



Psychosocial factors associated with the intention to get a COVID-19 booster vaccine: evidence from a low-income country

Dayanne Orellana^{1,2} · Andrea Mercado³ · Eric Roth²

Received: 5 December 2022 / Accepted: 7 May 2023

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023

Abstract

Aim To identify psychosocial predictors of the intention to get a booster COVID-19 vaccine in a low-income country, given that increasing booster vaccination rates against COVID-19 remains a global challenge, especially among low- and middle-income countries (LMIC).

Subject and methods We used an online survey to collect responses from a non-probabilistic sample of 720 Bolivians regarding vaccine uptake, motives, perceived confidence, information sources, attitudes favouring COVID-19 vaccines, biosafety behaviour, and sociodemographic characteristics. Descriptive, bivariate, and multivariate analyses were performed to identify significant associations and predictors.

Results We found that having already received the third dose, obtaining recommendations from family or friends, recommendation from the government, perceived confidence in the previously received dose, and higher attitudes in favour of COVID-19 vaccines significantly predicted the intention to get a booster dose. The associations were significant even when adjusting the model for sociodemographic variables.

Conclusion Including certain psychosocial factors could enhance the promotion of voluntary booster doses among residents of low- and middle-income countries such as Bolivia, where cultural, social, political, and contextual variables may influence health behaviour and increase health-associated risk factors.

Keywords COVID-19 · Vaccines · Secondary immunisation · Intention · Health behaviour

Introduction

The COVID-19 pandemic became one of the most significant threats to public health. After unprecedented economic and scientific efforts, several vaccines to prevent the

coronavirus were finally developed in record time (Davis et al. 2021), in order to control the spread of the virus to achieve population-wide immunity (Al-Amer et al. 2022; Davis et al. 2021). However, increasing people's willingness and voluntary decision to get a vaccine remains a challenge worldwide (Graeber et al. 2021; Al-Amer et al. 2022), mainly when referring to additional doses and their efficacy. Thus, making booster doses available and increasing their acceptance to guarantee immunity, especially for the delta variant (Mahase 2021) became an important global issue. There is still much controversy around promoting a booster vaccination dose. However, its use based on scientific evidence of its utility is encouraged while addressing the necessity to vaccinate more populations and guarantee vaccine equity (Centers for Disease Control and Prevention 2022; Croda and Ranzani 2021; Krause et al. 2021).

Between 2021 and the beginning of 2022, only 18% of the world population and only 9% of the Bolivian population received a booster dose of the COVID-19 vaccine (Holder 2021; Our World in Data n.d.). Bolivia showed

✉ Dayanne Orellana
dayaorellana@gmail.com

Andrea Mercado
andre.mantelo@gmail.com

Eric Roth
eroth@ucb.edu.bo

¹ Instituto de Investigaciones en Ciencias del Comportamiento (IICC), Universidad Católica Boliviana “San Pablo”, Av. 14 de Septiembre N° 4807, La Paz, Bolivia

² Experimental Research Unit (UIE), Department of Psychology, Universidad Católica Boliviana “San Pablo”, La Paz, Bolivia

³ Universidad Católica Boliviana “San Pablo”, Santa Cruz, Bolivia

one of the lowest rates in the region and among low- and middle-income countries (LMICs). Regarding vaccination intention, evidence shows that, globally, the overall intention ranged from 27.7% to 93.3% during the first year of the pandemic (Al-Amer et al. 2022). Despite little evidence being available when referring to the intention to receive a booster vaccine, research shows evidence in several populations: ranging from 91.1% to 84.80% in Chinese individuals (Lai et al. 2021; Tung et al. 2022), 62% in adult Americans (Yadete et al. 2021), or 71% within Poland's population (Rzymiski et al. 2021b).

Intention is a precondition for decision-making (Kesting 2006). Therefore, it is an essential variable to promote voluntary booster vaccine uptake. Vaccination intention may include the willingness to get a vaccine, acceptability, desirability, and positive attitudes towards it (Al-Amer et al. 2022). During the pandemic, research all around the globe enabled the identification of several contextual and individual COVID-19 disease-specific and vaccine-specific factors that may influence the variable in different samples. Differences in age, gender, educational level, ethnic identity, and even political affiliations have been found regarding vaccination intention (Kwok et al. 2021; Soares et al. 2021; Wong et al. 2021). In addition, concerning psychological variables, vaccination intention has been linked to beliefs and attitudes apropos perceived efficacy, confidence, the severity of COVID-19, COVID-19 vaccines, and information related to these topics (Biswas et al. 2021; Huynh et al. 2021; Sherman et al. 2021; Wismans et al. 2021).

On the other hand, some authors started exploring the intention to get a COVID-19 vaccine booster dose and its association with psychological and contextual variables such as the perceived effectiveness, safeness, risk, and necessity of the COVID-19 vaccines (Folcarelli et al. 2022; Rzymiski et al. 2021a; Tung et al. 2022), having received a previous dose (Tung et al. 2022), or side effect intensity experienced with past doses (Rzymiski et al. 2021b). Overall findings seem to be coincident with general vaccine intention-associated factors, such as higher perceived safeness and confidence in the COVID-19 vaccines, higher vaccine literacy, higher educational level, higher age, and more positive attitudes toward vaccination (Lai et al. 2021; Pal et al. 2021; Rzymiski et al. 2021b; Sugawara et al. 2021; Yadete et al. 2021).

Given that there are many reasons why an individual may not express an intention to get a booster dose, it is crucial to identify the predictor variables of COVID-19 booster dose vaccination intention in contexts such as Bolivia, which, among many LMICs, faced particular contextual barriers that increased health risks during pandemics (Anand et al. 2020). COVID-19 in general and vaccines in particular have been accompanied by political and sociocultural issues that

may negatively affect vaccination intention, such as a higher preference for traditional medicine, even supported by the government (Swissinfo.ch 2022), false information concerning COVID-19 and the vaccines (i.e., the virus being a hoax, or vaccines turning people into werewolves) (Médicos sin fronteras 2021), or anti-vaccine movements (Aliaga 2022), reflecting strong sociocultural influences on health behaviour. Hence, new evidence may contribute to public health messages and general vaccine promotion to be more precise and successful (Gatwood et al. 2021; Moola et al. 2021).

Due to the complexity and available evidence on vaccination intention, the influence of different individuals and particular contextual factors needs more attention. Given the peculiarity of social and cultural beliefs related to the COVID-19 vaccines in Bolivia, the influences on vaccination intention and intention to get a booster dose remain unknown. Therefore, our study aimed to explore the contextual and psychological predictors of the intention to get a booster vaccine in the Bolivian population. We hypothesise that several individuals and contextual factors regarding COVID-19 and vaccines may influence Bolivians' vaccination intention. Within these factors, we included: (a) factual information about respondents' vaccine uptake (i.e., number of received doses), (b) motives for receiving the vaccination, (c) perceived confidence in the COVID-19 vaccine, (d) information sources, (e) attitudes in favour of COVID-19 vaccines, and (f) biosafety behaviour during COVID-19.

Method

Participants

Initially, we collected data from 820 Bolivian people. However, for the purposes of the study, only people who have received at least one dose of the vaccine were included in the final sample ($N = 720$). The final sample included 63.9% of women ($n = 460$). Participants ranged from 17 to 85 years old ($M = 26.61$; $SD = 13.108$). The sample size calculation was made based on previous recommendations for logistic regression from observational analysis (Bujang et al. 2018), employing the formula $n = 100 + xi$, where x represents an integer representing 50 events per variable (EPV) and i represents the approximate number of observed variables (12). Therefore, we needed a minimum sample of 700 people.

Procedure

The survey was constructed by the team members based on several pieces of literature precedents. Due to the pandemic context, data collection was done remotely using Google Forms. An open call for participation was published on social media (Facebook, Instagram). The inclusion criteria

were being 18 years old or older, living in Bolivia, and having received at least one dose of the COVID-19 vaccine. The first part of the form asked if participants received a COVID-19 vaccine; if they marked they had not, the survey closed. The form required between 8 and 12 minutes to be completed. After participants finished the survey, they were asked to share the call with their contacts (snowball sampling). Data were collected between October and November of 2021.

Measurement

Before the first section, respondents needed to declare if they had received any dose of the COVID-19 vaccine; if not, they would automatically skip section 1.

Factual information about respondents' vaccine uptake Participants were asked about (a) which COVID-19 vaccine they had received; this variable was dichotomised based on the vaccine origin: western or eastern; (b) whether they had the minimum required dose total (half dose; full dose); (c) whether a third dose had been administered; (d) the time elapsed since the last dose was administered, measured on a five-point scale from 1 = less than a week to 5 = more than 6 months.

Motives for obtaining a vaccine The likelihood of receiving the COVID-19 vaccine if asked to do so by family/friends, government health officials, the church, or the media (less likely, same likelihood, more likely).

Information sources Participants were asked to check their most frequented sources of information related to COVID-19 topics; options included radio, television, social media, etc. These options were later recategorised to identify if the respondents employed scientific sources of information or were informed by government authorities.

Perceived confidence Five items measured the perceived contrast of each vaccine brand available during that period in Bolivia. The mean score of all the brands was used for the analysis. Additionally, participants needed to rate their perceived confidence in their received vaccine. Both types of measurement included a seven-point Likert scale.

Attitudes in favour of COVID-19 vaccines A five-point Likert scale with seven items related to beliefs and attitudes regarding vaccines was developed. After performing an exploratory factor analysis (EFA), we found that all the items measured a single common factor, explaining 60.31% of the total variance. The instrument's reliability was acceptable ($\alpha = .89$). The final score of this variable was an average of all items.

Biosafety behaviour To check if different types of health behaviours were related, we included the components of the Self-Care in COVID (SCCOVID) scale (De Maria et al. 2020). This scale measured the reported frequency of behaviours related to (a) individual protective measures (e.g., "don't touch (your own) eyes, nose, or mouth with your hands when outside the home, even when wearing gloves"), (b) social distancing (e.g., "restricted from leaving home"), and (c) environmental disinfection (e.g., "ensure home hygiene using chlorine- or alcohol-based products"). All items were responded to on a five-point Likert scale (1 = never; 5 = always). The scale's reliability was acceptable (Cronbach's $\alpha = .89$) within our sample.

Sociodemographic information This section included sex, age, educational level, individual COVID-19 contagion experience, and COVID-19 contagion or death of a relative.

Intention to get a booster vaccine Consistent with other studies' measurements with one item (Wismans et al. 2021; Wong et al. 2021; Lai et al. 2021; Babicki and Mastalerz-Migas 2022), we included the question, "Would you be willing to take a booster dose of COVID-19?", with a five-point Likert answer ranging from 1 = definitely not, to 5 = definitely yes. Later we dichotomised the responses as 0 = no intention (from 1 to 3 points) and 1 = intention to get a booster dose (4 points = yes and 5 points = definitely yes).

Data analysis

First, descriptive data were obtained for all continuous data and categorical data. Then, bivariate associations were performed employing the chi-square test and Student's *t*-test to identify significant relations between the dependent variable (DV) and the possible predictors. Fourteen variables from which statistical significance ($p < .05$) was reported were included in the multivariate analysis: vaccine origin, the minimum required dose completed, the third dose received, the time elapsed since the last dose received, getting information from government authorities, getting information from scientific sources, perceived confidence in COVID-19 vaccines in general, perceived confidence in the previously received vaccine, family and friends/government authorities recommending COVID-19 vaccination, church recommending COVID-19 vaccination, media recommending COVID-19 vaccination, biosafety norms, and attitudes in favour of COVID-19 vaccines.

Data exploratory analysis revealed that our five-point DV (intention) was highly skewed (-1.01). Therefore, we decided to use the dichotomous variable for the multivariable analysis. After checking for multicollinearity, having correlations lower than $r = .5$ between continuous variables, we performed crude and adjusted binomial logistic

regression models to calculate the odds ratio for having the intention to get a booster dose of COVID-19, and its 95% confidence intervals. We included the number of iterations, the omnibus test, the Nagelkerke pseudo- R -squared, and the Hosmer–Lemeshow goodness of fit for both models. The crude model included 14 possible predictors with previous evidence of significant association with the DV within the sample. The adjusted model included age, sex, and received postgraduate education, variables which, despite not having shown a significant association with the DV in this study, are statistically relevant in previous studies (Folcarelli et al. 2022; Rzymiski et al. 2021b). All statistical analysis was performed on IBM SPSS Statistics 26 software.

Results

Descriptive statistics and bivariate associations

Of 820 respondents, only 89.20% ($N = 720$) had already received at least one dose of the COVID-19 vaccine (final sample). Within this group, 83.1% ($n = 671$) received the total dose, and only 12.2% ($n = 80$) reported receiving the third dose. Table 1 presents the descriptive statistics for sociodemographic data and categorical variables related to vaccine intake for the complete sample and for subsamples of people with and without the intention to get a booster dose. No statistical associations were found between the DV (intention to get a booster dose) with sex, age, the vaccine origin, the time elapsed since the last dose, or getting information from the government or scientific sources.

We found that having postgraduate studies ($\chi^2 = 6.21$; $p < .05$), having the minimum required vaccination dose ($\chi^2 = 13.65$; $p < .01$), having received a third dose ($\chi^2 = 25.77$; $p < .01$), and receiving recommendations from family and friends ($\chi^2 = 45.77$; $p < .01$), from government authorities ($\chi^2 = 40.51$; $p < .01$), from a church ($\chi^2 = 8.11$; $p < .01$), and from general media ($\chi^2 = 27.08$; $p < .01$) were associated with reporting intention to receive a booster dose of the COVID-19 vaccine.

Additionally, Table 2 shows descriptive statistics in terms of means and standard deviations for continuous variables related to vaccine intake for the complete sample, and comparing between subsamples of people without and with the intention to get a booster dose. Results show that participants with an intention to get a booster dose also showed higher means for perceived confidence in the previously received vaccine ($t = 8.57$; $p < .01$) and in COVID-19 vaccines in general ($t = 7.38$; $p < .01$), biosafety behaviour ($t = 4.32$; $p < .01$), and positive attitudes towards COVID-19 vaccines ($t = 13.05$; $p < .01$).

Modelling the intention to receive a booster dose of the COVID-19 vaccine

Table 3 presents the odds ratios, 95% confidence intervals, and statistical significance for the crude and adjusted binomial logistic models. First, five iterations were performed concerning the crude model, obtaining a final -2 log-likelihood of 676.12. The omnibus test suggested significant differences between the predictive model without the predictors and the final model containing them ($\chi^2_{(14)} = 236.25$; $p < .001$). This model included 14 variables, from which six were significant predictors of the DV: perceived confidence in the previously received vaccine (OR = 1.27; 95% CI 1.06–1.52); having already received a third dose (OR = 4.10; 95% CI 1.75–9.59); time elapsed since the last dose received (OR = 1.24; 95% CI 1.01–1.52); attitudes in favour of COVID-19 vaccines (OR = 1.17; 95% CI 1.12–1.23); having family and friends who recommend COVID-19 vaccination (OR = 2.13; 95% CI 1.43–3.17); and having government authorities who recommend COVID-19 vaccination (OR = 1.71; 95% CI 1.12–2.61). We obtained a Nagelkerke pseudo- R^2 of .39, and 77.9% of cases were correctly classified for this model.

The second model includes adjustments by including the participants' age, sex, and educational status. We obtained a -2 log-likelihood of 674.59, and the omnibus test suggested significant differences between the predictive model without the predictors and the final model containing them ($\chi^2_{(17)} = 237.77$; $p < .001$). Hosmer-Lemeshow's goodness of fit test suggested that the data were adequately fitted in the model. Of the 14 variables introduced originally, only five remained significant after adjusting for age, gender, and educational status: perceived confidence in the previously received vaccine (OR = 1.26; 95% CI 1.05–1.51); having already received a third dose (OR = 3.71; 95% CI 1.53–8.99); attitudes in favour of COVID-19 vaccines (OR = 1.17; 95% CI 1.12–1.23); having family and friends who recommend COVID-19 vaccination (OR = 2.15; 95% CI 1.44–3.20); and having government authorities who recommend COVID-19 vaccination (OR = 1.76; 95% CI 1.15–2.70). The model correctly classified 77.8% of predicted cases, and a Nagelkerke pseudo- R^2 of .39 was obtained.

Conclusions and discussion

The main objective of this study was to identify significant predictors of the intention to receive a booster dose of the COVID-19 vaccine within a Bolivian sample. It was found that (1) having already received the third dose, (2) receiving recommendations by family, friends, and the government to receive vaccination, (3) perceived confidence in the previously received dose, and (4) showing attitudes in favour of

Table 1 Descriptive statistics for categorical variables and their association with vaccine intention

	Total sample <i>n</i> (%)	Without intention <i>n</i> (%)	With intention <i>n</i> (%)	χ^2	<i>p</i>
Sex					
Female	460 (63.9)	158 (34.3)	302 (65.7)	1.182	.28
Male	260 (36.1)	79 (30.4)	181 (69.6)		
Age groups					
17–20 years	199 (27.6)	69 (34.7)	130 (65.3)	2.53	.47
21–24 years	196 (27.2)	41 (36.6)	71 (63.4)		
25–39 years	146 (20.3)	43 (34.4)	82 (65.6)		
More than 40 years	179 (24.9)	84 (29.6)	200 (70.4)		
Educational level					
Up to high school	278 (38.6)	97 (34.9)	181 (65.1)	6.21	*
Up to college	311 (43.2)	109 (35.0)	202 (65.0)		
Up to postgraduate studies	131 (18.2)	31 (23.7)	100 (76.3)		
Vaccine origin					
Eastern	544 (75.6)	175 (32.2)	369 (67.8)	.563	.45
Western	176 (24.4)	62 (35.2)	114 (64.8)		
Minimum required dose					
No	136 (18.9)	63 (46.3)	73 (53.7)	13.65	**
Yes	584 (81.1)	174 (29.8)	410 (70.2)		
Third dose received					
No	632 (87.7)	229 (36.2)	403 (63.8)	25.77	**
Yes	88 (12.2)	8 (9.1)	80 (90.9)		
Time elapsed since the last dose					
Less than a week	44 (6.1)	17 (38.6)	27 (61.4)	2.245	.69
Less than a month	125 (17.4)	40 (32.0)	85 (68.0)		
Less than 2 months	257 (35.7)	900 (35.0)	167 (65.0)		
Less than 4 months	246 (34.2)	77 (31.3)	169 (68.7)		
More than 6 months	48 (6.7)	13 (31.3)	35 (72.9)		
Getting information from government authorities					
No	629 (87.4)	214 (34.0)	415 (66.0)	2.76	.10
Yes	91 (12.6)	23 (25.3)	68 (74.7)		
Getting information from scientific sources					
No	387 (53.8)	136 (35.1)	251 (64.9)	1.88	.17
Yes	333 (46.3)	101 (32.9)	232 (69.7)		
Having family and friends who recommend COVID-19 vaccination					
No	292 (40.6)	138 (47.3)	154 (52.7)	45.77	**
Yes	428 (59.4)	99 (23.1)	329 (76.9)		
Having government authorities who recommend COVID-19 vaccination					
No	392 (54.4)	169 (43.1)	223 (56.9)	40.51	**
Yes	328 (45.6)	68 (32.9)	260 (79.3)		
Having the church recommending COVID-19 vaccination					
No	583 (81.0)	206 (35.3)	377 (64.7)	8.11	**
Yes	137 (19.0)	31 (22.6)	106 (77.4)		
Having media recommending COVID-19 vaccination					
No	487 (67.6)	191 (39.2)	296 (60.8)	27.08	**
Yes	233 (32.4)	46 (19.7)	187 (80.3)		

* $p < .05$; ** $p < .01$

Table 2 Descriptive statistics of continuous variables and their association with vaccine intention

	Total sample M ± SD	Without intention M ± SD	With intention M ± SD	Student's <i>t</i>	<i>p</i>
Perceived confidence in the received vaccine (1)	5.49 (1.29)	4.88 (1.44)	5.78 (1.09)	8.57	**
Perceived confidence in general COVID-19 vaccines (2)	3.84 (1.69)	3.20 (1.65)	4.16 (1.63)	7.38	**
Biosafety behaviour (3)	45.79 (7.78)	43.94 (8.39)	46.69 (7.30)	4.32	**
Positive attitudes toward COVID-19 vaccines (4)	28.98 (5.28)	25.30 (5.89)	30.79 (3.84)	13.05	**

** *p* < .01

COVID-19 vaccines significantly predicted the intention to get a booster dose of COVID-19 vaccine. These results provide helpful evidence for addressing unprotected or not-fully protected subpopulations (see Alvarez Zuzek et al. 2022), and they might also help design better promotion programs and campaigns to increase the low vaccination rate of the Bolivian and global population with a booster dose of the COVID-19 vaccine. In addition, the findings encourage decision-makers to include several psychological and social

variables, such as the influence of family and friends or the perceived confidence in the last dose received, to increase voluntary vaccination of booster doses against COVID-19.

Recently, increased attention and efforts have been focused on promoting the uptake of booster doses of COVID-19 vaccines in different groups worldwide; however, global rates of people vaccinated with a booster dose are still low (Centers for Disease Control and Prevention 2022; European Medicines Agency 2022). Special

Table 3 Crude and adjusted logistic models for predicting the intention to get a booster dose

Predictor	Subgroups	OR _{cr} (95% CI)	OR _{adj} (95% CI)
Vaccine origin	Western (Ref.)	-	-
	Eastern	1.16 (0.72–1.87)	1.15 (0.71–1.85)
Minimum required dose completed	No (Ref.)	-	-
	Yes	0.98 (0.59–1.63)	0.97 (0.58–1.62)
Third dose received	No (Ref.)	-	-
	Yes	4.10 (1.75–9.59) **	3.71 (1.53–8.99) **
Getting information from government authorities	No (Ref.)	-	-
	Yes	1.12 (0.61–2.06)	1.12 (0.61–2.06)
Getting information from scientific sources	No (Ref.)	-	-
	Yes	1.22 (0.78–1.92)	1.24 (0.77–1.91)
Perceived confidence in COVID-19 vaccines in general	No (Ref.)	-	-
	Yes	1.13 (0.98–1.26)	1.11 (0.97–1.26)
Perceived confidence in previously received vaccine	No (Ref.)	-	-
	Yes	1.27 (1.06–1.52) **	1.26 (1.06–1.51) *
Having family and friends who recommend COVID-19 vaccination	No (Ref.)	-	-
	Yes	2.13 (1.43–3.17) ***	2.15 (1.44–3.20) ***
Having government authorities who recommend COVID-19 vaccination	No (Ref.)	-	-
	Yes	1.71 (1.12–2.61) *	1.76 (1.15–2.71) *
Having the church recommending COVID-19 vaccination	No (Ref.)	-	-
	Yes	0.90 (0.51–1.63)	0.91 (0.51–1.64)
Having media recommending COVID-19 vaccination	No (Ref.)	-	-
	Yes	1.11 (0.68–1.80)	1.12 (0.69–1.83)
Time elapsed since the last dose received		1.24 (1.01–1.52) *	1.22 (0.99–1.50)
Biosafety norms		1.01 (0.98–1.03)	1.01 (0.98–1.03)
Attitudes in favour of COVID-19 vaccines		1.17 (1.12–1.23) ***	1.17 (1.12–1.23) ***

Abbreviations: cr = crude model (−2 log-likelihood = 676.12; $\chi^2_{(14)} = 236.25$; Nagelkerke pseudo- $R^2 = 0.39$)adj = adjusted model (−2 log-likelihood = 674.594; $\chi^2_{(17)} = 237.77$; Nagelkerke pseudo- $R^2 = 0.39$)* *p* < .05; ** *p* < .01; *** *p* < .001

attention might be given in particular contexts, including most of those from LMICs, where sociocultural and psychological variables may influence health behaviour and increase health-associated risk factors (Anand et al. 2020). Our findings are consistent with previous studies concerning the influence of perceived confidence in COVID-19 vaccines on vaccination intention (Wismans et al. 2021; Sherman et al. 2021). Additionally, to have the intention to get a booster dose, it is also essential to perceive confidence and efficacy in previously received doses (Rzymiski et al. 2021b; Tung et al. 2022).

We also identified that having family or friends who recommend a booster dose is a significant predictor of vaccination intention. This may be related to the social and collective responsibility for receiving the COVID-19 vaccine (Wismans et al. 2021; Yu et al. 2021); this variable refers to “the willingness to protect others by one's vaccination through herd immunity” (Wismans et al. p.7). However, this motivation regarding protecting others may not be the only explanation. Social influence and social contagion have also been related to behavioural intention to receive a booster dose in past studies (Alvarez Zuzek et al. 2022; Zhao et al. 2021). Therefore, the influence one may receive from relatives and friends may be critical to improving vaccination campaigns, especially additional doses.

We also found two significant predictors of receiving a booster dose in Bolivia related to the government: receiving information regarding the booster dose from official government organisations, and the influence that the government exerts on its people (via coercive or persuasive methods). These results are consistent with past studies showing that trust in the government or having it as an information source is associated with vaccine intention and behaviour during the pandemic (Al-Amer et al. 2022; Biswas et al. 2021; Folcarelli et al. 2022; James et al. 2021; Pal et al. 2021; Yadete et al. 2021). This information is crucial, as it confirms the role and obligation of the government to promote, via the best means, the receipt of booster doses among its citizens. Our findings also support government authorities' essential role in increasing the intention of receiving a booster by improving public health messages and vaccine promotion (Gatwood et al. 2021; Moola et al. 2021).

Regarding demographic factors, no significant differences were found by sex, age, or educational level, similar to results found in previous studies (Sherman et al. 2021). Additionally, we found no significant associations between the source of information regarding COVID-19 and vaccines, and the intention to get a booster dose. These results contrast with those of previous studies that found significant associations between vaccine acceptability and perceptions, and different sources such as television and official governmental sites (Huyhn et al. 2021) or scientific sources (Nomura et al. 2021). Therefore, further studies and more

diverse populations are required to further explore these relationships.

Finally, concerning the number of received doses, we found no significant association between intention and having the minimum required dose. However, we found that participants who had already received a third dose were more willing to obtain an additional booster dose. To our knowledge, there is still no evidence supporting or contradicting this result. However, the first people authorised to receive the third dose in Bolivia were at-risk groups (elderly and immunocompromised patients). Therefore, this group's high risk of contagion might help explain their intention to get the fourth dose.

Study limitations

This is the first study that collected data on people's intention to get a booster dose of the COVID-19 vaccine in Bolivia and its associated factors. Although data were collected in several cities, one limitation is the lack of representativity due to possible data collection bias and the lack of a probabilistic sample. People with access to the Internet and social media had higher chances of receiving an invitation to the online survey. Moreover, we employed two self-reported questionnaires (biosafety behaviour and attitudes towards vaccination) that may need further psychometric testing for the Bolivian population, especially the questionnaire on attitudes, as it was a self-developed measure. Nevertheless, we tried to ensure reliability with Cronbach's alpha and factorial validity by performing exploratory factor analysis in both measures. Additionally, the dependent variable (vaccine intention) was measured by only one item. Although data from this study may serve as a precedent for future studies in the country and the region, the authors encourage researchers to include additional measures on vaccine intention.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s10389-023-01937-x>.

Acknowledgments We thank Brenda Copa, Angeles Reyes, and Leyna Conde for their assistance during the survey construction and data collection. We also thank Ana María Arias Ph.D. and Luis Adolfo Mercado Ph.D. for their useful advice on aspects of the data analysis. We also thank Guido Urizar, Ph.D., for his time reviewing the study and giving feedback.

Author contributions Conceptualisation: DO; Instrument construction: DO, ER, BC, LC, AR; Data collection: AM, DO, BC, LC, AR; Data analysis: DO, AM, ER; Writing, review & editing, DO and AM; Supervision and validation: ER. All authors have read and agreed to the published version of the manuscript.

Funding This work was financially supported by the Bolivian Catholic University.

Data availability The data described in this article are available in the Open Science Framework at <https://osf.io/nh93t/>

Declarations

Ethical approval Ethical approval from the Institutional Review Board at Universidad Católica Boliviana “San Pablo” was waived due to the study design and its implications. As a cross-sectional anonymised study, no ethical approval was required. However, in order to guarantee ethical standards, and based on the 8th section of the APA’s Ethical Principles of Psychologists and Code of Conduct (American Psychological Association 2017), we specified—through the callout and the survey’s informed consent—that participation was voluntary, anonymous, and confidential, and that no risks of any type were associated with the participation. Informed consent was obtained from all the participants.

Consent for publication No consent for publication was required as no personal information is published.

Conflict of interest disclosure The authors declare to have no conflict of interest regarding the research, authorship, and/or publication of this article.

References

- Al-Amer R, Maneze D, Everett B, Montayre J, Villarosa AR, Dwekat E, Salamonsen Y (2022) COVID-19 vaccination intention in the first year of the pandemic: A systematic review. *J Clin Nurs* 31(1–2):62–86. <https://doi.org/10.1111/JOCN.15951>
- Aliaga J (2022) Bolivia: La campaña contra el Covid-19 choca contra las bases antivacunas del MAS. *France 24*. Retrieved from <https://www.france24.com/es/am%C3%A9rica-latina/20220108-bolivia-vacunacion-gobierno-mas-contagios>. Accessed 15 Sept 2022
- Alvarez Zuzek LG, Zipfel C, Bansal S (2022) Spatial clustering in vaccination hesitancy: The role of social influence and social selection (PPR442382). <https://doi.org/10.1101/2022.01.11.22269032>
- American Psychological Association (2017) Ethical principles of psychologists and code of conduct. Retrieved from <https://www.apa.org/ethics/code>. Accessed 15 Sept 2022
- Anand S, Bradshaw C, Prabhakaran D (2020) Prevention and management of CVD in LMICs: Why do ethnicity, culture, and context matter? *BMC Med* 18(1):7. <https://doi.org/10.1186/s12916-019-1480-9>
- Babicki M, Mastalerz-Migas A (2022) Attitudes of poles towards the COVID-19 vaccine booster dose: an online survey in Poland. *Vaccines (Basel)*. 10(1):68. <https://doi.org/10.3390/vaccines10010068>
- Biswas MR, Alzubaidi MS, Shah U, Abd-Alrazaq AA, Shah Z (2021) A Scoping Review to Find Out Worldwide COVID-19 Vaccine Hesitancy and Its Underlying Determinants. *Vaccines* 9(11):1243. <https://doi.org/10.3390/VACCINES9111243>
- Bujang MA, Sa’at N, Sidik TMITAB, Joo LC (2018) Sample Size Guidelines for Logistic Regression from Observational Studies with Large Population: Emphasis on the Accuracy Between Statistics and Parameters Based on Real Life Clinical Data. *Malaysian J Med Sci: MJMS* 25(4):122–130. <https://doi.org/10.21315/mjms2018.25.4.12>
- Centers for Disease Control and Prevention. (2022) COVID-19 booster shot. Centers for disease control and prevention. Retrieved from <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/booster-shot.html>. Accessed 3 Mar 2022
- Croda J, Ranzani OT (2021) Booster doses for inactivated COVID-19 vaccines: If, when, and for whom. *Lancet Infectious Dis*. [https://doi.org/10.1016/S1473-3099\(21\)00696-4](https://doi.org/10.1016/S1473-3099(21)00696-4)
- Davis CJ, Golding M, McKay R (2021) Efficacy information influences intention to take COVID-19 vaccine. *British J Health Psychol*. <https://doi.org/10.1111/BJHP.12546>
- De Maria M, Ferro F, Ausili D, Alvaro R, De Marinis MG, Di Mauro S, Matarese M, Vellone E (2020) Development and Psychometric Testing of the Self-Care in COVID-19 (SCCOVID) Scale, an Instrument for Measuring Self-Care in the COVID-19 Pandemic. *Int J Environ Res Public Health* 17(21):7834. <https://doi.org/10.3390/ijerph17217834>
- European Medicines Agency (2022) EMA recommends authorisation of booster doses comirnaty from 12 years age. European medicines agency. Retrieved from <https://www.ema.europa.eu/en/news/ema-recommends-authorisation-booster-doses-comirnaty-12-years-age>. Accessed 10 June 2022
- Folcarelli L, Miraglia del Giudice G, Corea F, Angelillo IF (2022) Intention to Receive the COVID-19 Vaccine Booster Dose in a University Community in Italy. *Vaccines* 10(2):146. <https://doi.org/10.3390/vaccines10020146>
- Gatwood J, McKnight M, Fiscus M, Hohmeier KC, Chisholm-Burns M (2021) Factors influencing likelihood of COVID-19 vaccination: A survey of Tennessee adults. *Am J Health-System Pharm* 78(10):879–889
- Graeber D, Schmidt-Petri C, Schröder C (2021) Attitudes on voluntary and mandatory vaccination against COVID-19: evidence from Germany. *PLOS ONE* 16(5):e0248372. <https://doi.org/10.1371/journal.pone.0248372>
- Holder J (2021) Tracking coronavirus vaccinations around the world. *The New York times*. Retrieved from <https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html>. Accessed 15 Sept 2022
- Huynh G, Tran TT, Nguyen HTN, Pham LA (2021) COVID-19 vaccination intention among healthcare workers in Vietnam. *Asian Pacific J Tropical Med* 14(4):159. <https://doi.org/10.4103/1995-7645.312513>
- James EK, Bokemper SE, Gerber AS, Omer SB, Huber GA (2021) Persuasive messaging to increase COVID-19 vaccine uptake intentions. *Vaccine* 39(49):7158–7165. <https://doi.org/10.1016/j.vaccine.2021.10.039>
- Kesting P (2006) The Meaning of Intentionality for Decision Making. *SSRN Electronic J*. <https://doi.org/10.2139/ssrn.887088>
- Krause PR, Fleming TR, Peto R, Longini IM, Figueroa JP, Sterne JAC, Cravioto A, Rees H, Higgins JPT, Boutron I, Pan H, Gruber MF, Arora N, Kazi F, Gaspar R, Swaminathan S, Ryan MJ, Henao-Restrepo A-M (2021) Considerations in boosting COVID-19 vaccine immune responses. *Lancet (London, England)* 398(10308):1377–1380. [https://doi.org/10.1016/S0140-6736\(21\)02046-8](https://doi.org/10.1016/S0140-6736(21)02046-8)
- Kwok KO, Li K-K, WEI, W. I., Tang, A., Wong, S. Y. S., & Lee, S. S. (2021) Influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: A survey. *Int J Nurs Stud* 114:103854. <https://doi.org/10.1016/j.ijnurstu.2020.103854>
- Lai X, Zhu H, Wang J, Huang Y, Jing R, Lyu Y, Zhang H, Feng H, Guo J, Fang H (2021) Public Perceptions and Acceptance of COVID-19 Booster Vaccination in China: A Cross-Sectional Study. *Vaccines* 9(12):Article 12. <https://doi.org/10.3390/vaccines9121461>
- Mahase E (2021) Covid-19 booster vaccines: What we know and who’s doing what. *BMJ* n2082. <https://doi.org/10.1136/bmj.n2082>
- Médicos sin fronteras (2021) “Hombres lobo” y miedo a las vacunas: enfrentamos los mitos sobre COVID-19 en Bolivia. Médicos Sin Fronteras Argentina. Retrieved from <https://www.msf.org.ar/actualidad/hombres-lobo-y-miedo-a-las-vacunas-enfrentamos-los-mitos-sobre-covid-19-en-bolivia>. Accessed 10 Jun 2022
- Moola S, Gudi N, Nambiar D, Dumka N, Ahmed T, Sonawane IR, Kotwal A (2021) A rapid review of evidence on the determinants of and strategies for COVID-19 vaccine acceptance in low- and

- middle-income countries. *J Global Health* 11:05027–05027. PubMed. <https://doi.org/10.7189/jogh.11.05027>
- Nomura S, Eguchi A, Yoneoka D, Kawashima T, Tanoue Y, Murakami M, Sakamoto H, Maruyama-Sakurai K, Gilmour S, Shi S, Kunishima H, Kaneko S, Adachi M, Shimada K, Yamamoto Y, Miyata H (2021) Reasons for being unsure or unwilling regarding intention to take COVID-19 vaccine among Japanese people: A large cross-sectional national survey. *Lancet Regional Health - Western Pacific* 14:100223. <https://doi.org/10.1016/J.LANWPC.2021.100223>
- Our World in Data (n.d.) Share of people vaccinated against COVID-19. Mar 1:2022
- Pal S, Shekhar R, Kottewar S, Upadhyay S, Singh M, Pathak D, Kapuria D, Barrett E, Sheikh AB (2021) COVID-19 Vaccine Hesitancy and Attitude toward Booster Doses among US Healthcare Workers. *Vaccines* 9(11):11. <https://doi.org/10.3390/vaccines9111358>
- Rzymiski P, Poniedziałek B, Fal A (2021a) Willingness to Receive the Booster COVID-19 Vaccine Dose in Poland. *Vaccines* 9(11):1286. <https://doi.org/10.3390/vaccines9111286>
- Rzymiski P, Zeyland J, Poniedziałek B, Małecka I, Wysocki J (2021b) The Perception and Attitudes toward COVID-19 Vaccines: A Cross-Sectional Study in Poland. *Vaccines* 9(4):382. <https://doi.org/10.3390/vaccines9040382>
- Sherman SM, Smith LE, Sim J, Amlôt R, Cutts M, Dasch H, Rubin GJ, Sevdalis N (2021) COVID-19 vaccination intention in the UK: Results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. *Human Vaccines Immunotherapeutics* 17(6):1612–1621. <https://doi.org/10.1080/21645515.2020.1846397>
- Soares P, Rocha JV, Moniz M, Gama A, Laires PA, Pedro AR, Dias S, Leite A, Nunes C (2021) Factors Associated with COVID-19 Vaccine Hesitancy. *Vaccines* 9(3):300. <https://doi.org/10.3390/VACCINES9030300>
- Sugawara N, Yasui-Furukori N, Fukushima A, Shimoda K (2021) Attitudes of Medical Students toward COVID-19 Vaccination: Who Is Willing to Receive a Third Dose of the Vaccine? *Vaccines* 9(11):11. <https://doi.org/10.3390/vaccines9111295>
- Swissinfo.ch (2022) El Gobierno de Bolivia alienta la medicina tradicional contra la covid-19. *SWI swissinfo.ch*. Retrieved from https://www.swissinfo.ch/spa/coronavirus-bolivia_el-gobierno-de-bolivia-alienta-la-medicina-tradicional-contra-la-covid-19/46272836. Accessed 10 Jun 2022
- Tung T-H, Lin X-Q, Chen Y, Zhang M-X, Zhu J-S (2022) Willingness to receive a booster dose of inactivated coronavirus disease 2019 vaccine in Taizhou, China. *Expert Rev Vaccines* 21(2):261–267. <https://doi.org/10.1080/14760584.2022.2016401>
- Wismans A, Thurik R, Baptista R, Dejardin M, Janssen F, Franken I (2021) Psychological characteristics and the mediating role of the 5C Model in explaining students' COVID-19 vaccination intention. *PLOS ONE* 16(8):e0255382. <https://doi.org/10.1371/journal.pone.0255382>
- Wong LP, Alias H, Danaee M, Ahmed J, Lachyan A, Cai CZ, Lin Y, Hu Z, Tan SY, Lu Y, Cai G, Nguyen DK, Seheli FN, Alhammadi F, Madhale MD, Atapattu M, Quazi-Bodhanya T, Mohajer S, Zimet GD, Zhao Q (2021) COVID-19 vaccination intention and vaccine characteristics influencing vaccination acceptance: A global survey of 17 countries. *Infect Dis Poverty* 10(1):122. <https://doi.org/10.1186/s40249-021-00900-w>
- Yadete T, Batra K, Netski DM, Antonio S, Patros MJ, Bester JC (2021) Assessing Acceptability of COVID-19 Vaccine Booster Dose among Adult Americans: A Cross-Sectional Study. *Vaccines* 9(12):12. <https://doi.org/10.3390/vaccines9121424>
- Yu Y, Luo S, Mo PK, Wang S, Zhao J, Zhang G, Li L, Li L, Lau JT (2021) Prosociality and Social Responsibility Were Associated With Intention of COVID-19 Vaccination Among University Students in China. *Int J Health Policy Manag* 0. <https://doi.org/10.34172/ijhpm.2021.64>
- Zhao M, Liu H, Qu S, He L, Campy KS (2021) Factors associated with parental acceptance of influenza vaccination for their children: The evidence from four cities of China. *Human Vaccines Immunotherapeutics* 17(2):457–464. <https://doi.org/10.1080/21645515.2020.1771988>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.