

USING THE HEALTH BELIEF MODEL TO PREDICT VACCINATION INTENTION IN UNVACCINATED ADULTS IN LATVIA DURING THE COVID-19 PANDEMIC

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Communicated by Ilze Konrāde

Vaccination is a global health development success story that saves millions of lives every year and reduces the risk of getting various infectious diseases, including COVID-19. At the end of 2021, a rapid increase in the size of the population infected with COVID-19 and a low vaccination coverage were observed in Latvia (Centre for Disease Prevention and Control, 2021). Also, despite the available vaccines, by the beginning of May 2022, only 60.6% of the population of Latvia had completed the full course of vaccination against COVID-19. According to the Ministry of Health, the vaccination process is characterised by variability and flexibility, and in general, vaccination rates have declined in recent years. Therefore, the aim of the study was to investigate the vaccination predicting factors of unvaccinated adults in Latvia using the Health Belief Model (HBM) during the COVID-19 pandemic. The study sample consisted of 539 respondents aged 18 to 75 years ($M = 45.35$, $SD = 15.70$), who were not vaccinated against COVID-19 and who had to make a decision to vaccinate or not, and who were part of a representative sample of Latvian residents ($n = 1017$). The data was collected in September and were analysed using Spearman's rank correlation coefficient and multivariate linear regression analysis. A statistically significant moderate strong positive correlation was shown between vaccination intention and all six vaccination motives as perceived benefits ($r = 0.40\text{--}0.44$, $p < 0.01$); statistically significant but weak positive correlation between vaccination intention and risk appraisal as perceived threat ($r = 0.20$, $p < 0.01$) and COVID-19 experience as cues to action ($r = 0.20$, $p < 0.01$); and statistically significant negative but weak correlation for vaccination intention and fear of vaccination as perceived barriers ($r = -0.21$, $p < 0.01$). The results revealed a statistically significant positive association of vaccination intention and the components of HBM: perceived threats, perceived benefits and cues to action, as well as a statistically significant negative association with perceived barriers. The results revealed several factors that predict vaccination intention, explaining 32% of the variation in vaccination intention: education level, perceived threats, perceived benefits, perceived barriers, and cues to action. Higher levels of education, higher perceived threat of contracting COVID-19, many different social motives for vaccination (e.g., to be able travel), confidence that the vaccine will not cause significant side effects and long-term consequences, and experience with COVID-19 are factors that predicts an individual's intention to vaccinate against COVID-19.

Keywords: COVID-19 experience, cues to action, fear of vaccination, perceived barriers, perceived benefits, perceived threat, risk appraisal, vaccination motive.

INTRODUCTION

Until May 2022, more than 513 million cases of COVID-19 disease were reported all over the world (WHO, 2022). The

COVID-19 morbidity rates and the pandemic caused by COVID-19 drew the attention of the whole world to the infectious diseases and forced officials, governments and various institutions to take drastic measures for containment

of the pandemic (for example, hand washing, social distancing, quarantine implementation) (Neto *et al.*, 2021). Vaccination against COVID-19 as “an effective instrument of control, which reduces the overall morbidity rates, especially prevents severe COVID-19 disease cases, thus reducing the frequency of hospitalisation and mortality” (Centre for Disease Prevention and Control, 2021). The development and implementation of effective vaccination strategies contribute to reduction of the hospitalisation of COVID-19 patients as well as decrease the COVID-19 mortality rates (WHO, 2021). Also, the COVID-19 pandemic and the differences in vaccine uptake in various countries have highlighted issues on vaccination behaviour. The main question was, how to achieve an increase of the vaccination rates and what are the factors that influence the intent of vaccination and behaviour.

Vaccination against various diseases is a global health development success story, which saves the lives of millions and reduces the risk to contract various infectious diseases. However, the World Health Organisation has declared that despite the significant health development progress, the vaccination coverage globally has reduced in the last years. For the first time in ten years, in 2020, it declined again (WHO, 2022). Studies show that the vaccine hesitancy is related to both various cultural differences and political and psychological reasons (Hossain *et al.*, 2021), as well as due to active COVID-19 anti-vaccine movements (Greenberg *et al.*, 2019). At the same time, researchers have discovered that at least 60–72% herd immunity should be reached as a result of vaccination in order to stop spread of COVID-19 in society (Anderson, 2020).

Regardless that, at the end of 2020, in Europe the vaccination against COVID-19 was started (European Commission, 2021), Europe was one of the world's regions where due to COVID-19 pandemic a large number of deaths was reported from 2020 to 2021, when infecting with COVID-19 was both a direct and indirect cause of death (WHO, 2022). On 28 December 2020, vaccination against COVID-19 was launched in Latvia, and the first recipients of the vaccine were health care workers who treat patients with COVID-19 and employees of the Emergency Medical Assistance Service (Centre for Disease Prevention and Control, 2020). According to the number of available vaccines, support was given to expand the groups of persons to be vaccinated as soon as possible, incl. seniors in the age group 60+ and people with chronic diseases, employees of state administration and state security institutions (Ministry of Health, 2021a; 2021b). According to the COVID-19: Vaccination Strategy Implementation Plan and Vaccination Plan developed by the Ministry of Health, it was planned to vaccinate at least 60% of the population by the end of the third quarter of 2021 (30.09.2021) and to reach 82% of the total population (Ministry of Health, 2021a; 2021b). In order to communicate with the public to promote vaccination against COVID-19, several media campaigns were held, medical personnel were approached, and information about vaccines was regularly published and updated in safe information sources (Ministry of Health, 2021a; 2021b).

Even though as of 3 May 2021, the opportunity to get vaccinated was given to all residents of Latvia, the planned vaccination capacity of 100,000 vaccination episodes per week was actually reached for four weeks. However, as the summer continued, the vaccination capacity decreased (State Audit Office of the Republic of Latvia, 2022). The State Audit Office stated that, although the Ministry of Health had generally provided the necessary measures such that along with the first deliveries of vaccines received in Latvia, sequential vaccination of priority groups and later the entire society against COVID-19 was started, the initially set goal of vaccination coverage of at least 70% of the adult population was not achieved by the end of the summer of 2021, as only 46.4% of the adult population was fully vaccinated. Also, in Latvia at the end of 2021 a rapid increase of COVID-19 cases and a low vaccination coverage was observed (Centre for Disease Prevention and Control, 2021). For example, in October 2021, of the 533 people who were infected with COVID-19 and died, 466 (87.4%) were not vaccinated against COVID-19 or had not yet completed the vaccination course. A comparison of the death rate (per 100,000 population) between vaccinated and unvaccinated/partially vaccinated people shows that unvaccinated and partially vaccinated people had a 6.1 times higher risk of death from COVID-19 infection than fully vaccinated people (Centre for Disease Prevention and Control, 2021). And unfortunately, as the data summarised by the European Centre for Disease Prevention and Control shows, in the period of time from 21 February to 6 March 2022, Latvia ranked the first place among the countries of the European Union and the European Economic Area in terms of mortality diagnosed with COVID-19 and the second place in terms of contracting COVID-19 disease (LETA, 2022).

Starting from 1 April 2022, most of the COVID-19 safety measures were cancelled in Latvia (State Chancellery, 2022), along with a decrease in the number of people infected with COVID-19 and mortality rates. As informed by the National Health Service, by the beginning of May 2022, 60.6% of the population of Latvia had completed the full course of vaccination against COVID-19, while 27.5% had received a revaccination dose (National Health Service, 2022). However, the vaccination process is characterised by changeability and flexibility (Ministry of Health, 2022), therefore, with the purpose of further containment of the spread of the disease, including improving the health in the society, it is necessary to encourage the desire and intent of individuals to be vaccinated and to do it as well. Therefore, it is essential to establish factors predicting the intent of vaccination in adults in Latvia within the framework of the Health Belief Model, which has proved to be a useful instrument for research of the health behaviour and identification of the main beliefs related to health behaviour.

The Health Belief Model – HBM (Rosenstock, 1974) is one of the most effective theoretical models in the field of research of health behaviour (Karl *et al.*, 2021), it is widely used (Yarbrough and Braden, 2001; Brewer and Fazekas, 2007; Johnson *et al.*, 2008; Kan and Zhang, 2018), and suc-

cessfully predicts a range of health behaviours, including vaccination (Lau *et al.*, 2020). The HBM consists of six core components — the perceived susceptibility of the disease, the perceived severity of the disease, the perceived benefits and the perceived barriers, the cues to action, and self-efficacy (Champion and Skinner, 2008). In order to describe and predict a certain health behaviour and the possibility, that this behaviour will be implemented, each of these components can be used jointly or separately (Hayden, 2017).

The following components of HBM were used within the framework of this research:

- 1) the perceived threats, as risk appraisal, describes an individual's perceived severity and perceived susceptibility of the threat to a negative health outcome (Hayden, 2017), e.g. getting infected with COVID-19;
- 2) the perceived benefits, such as vaccination motives, describes an individual's belief about the value and usefulness of this new behaviour, which would reduce the risk of getting sick (Smith *et al.*, 2011);
- 3) the perceived barriers, such as fear of vaccination, describes the individual's belief about the difficulties of implementation of the recommended health behaviour (Hayden, 2017);
- 4) the cues to action, such as experience with COVID-19, describes factors, which stimulate a certain behaviour (Al-Metwali *et al.*, 2021).

According to the HBM, an individual's motivation to engage in a particular health behaviour, namely to get vaccinated against COVID-19, is determined by perceived susceptibility to COVID-19 and perceived severity of COVID-19, as well as perceived benefits and perceived barriers to getting vaccinated against COVID-19 and cues to action, such as information received from media about the prevalence of the disease, its consequences and available treatment (Shmueli, 2021). Also, previous studies have found that factors such as pandemic concerns and perceived threat are positively related to vaccination intention (Ashbaugh *et al.*, 2013; Liao *et al.*, 2013; Iacob *et al.*, 2021), vaccination habit against seasonal influenza (Schmid *et al.*, 2017; Iacob *et al.*, 2021), confidence in the safety of the vaccine and information about incidence rates and the disease itself from authorities, health organisations, as well as information received from other people who want to get vaccinated (Podlesek *et al.*, 2011; Iacob *et al.*, 2021).

Researchers (Lin *et al.*, 2020; Hossain *et al.*, 2021) have also found that components of the HBM, such as perceived benefits, i.e. increasing and emphasising them to the individual and society, as well as high perceived susceptibility and perceived severity of illness, increase an individual's motivation to get vaccinated against COVID-19. In contrast, as perceived barriers to vaccination increase, the individual's motivation to implement vaccination behaviour decreases (Lin *et al.*, 2020; Hossain *et al.*, 2021). For exam-

ple, in a study that was conducted in China ($n = 3541$ with the aim to investigate vaccine demand and hesitancy by assessing the intention to vaccinate against COVID-19 and willingness-to-pay, the majority reported a probably yes to intent vaccine (54.6%), aged from 18 to 75, 48.1% male) — perceived benefits and barriers to vaccination (namely vaccine efficacy and adverse event concerns) of the HBM constructs were significant predictors of COVID-19 vaccination intent (Lin *et al.*, 2020). The findings of this study showed that one of the useful recommendations for tailored interventions to enhance the acceptance of a COVID-19 vaccines is to make promotional messages framing the benefit of vaccination and concerns about new vaccine safety.

Furthermore, vaccination against various infectious diseases is part of health behaviour and can be described as taking protective measures to reduce the incidence and spread of disease; for example, during the COVID-19 pandemic, part of the preventive health behaviour was wearing face masks, regular hand washing, avoiding from public places and vaccination (Ngamchaliew *et al.*, 2022). On the other hand, a study (Sherman *et al.*, 2021) showed that intention is one of the main drivers of behaviour in order to achieve behavioural changes, to implement healthy behaviour, but the authors assumed that the intention to vaccinate was much greater for a larger number of people than the actually implemented vaccination behaviour. Vaccination intention can be described as an individual's will to implement vaccination behaviours, which is influenced by several factors — both health protection factors (vaccination can protect an individual's health in the long term, as well as endanger it), and social and political factors (Borah *et al.*, 2021; Loomba *et al.*, 2021; Pivetti *et al.*, 2021; Sombultawee *et al.*, 2021; Barattucci *et al.*, 2022).

Research conducted in recent years, including studies conducted during the COVID-19 pandemic, have found an increased tendency in the public to postpone or hesitate to get vaccinated (WHO, 2014; Pollack *et al.*, 2020; Seangpraw *et al.*, 2022). Several authors (Shapiro *et al.*, 2018; Suppli *et al.*, 2018; Kerrigan *et al.*, 2020; Pollack *et al.*, 2020; Seangpraw *et al.*, 2022) have indicated that hesitancy to vaccinate is associated with refusal of vaccinations, both with uncertainty in making a decision to vaccinate or not to vaccinate, and with vaccination postponement or delay to vaccinate when vaccines are freely available, for example, when vaccination is paid for from the state budget.

In view of the above, the aim of this research was to investigate the predicting factors of vaccination intention in adults in Latvia within the framework of the HBM during the COVID-19 pandemic and to propose the following hypotheses:

H1: Vaccination intention had a positive relation with the perceived threats, the perceived benefits and the cues to action and a negative relation with the perceived barriers in adults in Latvia during COVID-19 pandemic;

H2: The perceived threats, the perceived benefits, the perceived barriers and the cues to action were significant predictors of vaccination intention in adults in Latvia during COVID-19 pandemic.

MATERIALS AND METHODS

The cross-sectional data of this study were obtained within the framework of the State Research Programme Project “Challenges of Latvia and the society and their solutions in the international context” (VPP INTERFRAME-LV), where adapted and developed instruments were used.

Measures. The following scales and questionnaires were used in the survey from the project, “Challenges and their solutions of Latvia and the society in the international context” (VPP INTERFRAME-LV):

1. The vaccination intention (dependent variable) was determined using the question: “Which of these answers refer to you?” Answers were coded from 1 to 5: 1 – I will definitely not get vaccinated, 2 – I will likely not get vaccinated, 3 – It is hard to say, 4 – I will likely get vaccinated, 5 – I will definitely get vaccinated.
2. Perceived threats (independent variable) were assessed using the following statements as risk appraisal: “I think my chances of getting infected with COVID-19 are”, “Picturing myself getting COVID-19 is something I find”, “I am sure I will NOT get infected with COVID-19”. Each answer had to be rated on a 5-point Likert scale from “strongly disagree” (1 point) to “strongly agree” (5 points). The statements obtained from the COVID-19 Own Risk Appraisal Scale (Jaspal *et al.*, 2020) and adapted for the cultural environment in Latvia. Three independent translators made the translation from English to the Latvian language. First, psychometric properties of the scale were assessed. Internal consistency Cronbach’s alfa was 0.60.
3. Perceived benefits (independent variable) were assessed as motives to get vaccinated using six independent statements: “1) I got vaccinated/will get vaccinated against COVID-19, in order to promote collective immunity, protecting relatives and other people from the infection, 2) I got vaccinated/will get vaccinated against COVID-19, to end the pandemic”, 3) “I got vaccinated/will get vaccinated against COVID-19, to protect myself from serious infection”, 4) “I got vaccinated/will get vaccinated against COVID-19, so that I can travel, attend events”, 5) “I got vaccinated/will get vaccinated against COVID-19, to end the restrictions and be able to return to previous life” 6) “I got vaccinated/will get vaccinated against COVID-19, because I need it”. Each answer had to be rated on a 5-point Likert scale from “strongly disagree” (1 point) to “strongly agree” (5 points). The first three questions were borrowed from the surveys of Rzymiski *et al.* (2021). Other questions were created just for this project.
4. Perceived barriers (independent variable) were assessed as fear of vaccination against COVID-19: “Are you afraid of... 1) serious allergic reactions after vaccination (anaphylactic shock), 2) other serious side effects after vaccination, 3) potential unknown long-term consequences from vaccine, 4) possible adverse effects on the reproductive system (unable to have children), 5) possible autoimmune reaction after vaccination”. Each answer had to be rated on a 5-point Likert scale from “strongly disagree” (1 point) to “strongly agree” (5 points). The questions were obtained from the survey of Rzymiski *et al.* (2021). Psychometric properties of the scale were assessed. Internal consistency Cronbach’s alfa was 0.92.
5. Cues to action (independent variable) were assessed according to COVID-19 experience, where the respondents had to assess their personal experience with COVID-19 — “a family member was sick; a friend, acquaintance, colleague was sick; a relative, friend, acquaintance, colleague died; I have not directly come across with the disease; I was sick”. The answers were coded: 0 – “No”, 1 – “Yes” and combined in a scale.

Procedure. The data were collected in the period of time from 10–22 September 2021, performing direct interviews at places of residence of the respondents. The research selection method was stratified random selection in an administrative territory. No less than 100 sampling points were selected randomly from all populated areas of Latvia, using the population in the populated areas as a measure of proportionality. A number of starting sampling points were determined in each settlement and a maximum of ten interviews were collected at each sampling point. In the household, only one person (respondent) was interviewed. The respondent was selected according to the nearest birthday or Kish grid principle. If the selected respondent was not available, the interviewer tried to contact him again, but the number of visits to the selected household did not exceed three times. If all three contact attempts were unsuccessful, the interviewer selected the respondent in the next household according to the rules of the route (Šuriņa *et al.*, 2022). The data were collected by the research centre SKDS.

Participants. The sample of $n = 1017$ respondents aged from 18 to 75 ($M = 46.53$, $SD = 16.22$) consisted of a nationally representative selection of Latvia within the project “The challenges of Latvia and the society and their solutions in international context” (VPP INTERFRAME-LV), according to the administrative territorial division.

In order to achieve the aim of this study and determine the factors that would be important motivations for vaccination among unvaccinated individuals, the respondents, who were not vaccinated against COVID-19, were selected for the data analysis, creating a sample of $n = 539$ respondents ($M = 45.35$, $SD = 15.70$), according to feature “vaccination intention”: 30.80% ($n = 166$) definitely will not get vaccinated, 33.40% ($n = 180$) most likely will not get vaccinated,

Table 1. Sociodemographic characteristics of study sample

Demographic variables	n (%)
Age (groups)	
18–24	50 (9.3)
25–34	112 (20.8)
35–44	111 (20.6)
45–54	90 (16.6)
55–63	100 (18.6)
64–75	76 (14.1)
Sex	
Male	285 (52.9)
Female	254 (47.1)
Education level	
Primary education	54 (10.0)
Secondary education	392 (72.8)
Higher education	93 (17.2)
Marital status	
Married or live with partner	299 (55.5)
Divorce	74 (13.7)
Non-married	118 (21.9)
Widow	48 (8.9)
Children under 18	
Yes	171 (31.7)
No	368 (68.3)
Employment	
Yes	333 (61.8)
No	206 (38.2)
Place of residence	
Riga	145 (26.9)
Other city	210 (39.0)
Other	184 (34.1)
Spoken language of family	
Latvian	307 (57.0)
Russian	228 (42.3)
Other	4 (0.7)

Note: $n = 539$

11.50% ($n = 62$) hard to say, 16.88% ($n = 91$) will likely get vaccinated, 7.42% ($n = 40$) will definitely get vaccinated. The detailed description of the sample is presented in Table 1.

Data analysis. The data processing and analysis were performed using the data processing programmes MS Excel 365 and IBM SPSS Statistics 27.0. Since the empirical distribution of all psychological variables did not correspond to the normal distribution, non-parametric methods of data analysis were used in the data analysis. All significant correlation results were reviewed, if the level of significance was as follows: $p < 0.05$, $p < 0.01$. To determine, whether correlation between the vaccination intention and the components of the HBM, the Spearman's rank correlation coefficient was applied. To determine, what components of the HBM predict the vaccination intention, multi-factor linear regression analysis was used.

RESULTS

Frequency of statistically significant association of HBM constructs with COVID-19 vaccination intention. In order to verify H1, proposed within the framework of the research, and determine whether a relationship exists between the vaccination intention and the constituent constructs of the HBM (perceived threats, perceived benefits, perceived barriers, and the cues to action) for adults in Latvia during COVID-19 pandemic, the Spearman's rank correlation test was performed (see Table 2). The obtained results show a statistically significant moderately strong correlation between vaccination intention and all six vaccination motives as the perceived benefits were established: to promote collective immunity, protecting relatives and other people from the infection ($r = 0.40$, $p < 0.01$); to end the pandemic ($r = 0.44$, $p < 0.01$); to protect myself from serious infection ($r = 0.44$, $p < 0.01$); to be able to travel/attend events ($r = 0.42$, $p < 0.01$); to end the restrictions and be able to return to previous life ($r = 0.42$, $p < 0.01$); because I need it ($r = 0.42$, $p < 0.01$). A statistically significant, but weak, positive correlation was established between the vaccination intention and the risk appraisal as the perceived threats ($r = 0.20$, $p < 0.01$), and COVID-19 experience as the cue to action (for example, an individual himself and/or a relative, friend has infected with COVID-19 or someone died from this disease) ($r = 0.20$, $p < 0.01$). According to the obtained results, a statistically significant negative, but weak correlation was established between vaccination intention and the fear of vaccination as the perceived barriers ($r = -0.21$, $p < 0.01$).

Association between vaccination intention, education level and the Health Belief Model constructs. In order to verify H2, proposed within the framework of the research, and to determine, whether the constructs of the HBM (perceived threats, perceived benefits, perceived barriers, and the cues to action) predict the vaccination intention for adults in Latvia during COVID-19 pandemic, multi-factor linear regression analysis was used (see Table 3). Firstly, in order to perform the regression analysis, the association of vaccination intention with demographic variables (age groups, gender, education level, marital status, children under 18, employment, place of residence, spoken language of family) and components of the HBM model were examined by performing the Spearman's rank correlation test. According to the obtained results, a statistically significant but very weak correlation was found between vaccination intention and the level of education in the sample of non-vaccinated respondents. The obtained results did not reveal a relationship with other demographic indicators, incl. age. Taking the results into account in the further multi-factor linear regression analysis, education level was the only variable from demographic variables that was taken (Uyanık and Güler, 2013).

The results of the multi-factor linear regression analysis demonstrated that the level of education, the perceived threats, the perceived benefits as motives of getting vaccinated, the perceived barriers as fear of getting vaccinated

Table 2. Significance ratio of Health Belief Model constructs with COVID-19 vaccination intention

Variables	1	2	3	4	5	6	7	8	9	10
1.Vaccination intention	1									
2.Risk appraisal	0.20**	1								
3.Vaccination motive - to promote collective immunity, protecting relatives and other people from the infection	0.40**	0.07**	1							
4.Vaccination motive - to end the pandemic	0.44**	0.55**	0.88**	1						
5.Vaccination motive - to protect myself from serious infection	0.44**	0.07*	0.78**	0.83**	1					
6.Vaccination motive - to be able to travel/at-tend events	0.42**	0.06*	0.66**	0.69**	0.67**	1				
7.Vaccination motive - to end the restrictions and be able to return to previous life	0.42**	0.09**	0.73**	0.78**	0.76**	0.73**	1			
8.Vaccination motive - because I need it	0.42**	0.07*	0.68**	0.71**	0.72**	0.65**	0.71**	1		
9. Fear of vaccination	-0.21**	0.09**	-0.43**	-0.46**	-0.43**	-0.38**	-0.42**	-0.39**	1	
10. COVID-19 experience	0.20**	0.20**	0.19**	0.15**	0.15**	0.16**	0.13**	0.14**	0,01	1

Note: The Spearman's rank correlation coefficient, n = 539, ** $p < 0.01$, * $p < 0.05$.

Table 3. Association between vaccination intention, education level and the Health Belief Model constructs

<i>Vaccination intention</i>	β	R^2	F
		0.32	25.70***
Education level	0.21*		
Risk appraisal	0.21*		
Vaccination motive - to promote collective immunity, protecting relatives and other people from the infection	-0.001		
Vaccination motive - to end the pandemic	0.09		
Vaccination motive - to protect myself from serious infection	0.14		
Vaccination motive -to be able to travel/attend events	0.13*		
Vaccination motive - to end the restrictions and be able to return to previous life	0.07		
Vaccination motive - because I need it	0.23**		
Fear of vaccination	-0.17*		
COVID-19 experience	0.16**		

Note: Multiple linear regression * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

and cues to action, such as COVID-19 experience, can predict the intent of getting vaccinated ($R^2 = 0.32$, $F(10.527) = 25.70$, $p < 0.001$), explaining 32% of the variation indices of the vaccination intention (see Table 3).

DISCUSSION

The research was conducted within the framework of the HBM, which is widely used in identification of various health beliefs and predicting the health behaviour, with the purpose to investigate the predictive factors of the vaccination intention of adults in Latvia during the COVID-19 pandemic. The following components of the HBM were used in the framework of the research: the perceived threats as risk appraisal, the perceived benefits as vaccination motives, the

perceived barriers as fear of vaccination, the cues to action as COVID-19 experience, and the level of education.

The obtained results revealed a relationship between vaccination intention and the components of HBM, such as the perceived threats, the perceived benefits, the perceived barriers, and the cues to action, which confirm H1. The respondents, who had intent to get vaccinated (most likely get vaccinated/definitely get vaccinated) felt a higher personal risk of getting COVID-19 (higher level of the perceived threats), they had personal experience with COVID-19 (as the cues to action), they had more motives why to get vaccinated (the perceived benefits from vaccination), as well as a lower level of fear from vaccination, its consequences and possible side effects. These findings are similar with previous research, in which the relationship between the perceived sus-

ceptibility to the disease, the severity of the disease (both of these components can be combined into one component — the perceived threats), the perceived benefits, the perceived barriers and the cues to action with preventive behaviour during COVID-19 pandemic was established (Tadesse *et al.*, 2020; Yehualashet *et al.*, 2021).

As previously mentioned, at the end of 2020, the first vaccines against COVID-19 were received in Latvia and targeted vaccination was started, starting with healthcare workers, residents in the age group 60+ and people with chronic diseases (Ministry of Health, 2021a; 2021b). As vaccination campaigns continued, implementing the Vaccination Plan, vaccination against COVID-19 was already available to all groups of society on 3 May 2021. It was predicted that the vaccination coverage would be 70% by the end of the summer of 2021, but only 46.4% of the population of Latvia had been vaccinated (State Audit Office of the Republic of Latvia, 2022). Also, during the time period when the research data were collected (September 2021), more than a year after the declaration of the COVID-19 pandemic — on 11 March 2020 (WHO, 2020), when information about COVID-19 was widely available and Latvian society had experienced multiple waves of COVID-19. Among them, as reported by the Centre for Disease Prevention and Control, during the third wave of the spread of COVID-19, for example, in September 2021, the incidence of COVID-19 in people who were not directly vaccinated, or those who had partially implemented vaccination, was 2.7 times higher than vaccinated people (Centre for Disease Prevention and Control, 2021). These results and other studies indicate (Ashbaugh *et al.*, 2013; Liao *et al.*, 2013; Iacob *et al.*, 2021; Shmueli, 2021) perceived higher personal risk of getting COVID-19 and the belief that it could pose a serious threat to an individual's health are the main factors affecting intent to get vaccine against COVID-19.

The obtained results of the study showed that directly perceived benefits from vaccination have a closer relationship with vaccination intention, unlike other components of the HBM that were used in this study. Similar results have been found elsewhere, where it has been established that during the COVID-19 pandemic, directly perceived benefits are one of the main factors that encourage the acquisition of new behaviours and its implementation (Bechard *et al.*, 2021). The closest connection to the intention to vaccinate was found with several motivations for vaccinating as perceived benefits — to promote collective immunity by caring for fellow human beings; to end the pandemic; to protect yourself from becoming seriously ill in case of infection; to restore the ability to travel and attend events; to end the restrictions and be able to return to the previous life; and because it was/is necessary for me.

These results could be explained by the fact that during the COVID-19 pandemic, extensive information about the benefits of vaccination was provided in the public space, inviting residents to get vaccinated, including that it would promote collective immunity and protect people from getting sick or from the course of a serious illness. For exam-

ple, studies conducted in Great Britain and the United States found that one of the motivations for vaccination during the COVID-19 pandemic was to vaccinate to protect oneself from getting sick (Loomba *et al.*, 2021; Seangpraw *et al.*, 2022). On the other hand, if an individual is convinced that getting sick can cause serious social consequences, such as job loss or a significant health threat, such as disability, then his motivation to implement health behaviours increases (Daniati *et al.*, 2021). Considering the fact that Latvian society had to face the restrictions caused by the COVID-19 pandemic from spring 2020 to April 2022, when most of the security measures were cancelled (State Chancellery, 2022), which thus affected everyone both social and cultural as well as economic life, then one of the main motives to implement the vaccination behaviours could have been the desire to end the pandemic and for everything to return to the previously usual order.

Studies have found that factors such as concerns about the pandemic and the perceived threats (Ashbaugh *et al.*, 2013; Liao *et al.*, 2013), vaccination habit against seasonal flu (Schmid *et al.*, 2017), confidence about safety of vaccine and the information provided by government institutions, health organisations about the indicators of contracting the disease and disease itself, as well as information received from other people, who wish to get vaccinated (Podlesek *et al.*, 2011) are positively related to vaccination intention. Likewise, studies have found that vaccination intention is related to the level of education of an individual (Bonfiglioli *et al.*, 2013; Truong *et al.*, 2022). For example, in a study performed in Canada (Jantzen *et al.*, 2022), where factors related to hesitation regarding to vaccination against COVID-19 were studied regarding middle-aged adults, it was found that one of the reasons for delaying the vaccination was a low level of income, as well as the income decrease due to COVID-19 pandemic for individuals with a low level of education.

The results of this study also revealed an association between components of the HBM (perceived threats, perceived benefits, perceived barriers, cues to action) and vaccination intention, which confirms H2. Namely, the results show the significance of level of education, perceived threats of contracting COVID-19, subjective motive to get vaccinated (for example, in order to be able to travel, attend events or to end the restrictions and return to the normal life), confidence that the vaccine will not cause significant side effects and long-term consequences, and the experience of COVID-19 in prediction of the vaccination intention.

If a new behaviour is accepted and implemented, an individual should have confidence that the advantages and benefits of this new behaviour will outweigh the consequences, which are caused or will be caused by the previous behaviour — whereas this confidence will allow to overcome the perceived threats and trigger the change of behaviour (Hayden, 2017). For example, during the COVID-19 pandemic, if an individual had perceived the obstacles of the recommended health behaviour as significant, then he would be less motivated to change his own behaviour and

follow the recommendations of the preventive health behaviour (Khani-jeihooni *et al.*, 2020; Karl *et al.*, 2021). In accordance with the HBM, an individual's motivation to implement a certain health behaviour, namely, to get vaccinated against COVID-19, is determined by the perceived susceptibility to COVID-19 and the perceived severity of COVID-19, as well as the perceived benefits and the perceived barriers from vaccination against COVID-19 and the cues to action, for example, the received information from mass media sources about the spread of the disease, its consequences and the available medication (Schmueli, 2021).

For example, a study performed in Romania revealed a relationship between the concerns about COVID-19 pandemic, vaccination intention, and the components of HBM — perceived threats (the perceived susceptibility to disease and the perceived severity of disease) and perceived benefits from vaccination (Iacob *et al.*, 2021). The perceived threats and the perceived benefits influence the concerns about the pandemic and the intent to get vaccinated as mediators. Thus, it can be concluded, that the perceived benefits from vaccination against COVID-19 and its effectiveness may motivate individuals to implement the vaccination behaviour. However, the main reasons for delay of vaccination are the concern that COVID-19 vaccines may cause serious side effects (the perceived barriers), as well as the lack of trust in governments (the cues to action) (Nguyen *et al.*, 2021). The findings discovered by the previously mentioned authors correspond to the results obtained in this research. Namely, the components of HBM — the perceived threats, the perceived benefits, the perceived barriers, and the cues to action — have an association with the intent to get vaccinated and its prognosis. In other words, an individual may decide about vaccination, realise the plan (the vaccination intention), if he has serious concerns about the possibility of contracting a particular disease (the perceived threats), he sees benefits from implementation of this behaviour, for example, thus the pandemic may end and travelling may be possible again (the perceived benefits), there is a low level of perceived threats and concerns about possible side effects of vaccines (the perceived threats) and the experience with contracting the disease, when, for example, a close friend or a family member was infected (the cues to action).

Other studies (Hossain *et al.*, 2021; Lin *et al.*, 2020) have discovered that the components of HBM, such as the perceived benefits, such as their increase and their highlighting in the eyes of an individual or society, as well as the highly perceived susceptibility to the disease and the perceived severity of the disease, promote the individual's motivation to get vaccinated against COVID-19. While the perceived barriers from the vaccination increases, the motivation of an individual to get vaccinated decreases. Thus, in order to minimise the difficulties caused by the COVID-19 pandemic, to contain the spread of the disease and to increase the vaccination rate against COVID-19, it is important to understand the factors having a significant role in prognosis of the vaccination intention. Within the framework of this research

those components of the HBM are identified, which are significant predictors of the vaccination intention for adults in Latvia during the COVID-19 pandemic — the perceived threats, perceived benefits, perceived barriers, and cues to action. The concerns felt by an individual about the possibility of contracting a particular disease, the visible benefits from the implemented health behaviour, for example, the possibility to travel and visit public areas, the confidence of surmountable obstacles, for example, vaccine will not cause serious side effects, and the personal experience of a particular disease as cues to action, are important factors, which would implement the recommended health behaviour.

The strengths of this research are the applied HBM, which is one of the most effective theoretical models in the field of research of health behaviour (Karl *et al.*, 2021), and the applied variables (the perceived threats, the perceived benefits, perceived barriers and the cues to action), whose relationship between the preventive behaviour during COVID-19 pandemic was established in previous studies (Tadesse *et al.*, 2020; Yehualashet *et al.*, 2021). Also, the data used in the study were collected in the period from 10 to 22 September 2021, when there was no regulation in Latvia yet (entered into force on 9 October 2021) regarding, for example, whether an employee can only perform his work duties in person, if he has a certificate of primary vaccination, booster vaccination or transmission of illness (Latvijas Vēstnesis, 2021, 720). The results of the research obtained in this way reflect more the true motivation of individuals to implement vaccination, which is less influenced by any political and legal decisions.

This study has several limitations that could have impact on the results. One of them is the period of time when the data were collected. The data for the research were collected in the period of time from 10–22 September, 2021, when the vaccination activity only started to grow, due to fact that a vaccination certificate was required at workplaces, but the vaccination coverage on 1 September 2021 was still only 698 thousand people vaccinated against COVID-19 in Latvia which was 37% of the permanent population (Central Statistical Bureau, 2021). The second limitation for the research was the sample — its uneven distribution by the intent of vaccination — only 25% of all respondents answered that they definitely or will likely to get vaccinated, whereas 64% answered that they will definitely or likely not to get vaccinated. Thus, those respondents who had the intention to get vaccinated were disproportionately represented in this sample. The third limitation of the research was the used instrument for assessment of the perceived threats where the assertions were borrowed from the COVID-19 Risk Appraisal Scale — CORAS (Jaspal *et al.*, 2020) and adapted for the cultural environment of Latvia. Cronbach's alfa of this scale is 0.60, which points to a weak internal consistency, although it lies within the range of the allowable internal consistency $\alpha = 0.60\text{--}0.70$ (Ursachi *et al.*, 2015).

Irrespective of the obtained results and both proposed hypothesis that were confirmed in the research, further work

on the identification of the factors predicting the vaccination intention, as well as the factors predicting the vaccination itself should be continued for launching the vaccination campaigns more successfully and for minimisation of the morbidity rates possibly better and to increase the vaccination coverage. Also, in the future when performing research about the vaccination intention within the framework of the HBM, the self-efficacy component should be included, because, as the researchers have discovered, the self-efficacy perceived during COVID-19 pandemic has a significant role in the perceived seriousness of contracting the diseases and the implementation of the preventive health behaviour (González-Castro *et al.*, 2021). A relationship was established between an individual's lower self-efficacy and greater anxiety of COVID-19 pandemic, higher level of the perceived threats, the bigger perceived benefits from vaccination and larger quantity of the purchased hygiene products by individuals with chronic diseases (Iacob *et al.*, 2021).

The results of this research will enhance existing discussions and add to the empirical research base on predictors of vaccination intention within the framework of the Health Belief Model. In addition, the obtained results and conclusions can be useful not only for analysing vaccination behaviours during the COVID-19 pandemic, but also in cases of other disease outbreaks, to implement prophylactic health protection measures, reduce cases of illness and spread of the disease, and determining factors that play an important role in predicting vaccination intention, that is, what motivates an individual to realise vaccination behaviours. Taking into account the above, factors such as the perceived threat of the particular illness, the perceived benefits and obstacles of the recommended health behaviours, as well as action-promoting stimuli such as personal experience with the illness can play an important role in achieving a change in behaviours, and thus could promote vaccination coverage, reduce the spread of disease and improve public health.

CONCLUSIONS

Vaccination against COVID-19 is one of the most effective safety measures in order not only to reduce the risk of falling ill, but also the avoid severe course of the disease and contain the spread of the disease. The study found the expected associations between components of the Health Belief Model and vaccination intention in a sample of unvaccinated adults in Latvia during the COVID-19 pandemic. Firstly, the results of the analysis showed that perceived threats as risk appraisal, perceived benefits as vaccination motives, and cues to action as the COVID-19 experience are positively related to vaccination intention; but perceived threats as fear of vaccination are negatively related to vaccination intention. Secondly, the obtained results show that, like elsewhere in the world, the component of the Health Belief Model as perceived benefits has a significant relationship with vaccination intention. Perceived benefits as vaccination motives (to promote collective immunity, protecting relatives and other people from the infection; to end

the pandemic; to protect myself from serious infection; to be able to travel/attend events; to end restrictions and be able to return to the previous life; because I need it) showed a moderately strong relationship with vaccination intention. Perceived threat (possibility of getting infected with COVID-19), perceived benefits as vaccination motives (to be able to travel, attend events; because I need it), perceived barriers (beliefs that the vaccine will not cause significant side effects and long-term consequences), cues to action (COVID-19 experience) and level of education were significant factors in predicting vaccination intention during the COVID-19 pandemic in a sample of unvaccinated adults in Latvia. And the HBM component perceived benefits as a vaccination motive "because I need it" was found to be the most significant predictor of vaccination intention during the COVID-19 pandemic in a sample of unvaccinated adults in Latvia. In general, the perceived benefits of vaccination against COVID-19, emphasising the benefits of vaccination from the individual's subjective point of view, and the promotion of public education about the effectiveness and safety of vaccination can motivate individuals to implement vaccination behaviour.

ETHICS

Rīga Stradiņš University Research Ethics Committee permit Nr. 22-2/474/2021 was obtained for the purposes of conducting this research. The study was conducted following the principles of the World Medical Declaration of Helsinki (Šuriņa *et al.*, 2022).

ACKNOWLEDGEMENTS

We would like to express gratitude to the State Research Programme Project "Challenges of Latvian and the society and their solutions in the international context" (INTERFRAME-LV) and the research centre SKDS for collection of data.

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Received 15 February 2023

Accepted in the final form 23 January 2024

VESELĪBAS PĀRLIECĪBAS MODEĻA PIELIETOŠANA VAKCINĀCIJAS NODOMU PROGNOZĒŠANĀ NEVAKCINĒTIEM PIEAUGUŠAJIEM LATVIJĀ COVID-19 PANDĒMIJAS LAIKĀ

Vakcinācija ir globāls veselības attīstības veiksmes stāsts, kas katru gadu glābj miljoniem cilvēku dzīvību un samazina risku saslimt ar dažādām infekcijas slimībām, t.sk. ar Covid-19. Latvijā 2021. gada nogalē bija vērojams straujš ar Covid-19 inficēto iedzīvotāju skaita pieaugums un zema vakcinācijas aptvere, un neraugoties uz pieejamām vakcīnām, līdz 2022. gada maija sākumam tikai 60,6% Latvijas iedzīvotāju bija pabeiguši un 27,5% bija saņēmuši revakcinācijas devu. Kā norāda Veselības ministrija, vakcinācijas procesam ir raksturīga mainība un elastība, kā arī kopumā vakcinācijas temps pēdējos gados ir samazinājies. Tāpēc pētījuma mērķis bija izpētīt vakcinācijas nodomu prognozējošos faktorus nevakcinētiem pieaugušajiem Latvijā. Veselības pētījuma izlasi veidoja 539 respondenti vecumā no 18 līdz 75 gadiem ($M = 45,35$, $SD = 15,70$), kuri nebija vakcināti pret Covid-19, kuriem bija vēl jāpieņem lēmums par vakcināciju un kuri bija daļa no nacionāli reprezentatīvas Latvijas izlases ($n = 1017$). Dati tika ievākti 2021. gada septembrī un analizēti, izmantojot Spīrmena rangu korelācijas koeficientu un daudzfaktoru lineārās regresijas analīzi. Statistiski nozīmīga vidēji cieša pozitīva korelāciju tika uzrādīta starp vakcinācijas nodomu un visiem sešiem vakcinācijas motīviem kā uztvertajiem ieguvumiem ($r = 0,40 - 0,44$, $p < 0,01$); statistiski nozīmīga, bet vāja pozitīva korelācija starp vakcinācijas nodomu un riska novērtējumu kā uztvertajiem draudiem ($r = 0,20$, $p < 0,01$) un Covid-19 pieredzi kā rīcību veicinošiem stimuliem ($r = 0,20$, $p < 0,01$); statistiski nozīmīga negatīva, bet vāja korelācija vakcinācijas nodomam un bailēm no vakcinācijas kā uztvertajiem šķēršļiem ($r = -0,21$, $p < 0,01$). Rezultāti uzrādīja vairākus faktorus, kuri prognozē vakcinācijas nodomu, izskaidrojot 32% no vakcinācijas nodomu rādītāju variācijas: augstāks izglītības līmenis, uztvertie draudi, uztvertie ieguvumi, uztvertie šķēršļi un rīcības nosacījumi. Augstāks izglītības līmenis, augstāks uztverto draudu līmenis par iespēju inficēties ar Covid-19, vairāki vakcinācijas motīvi (piemēram, lai varētu ceļot), pārliecība, ka vakcīna neradīs būtiskas blakusparādības un ilgtermiņa sekas, kā arī Covid-19 pieredze ir tie faktori, kuri ļauj prognozēt indivīda nodomu vakcinēties pret Covid-19.