

ASSESSMENT OF FACTORS RELATED TO COVID-19 PREVENTIVE HEALTH BEHAVIOURS USING A HEALTH BELIEF MODEL

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Non-pharmaceutical interventions, including physical distancing, hand hygiene, mask wearing, are some of the most effective public health interventions against COVID-19 spread. Adoption of these measures can vary in different countries and even in different populations within a country. The goal of our study was to investigate factors that influence adoption of these preventive health behaviours in the Latvian population within the Health Belief Model framework, while also expanding on the models cues to action dimension by testing if evaluation of COVID-19-related government actions and belief in COVID-19 related conspiracy theories could be used as such. Our quantitative cross-sectional study that was carried out in Latvia before the second wave of COVID-19 pandemic included two samples of major population language groups ($n_{\text{Latvian}} = 452$; $n_{\text{Russian}} = 190$) and showed differences that could potentially improve adoption of preventive health behaviours in Latvia if regarded in informing and educating the public. It was also found that evaluation of COVID-19-related government actions has statistically significant impact on preventive health behaviour and could be used as cues to action within the HBM, while belief in COVID-19-related conspiracy theories had no association with preventive health behaviour.

Keywords: *perceived threat, conspiracy theories, government action evaluation, pandemic.*

INTRODUCTION

According to the European Centre for Disease Prevention and Control (ECDC), non-pharmaceutical interventions, which include physical distancing, hand hygiene, mask wearing and other preventive health behaviour, are the most effective public health interventions against COVID-19, after vaccination (ECDC, 2021). ECDC has also pointed out that support and adherence to these measures has varied considerably across different countries and even different population groups within countries. Therefore, within our theoretical study on dimensions of the Health Belief Model during the COVID-19 outbreak, we also focused on assessing local preventive health behaviour patterns, which might provide the possibility to incorporate this new knowledge

when developing future policies and public information campaigns regarding current and/or future pandemics.

We consider health behaviour as defined by Kasl and Cobb (1966): “Health behaviour is any activity undertaken by a person believing himself to be healthy, for the purpose of preventing disease or detecting it in asymptomatic stage”. Within our study in the context of the COVID-19 pandemic, we will refer to physical distancing, hand hygiene, and mask wearing as preventive health behaviour.

One of the most widely used theoretical frameworks for health behaviour research to date is the Health Belief Model (HBM) (Fig. 1). This framework is based on the notion of cognitive theory that actions of a person are impacted by

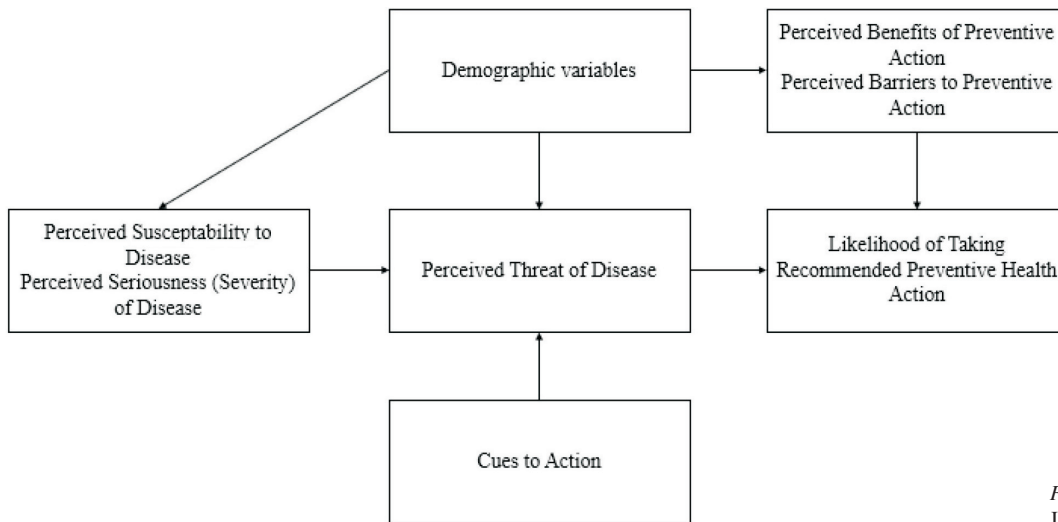


Fig. 1. Health Belief Model (after Janz and Becker, 1984)

thinking, evaluation, assumptions, and expectations (Skinner *et al.*, 2015). A literature review after the 2009 H1N1 influenza pandemic identified age, gender, education, perceived susceptibility to disease, and perceived severity of disease as some of the general important predictors of protective behaviours (Bish and Michie, 2010), which supports the use of these elements in the HBM for assessment of preventive health behaviour in a pandemic setting.

The dimensions of the HBM include – demographic variables; perceived susceptibility to and perceived seriousness of a disease that form perceived threat of disease; cues to action; perceived benefits and barriers to preventive action; and likelihood of taking the recommended preventive health action. Perceived benefits and barriers of preventive action were not subject to this study.

Perceived threat is a combined variable formed by perceived susceptibility to disease and perceived seriousness/severity of the disease (Skinner *et al.*, 2015). Several previous studies showed that perceived risk and threat were positively associated with wearing a mask and greater participation in social distancing (Garfin *et al.*, 2021; DeSalvo *et al.*, 2022; Romano *et al.*, 2022).

Cues to action are referred to as “internal or external factors that could trigger the health behaviour” (Skinner *et al.*, 2015). To our knowledge, to date of this research, evaluation of COVID-19-related government actions and beliefs in COVID-19-related conspiracy theories have not been tested within the HBM as potential cues to action, which add to the influence on the preventive health behaviour. In previous research, evaluation of government actions and beliefs in conspiracy theories have been shown to have certain association with complying with COVID-19 spread preventive measures. For example, conspiracy beliefs were found to reduce actions associated with preventive health behaviour and vaccination intention (Allington *et al.*, 2020; Romer and Hall Jamieson, 2020; Hughes *et al.*, 2022), and lessen support for preventive policies in the early stages of pandemic (Earnshaw *et al.*, 2020). A recent meta-analysis of 53 papers on the data for the year 2020 concluded that

trust in conspiracy beliefs predicted lower engagement in COVID-19 preventive measures, both cross-sectionally and over time, and could be acknowledged as a “non-negligible threat to public health” (Bierwiazzonek *et al.*, 2022).

COVID-19 research showed that individuals with high government trust complied with epidemiological restrictions regardless of the level of concern about the pandemic (Lalot *et al.*, 2022) and higher trust in politics, government and its actions and advice regarding COVID-19 was significantly associated with higher participation in preventive health behaviour (Dohle *et al.*, 2020; Kim and Tandoc, 2021; Han *et al.*, 2021), which showed that higher trust in government could be helpful in achieving wider implementation of preventive health behaviour.

Previous research on sociodemographic variables showed that older individuals took significantly more preventive actions than younger people (Hutchins *et al.*, 2020; Luo *et al.*, 2021). A lower education level was associated with lower perceived severity and probability of contracting COVID-19, whereas higher education level showed association with compliance in hand washing in women and complying with social distancing in men (Rattay *et al.*, 2021). Yet, the results are mixed if women are more likely to get involved in preventive health behaviour overall or this gender difference is non-significant (Haischer *et al.*, 2020; Guo *et al.*, 2021; Howard, 2021). Countryside residents were observed to be less likely to participate in hand washing, mask wearing, and distancing behaviour (Callaghan *et al.*, 2021).

Results on the relationships between COVID-19-related conspiracy beliefs and demographic variables such as age, gender, education the results are not consistent (Mulukom *et al.*, 2022). Van Mulukom and colleagues in their systematic review suggested that “the effect of age and gender on COVID-19-related conspiracy beliefs may be part of a complex interplay of psychological and social factors”. Yet, considering that the results of various COVID-19-related factors can vary in different populations, we continue our work to investigate these variables in Latvian samples.

Based on the Health Belief Model, the aim of our study was, in the context of the COVID-19 pandemic in Latvia, to investigate, the sociodemographic profile associated with complying with preventive health behaviour, such as social distancing and hygiene requirements, determine influence of perceived threat on preventive health behaviour and assess if evaluation of COVID-19-related government actions and beliefs in COVID-19-related conspiracy theories can be used as cues to action within the HBM framework.

In our research we hypothesise:

H1: Perceived threat positively predicts preventive health behaviour.

H2: Evaluation of COVID-19-related government actions can be used as cue to action within the HBM.

H3: More positive evaluation of COVID-19-related government actions positively affects adherence to preventive health behaviour.

H4: Belief in COVID-19-origin-related conspiracy theories can be used as cues to action within the HBM.

H5: Belief in COVID-19-origin-related conspiracy theories will be negatively associated with preventive health behaviour.

MATERIALS AND METHODS

Participants. In total, 642 respondents participated in the study, age 18 to 95 ($M = 55.63$, $SD = 19.30$). Among the participants, 66.20% ($n = 425$) were female and 33.80% ($n = 217$) were male. About one-third of the respondents (34.60%, $n = 222$) reported living in the capital (Rīga), another third reported to live in other city in Latvia (33.20%, $n = 213$) and the rest reported to be living in the countryside (32.20%, $n = 207$). 15.70% ($n = 101$) of participants had basic education or lower, 19.30% ($n = 124$) — secondary education, 34.30% ($n = 220$) — vocational education, and 30.70% ($n = 197$) had higher education.

The sample was selected using a multi-stage stratified random sampling method. The populated areas where interviews took place were selected through systematic probability sampling. Subsequently, trained interviewers from SIA KANTAR created routes and selected households in accordance with a specifically advised methodology.

The study was performed in two languages to receive more representative data of the Latvian population as Latvian is native language to about 60.8% of the population and Russian — to about 36% (CSP, 2019). In total there were 452 (70.40%) participants who answered the questionnaires in Latvian and 190 (29.60%) in Russian. The language groups were equalised by gender, age groups, and education. For detailed breakdown of sociodemographic data please refer to Table 1.

No participants in our sample had confirmed personal experience with the COVID-19 virus. 2% of the sample reported

Table 1. Sociodemographic characteristics of the research sample

Sociodemographic variables	Latvian		Russian		Total	
	n	%	n	%	n	%
Gender ($\chi^2 = 0.91, p = 0.34$)						
Male	158	34.96	59	31.05	217	33.80
Female	294	65.04	131	68.95	425	66.20
Age group ($\chi^2 = 2.19, p = 0.34$)						
18 - 44	150	33.19	52	27.37	202	31.46
45 - 64	127	28.1	56	29.47	183	28.50
65 plain	175	38.72	82	43.16	257	40.03
Place of residence ($\chi^2 = 51.21, p < 0.01$)						
Rīga	123	27.21	99	52.11	222	34.58
Other city	149	32.96	64	33.68	213	33.18
Countryside	180	39.82	27	14.21	207	32.24
Education ($\chi^2 = 6.31, p = 0.10$)						
Basic or lower	81	17.92	20	10.53	101	15.73
Secondary	89	19.69	35	18.42	124	19.31
Vocational	149	32.96	71	37.37	220	34.27
Higher	133	29.42	64	33.68	197	30.69

Note: $n = 642$

having similar symptoms, but they were not sure it was COVID-19. 0.30% had a relative with confirmed COVID-19 diagnosis, and 1.40% had a relative who had similar symptoms, but did not have a confirmed diagnosis.

Measures. Interviews included sociodemographic questionnaire and the following scales “Perceived fear of contracting COVID-19”, “Perceived COVID-19 severity”, “Evaluation of COVID-19 related government actions”, “Belief in COVID-19-origin-related conspiracy theories” and “COVID-19-related preventive health behaviour” (Krumina *et al.*, 2022).

Perceived COVID-19 threat (Krumina *et al.*, 2022). According to the HBM, perceived threat is a combined variable of perceived fear of contracting the disease and perceived severity of this disease, so perceived COVID-19 threat was measured by two separate scales, and a combined latent variable was derived from the results. We used two newly developed scales within this study — “Perceived fear of contracting COVID-19” and “Perceived COVID-19 severity”. The “Perceived fear of contracting COVID-19” scale consisted of six items that were rated on a 5-point Likert scale ranging from 1 (“Not at all”) to 5 (“Very much”). The “Perceived COVID-19 severity” scale consisted of five items rated on 4-point Likert scale ranging from 1 (“Don’t agree”) to 4 (“Agree”).

Evaluation of COVID-19-related government actions (Krumina *et al.*, 2022). The evaluation of COVID-19 related government actions was based on a 6-item scale constructed of items of general questionnaire that evaluate if participants find government actions regarding pandemic relevant, necessary, and effective, by reporting their opinion on 4-point Likert scale ranging from 1 (“Don’t agree”) to 4 (“Agree”).

Belief in COVID-19-origin-related conspiracy theories (Krumina *et al.*, 2022). To evaluate a participant's belief, which was common at the time, of COVID-19 origin related to conspiracy theories, our researchers devised a 12-item novel scale based on a similar principle as Belief in Conspiracy Theories Inventory (Swami *et al.*, 2010). Within this scale, participants reported the degree to which they endorse each of the 12 theories on 5-point Likert scale, ranging from 1 ("I don't believe") to 5 ("I am sure of it").

COVID-19-related preventive health behaviour (Krumina *et al.*, 2022). "COVID-19 related preventive health behaviour" was assessed by a 12-item scale developed by our research team, consisting of two subscales – "Hygiene behaviour" and "Distancing behaviour". Within this scale, participants reported the degree to which they agree on them engaging in a particular preventive behaviour on a 4-point Likert scale, ranging from 1 ("Don't agree") to 4 ("Agree"). This scale allowed to evaluate both the total scale score, and separately the scores of the subscale of interest.

Procedure. This research was carried out as a quantitative cross-sectional study within the adult population in Latvia. Data was collected between 25 September and 9 November 2020, shortly before the second wave of COVID-19 pandemic in Latvia. Computer-assisted face-to-face interviews in two languages (Latvian and Russian) were delivered by a specially trained team.

The study was carried out within the larger project "Research on Proliferation of Psychiatric Disorders and Suicidal Behaviour in the Adult Population of Latvia" (Id. Nr. VM 2018/32/ESF) as part of the ESF project "Complex health promotion and disease prevention measures" (Id. Nr.9.2.4.1/16/I/001).

Statistical analysis was performed using IBM SPSS 27, with additional use of the Sobel test for mediation analysis.

RESULTS

Sociodemographic variables. To analyse sociodemographic data differences and associations with HBM variables, we used two non-parametric tests. Gender differences across observed COVID-19-related variables were assessed using the Mann–Whitney U Test. It was found that there were no gender differences in COVID-19-origin-related conspiracy beliefs. Women in both language samples per-

ceived COVID-19 threat higher, were more likely to engage in COVID-19-related preventive health behaviour, as well as evaluated COVID-19 related government actions more positively than men (Table 2).

Age group differences across observed COVID-19-related variables were assessed by a Kruskal–Wallis H Test with subsequent pairwise comparisons with a Bonferroni correction for multiple comparisons. In the Latvian language sample (LLS), respondents in the age group of 45–64 years old reported the highest belief in COVID-19-origin-related conspiracy beliefs, which was non-significantly higher than in the younger group, yet statistically significantly higher than for those who were 65 years old or older. However, in the Russian language sample (RLS) there were no significant differences among the mentioned age groups (Tables 3 and 4).

In the LLS, those of age above 65 years perceived COVID-19 threat significantly higher than younger respondents, and in RLS there were no significant differences between the age group 45–64 and 65 years and older, yet both groups scored significantly higher on threat appraisal than respondents in the age group 18–44 years. Older individuals in both language samples evaluated COVID-19-related government actions significantly more positive than younger ones (Tables 3 and 4).

There were no significant differences among age groups in engaging in hygiene guidelines in LLS, yet in the RLS respondents in age group 18 to 44 years had significantly lower engagement in following hygiene guidelines than both participants in age groups 45 to 64 and 65 years and above. Comparing adherence to distancing guidelines, in the LLS participants, the age group above 65 had significantly higher results than those in the group 18 to 44 years, and in RLS — both participants in the group 44 to 64 years and those above 65 years had significantly higher adherence to distancing guidelines than younger group (18–44 years). For a detailed view of statistical analysis results see Tables 3 and 4.

Education level differences across observed COVID-19-related variables were assessed by a Kruskal–Wallis H Test with subsequent pairwise comparisons with a Bonferroni correction for multiple comparisons. Analysis of education level differences showed no significant differences in COVID-19-origin-related conspiracy beliefs among education levels in RLS, yet there were statistically significantly

Table 2. Gender differences across observed COVID-19 related variables

COVID-19 related variables	Latvian				Russian			
	Mean rank		U	p	Mean rank		U	p
	Male	Female			Male	Female		
COVID-19-Origin-Related Conspiracy beliefs	230.04	224.60	22666.00	0.67	96.19	95.19	3824.00	0.91
Perceived COVID-19 threat	203.13	239.06	26918.00	0.005*	78.44	103.18	4871.00	0.004*
Evaluation of COVID-19-related government actions	204.30	238.43	26734.00	0.008*	78.53	103.14	4865.50	0.004*
COVID-19-related preventive health behaviour (Hygiene)	189.78	246.23	29027.50	< 0.001*	75.90	104.33	5021.00	< 0.001*
COVID-19-related preventive health behaviour (Distancing)	195.16	243.34	28178.00	< 0.001*	76.26	104.16	4999.50	< 0.001*

Note: Mann–Whitney U Test, * $p < 0.05$

Table 3. Differences across observed COVID-19 related variables

Language group	Variable	n	Mean rank	df	H	p
Latvian	COVID-19-Origin-Related Conspiracy beliefs			2	11.62	0.003*
	18-44	150	221.49			
	45-64	127	258.50			
	65 or more	175	207.57			
Russian	COVID-19-Origin-Related Conspiracy beliefs			2	1.92	0.380
	18-44	52	93.47			
	45-64	56	88.48			
	65 or more	82	101.48			
Latvian	Perceived COVID-19 threat			2	14.59	< 0.001*
	18-44	150	204.26			
	45-64	127	212.47			
	65 or more	175	255.74			
Russian	Perceived COVID-19 threat			2	13.75	0.001*
	18-44	52	72.03			
	45-64	56	99.62			
	65 or more	82	107.57			
Latvian	Evaluation of COVID-19-related government actions			2	41.02	< 0.001*
	18-44	150	177.69			
	45-64	127	223.89			
	65 or more	175	270.23			
Russian	Evaluation of COVID-19-related government actions			2	42.83	< 0.001*
	18-44	52	56.78			
	45-64	56	95.24			
	65 or more	82	120.23			
Latvian	COVID-19-related preventive health behaviour (Hygiene)			2	1.40	0.496
	18-44	150	236.60			
	45-64	127	219.39			
	65 or more	175	223.00			
Russian	COVID-19-related preventive health behaviour (Hygiene)			2	21.66	< 0.001*
	18-44	52	65.73			
	45-64	56	102.44			
	65 or more	82	109.64			
Latvian	COVID-19-related preventive health behaviour (Distancing)			2	14.23	< 0.001*
	18-44	150	197.99			
	45-64	127	224.61			
	65 or more	175	252.31			
Russian	COVID-19-related preventive health behaviour (Distancing)			2	26.81	< 0.001*
	18-44	52	62.35			
	45-64	56	103.92			
	65 or more	82	110.77			

Note: Kruskal-Wallis Test, * $p < 0.05$

higher scores in the vocational secondary education group compared to basic, secondary, and higher education groups in LLS. Comparing threat appraisal scores among education levels there were no significant differences in RLS, but in the LLS there was statistically significantly higher threat appraisal among respondents with higher education than those with basic or vocational education. In the LLS those with higher education were more likely to engage in preventive health behaviour than those with basic education level, and there were no differences among education groups in RLS. Both language samples showed no significant differences among education groups in COVID-19-related government action evaluation. For a detailed view of statistical analysis results see Tables 5 and 6.

Analysing whether there are any significant differences among individuals who live in the capital, other major city or in the countryside, analyses showed no differences in COVID-19-origin-related conspiracy beliefs and threat appraisal. Comparing residence groups, the results showed that engagement in health behaviour was significantly higher in the capital than other cities or countryside in LLS, yet it was significantly lower in RLS. There were no significant differences among residence groups in RLS in government action evaluation, yet in LLS those who lived in the capital showed significantly higher scores than those in other cities. For a detailed view of statistical analysis results see Tables 7 and 8.

Table 4. Age group pairwise comparison across observed COVID-19 related variables

Language group	Variable	Pairwise comparison	df	H	p^a
Latvian	COVID-19-Origin-Related Conspiracy beliefs		2	11.62	0.003
		18–44 – 65 or more			1.000
		18–44 – 45–64			0.055
		45–64 – 65 or more			0.002*
Russian	COVID-19-Origin-Related Conspiracy beliefs		2	1.92	0.383
		18–44 – 65 or more			
		18–44 – 45–64			
		45–64 – 65 or more			
Latvian	Perceived COVID-19 threat		2	14.59	< 0.001*
		18–44 – 65 or more			0.001*
		18–44 – 45–64			1.000
		45–64 – 65 or more			0.013*
Russian	Perceived COVID-19 threat		2	13.75	0.001*
		18–44 – 65 or more			0.001*
		18–44 – 45–64			0.028*
		45–64 – 65 or more			1.000
Latvian	Evaluation of COVID-19-related government actions		2	41.02	< 0.001*
		18–44 – 65 or more			< 0.001*
		18–44 – 45–64			0.010*
		45–64 – 65 or more			0.007*
Russian	Evaluation of COVID-19-related government actions		2	42.83	< 0.001*
		18–44 – 65 or more			< 0.001*
		18–44 – 45–64			0.001*
		45–64 – 65 or more			0.025*
Latvian	COVID-19-related preventive health behaviour (Hygiene)		2	1.40	0.496
		18–44 – 65 or more			
		18–44 – 45–64			
		45–64 – 65 or more			
Russian	COVID-19-related preventive health behaviour (Hygiene)		2	21.66	< 0.001*
		18–44 – 65 or more			< 0.001*
		18–44 – 45–64			0.002*
		45–64 – 65 or more			1.000
Latvian	COVID-19-related preventive health behaviour (Distancing)		2	14.23	< 0.001*
		18–44 – 65 or more			< 0.001*
		18–44 – 45–64			0.265
		45–64 – 65 or more			0.200
Russian	COVID-19-related preventive health behaviour (Distancing)		2	26.81	< 0.001*
		18–44 – 65 or more			< 0.001*
		18–44 – 45–64			< 0.001*
		45–64 – 65 or more			1.000

Note: Kruskal–Wallis Test post hoc, * $p < 0.05$, ^aSignificance values for pairwise comparison have been adjusted by the Bonferroni correction for multiple tests.

Perceived threat and preventive health behaviour. To analyse the impact of perceived COVID-19 threat on adherence to preventive health behaviour during the COVID-19 pandemic before the second wave in the Latvian population, a linear regression analysis was used. After testing for linear regression analysis assumptions, the RLS data notably violated the assumption of homoscedasticity and residual normal distribution. As such, regression analysis was only performed for the LLS data.

Linear regression analysis revealed that the Perceived COVID-19 Threat score predicts COVID-19-related preventive health behaviour explaining 10% of following hygiene guidelines variation ($R^2 = 0.10$, $F(1.450) = 50.99$, $p <$

0.001) and 16% of following distancing guidelines variation ($R^2 = 0.16$, $F(1.450) = 87.04$, $p < 0.001$) (Fig. 2).

Cues to action. By assessing assumptions for testing set hypotheses, hypotheses H4 and H5 were rejected since COVID-19-Origin-Related Conspiracy Beliefs did not significantly correlate with preventive health behaviour in any of the observed samples (Table 9). Due to this, only Evaluation of COVID-19 Related Government Action was further used for mediation analysis.

For the mediation model, a combined total score for the COVID-19-related preventive health behaviour scale was used. The mediating effect of COVID-19 threat appraisal

Table 5. Education differences across observed COVID-19 related variables

Language group	Variable	n	Mean rank	df	H	p
Latvian	COVID-19-Origin-Related Conspiracy beliefs			3	16.35	< 0.001*
	Basic or lower	81	211.67			
	Secondary	89	205.06			
	Vocational	149	261.62			
	Higher	133	210.53			
Russian	COVID-19-Origin-Related Conspiracy beliefs			3	1.49	0.684
	Basic or lower	20	91.08			
	Secondary	35	104.17			
	Vocational	71	96.64			
	Higher	64	90.88			
Latvian	Perceived COVID-19 threat			3	15.42	0.001*
	Basic or lower	81	192.73			
	Secondary	89	230.31			
	Vocational	149	213.28			
	Higher	133	259.32			
Russian	Perceived COVID-19 threat			3	5.82	0.121
	Basic or lower	20	87.38			
	Secondary	35	77.34			
	Vocational	71	101.57			
	Higher	64	101.23			
Latvian	Evaluation of COVID-19 related government actions			3	3.47	0.325
	Basic or lower	81	205.4			
	Secondary	89	220.85			
	Vocational	149	231.64			
	Higher	133	237.37			
Russian	Evaluation of COVID-19-related government actions			3	7.11	0.069
	Basic or lower	20	74.45			
	Secondary	35	84.14			
	Vocational	71	97.14			
	Higher	64	106.47			
Latvian	COVID-19-related preventive health behaviour (Hygiene)			3	16.46	< 0.001*
	Basic or lower	81	179.34			
	Secondary	89	224.29			
	Vocational	149	229.20			
	Higher	133	253.67			
Russian	COVID-19-related preventive health behaviour (Hygiene)			3	5.14	0.162
	Basic or lower	20	71.13			
	Secondary	35	91.37			
	Vocational	71	100.61			
	Higher	64	99.71			
Latvian	COVID-19-related preventive health behaviour (Dis-tancing)			3	3.14	0.370
	Basic or lower	81	206.79			
	Secondary	89	227.49			
	Vocational	149	225.39			
	Higher	133	239.08			
Russian	COVID-19-related preventive health behaviour (Dis-tancing)			3	2.43	0.488
	Basic or lower	20	86.98			
	Secondary	35	87.23			
	Vocational	71	95.38			
	Higher	64	102.82			

Note: Kruskal–Wallis Test, * $p < 0.05$

Table 6. Education level pairwise comparison across observed COVID-19 related variables

Language group	Variable	Pairwise comparison	df	H	p^a
Latvian	COVID-19-Origin-Related Conspiracy beliefs		3	16.35	< 0.001*
		Secondary–Higher			1.000
		Secondary–Basic			1.000
		Secondary–Vocational			0.007*
		Higher–Basic			1.000
		Higher–Vocational			0.006*
		Basic–Vocational			0.032*
Russian	COVID-19-Origin-Related Conspiracy beliefs		3	1.49	0.684
Latvian	Perceived COVID-19 threat		3	15.42	0.001*
		Secondary–Higher			0.629
		Secondary–Basic			0.366
		Secondary–Vocational			1.000
		Higher–Basic			0.002*
		Higher–Vocational			0.019*
		Basic–Vocational			1.000
Russian	Perceived COVID-19 threat		3	5.82	0.121
Latvian	Evaluation of COVID-19-related government actions		3	3.47	0.325
Russian	Evaluation of COVID-19-related government actions		3	7.11	0.069
Latvian	COVID-19-related preventive health behaviour (Hygiene)		3	16.46	< 0.001*
		Secondary–Higher			0.599
		Secondary–Basic			0.149
		Secondary–Vocational			1.000
		Higher–Basic			< 0.001*
		Higher–Vocational			0.694
		Basic–Vocational			0.034*
Russian	COVID-19-related preventive health behaviour (Hygiene)		3	5.14	0.162
Latvian	COVID-19-related preventive health behaviour (Dis-tancing)		3		0.370
Russian	COVID-19-related preventive health behaviour (Dis-tancing)		3		0.488

Note: Kruskal–Wallis Test post hoc, * $p < 0.05$, ^aSignificance values for pairwise comparison have been adjusted by the Bonferroni correction for multiple tests.

was evaluated with Evaluation of COVID-19 Related Government Action as an independent variable and COVID-19-related preventive health behaviour as a dependent variable. Also, linear regression between Evaluation of COVID-19 Related Government Action as an independent variable and COVID-19-related preventive health behaviour as a dependent variable was evaluated. It was found that there was both direct association of Evaluation of COVID-19 Related Government Action and COVID-19-related preventive health behaviour, as well as one mediated by Perceived Threat of COVID-19 (Figs. 3, 4).

DISCUSSION

The results of this study show how age, gender, education, residence area, COVID-19 threat perception, evaluation of COVID-19 related government actions, and beliefs in COVID-19-related conspiracy theories relate to preventive health behaviour in the Latvian population sample, and what differences can be observed in two language subsamples of the same population. This provides additional insight in the overall situation and on some specific aspects to take into consideration.

Our research showed that women seem to perceive the COVID-19-related threat more seriously, evaluate COVID-19-related government actions more positive, and be more involved in preventive health behaviour than men, in both Latvian and Russian language samples. Older individuals tend to perceive COVID-19 threat higher and evaluate government COVID-19-related actions more positively.

In line with previous research that shows that older individuals take significantly more preventive actions (Hutchins *et al.*, 2020; Luo *et al.*, 2021), our research showed a similar pattern, however we see that it does not hold for both types of preventive behaviour in both samples. For example, there were no significant differences among age groups in engaging in hygiene guidelines in the Latvian sample. It has been suggested that younger people might rely more on evaluation of their coping resources and how effective those resources could be, while older people rely more on their perception of severity of COVID-19 disease in engaging with protective behaviours (Kim and Crimmins, 2020). This might suggest that attempts to motivate the public were more successful in the Latvian speaking population about hygiene, and in the future some adjustments on motivating

Table 7. Place of residence differences across observed COVID-19 related variables

Language group	Variable	n	Mean rank	df	H	p
Latvian	COVID-19-Origin-Related Conspiracy beliefs			2	0.852	0.653
	Rīga	123	217.96			
	Other city	149	226.93			
	Countryside	180	231.98			
Russian	COVID-19-Origin-Related Conspiracy beliefs			2	1.25	0.536
	Rīga	99	97.70			
	Other city	64	96.67			
	Countryside	27	84.65			
Latvian	Perceived COVID-19 threat			2	5.30	0.071
	Rīga	123	246.88			
	Other city	149	210.28			
	Countryside	180	226.00			
Russian	Perceived COVID-19 threat			2	7.29	0.026*
	Rīga	99	85.40			
	Other city	64	104.36			
	Countryside	27	111.52			
Latvian	Evaluation of COVID-19-related government actions			2	7.86	0.020*
	Rīga	123	251.21			
	Other city	149	206.83			
	Countryside	180	225.9			
Russian	Evaluation of COVID-19-related government actions			2	0.54	0.765
	Rīga	99	95.40			
	Other city	64	98.34			
	Countryside	27	89.15			
Latvian	COVID-19-related preventive health behaviour (Hygiene)			2	29.12	< 0.001*
	Rīga	123	280.28			
	Other city	149	201.58			
	Countryside	180	210.38			
Russian	COVID-19-related preventive health behaviour (Hygiene)			2	5.95	0.051
	Rīga	99	86.24			
	Other city	64	104.67			
	Countryside	27	107.72			
Latvian	COVID-19-related preventive health behaviour (Distancing)			2	8.22	0.001*
	Rīga	123	241.12			
	Other city	149	201.68			
	Countryside	180	237.05			
Russian	COVID-19-related preventive health behaviour (Distancing)			2	13.43	0.001*
	Rīga	99	81.59			
	Other city	64	109.70			
	Countryside	27	112.87			

Note: Kruskal–Wallis Test, * $p < 0.05$

the Russian speaking population need to be done, as well as the Latvian, in terms of the value of distancing.

The current study adds to the notion of mixed results on COVID-19 related conspiracy beliefs in relation to demographic variables (Mulukom *et al.*, 2022) such as age, gender, education. While a previous work (Mulukom *et al.*, 2022) showed that there are inconsistencies on whether older or younger people trust more in these conspiracies, our results showed that there might not necessarily be a linear association. In fact, there could be proposed a study on testing if certain generational margins with local socio-political context can show any significant associations.

Our results demonstrate that higher COVID-19 threat perception, related to fear of contracting the virus and perception of the seriousness of the virus, are associated with lower scores on conspiracy beliefs and higher participation in following hygiene and distancing behaviours, which confirms our H1. Also, perceived threat, according to our results, contributed to a higher participation in COVID-19-related preventive health behaviour as a mediator to positive evaluation of COVID-19-related government actions, which confirms our H3. These results could signal that an adequate level of perceived threat could be helpful, as it might be contributing to favourable social and health behaviour. However, more detailed investigation would be suggested

Table 8. Place of residence pairwise comparison across observed COVID-19 related variables

Language group	Variable	Pairwise comparison	df	H	p^a
Latvian	COVID-19-Origin-Related Conspiracy beliefs		2	0.85	0.653
Russian	COVID-19-Origin-Related Conspiracy beliefs		2	1.25	0.536
Latvian	Perceived COVID-19 threat		2	5.30	0.071
Russian	Perceived COVID-19 threat		2	7.29	0.026*
		Rīga – Other city			0.095
		Rīga – Countryside			0.086
		Other city – Countryside			1.000
Latvian	Evaluation of COVID-19-related government actions		2	7.86	0.020*
		Rīga – Other city			0.015*
		Rīga – Countryside			0.288
		Other city – Countryside			0.555
Russian	Evaluation of COVID-19-related government actions		2	0.54	0.765
Latvian	COVID-19-related preventive health behaviour (Hygiene)		2	29.12	< 0.001*
		Rīga – Other city			< 0.001*
		Rīga – Countryside			< 0.001*
		Other city – Countryside			1.000
Russian	COVID-19-related preventive health behaviour (Hygiene)		2	5.95	0.051
Latvian	COVID-19-related preventive health behaviour (Distancing)		2	8.22	0.016*
		Rīga – Other city			0.038*
		Rīga – Countryside			1.000
		Other city – Countryside			0.041*
Russian	COVID-19-related preventive health behaviour (Distancing)		2	13.43	0.001*
		Rīga – Other city			0.004*
		Rīga – Countryside			0.025*
		Other city – Countryside			1.000

Note: Kruskal–Wallis Test post hoc, * $p < 0.05$, ^aSignificance values for pairwise comparison have been adjusted by the Bonferroni correction for multiple tests.

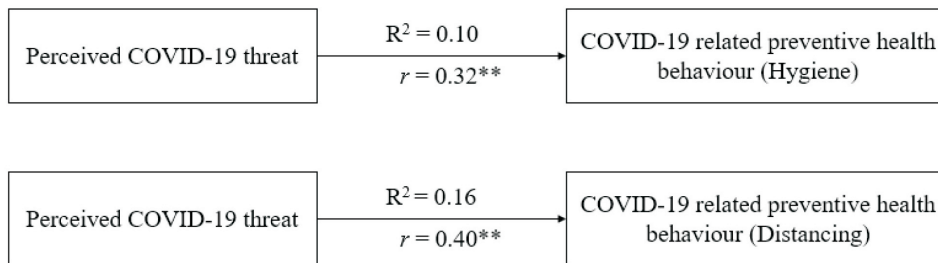


Fig. 2. Linear regression results of perceived COVID-19 threat score on COVID-19 related preventive health behaviour.

Table 9. COVID-19-Origin-Related Conspiracy beliefs and Evaluation of COVID-19 related government actions correlations with preventive health behaviour

Variable	1.	2.	3.	4.
1. COVID-19 Origin Related Conspiracy beliefs	–			
2. Evaluation of COVID-19 related government actions	0.132**	–		
3. COVID-19 related preventive health behaviour (Hygiene)	–0.018	0.354**	–	
4. COVID-19 related preventive health behaviour (Distancing)	–0.059	0.500**	0.495**	–

Note: Latvian language sample. Spearman correlation coefficients. ** $p < 0.01$

Variable	1.	2.	3.	4.
1. COVID-19-Origin-Related Conspiracy beliefs	–			
2. Evaluation of COVID-19-related government actions	–0.167*	–		
3. COVID-19-related preventive health behaviour (Hygiene)	0.030	0.430**	–	
4. COVID-19-related preventive health behaviour (Distancing)	0.101	0.411**	0.548**	–

Note: Russian language sample. Spearman correlation coefficients. * $p < 0.05$, ** $p < 0.01$

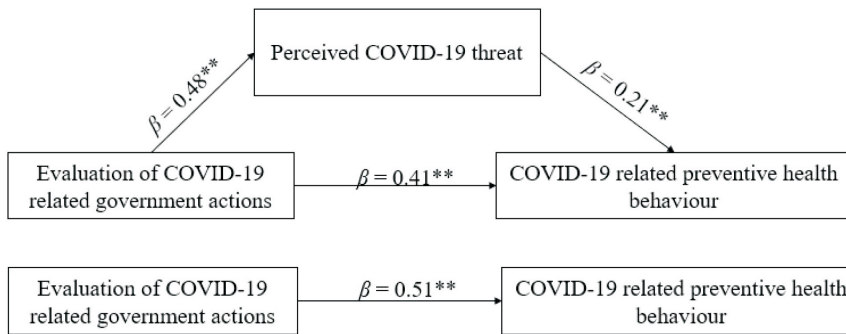


Fig. 3. Mediation analysis result visualisation for perceived COVID-19 threat on evaluation of COVID-19-related government action and COVID-19-related preventive health behaviour.

Fig. 4. Regression analysis result visualisation for evaluation of COVID-19-related government action and COVID-19 related preventive health behaviour.

to find better ways of communicating and educating on actual threat without causing unnecessary anxiety in people. The acquired results also show that evaluation of COVID-19-related government actions can indeed be used as a cue to action within the HBM in pandemic settings, therefore confirming H2.

Unlike some previous research (Allington *et al.*, 2020; Earnshaw *et al.*, 2020; Hughes *et al.*, 2022), our study showed no association between COVID-19 conspiracy beliefs and preventive health behaviour. Therefore, H4 and H5 were rejected. Some of the assumptions that we might suggest are that there could be some sociocultural, locally specific variables in play, or the difference might also be connected to the presence of respondents with personal COVID-19 experience in the sample. As our sample did not include participants who had personal experience, yet some of the observed previous studies did or did not control for it. Further research would be necessary to clarify the association or the lack of it. However, considering that the examined conspiracy theories are related to the origin of the virus rather than its specific impact and direct threats to humans, such as in the case of vaccines, there is also the possibility that belief in these conspiracy theories is not a significant indicator in the context of preventive health behaviour. Therefore, the differences in the findings of various studies in this regard can be explained by some other factors.

We would like to note the limitations of our study. The study was performed between the first and second wave of pandemic in Latvia and might not precisely represent situation in another timeframe. Self-report scales were used, which do not allow for the assessment of real behaviour. Also, our study was part of another major study, and as a result the average time of an interview was about 65.2 minutes, which might have impacted the participation rate and sample due to certain personal factors of potential participants.

Understanding population-specific features that are involved in preventive health behaviour broaden our understanding and give valuable insight in local policies in preparing for the next waves of COVID-19 or other future pandemics. Also, identifying additional specific cues to action that influence peoples' participation in preventive health behaviour gives additional perspective on mechanisms that build our behaviour decisions. In a future study we suggest that the full Health Belief Model needs to be applied to assess cumulative impact of observed variables.

CONCLUSIONS

Our research suggests that in a health crisis situation, evaluation of government actions could play a valuable role in motivating people to be more involved in preventive health behaviour and as such be used as a cue to action within the HBM framework. Beliefs in COVID-19-related conspiracy theories, however, showed no significant associations, yet since the worldwide results differ this could point to the necessity of broader study on why these beliefs are meaningful in some populations and not in another.

The results of our study also point out that in the local context of Latvia, our epidemiological situation might benefit if younger people and men specifically would be targeted additionally when health educational interventions in pandemic context are executed, and there might be a need for tailoring such interventions in the Russian speaking population to improve our overall health behaviour situation in the country.

ETHICS

Permission for the study was received from Rīga Stradiņš University (RSU) Research Ethics Committee (Nr.6-1/07/28).

Computer assisted face-to-face interviews were delivered by a specially trained team. For data gathering, European Society for Opinion and Marketing Research (ESOMAR) standards were applied as well as SIA "TNS Latvia" global data gathering standards. All data was anonymous and used only in aggregated form.

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AR COVID-19 PREVENTĪVO VESELĪBAS UZVEDĪBU SAISTĪTO FAKTORU NOVĒRTĒJUMS VESELĪBAS PĀRLIECĪBAS MODEĻA IETVAROS

Nefarmaceutiskie līdzekļi, tādi kā masku valkāšana, sociālā distancēšanās, roku higiēna, ir vieni no visefektīvākajiem sabiedriskās veselības līdzekļiem pret Covid-19 izplatību. To ieviešana sabiedrībā var atšķirties katrā valstī un pat atsevišķās populācijās vienas valsts ietvaros. Mūsu pētījuma mērķis bija Veselības pārliecības modeļa ietvaros izpētīt faktoros, kas saistīti ar šo uzvedību ieviešanu Latvijas iedzīvotājiem, vienlaicīgi izvērtējot, vai tādi faktori kā valdības ar Covid-19 saistītās rīcības novērtējums un ticība Covid-19 izcelsmes sazvērēstības teorijām var tikt skatītas kā rīcību veicinošie stimuli šī modeļa kontekstā. Mūsu pētījums tika veikts Latvijas izlasē īsi pirms otrā pandēmijas viļņa, iekļaujot divas pamata valodu grupas ($n_{\text{Latviešu}} = 452$; $n_{\text{Krievu}} = 190$). Pētījuma rezultāti norāda uz nišiem, kas potenciāli varētu uzlabot preventīvas veselības uzvedības plašāku ieviešanu Latvijas iedzīvotāju vidū, kā arī parāda, ka valdības ar Covid-19 saistītās rīcības novērtējumam ir statistiski nozīmīga ietekme uz šo uzvedību. Pretēji gaidītajam ticība Covid-19 izcelsmes sazvērēstības teorijām saistības ar preventīvo veselības uzvedību neuzrādīja.