"Using behavioral insights to inform the COVID-19 vaccine response in Kosovo[1]: Population perceptions and interventions"☆

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ABSTRACT

Objective: Understand population perceptions in Kosovo[1] regarding COVID-19 vaccination to inform the pandemic response.

Methods: Five rounds of a cross-sectional survey in representative samples of adults during 2020–2021. Analysis includes descriptive statistics, hierarchical cluster analysis, segmentation and logistic regressions.

Results: Self-reported intention to vaccinate increased after the introduction of COVID-19 vaccines in Kosovo.[1] In less than one year, vaccination intentions increased from 36% to 66% of those unvaccinated. Predictors for vaccine intentions included gender, age, trust in health authorities. Segmentation analysis identified population segments that had high vaccine nintentions but low uptake, informing messages and campaign initiatives designed to translate intentions into behavior.

Conclusion: Identifying people's perceptions and behavior is essential to support evidence-based policy making, especially during outbreak response.

Innovation: BI is an innovative focus of research in Kosovo [1] where little BI data had been collected prior, and provided a unique understanding of population views, attitudes and behaviors related to COVID-19. These findings were not only essential for an evidence-based pandemic response but also laid the foundation for future broad application of BI to inform interventions that seek to enable, support and promote health-related behaviurs in Kosovo[1]

1. Introduction

In a public health emergency such as the COVID-19 pandemic, it is critical to assess the populations' risk perceptions, behaviors, trust, knowledge, and health literacy alongside epidemiological and other data in order for health care institutions and other involved stakeholders to design and implement appropriate responses to the new situation [1]. The COVID-19 pandemic, declared by WHO on March 11th, 2020 [2], has had serious implications in terms of health, social, and economic outcomes for individuals and society in general. Public health authorities and organizations globally focused on several measures including non-pharmaceutical preventive methods [3], COVID-19 vaccine development and mass vaccination [4]. Both are essential public health strategies for increasing community-level immunity and preventing serious illness [5]. In response to the looming global public health emergency, Kosovo [1] institutions established a committee for communicable diseases and approved a preparedness action plan for COVID-19. When the first two positive cases were diagnosed in March 2020, preventive public health measures became mandatory: mask wearing, physical distancing and disinfecting surfaces, and these served throughout the pandemic as the main non-pharmaceutical public health measures in place. In the second year of the pandemic, vaccination

played the key role in pandemic management and infection prevention. Since the first COVID-19 vaccines became available on December, 11th 2020 [6], a major focus of research has been population perceptions, behaviors, attitudes, barriers and drivers related to vaccination against COVID-19. As vaccines were introduced, studies on COVID-19 vaccine acceptance and intentions [7] showed great variance between countries, ranging from very low to very high acceptance rates in different countries, as well as between different population groups, including related to gender and age. Complacency and worry about side effects were reported as reasons not to vaccinate while concern about severe disease motivated intentions to vaccinate [8].

The aim of our study is to investigate perceptions and behaviors of the population regarding COVID-19 vaccination over five rounds of data collection. Rounds of study conducted during the COVID-19 time are not intricately linked with the waves of the pandemic due to logistical, financial and methodological aspects in a rapidly evolving public health crisis. Design and execution of rigorous scientific studies demand careful consideration of ethical guidelines, methodology, participant recruitment, data collection, leading to results in study rounds that may not line up with the waves of pandemic. The specific objective is to understand drivers and barriers to vaccine intentions in the population in Kosovo.[1] The main hypothesis is that population perceptions regarding COVID-19 vaccination differed through study rounds and across socio demographic characteristics, epidemiological situation and current public health measures, including availability of the COVID-19 vaccines.

2. Methods

2.1. Study design and background

The research is based on data collected through a series of repeated cross-sectional surveys between September 2020 and July 2021. A total of five survey rounds were fielded every two months, except for the fifth round, which for practical reasons was collected four months after the previous round (September 2020, November 2020, January 2021, March 2021 and July 2021). Each round of the survey was conducted on a different sample of respondents while the majority of the questions remained unchanged. The study focused on a range of public health and social measures, however, for the purpose of this paper we have decided to fcus on the vaccination-related findings alone. The surveys were commissioned by the Institute of Public Health of Kosovo[1] (IPHK) with technical support and professional expertise of the World Health Organization (WHO) Office in Pristina and WHO Regional Office for Europe in Copenhagen.

2.2. Participants and study sample

Surveys were conducted using Computer Assisted Telephone Interviewing (CATI). To ensure random selection, random digit dialing was used combined with quota sampling, set at approximately 1000 respondents [9] per round, following distribution across Kosovo[1] per gender (male/female), place of residence (urban/rural), age groups (18–34 years, 35–54 years, above 55 years), and level of education (primary, secondary and higher education) (Appendix A, Table A.1). Groups excluded from the survey were foreigners (preventing communication and cultural difficulties), children under 18 (ensuring that participants have the legal capacity to provide informed consent), persons in hospitals, prisons, military facilities (ensuring that the study maintains focus on the desired population independent of specific environments or conditions), and persons without mobile phones (ensuring the practicality and relevance of methodology, minimizing data collection challenges and potentially boosting response rates).

2.3. Behavioral insights (BI) instrument and questionnaire

Data were collected using a standardized questionnaire developed by WHO Regional Office for Europe in collaboration with the University of Erfurt, Germany [9], and adopted for use in 30 European countries. Variables included: Socio-demographic; Personal experience with COVID-19; Health literacy; Perception of risk for COVID-19; Readiness and perceived self-efficacy; Prevention behaviors; Confidence in information sources; Use of information resources; Frequency of information search; Trust in institutions (perceptions); Policies, interventions (perceptions); Conspiracies (perceptions); Testing and tracing; Fairness (perceptions); Restrictions (pandemic transition phase); Unwanted behaviors; Well-being; COVID-19 vaccines. Socio-demographic variables included age, sex, geographical category (urban or rural) and education level. In Kosovo[1] this BI instrument was adopted to the pandemic situation and current public health and social measures (PHSM). Perception questions were measured using a seven-point Likert scale, average length of interview was 25 to 30 min.

2.4. Statistical analysis

The statistical data analysis was carried out using R notebook and SPSS package. This research presents the results of two types of analyses: descriptive and inferential.

2.4.1. Segmentation analysis

To help develop policy interventions and convert people's vaccine intention into vaccine uptake, insight was required to understand overall groups in Kosovo[1] with similar attitudes and perceptions pertaining to vaccination. To this end an attitudinal segmentation was implemented. The segmentation included the following input variables: whether the respondent reports that he/she is vaccinated, as well as the intention to get vaccinated for those who are not vaccinated [*Vaccination uptake and vaccination intention are measured by two distinct variables in the survey. However, for the purpose of this segmentation they are combined into a single derived variable. The derived variable is obtained by adding an additional category to the intention scale to capture having been vaccinated. As a result the variable measures vaccination intention and ranges from strongly disagreeing with wanting to get vaccinated to actually having been vaccinated*]; the strength of believing that vaccination can control the spread of COVID-19; the self-assessed extent to which the vaccination decision depends on effectiveness of the vaccine; the self-assessed extent to which the vaccination decision depends on the possibility of the vaccine having serious side-effects; the strength of believing that everyone should be vaccinated according to the routine immunization schedule; self-assessed COVID-19 related risk perception [*A three-part variable comprised of the self-assessed probability of getting infected with COVID; susceptibility to being infected with COVID-19; and the self-assessed severity of the disease were they to be infected with COVID-19*]; PHSM uptake index [*Index is calculated for each round of data collection using the available measures of self-reported protective behaviors present in that round*]. The intention was to create a behavioral segmentation that was driven purely by attitudes and self-reported practices. For this reason, demographic characteristics were not used to create the segments, but were used later to characterize the segments.

The segmentation was implemented using agglomerative hierarchical cluster analysis. Two key criteria were used to select the number of clusters. First, the segmentation implemented on the data collected in Kosovo[1] was part of a broader segmentation project coordinated by WHO Regional Office for Europe, and the structure of the segments needed to be comparable across health systems in WHO European Region. Second, the segments obtained needed to be able to clearly identify

distinct groups and be useful from a policy perspective. A 5-cluster solution was chosen based on these two criteria. The analysis was run using the 'cluster' library in R.

Following the segmentation, each of the 5 segments were profiled using a wide range of variables by tabulating them against the segments. To assess whether the differences between segments were noteworthy we carried out significance testing. We used z-score tests to compare proportions between each segment and the overall value for the entire sample. We deemed a difference to be statistically significant if it was below the 0.05 level.

2.4.2. Regression analysis

This section includes a set of regression analyses aimed at identifying the drivers of vaccine acceptance within each of the survey rounds. This enables us to look across time and try to draw conclusions about the changes in driver structure as the pandemic progressed. The original vaccination intention variable, measured using a 7-point Likert scale, was recoded into a dichotomous variable that indicates acceptance versus hesitancy: the highest 3 answers expressing agreement were recoded as 'acceptance' while the mid-point and the lowest 3 answer options expressing disagreement were recoded as 'hesitancy'. The analysis was implemented using logistic regression, with a separate regression being undertaken for each round. The results (Appendix A, Table A.3) are expressed using odds ratios, expressed on a logarithmic scale ranging between 0 and plus infinity. The value 1 indicates the lack of a relationship. Values between 0 and 1 indicate a negative impact, while values above 1 suggest a positive impact. Finally, model fit can be evaluated using Tjur's pseudo R^2 reported in Appendix A, Table A.3.

2.5. Ethical considerations

Ethical approval was obtained from the Ethics Committee, Chamber of Doctors in Kosovo[1] (protocol number 03/2020, date 24.06.2020), the Ethics Committee of IPHK (dated 12.05.2021) and Ethics Commission of the Faculty of Medicine, University of Pristina (protocol number 4381, dated 21.05.2021). Ethical approval was also granted by the WHO Ethical Review Committee (ERC.0003431 dated 17.10.2020). Participants were informed about the content of the study and they were free to withdraw anytime during the interview; verbal consent was obtained. This article presents part of results from the PhD thesis for first author.

3. Results

In the **first round** of the study, when COVID-19 vaccines were not yet available, results show that overall acceptance of future COVID-19 vaccines is fairly low. Over half (53%) say they would not get vaccinated if a vaccine becomes available and recommended for them, while 36% say they would (Fig. 1). Those who would not have the vaccine in particular include those who are younger, female, don't trust public health authorities or the medical sector, don't work in health care, think the pandemic is media hyped, perceive the virus to be spreading slowly, and search for information on COVID-19 less often (Appendix AA. 2). Over one third (35%) say they would not get vaccinated if they believed they had previously been infected with virus and/or if everyone else was vaccinated (33%) (Fig. 1).

The **second round** shows that over half of the respondents say they would not get vaccinated if a vaccine became available and was recommended for them, while 38% want to get vaccinated and 12% have not yet decided. Unwillingness to get vaccinated remains high (50%) although 48% report believing the vaccine can help control the spread of COVID-19.

During the **third round** as Figs. 2 and 3 highlight, vaccine acceptance significantly increases to 45% and fewer respondents express an unwillingness to get vaccinated, with 35% of respondents strongly against getting vaccinated. The belief in the effectiveness of the vaccine is 52%. The proportion of undecided respondents is 14%, strong doubters 34%.

The **fourth round** shows that vaccine acceptance reaches 53%, which is higher compared to the previous data, but concerns over vaccine safety continued to be high as well. The belief in the effectiveness of the vaccine is 57%. However, the proportion of undecided people is 13%, and strong doubters 30%.

During the **fifth round**, when vaccines become available in Kosovo,[1] the results show that 21% of the respondents say they have been already vaccinated. Men are more likely to say they have been vaccinated, especially those in older age groups (50–64, over 65) as well as people with chronic illness (Appendix A.2).

Focusing on the vaccination intentions of the remaining 79% of the sample, the analysis shows a statistically significant increase in acceptance rates to 66%. This can be compared to 53% in round 4 (four months earlier) or 36% (ten months earlier) in round 1. Moreover, the proportion of those who said they will definitely not get vaccinated drops to 16% compared to 46% in round 1.

Fig. 3 suggests that the round-on-round increases in vaccine intention are not statistically significantly different. However, when comparing round 1 and round 5, the difference attains statistical significance (calculated using the z score test for population proportions).
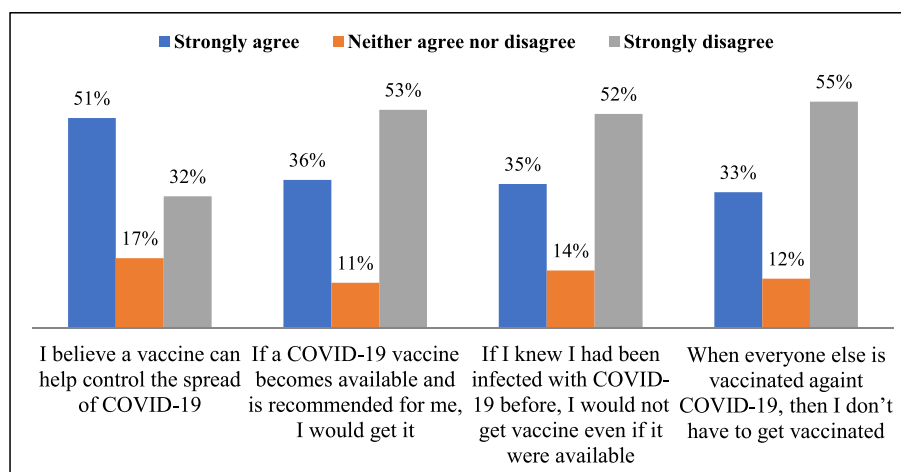

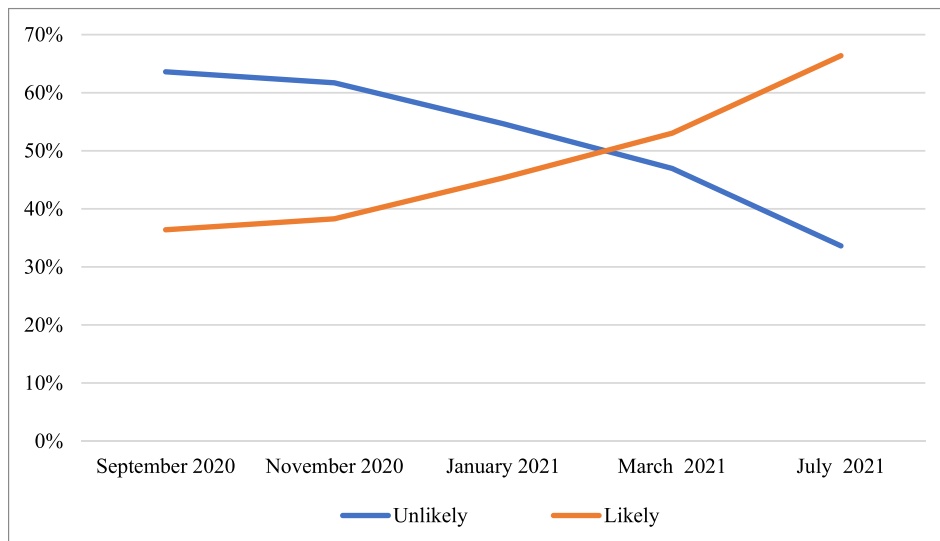**Fig. 1.** COVID -19 vaccination attitudes in Kosovo,[1] October 2020.

Fig. 2. COVID-19 vaccine intentions of those unvaccinated over time in Kosovo[1].
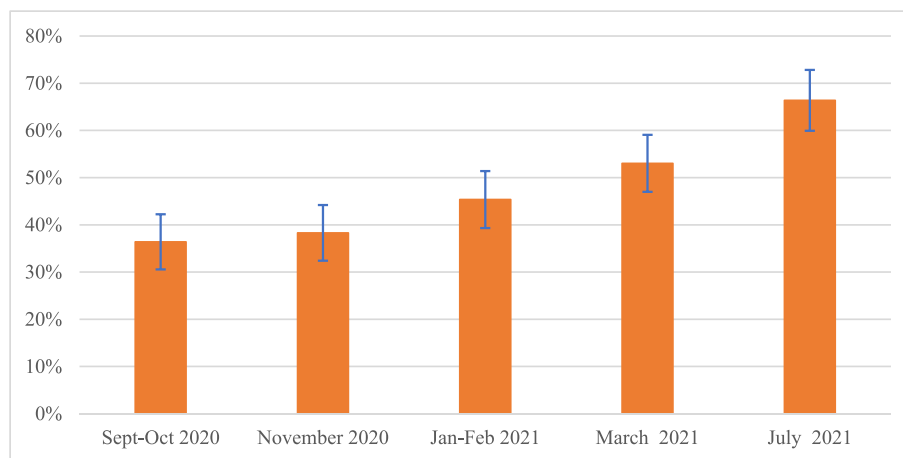

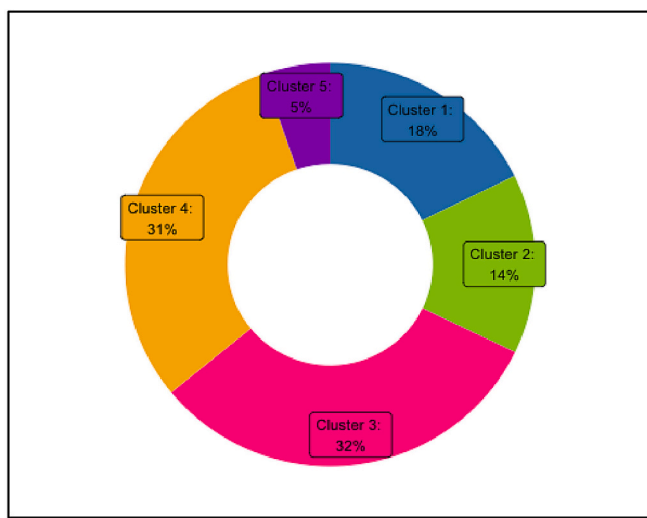**Fig. 3.** COVID-19 vaccine acceptance over time in Kosovo[1].

Fig. 4. COVID-19 vaccine uptake segments.

3.1. Vaccine acceptance segmentation analysis in Kosovo [1] in Round 5

The descriptive statistics suggest that by round 5, three months after vaccine introduction, there is a clear reversal of the trend in vaccine acceptance, with close to 70% of respondents agreeing that they intended to get vaccinated. To help achieve the conversion of vaccination intention into behavior—people actually getting vaccinated—the population was segmented using cluster analysis identifying 5 segments based on respondents' perceptions, attitudes and reported behaviors pertaining to COVID-19 vaccination. Fig. 4 shows the five segments in relation to each other while Fig. 5 shows the key factors within each cluster.

Cluster 1 (18%) includes strong vaccination skeptics, with lower vaccination uptake, less likely to support routine immunization, more likely to perceive that COVID-19 is media hyped and to perceive COVID-19 as being low risk for them. This group has less trust in medical professionals and in information from health authorities, the lowest average age, higher education levels but lower levels of health literacy.

Cluster 2 (14%) also includes skeptics, but their scepticism is directed towards their own risk of being affected by COVID-19, less so towards the existence of the virus. This group has lower vaccination uptake and intention but are not against routine immunization. They perceive themselves to be at low risk of COVID-19 infection and are less
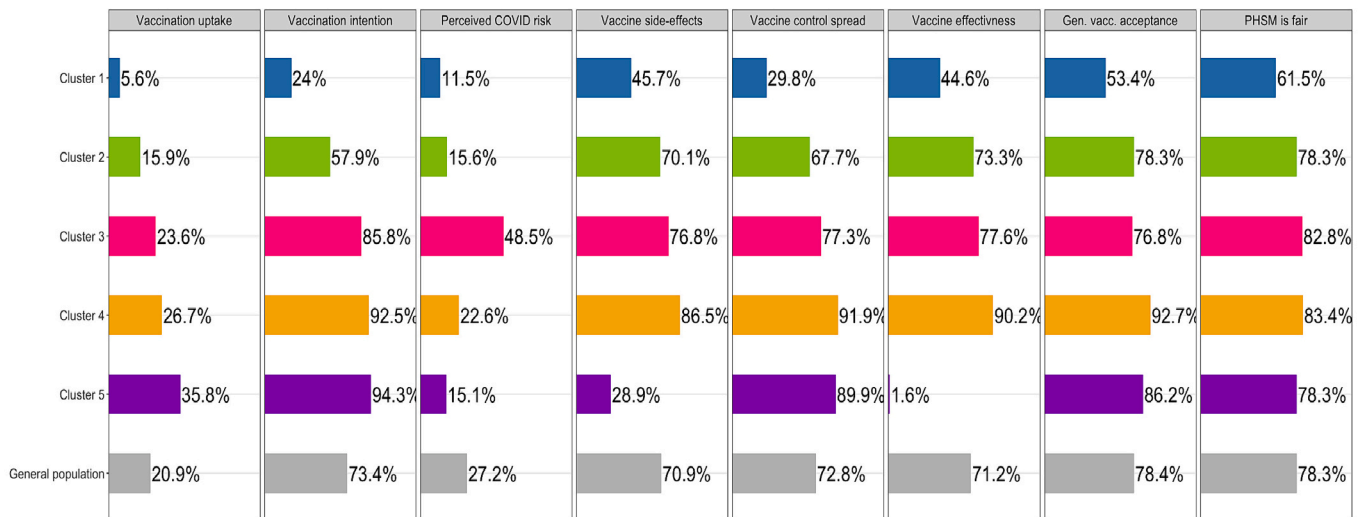
Fig. 5. Profiles of the COVID-19 vaccine uptake segments compared to the entire sample.

likely to believe the vaccine can control the spread of the virus.

Cluster 3 (32%) includes respondents who may be willing to get vaccinated but are worried. They are more likely to think about COVID-19 often and believe themselves to be at risk of COVID-19 but are also more concerned about the vaccines' side effects and effectiveness. This group has higher trust in medical professionals, are of average age, are more likely to be female with average education and health literacy.

Cluster 4 (31%) includes respondents that accept vaccination but display some concern and do not believe themselves to be at risk from COVID-19.

Finally, Cluster 5 (5%) contains the highest levels of vaccine acceptance.

The segmentation analysis shows that there are three groups of respondents (Clusters 3 through 5) who have high levels of vaccination intention, but relatively low uptake, that could be targeted to turn *intention* into *behavior*. To generate insight into how residents could be targeted, we carried out analysis to understand the drivers of vaccination intentions.

3.2. Comparing the drivers of vaccine intention over time

Table A.3 includes the results of the logistic regression aimed at identifying the drivers of vaccine acceptance in each of the five rounds.

The results indicate that there is a significant relationship between **gender** and vaccination intention: women, compared to men, are less likely to want to get vaccinated.

In round 1, there is a clear and significant positive effect of higher education status in favor of intending to get vaccinated. In this round, respondents 65 years and over appear to be more likely to accept a potential vaccine. This effect reemerges in round 4 and then strengthens in round 5. In these rounds respondents over 50 appear to be more likely to intend to get vaccinated, while younger people express lower vaccine intentions.

The results also indicate that as the level of **economic worry** increases (in rounds 3, 4 and 5) so does the intention of accepting the vaccine. There is a positive relationship between thinking that the **actions** taken by public health authorities (such as PHSM) in response to the pandemic were fair. The perceived risk of getting infected does have a positive effect on vaccination intention attitudes in the first three rounds, but not in rounds 4 and 5, which were both fielded after the

Omicron variant had emerged.

4. Discussion and conclusion

4.1. Discussion

The COVID-19 pandemic was a major global public health event that challenged, tested and exhausted health systems everywhere. In the aftermath of this overwhelming crisis whose consequences in terms of death, disease, financial cost and health and social system destruction may never be fully documented, it is critical to document and publish available data and studies and contribute to the joint global learning process. Throughout the five rounds of our study in Kosovo[1] we saw a steady increase in respondents' intentions to get vaccinated. Vaccine intentions increased between rounds 3 (January/ February 2021) and 4 (March 2021), when COVID-19 vaccines became available and were distributed as per the Kosovo[1] vaccination plan. During this same timeframe, the incidence of confirmed COVID-19 positive cases increased to 5908 positive COVID-19 cases per week, compared to January 2021 with 1975 cases (Appendix A, Table A.4). The worsening epidemiological situation might have impacted peoples' decisions on vaccine uptake and may have influenced individuals' choices regarding the acceptance of vaccines. Our data shows that financial worries may have also increased intentions. New public health policy initiatives are frequently met with scepticism before implementation but tend to gain greater acceptance after implementation [10]. However, public health authorities must be ready to address scepticism both in the short and long term. Even if the introduction of a new vaccine is initially successful, past experiences demonstrate that potential public concerns can change and negatively affect trust and adoption if not addressed on time [11].

Vaccines were a highly anticipated intervention for combating COVID-19, and hundreds of global institutions worked at incredible speeds to develop them [12-19]. The public's perceptions of vaccine and disease, as well as their attitudes towards the vaccine, influence vaccine acceptability [14]. A global systematic review of vaccine acceptance rates [20], conducted between March and December 2020, showed that the lowest rates were in Kuwait (23.6%), Jordan (28.4%), Italy (53.7), Russia (54.9%), Poland (56.3%), the United States (56.9%), and France (58.9%). Comparatively, round 1 data in Kosovo[1] showed that 36% of

respondents had positive vaccine intentions at this point before vaccines had become available.

The first shipment of COVID-19 vaccines arrived in Kosovo[1] at the end of March 2021 through COVAX mechanism [21]. Vaccination initially targeted people over 65 years old, people with chronic diseases (all ages) and health care workers. Mass vaccination started in the middle of June 2021 [22], beginning with teachers, security forces and other staff directly involved in managing COVID-19. During the third phase of the vaccination process, the general population became eligible, including children above 5 years old. As per WHO dashboard data on 30th of June 2023 [23], in Kosovo,[1] 46 out of 100 people have received two doses of vaccine (globally: 65 out of 100 people). Booster doses were showing very low rates, with only around 6 out of 100 people having received booster doses (globally: 30 out of 100 people) [24]. Despite increasing vaccine intentions over time, official statistics show that less than half the population in Kosovo[1] had received two doses of COVID-19 vaccine at the time of fifth round of study. Finding from our data show that people who were less willing to accept vaccines were younger adults, females and people with lower levels of education. This evidence was used to develop targeted interventions to increase vaccine acceptance. A qualitative pilot study in June 2021 [25], explored reasons for vaccine hesitancy among younger respondents (aged 16 to 29 years) and found concerns about the safety and contents of the vaccine and side effects. Female participants, in particular, expressed strong concerns about the vaccine's possible impact on fertility and a belief that the vaccine was not necessary for young people, who they saw as at low-risk for COVID-19. Facebook and other social media posts in Kosovo[1] around this time were spreading misinformation, especially related to infertility, and this may help explain the reluctance of younger people to vaccinate. The two studies together provided important insights into the state of vaccine acceptance and reasons behind. IPHK presented study results to Kosovo[1] health authorities, stakeholders and donors. Kosovo[1] public health authorities, the British Embassy in Pristina, and the United Nations Population Fund (UNFPA) with joint coordination of the United Nations Kosovo[1]Team (UNKT) and the association of Kosovo[1] municipalities, then used data and evidence from our study to develop and implement awareness raising campaigns for COVID-19 prevention, compliance with PHSM and preparations for the vaccination process [26]. The three-month awareness raising campaign drew attention of the population, and this might have positively impacted the increased intention that we saw for COVID-19 vaccination.

Our study contributes to the literature showing differences in vaccine acceptance over time as well as a variety of socio-demographic characteristics, barriers and drivers of acceptance of COVID-19 vaccines. Such studies are essential for understanding the context and achievement of COVID-19 vaccination programs [8,27]. Study also represents a strong and positive effort on the part of public health authorities in Kosovo[1] to include population perspectives in the response to the COVID-19 pandemic.

4.2. Innovation

BI is an innovative focus of research in Kosovo[1] where little BI data had been collected prior to the COVID-19 pandemic. BI provides a unique understanding of population views, attitudes and behaviors related to COVID-19. These findings make an important contribution to overall knowledge about COVID-19 and will be essential for the development of evidence-based policies and targeted interventions in Kosovo,[1] in particular regarding COVID-19 vaccine acceptance and pandemic preparedness. BI research bridges theoretical concepts with practical application, offering policymakers and relevant stakeholders' actionable insights and evidence to enhance public health interventions.

4.3. Conclusion

Evidence derived from this study enabled policymakers and public heath institutions in Kosovo[1] to recommend appropriate messages and to design tailored public health and social interventions. Understanding vaccine perceptions and motivators, how these are associated with demographic factors and self-reported behaviors is crucial for promoting pandemic preparedness in the future.

4.4. Limitations

This study has **limitations.** Not all variables were collected in every round of the survey, in particular during the period before vaccines became available.

Due to financial, logistical difficulties and, lack of workforce, regular or more frequent rounds of research were not able to be conducted.

CRediT authorship contribution statement

Florie Miftari Basholli: Conceptualization, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Merita Berisha:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing, Project administration. **Martha Scherzer:** Conceptualization, Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing. **Isme Humolli:** Conceptualization, Funding acquisition, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Naser Ramadani:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Katrine Bach Habersaat:** Conceptualization, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing. **Zsolt Kiss:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

Declaration of competing interest

All authors have seen and approved this manuscript. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors alone are responsible for the views expressed in this manuscript and they do not necessarily represent the decisions or policies of the World Health Organization.

Table A.1
Demographic data of respondents from study rounds in Kosovo [1].

Demographic data	Round I *Sept-Oct 2020*	Round II *November 2020*	Round III *Jan-Feb 2021*	Round IV *March 2021*	Round V *June 2021*
Age-group					
18–29	143	187	182	177	205
30–49	432	410	384	405	411
50–64	309	314	315	309	292
65+	116	89	120	116	100
Total	1000	1000	1001	1007	1008
Gender					
Male	575	609	507	564	598
Female	425	391	494	443	410
Total	1000	1000	1001	1007	1008
Residency					
Rural	559	496	451	518	538
Urban	441	504	550	489	470
Total	1000	1000	1001	1007	1008
Education					
Primary school	270	225	262	242	195
Secondary school	451	468	411	449	537
Higher education	279	307	328	316	276
Total	1000	1000	1001	1007	1008
Healthcare profession					
No	908	916	897	919	973
Yes	92	84	104	88	35
Total	1000	1000	1001	1007	1008
Chronic disease					
No	863	885	839	846	833
Yes	124	101	136	151	146
Don't know	13	14	26	10	29
Total	1000	1000	1001	1007	1008
Infected					
No	917	906	741	714	776
Yes	83	94	156	205	232
Don't know	0	0	104	88	0
Total	1000	1000	1001	1007	1008

Table A.2
Drivers of vaccine acceptance during Round 1 and 5 in Kosovo [1].

Round 1, October 2020				Round 5, June 2021			
If COVID-19 vaccine becomes available and is recommended for me, I would get it				I am completely confident that COVID-19 vaccination is safe			
Predictors	Beta	standardized CI	p	Predictors	Beta	standardized CI	p
Age	0.10	0.04–0.16	**0.002**	Age	2.22	1.73–2.87	**<0.001**
Gender: female (vs.male)	−0.14	−0.20–0.08	**<0.001**	Gender: female (vs.male)	0.82	0.55–1.22	0.328
Working in healthcare	−0.11	−0.17–0.05	**<0.001**	Education: secondary (vs.primary)	1.83	1.11–3.07	**0.02**
Perceived susceptibility	0.09	0.03–0.15	**0.004**				
Trust in the government	0.20	0.14–0.26	**<0.001**				
Perceiving virus as spreading fast	0.08	0.02–0.14	**0.010**	Education: terciary (vs.secondary)	2.76	1.55–4.99	**0.001**
Perception of media hype	−0.08	−0.14–0.01	**0.015**				
Frequency of searching for information	0.07	0.01–0.13	**0.023**	Belonging to risk group	3.38	2.11–5.43	**<0.001**
Observations: 1000				Observations: 1008			
R^2 / adjusted R^2 0.163 / 0.152				R^2 / adjusted R^2 0.079 / 0.277			

Table A.3
Vaccine intentions: dependent variables from study rounds in Kosovo[1]

	Sep-20	Nov-20	Jan-21	Mar-21	Jul-21
Intercept	0.02 ***	0.01 ***	0.02 ***	0.03 ***	0.02 ***
Female (Ref: Male)	0.69 *	0.65 *	0.52 ***	0.59 **	0.72
Age: 20–49 (Ref: [18–29])	1.02	0.79	0.94	1.24	1.37
Age: 50–64 (Ref: [18–29])	1.15	0.85	0.83	1.72 *	3.19 ***
Age: > 65 (Ref: [18–29])	2.03 *	0.86	1.17	1.94 *	4.04 **
Education: Secondary (Ref: Primary or no education)	1.23	0.92	0.82	0.8	1.06
Education: Higher education (Ref: Primary or no education)	1.81 *	0.99	0.73	0.95	1.47
Perception of COVID-19 risk (probability of getting COVID)	1.21	0.95	1.26	1.36	1.39
Worry about negative economic consequences	1.08	1.17	1.67 *	1.72 **	2.36 ***
Thinking a recommendation for the vaccine from a GP is important	1.01	0.99	1.01	1.20 **	1.11
Thinking a recommendation for the vaccine from the MOH is important	1.21 ***	1.31 ***	1.18 *	1.19 **	1.11
Trusting medical professionals (GPs)	1.09	1.09	1.01	1.09	1.03
Trusting medical professionals (hospitals)	1	1.14 *	0.94	1.03	1.04
Trusting information from medical professionals	1.09	1.09	1.15 **	0.95	1.12
Considering the risk of getting infected when vaccine is available	1.24 ***	1.14 *	1.16 *	1.04	1.01
Thinking it's important for the vaccine to be easy to get	1.06	0.99	1.05	1.02	1.11
Thinking the vaccine does not have serious side-effects	1.02	1.03	1.16 **	1.04	1.03
Thinking that COVID-19 is media hyped	0.75	0.66 **	1	0.74	0.79
Seeking information about COVID-19 frequently	1.03	1.12 **	1	1.03	1.14 **
Thinking PHSM measures are fair	0.98	1.11	1.47 ***	1.23 *	1.32 *
Observations	*865*	*940*	*827*	*879*	*793*
R^2 Tjur	*0.242*	*0.246*	*0.328*	*0.253*	*0.25*

Note: results of logistic regressions, odds ratios are reported. * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

DEMOGRAPHIC DATA	Round I Sept-Oct 2020	Round II November 2020	Round III Jan-Feb 2021	Round IV March 2021	Round V June 2021
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GENDER					
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Secondary school	451	468	411	449	537
Higher education	279	307	328	316	276
Total	1000	1000	1001	1007	1008
HEALTHCARE PROFESSION					
No	908	916	897	919	973
Yes	92	84	104	88	35
Total	1000	1000	1001	1007	1008
CHRONIC DISEASE					
No	863	885	839	846	833
Yes	124	101	136	151	146
Don't know	13	14	26	10	29
Total	1000	1000	1001	1007	1008
INFECTED					
No	917	906	741	714	776
Yes	83	94	156	205	232
Don't know	0	0	104	88	0
Total	1000	1000	1001	1007	1008

Fig. A.1. Public health and social measures in Kosovo[1] during COVID-19 Pandemic.
Source: https://covid19.who.int/region/euro/country/xk

Table A.4
Epidemiological situation in Kosovo[1] during study round 3 and 4

Week	Confirmed cases	Weekly change %
11–17.01.2021	1975	10.21
18–24.01.2021	2201	11.44
25–31.01.2021	2235	1.54
01–07.02.2021	2075	−7.16
08–14.02.2021	2086	0.53
01–07.03.2021	3697	31.0
08–14.03.2021	4148	13.2
15–21.03.2021	4704	12.3
22–28.03.2021	5675	20.6
29.03–04.04.2021	5908	4.11

Source: https://covid19.who.int/region/euro/country/xk

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