in India of 7.0 (6.0, 8.0), to the highest test scores in Romania of 11.0 (10.0, 11.0) (Table 2).

A multiple linear regression model showed that being male (β: -0.437; p=0.003) and older age group (>30) (β: -0.028; p<0.001) were associ-

Table 2. Knowledge test, attitudes and practices questionnaire results in five countries

Parameter	B&H N=132	India N=150	Romania N=265	Kosovo N=178	Germany N=307
Knowledge test results (median, 25th, 75th percentile)	10.0 (8.5, 11.0)	7.0 (6.0, 8.0)	11.0 (10.0, 11.0)	10.0 (9.0, 11.0)	10.0 (9.0, 11.0)
Answer	**No (%) of participants per country**				
	A1: Agreeing that COVID-19 will finally be contained				
Yes	47 (35.6)	60 (40.0)	158 (59.6)	88 (49.4)	122 (39.7)
No	39 (29.5)	74 (49.3)	36 (13.6)	35 (19.7)	93 (30.3)
I don't know	46 (34.9)	16 (10.7)	71 (26.8)	55 (30.9)	92 (30.0)
	A2: Agreeing that the country will win the fight against COVID-19				
Yes	70 (53.0)	94 (62.7)	179 (67.5)	108 (60.7)	265 (86.3)
No	62 (47.0)	56 (37.3)	86 (32.5)	70 (39.3)	42 (13.7)
	P1: Visiting crowded places				
Yes	42 (31.8)	70 (46.7)	107 (40.4)	60 (33.7)	123 (40.1)
No	90 (68.2)	80 (53.3)	158 (59.6)	118 (66.3)	184 (59.9)
	P2: Wearing face masks outside home				
Yes	121 (91.7)	136 (90.7)	250 (94.3)	171 (96.1)	250 (81.4)
No	11 (8.3)	14 (9.3)	15 (5.7)	7 (3.9)	57 (18.6)

B&H, Bosnia and Herzegovina;

ated with lower knowledge scores, while being single (β: 1.026; p<0.001) and being employed in mental labour sector (β: 0.402; p=0.032) were associated with higher knowledge test scores. Regarding attitudes, 716 (69.3%) of the subjects agreed that their country would win the fight versus COVID-19 and only 475 (46.0%) agreed that the virus would be finally contained (Table 3). No independent predictors were determined for any of the attitudes included in the questionnaire.

The vast majority of the participants had not visited any crowded place, 630 (61.0%), and wore masks when they were going out, 928 (89.9%) in recent days. Binary logistic model showed that being female (OR=0.731; p=0.022), having higher knowledge scores (OR=0.929; p=0.017) and being a mental worker (OR=0.713; p=0.031) were associated with decreased exposure to crowded places. The model showed no statistical significance (p=0.301); it explained 2.4% (Nagelkerke R2) and correctly classified 62.2% of cases (Table 3).

High school or lower level of education (OR=0.616; p=0.024) decreased the action of wearing a mask in public places, while higher knowledge scores (OR=1.112; p=0.013) increased it. The model showed no statistical significance (p=0.290); it explained 3% (Nagelkerke R2) and correctly classified 89.7% of cases (Table 3).

Table 3. Multiple linear regression model in association with knowledge test scores and independent predictors determined by logistic regression model in association with various practices towards COVID-19

K: Multiple linear regression model in association with knowledge test scores

Variable	β Coefficient	t	p
Gender (male vs female)	-0.437	-3.002	0.003
Age (>30 vs younger)	-0.028	-3.602	<0.001
Education (Master's degree and above vs other)	0.331	1.690	0.091
Marital status (single vs married)	1.026	5.188	<0.001
Employment (mental labour vs other)	0.402	2.149	0.032
Variable	**OR**	**95% CI**	**p**
P1: Independent predictors in association with visiting crowded places			
Gender (female vs male)	0.731	0.559-0.955	0.022
Knowledge score (high vs low)	0.929	0.875-0.987	0.017
Employment (mental labour vs other)	0.713	0.525-0.969	0.031
P2: Independent predictors in association with wearing face masks in public places			
Education (high school and lower vs other)	0.616	0.405-0.937	0.024
Knowledge scores (high vs low)	1.112	1.023-1.210	0.013

t, t-test; OR, Odds ratio; CI, Confidence interval
P1: The model was not statistically significant (p=0.301); it explained 2.4% (Nagelkerke R2) and correctly classified 62.2% of cases
P2: The model was not statistically significant (p=0.290); it explained 3% (Nagelkerke R2) and correctly classified 89.7% cases;

DISCUSSION

Our results showed that most of the respondents were aware of the existence of COVID-19 with knowledge questions correct rates varying between 60.6% and 90.8%, similarly with studies from other regions of the world (9,12) and with studies relating to other epidemics (13,14). Variations between correct rates of knowledge questions regarding the novel coronavirus are explained by the variability of the population included in the study. Our study sample was mostly represented with females (except in India where the majority were males) and had a high school degree or lower (except in Kosovo where the majority held a bachelor's degree). Furthermore, not all subjects had the same access to new platforms, Internet, television and other mass media, which could lead to lack of knowledge regarding COVID-19.

Knowledge test results varied through the population studied by geographical area, which could

be a consequence, the same one as for knowledge correct rates. We identified age and marital status as strong predictors for higher knowledge test scores, as well as the gender, which was also significantly associated with the grade of information about the COVID-19. These results are supported by other research that demonstrated that females and older age are more aware and informed about infectious diseases (13,15). Moreover, data from the literature described an association between knowledge, high-income and education (16). Therefore, it is essential to target risk groups represented by young people, low-educated, low-income, and males.

Concerning infectious diseases and their spread, other studies showed that higher knowledge scores are associated with positive attitudes and lower risk of dangerous practices (17,18).

Regarding attitudes, our subjects mostly agreed that their country would win the fight versus COVID-19 and less than half agreed that the virus would be finally contained. Our results showed a more pessimistic attitude regarding the potential control of the virus when compared with Saudi Arabia (94%) and China (90.8%) (9,12). One possible explanation of the phenomenon may be that the previously published studies analysed data after a short evolution of the spread of the disease; moreover, these results showed a higher level of confidence for the specified country control over the disease, 97.0 % for Saudi Arabia and 97.1% for China (9,12). The two countries took unprecedented measures for protecting the population, with extended lockdowns, multiple restrictions for individuals and conducted intensive awareness campaigns through news channels, which may explain the differences between our results and their responses (9). Another important factor that may influence subjects' attitudes is different psychological types of the subjects: it has been demonstrated that during a pandemic or a natural disaster, people tend to control their negative emotion less and express anxiety that may affect their attitude (19).

The level of knowledge and the attitude dictate the practice of a population concerning a selected theme (20). A proportion of 61% of the subjects included in our study did not visit any crowded place and 89.9% of the people wore masks while going out indicating a relatively appropriate level of adherence to preventive practices.

Our study had several limitations. Firstly, we performed a cross sectional questionnaire-based study and were unable to assess whether the practices and attitudes of the study population changed over time as the disease spread subsequently. Our study was also limited by the fact that we were unable to reach out those patients who did not have internet access and thus could not participate in the study. Apart from the restricted sample representativeness the lack of a standardized KAP questionnaire for COVID awareness was another limitation of the study. A population based standardized KAP questionnaire for COVID-19 needs to be made and implemented on a larger scale with easy access and understanding. Also, rural and often neglected sections of the society need to be attended. Further, such studies are recommended to look into the KAP of COVID-19 especially, in low socioeconomic and low-income vulnerable population groups. The KAP studies find their great utility in the development of policy strategies and healthcare programmes (21).

The results of our study showed that males were associated with lower knowledge scores, while older aged, being single and being employed in mental labour sector are associated with a higher knowledge test score. The results are similar to the data obtained in other research regarding infection with SARS or MERS, showing that males used significantly lower preventive measures than females (22,23). Regarding COVID-19 pandemic, older age males are considered at risk population and vulnerable in front of the disease. Other authors suggest that an efficient way of targeting this segment of the population is through females from their community or families (22).

The particularity of presented work consists of heterogeneity of the population by choosing countries with different profiles, and its unicity is given by the chosen time of evaluation, after approximately one year from the appearance of the pandemic, leading to valuable information about the evolution of perception from the general population toward the chosen topic.

In conclusion, our results imply that the health education may be more efficient if addressed to certain subgroups of population, taking into consideration the evaluated parameters. In particular, these targeted programs may be developed for people with lower level of education, for

males or for older age groups in order to obtain maximum results and better knowledge, positive attitudes and improved practices towards COVID-19 pandemic.

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