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## **DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS, HEALTH STATUS AND POLITICAL ORIENTATION AS PREDICTORS OF COVID-19 VACCINE HESITANCY AMONG THE SLOVENIAN PUBLIC**

### ABSTRACT

*The present study examined predictors of the intention to become vaccinated against Covid-19 among the Slovenian public. A cross-sectional, non-probability sample was collected through an online survey in March and April 2020 (N = 826;  $M_{age} = 33.2$  years). We tested four groups of predictors: demographic and socioeconomic characteristics, health status and political (left-right) orientation. Our ordinal regression model explained 44% of the variance in Covid-19 vaccine hesitancy. All six predictors had a significant impact on vaccine hesitancy, which was significantly higher among women, among 30–39-year-olds, the less educated, the self-employed and unemployed, those reporting excellent self-rated health and those with a centrist political orientation (followed by right-oriented respondents). Implications of the results are discussed.*

**KEY WORDS:** Covid-19 vaccine, vaccine hesitancy, predictors of vaccine uptake, social inequalities, health status

# Demografski, socioekonomski, zdravstveni in politični napovedovalci oklevanja pred cepljenjem proti covidu-19 med slovensko javnostjo

## IZVLEČEK

V pričujoči raziskavi smo proučevali napovedovalce namere za cepljenje proti covidu-19 med slovensko javnostjo. Presečni, neverjetnostni vzorec je bil pridobljen s spletno anketo med marcem in aprilom 2020 ( $N = 826$ ;  $M_{\text{starost}} = 33,2$  leta). Analizirali smo štiri skupine napovedovalcev oklevanja: demografske in socioekonomske napovedovalce, zdravstveni status in politično usmeritev (levo/desno). Naš ordinalni regresijski model je razložil 44 % variance v oklevanju pred cepljenjem proti covidu-19. Vseh šest napovedovalcev je učinkovalo na oklevanje pred cepljenjem, ki je bilo statistično značilno višje med ženskami in med 30–39-letniki, nižje pa med manj izobraženimi, samozaposlenimi in brezposelnimi, tistimi z odličnim samoocenjenim zdravjem in tistimi s sredinsko politično usmeritvijo (sledili so desno usmerjeni anketiranci). V sklepnem delu prispevka razpravljamo o implikacijah rezultatov naše raziskave.

**KLJUČNE BESEDE:** cepivo proti covidu-19, oklevanje pred cepljenjem, napovedovalci namere za cepljenje, družbene neenakosti, zdravje

## 1 Introduction

### 1.1 Vaccine Hesitancy as a Global Public Health Threat

Scientists around the world have been trying for most of 2020 to develop a safe and effective Covid-19 vaccine. However, even when the vaccine is available, access to it will not be equal – neither globally nor within countries. Some underprivileged social groups will never get access to the vaccine, while some will get access much later than others. There is a third group that interests us in the present study: those who will have access to the vaccine but will decide *not* to get vaccinated. Social inequalities in vaccine uptake are well documented (Arat et al. 2019; Restrepo-Méndez et al. 2016). In addition, vaccine hesitancy – negative attitudes toward vaccination, rejection of, or delaying vaccine uptake for oneself or one's child (Yaqub et al. 2014; WHO 2019) – has played an increasingly important role in recent years, with the World Health Organization declaring it as one of the top ten threats to global health (WHO 2019). The public in less developed countries – where vaccine-preventable diseases still pose a substantial health risk to everyone – has high trust in the effectiveness and safety of vaccines. In contrast,

the Western public has become increasingly sceptical of vaccines (Larson et al. 2016), in part because of the efficiency of vaccines in preventing diseases: “when a community stops worrying about a disease threat, complacency can paradoxically cause it to resurface” (Allen and Butler 2020: 53).

As with any other vaccine hesitancy, Covid-19 vaccine hesitancy needs to be understood as a decision-making process that is embedded in the social structure and associated with various social trends and cultural changes. Slovenia has one of the largest proportions of vaccine-hesitant citizens in the world, as does the rest of East-Central Europe (Larson et al. 2016). A representative national poll in June 2020 found that 55% of Slovenians would be willing to get the Covid-19 vaccine if available, while the number fell to only 35% in October 2020 (Mediana 2020). A public opinion poll from Poland, another East-central European country, indicates a somewhat higher, yet still relatively low willingness to accept the Covid-19 vaccine (66%–69%) (Statista 2020). An unpublished study in the U. S. found that 23% of adults would *not* get vaccinated against Covid-19 once a vaccine becomes available (Trujillo and Motta 2020).

These sparse preliminary studies on vaccination intention indicate that Covid-19 vaccine hesitancy may present a significant obstacle in establishing herd immunity in the Western and European population. It is also important that studies have not examined which social groups within countries are the most hesitant towards the Covid-19 vaccine. It is crucial to study whether differences exist in Covid-19 vaccine hesitancy according to various social and political characteristics to prepare strategies and effective communication and public health campaigns targeted explicitly to the most vaccine-hesitant social groups. Existing public health and social policy efforts based on scientific findings on hesitancy towards other specific vaccines, or vaccines in general, will be effective only insofar as it is established that general vaccine hesitancy predictors are similar to the predictors of Covid-19 vaccine hesitancy.

Tailored campaigns focusing on specific social groups are therefore needed, since “promoting an equal vaccine uptake across population groups may magnify inequalities in infectious disease risk” (Munday et al. 2018). While the Covid-19 pandemic has affected the whole world, it is most threatening for those who have underlying illnesses, including heart or respiratory diseases, high blood pressure and diabetes (Yang et al. 2020). Since these health conditions are most prevalent among those facing difficult socioeconomic circumstances (McNamara et al. 2017), we are currently witnessing how “social inequalities in health are profoundly, and unevenly, impacting Covid-19 morbidity and mortality” (Abrams and Szeffler 2020).

In the next part of our paper, we present a brief overview of findings on four sets of predictors of vaccine hesitancy--demographic and socioeconomic

characteristics, health status and political orientation--and present our hypotheses. In the third part, we summarize recent studies on Covid-19 vaccine hesitancy. In the fourth part, we present the methods employed in our study, describe our sample and the indicators used. In the Results section, we test our hypotheses, and in the final part of the paper, we discuss the scientific and practical implications of our findings.

## 1.2 Predictors of Vaccine Hesitancy

While gender is a key demographic variable examined in vaccine hesitancy research, previous studies do not show consistent gender differences in vaccine attitudes. For example, while men are more likely to have better knowledge about vaccination than women (Ritvo et al. 2003), and are less likely to trust non-professional sources of vaccine-related information (Freed et al. 2011), several other studies show more positive vaccine attitudes among women (Callaghan et al. 2019; Larson et al. 2016). Gender differences in vaccine hesitancy may vary by type of vaccine; women, for example, express more positive attitudes towards a vaccine against HPV. This could be due to health campaigns being aimed at them, since certain types of HPV can cause cervical cancer (Bynum et al. 2011). Tusimin et al. (2019) examined knowledge about and attitudes towards the HPV vaccine among students and found that young women had better knowledge and more positive vaccine attitudes than men. On the other hand, some studies did not find gender differences in vaccine attitudes (Hornsey et al. 2018), including attitudes towards the HPV (Lee Mortensen et al. 2015) and MMR vaccines (Casiday et al. 2006).

Age is another demographic characteristic that impacts vaccine attitudes and uptake. Studies show more positive attitudes towards seasonal influenza vaccines among older adults (Peretti-Watel et al. 2013; Chapman and Coups 1999), who also have higher vaccine uptake (Börjesson and Enander 2014). In a study conducted in eleven European countries (France, Germany, Italy, UK, Spain, Austria, Czech Republic, Finland, Ireland, Poland and Portugal), age proved to be a predictor of influenza vaccine uptake, with individuals older than 65 having higher rates of uptake (Endrich et al. 2009). The elderly may hold more positive vaccine attitudes because they are an at-risk group. We similarly anticipate more favourable attitudes among the elderly toward the intention of receiving a Covid-19 vaccination, since data indicates they are most likely to have a more severe disease progression and Covid-19 mortality increases with age (Promislow 2020).

Concerning socioeconomic predictors, educational level and employment status are among the factors that impact vaccine hesitancy. Several studies on

educational inequalities in vaccine attitudes indicate that higher educational level is linked to pro-vaccine attitudes, for example, in Canada (Ritvo et al. 2003), the U. S. and Australia (Bocquier et al. 2017), Belgium (Vandermeulen et al. 2008), and China (Zeng et al. 2019). Some studies, on the other hand, show higher educational levels being associated with negative vaccine attitudes (Endrich et al. 2009; Hak et al. 2005). One reason might be that better educated individuals are more likely to express "healthism" (Crawford 1980), i.e. exercising increased self-control over their health (Bocquier et al. 2017; Peretti-Watel et al. 2014), and taking an individualistic approach to their own health and that of their children (Swaney and Burns 2019). In other words, individuals with a more privileged socioeconomic background have the desire and resources to be (or to feel) more in control of their lifestyle and health behaviours, including their children's, having the perception that they know best what is right for their health (more than professionals and scientific data). Such an egocentric worldview puts the individual and their immediate family members at the centre of the individual's decision-making processes, largely disregarding the wider community and society.

Compared to educational background, employment status has been a much less researched predictor of vaccine attitudes and uptake, and one with inconsistent results. For example, Gracie and colleagues (2011) found that a group of employed women and students were more likely to receive the H1N1 vaccine during the 2009-2010 influenza pandemic than women of other activity status; however, differences became insignificant once education was taken into account. Compared to the unemployed, those who are employed are less vaccine-hesitant among the general public (Larson et al. 2016), and among parents (Mohd Azizi et al. 2017). On the other hand, a study conducted in North Carolina by Horney and colleagues (2010) found that those in full-time and part-time employment showed lower intent to receive the influenza vaccine than the non-employed group (the unemployed and students).

Health status has previously also been identified as a predictor of vaccine attitudes and uptake. As expected, less healthy individuals express less vaccine hesitancy (Guthrie et al. 2017), and individuals with poorer health are more likely to get vaccinated against influenza (Wu 2003). Since poorer health increases vulnerability, not getting vaccinated could result in a stronger negative impact of vaccine-preventable disease on one's health status.

Finally, political orientation also exerts an impact on vaccine attitudes. Studies show that individuals with a conservative political orientation are more likely to be vaccine-hesitant (Hornsey et al. 2018; Hoffman et al. 2019; Rabinowitz et al. 2016). In addition to anti-vaccination attitudes, political conservatism was also

found to be associated with distrust of vaccine information provided by professionals (Hamilton 2015). Vaccine hesitancy could therefore be explained by political ideology; the latter affects trust in information sources, but also the choice of information used about vaccines, so that the information is consistent with the individual's ideology (Baumgaertner et al. 2018). Since the Republican U. S. President D. Trump has publicly expressed anti-vaccine statements (Hornsey et al. 2020), it is more likely that in the U. S. Republican voters also hold these beliefs. On the other hand, liberal ideology is more compatible with vaccine science, and self-identified Democrats are more likely to report accurate scientific beliefs (Joslyn and Sylvester 2019).

### 1.3 Predictors of Covid-19 Vaccine Acceptance

In 2020, Covid-19 vaccine hesitancy and its predictors were examined in various cultural contexts. For example, a study from China found gender differences in Covid-19 vaccine acceptance, with men expressing greater intention to be vaccinated against Covid-19 than women (Wang et al. 2020). Gender differences in Covid-19 vaccine acceptance were also found in the Australian and U. S. population, with men expressing greater willingness to be vaccinated (Malik et al. 2020; Reiter et al. 2020; Faasse and Newby 2020) and greater trust in the Covid-19 vaccine (Latkin et al. 2021). Research conducted in seven European countries (Denmark, France, Germany, Italy, Portugal, Netherlands, and the UK) similarly demonstrated that willingness to accept the future Covid-19 vaccine was higher among men (Neumann-Böhme et al. 2020). The same study also identified age differences: men older than 55 years of age showed the greatest willingness to be vaccinated, while those aged between 18 and 24 were the most hesitant. Even though women were generally more hesitant than men in all observed age groups, those aged 45–55 were the most hesitant about getting vaccinated (ibid.). Studies consistently proved that older adults were more likely to be willing to get vaccinated against Covid-19 than younger individuals (Lazarus et al. 2020; Malik et al. 2020; Sherman et al. 2020).

Socioeconomic status (education and income) also proved to be a significant predictor of intended Covid-19 vaccination, since those with higher education and higher income were more likely to express vaccine acceptance (Lazarus et al. 2020; Reiter et al. 2020; Ward et al. 2020), though not in some countries (Faasse and Newby 2020).

Research on health status as a predictor of vaccine hesitancy, on the other hand, is scarce for vaccine hesitancy in general, and for Covid-19 vaccine in particular. A study by Reiter and colleagues (2020) examined health status as a Covid-19 vaccine predictor and found that underlying medical conditions increased the

willingness to get vaccinated among U. S. adults. A study among Australians, on the other hand, found self-rated health and disability were not significant predictors of Covid-19 vaccine uptake intention (Faasse and Newby 2020; Edwards et al. 2020). Therefore, studies need to examine whether health status is a predictor of Covid-19 vaccine hesitancy, above and beyond other determinants of health, including in a non-English cultural context. In sociological survey data, two subjective health measures have previously been widely employed – self-rated health and self-reported chronic disability/illness – which we also examined in our study.

Finally, similar to existing vaccines, there is evidence that in the current Covid-19 pandemic, political orientation also drives scepticism towards scientific and public health recommendations for self-protective behaviours, such as social distancing, wearing masks and handwashing (Yamey and Gonsalves 2020). In the U. S., for example, a conservative orientation and Republican self-identification – as exemplified by actions and public statements by President Trump and Republican members of congress – is linked with not following WHO, CDC and other public health recommendations (Cheng 2020) and with lower Covid-19 vaccine trust (Latkin et al. 2021). In a study of Covid-19 vaccine acceptance and political ideology among French adults, it was found that those who affiliate themselves with Far-Right political ideology reported lower future Covid-19 vaccine acceptance (Ward et al. 2020).

#### **1.4 The Aim of the Study and Hypotheses**

Since various predictors of Covid-19 vaccine hesitancy have yet to be systematically examined among the Slovenian public, we collected data on Covid-19 vaccine attitudes among the public in Slovenia, a high-income East-Central European country (UNDP 2019). We aimed to examine four groups of predictors of Covid-19 vaccine hesitancy: demographic (gender and age) and socioeconomic characteristics (educational level and employment status), health status (self-rated health and self-reported chronic illness) and political orientation. Based on the existing literature review, we set the following hypotheses:

- H1: Men are less likely to express Covid-19 vaccine hesitancy than women (Neumann-Böhme et al. 2020; Reiter et al. 2020; Wang et al. 2020).
- H2: Younger adults are more likely to express Covid-19 vaccine hesitancy than older adults (Lazarus et al. 2020; Malik et al. 2020; Peretti-Watel et al. 2013).
- H3: Individuals with a higher educational background (Lazarus et al. 2020; Reiter et al. 2020; Ward et al. 2020) (H3a) and those in employment (Larson et al. 2016; Mohd Azizi et al. 2017) (H3b) are more likely to express the least Covid-19 vaccine hesitancy than are individuals with lower education and those not in employment.

H4: Individuals with poorer health are more likely to express lower vaccine hesitancy than individuals with better health (Guthrie et al. 2017; Wu 2003).

H5: Individuals who express leftist political orientations are less likely to express vaccine hesitancy than individuals with rightist political orientations (Hoffman et al. 2019; Hornsey et al. 2018; Ward et al. 2020).

## 2 Method

### 2.1 Sample

A cross-sectional quantitative study was performed between March 17<sup>th</sup> and April 1<sup>st</sup>, 2020. The non-probability sample survey was collected by inviting respondents over the age of 18 to participate, using the snowball technique via e-mail and social networks (Facebook, Twitter and Instagram) and the University of Maribor website. The sample was obtained through an online survey tool Ika.si, and it comprised 851 Slovenians ( $M_{age}=33.2$  years). Most respondents reported being employed (55.11%) and having a first-cycle degree (34.9%). We should mention that our sample (Table 1) has several shortcomings. Besides not being representative of the Slovenian public, it did not contain elderly persons above the age of 65, since online survey dissemination did not reach this age group in our study. For these reasons, we divided the respondents into three age groups of relatively similar size. Studies of vaccine hesitancy during current and future waves need to include the elderly in the sampling strategy. In addition, based on the mean value of vaccine hesitancy ( $M=6.29$ ), our sample consisted of a substantial proportion of Covid-19 vaccine sceptics.

**Table 1: Sample characteristics.**

	Group	%
Gender	Female	84.5
	Male	15.5
Age	18–29 years	38.2
	30–39 years	35.0
	40+ years	26.8
Education	High school diploma or lower	31.4
	First-cycle degree	34.9
	Second-cycle degree or higher	33.6
Employment status	Unemployed	7.3
	Self-employed	12.3
	Employed	55.1

	Student	25.3
Health	Poor/fair health	5.8
	Good health	24.3
	Very good health	47.2
	Excellent	22.7
Political orientation	Left	34.7
	Centre	51.1
	Right	14.2
Vaccine hesitancy		6.29*

Note: \* = mean.

## 2.2 Measures

Vaccine hesitancy was measured with a question about the intention to get vaccinated: "How likely would you get vaccinated against the new coronavirus (Covid-19) if the vaccine were available?" (0=*not likely at all*; 10=*very likely*). The values were recoded with 0 indicating the lowest and 10 indicating the highest Covid-19 vaccine hesitancy.

The following four demographic and socioeconomic predictors were measured: gender (1=male; 2=female), age group (1=18–29 years; 2=30–39 years; 40 and above), education (1=high school or less; 2=first-cycle degree; 3=second-cycle degree or higher) and employment/activity status (1=unemployed; 2=self-employed; 3=employed; 4=students).

*Health status* was measured with two single-item questions; a standard measure of self-rated health (Idler and Benyamini 1997) and a measure of longstanding chronic illness or disability (European Social Survey Round 7 Data 2015). Respondents were asked: "In general, how would you rate your health? Would you say it is?" (1=*poor*; 5=*excellent*). Disability was tapped with the following question: "Are you hampered in your daily activities in any way by any longstanding illness, or disability, infirmity or mental health problem? If yes, is that a lot or to some extent?" (1=*Yes, a lot*; 2=*Yes, to some extent*; 3=*No*). The disability variable was dichotomized in our analysis (1=*Yes*; 2=*No*).

Political orientation was measured with the following question: "In politics, people sometimes talk of "left" and "right". Where would you place yourself on a scale, where 0 means the left and 10 means the right?" Original values were recoded into three groups: left (0–4), centre (5) and right (6–10).

## 2.3 Plan of Analysis

Statistical Package for the Social Sciences Program (IBM SPSS Statistics Versions 26) was used for the analyses. We first examined the bivariate correlation between Covid-19 vaccine hesitancy and seven predictor variables. The results (not shown) indicated that all but one predictor (health disability status) were significantly associated with Covid-19 vaccine hesitancy. In the Results section, we present the ordinal regression model with six predictors simultaneously included in the model. The aim was to tease out the effect of each predictor on vaccine hesitancy, while controlling for all other predictors in a single model.

## 3 Results

Table 2 shows the results of our ordinal regression analysis. We included four sets of predictors, i.e. all seven predictor variables. Our ordinal regression model predicting Covid-19 vaccine hesitancy was significant ( $p < 0.001$ ), explaining 44.4% of the variance (Nagelkerke). In line with H1, women were significantly more vaccine-hesitant than men ( $p < 0.001$ ). Compared to the oldest age group, the middle-age group showed significantly higher vaccine hesitancy ( $p < 0.05$ ), while the youngest age group was the least hesitant ( $p < 0.001$ ). These results do not support H2.

Educational level was also a significant predictor of Covid-19 vaccine hesitancy. Those with a high school diploma or less ( $p < 0.05$ ) and those with a first-cycle degree ( $p < 0.01$ ) were significantly more hesitant than those in the highest educational group (having at least a second-cycle degree), corroborating hypothesis H3a. Employment/activity status also proved to be a significant predictor. Students were the least vaccine-hesitant status group ( $p < 0.001$ ); the self-employed were the most vaccine-hesitant, followed by the unemployed and the employed group. These results support H3b.

Respondents who reported "excellent" self-rated health showed the greatest vaccine hesitancy ( $p < 0.001$ ), while hesitancy declined with worsening self-rated health, corroborating H4. Finally, compared to those with rightist political orientation, those with centrist political orientation had significantly higher vaccine hesitancy ( $p < 0.05$ ), while left-oriented respondents reported significantly lower Covid-19 vaccine hesitancy ( $p < 0.05$ ), compared to centre- and right-oriented respondents. These results, again, support H5.

**Table 2: Ordinal regression model (parameter estimates) predicting Covid-19 vaccine hesitancy among the Slovenian public.**

		Estimate	S.E.	Wald	Sig.	95% CI	
						LL	UL
	Gender (male) <sup>1</sup>	-0.70	0.20	12.36	0.000	-1.09	-0.31
Age	18-29 year <sup>2</sup>	-1.16	0.24	22.74	0.000	-1.63	-0.68
	30-39 years <sup>2</sup>	0.50	0.21	5.87	0.015	0.10	0.90
Education	High school diploma or lower <sup>3</sup>	0.63	0.22	8.30	0.004	0.20	1.05
	First-cycle degree <sup>3</sup>	0.74	0.20	14.16	0.000	0.35	1.12
Employment status	Unemployed <sup>4</sup>	1.79	0.34	27.66	0.000	1.12	2.44
	Self-employed <sup>4</sup>	2.94	0.39	58.37	0.000	2.18	3.69
	Employed <sup>4</sup>	1.40	0.25	31.76	0.000	0.91	1.88
Health	Poor/fair health <sup>5</sup>	-1.44	0.36	16.51	0.000	-2.14	-0.75
	Good health <sup>6</sup>	-1.44	0.23	38.74	0.000	-1.89	-0.98
	Very good health <sup>6</sup>	-0.90	0.21	18.71	0.000	-1.31	-0.49
Political orientation	Left political orientation <sup>6</sup>	-0.58	0.22	6.63	0.010	-1.01	-0.14
	Center political orientation <sup>6</sup>	0.50	0.22	5.09	0.024	0.07	0.93

Notes: Reference groups: <sup>1</sup>female; <sup>2</sup>40+ year-olds; <sup>3</sup>Second-cycle degree or higher; <sup>4</sup>Students; <sup>5</sup>Excellent self-rated health; <sup>6</sup>Rightist political orientation.

## 4 Discussion

In the present study, we examined demographic and socioeconomic characteristics, health status and political orientation as predictors of Covid-19 vaccine hesitancy among the Slovenian public. The results indicate that all four sets of predictors impact vaccine hesitancy. Women, individuals in the middle-age group (30–39-years-olds), those with lower levels of education, the self-employed and unemployed, those with better subjective health, and those with centrist and rightist political orientations were the most reluctant to get vaccinated against Covid-19 in the first wave of the coronavirus epidemic in Slovenia during Spring 2020.

Our findings show some encouraging results in the sense that vaccine hesitancy might not increase social inequalities in health. For example, our finding that those with the poorest health are the least vaccine-hesitant indicates that, once the vaccine is available, uptake will likely be higher among the most health-vulnerable social groups (as long as they have the same access to the vaccine as other groups). Our results are therefore consistent with a study conducted by

Guthrie and colleagues (2017) on determinants for rejecting seasonal influenza vaccine. In addition, men, who are also more likely to have a worse Covid-19 disease progression than women (Klein et al. 2020), express lower vaccine hesitancy.

On the other hand, several findings from our study indicate worrying patterns for social inequality. For example, the 30–39 age-group is the most vaccine-hesitant, and the 40+ age group is the second most hesitant. This is an important public health problem, since the 30–39 age-group – who reported the highest vaccine hesitancy in our sample – is significantly affected in terms of a higher numbers of Covid-19 infections being reported in this age group, based on Covid-19 case data in Slovenia (Covid-19 sledilnik 2020). While not the most health-vulnerable, this age group is the most geographically mobile in everyday life (SURs 2021), which means that the potentially lowest vaccine uptake among younger adults might increase the likelihood of this group's members spreading the disease to others, including the most vulnerable population of society (Boehmer et al. 2020).<sup>1</sup> Campaigns and vaccine promotion strategies should therefore address the 30-39-year-old age group in particular. It is crucial to communicate to the general public that the elderly are not the only ones who are likely to get Covid-19 but are the most at risk for severe disease progression, have the highest Covid-19 mortality and are likely to get it from younger (unvaccinated) people (Boehmer et al. 2020).

Our study also revealed that the two lowest educated groups are the most Covid-19 vaccine-hesitant. We found that unemployment status was also linked to higher vaccine hesitancy. On the other hand, the self-employed reported the highest vaccine hesitancy. These findings indicate that, although public health campaigns should be aimed at those from lower socioeconomic backgrounds, high-socioeconomic status groups also need to be addressed. Unfortunately, we did not test for the effect of income, and it remains unclear whether, in our sample, the self-employed were socially privileged groups, or were perhaps mainly from middle SES. The question of self-employment status as a predictor of vaccine hesitancy needs to be further analysed in future studies.

We also found that centrist political orientation was linked to higher vaccine hesitancy. This is surprising, since studies on hesitancy toward other types of vaccine have shown increased vaccine scepticism mainly among those on the right of the political spectrum (Hoffman et al. 2019; Hornsey et al. 2018; Joslyn and Sylvester 2019), although recent evidence from the U.S. suggests that "Other" political orientation (neither Republican, Democrat nor Independent) is linked

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1. Insofar as the vaccine would also prevent Covid-19 transmission.

to increased vaccine hesitancy (Latkin et al. 2021). Again, future studies should examine the mediating mechanisms that make the centre-oriented respondents in Slovenia the most Covid-19 vaccine-hesitant (if our finding is confirmed on representative samples), including studying cultural value orientations, economic attitudes etc. In addition, it may be that those placing themselves in the centre on the political orientation scale have low trust in conventional political parties (left, right and centre) and that their self-placement indicates a protest orientation and low levels of trust in established intuitions (political, but also medical institutions and science in general). Future studies should examine the underlying mechanisms in more detail.

To summarize, our study indicates that some social groups will probably be less likely to decide to get a Covid-19 vaccine. Not being vaccinated poses a health risk not only to oneself but also to people in one's community and because of transmission of infections, to general public health. To prevent the spread of infectious disease, it is necessary to achieve herd immunity, which requires a high proportion of the population to be vaccinated. For example, to achieve collective immunity against measles, 95% of the population has to be vaccinated (Salmon et al. 2015). For now, it remains unclear whether the vaccines currently used against Covid-19 will prevent not only disease but also transmission of the virus from infected to healthy persons.<sup>2</sup> This means that both the concept of herd immunity and reaching sufficient levels of immunity remain unclear in the case of Covid-19. Nonetheless, based on our results, future public health interventions and campaigns in Slovenia should primarily address women, the 30–39 age-group, lower educated individuals, the unemployed and the self-employed.

Additionally, centrist political parties and their leaders could also have a positive impact on their voters and supporters if they communicate the personal and public health significance of the uptake of a safe and efficient Covid-19 vaccine. Finally, since healthier people have less interest in getting vaccinated, it is essential that healthcare institutions, physicians, nurses and other healthcare professionals, in communication with patients and the general population, emphasize that the vaccination protects not only ourselves but also other individuals. This includes family members, who may be at greater risk because of poorer health or lower socioeconomic status. Since health problems and symptoms are unequally distributed not only by age group but also across socioeconomic strata, with worse health outcomes being more prevalent among the socioeconomically and ethnically

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2. For example, if vaccinated people can still get infected with Covid-19 and pass on the virus to other people, then vaccination will not provide herd immunity. Of course, it would still prevent serious disease outcomes and drastically reduce mortality.

disadvantaged and other minority groups, engagement by professionals and the public toward equal Covid-19 vaccine uptake is key for acquiring greater social equality. This will only be achieved if the public, institutions and decision-makers have common goals and only alongside evidence-based public health campaigns.

From a more critical perspective, it seems vaccine hesitancy in our sample is more widespread among the cluster of healthy, highly educated, self-employed, politically centrist, middle-aged respondents. Further investigation is warranted, for example, on whether this cluster's values and attitudes rank high on self-sufficiency and egocentrism and low on prosocial orientation and social solidarity. In addition, refusal of vaccination among different social groups has different social consequences, since social groups do not have the same (public) role and influence in the society. Middle-aged, educated, "self-made", healthy people have more followers – online and in real life – and are more influential trendsetters than the less educated, less healthy groups.

In conclusion, despite its limitations, our study carried out during the first wave of the Covid-19 epidemic could represent a starting point for further research in the present (second) wave and potential future waves of the epidemic, since there is currently a lack of research on Covid-19 vaccine hesitancy in Slovenia. Future studies should include higher-quality samples and should examine additional variables not included in our model. For example, perceived risk of Covid-19 disease and (potential risk of) vaccination differ between various social groups. Future studies will provide additional insight that is urgently needed for successfully combating the Covid-19 epidemic in Slovenia.

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