

# WILLINGNESS TO GET VACCINATED AGAINST COVID-19: PROFILES AND ATTITUDES TOWARDS VACCINATION

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# Willingness to get vaccinated against Covid-19: profiles and attitudes towards vaccination

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## Abstract

*Background:* High uptake of a Covid-19 vaccine is required for a successful vaccination campaign that manages to reach herd immunity.

*Objective:* To identify the predictors associated with someone's willingness to get vaccinated against Covid-19, and to investigate whether these coincide with the predictors of attitudes towards vaccination in general.

*Methods:* A representative sample of 2,060 Belgians were surveyed between 6 and 16 October 2020. Regression analyses were used to calculate adjusted and non-adjusted odds ratios of variables associated to someone's willingness to become vaccinated and to vaccine attitudes in general.

*Results:* 34% (n=651) of the participants reported that they will definitely get vaccinated against Covid-19 once a vaccine is available and 39% (n=742) that they would "probably". Intended uptake was strongly associated with age, opinion on the government's dealing with the Covid-19 pandemic, medical risk and spoken language, and to a lesser extent with gender and having known someone who was hospitalised because of Covid-19. Similar predictors were identified for attitudes to vaccination in general. However, Covid-19 vaccine hesitancy was more marked in age groups below 54 years old. We further analysed a sample of 17% (n=349) of the participants found favourable to vaccination in general but not willing to vaccinate against Covid-19. These people were mainly female, young, French speaking, slightly less educated, and working. They also did not belong to a Covid-19 risk group, were very dissatisfied with the government's dealing with the Covid-19 crisis, and did not know personally someone who was hospitalized because of Covid-19.

*Conclusions:* The majority of Belgians intend to get vaccinated, though uptake is lower in groups at lower risk of severe forms of Covid-19. Levels of vaccine hesitancy seem higher for Covid-19 vaccination than for other vaccines, with a substantial part of the population being convinced of the utility of vaccination in general but nonetheless being hesitant about the Covid-19 vaccine. Communication campaigns will need to inform on the safety and efficacy of Covid-19 vaccination to encourage uptake.

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## **1. Introduction**

After months of global public health crisis that has paralyzed our societies, safe and effective vaccines that protect against Covid-19 are becoming available (Voysey et al. 2020, Polack et al. 2020). The next crucial challenge will be to deploy these vaccines with sufficiently high vaccination coverage rates in the population so that thresholds required for herd immunity can be reached. For vaccine efficacies of approximately 80%, it has been estimated that herd immunity requires that minimally 60% (Altmann, Douek, and Boyton 2020) but possibly up to 90% of the population become vaccinated (Anderson et al. 2020). Herd immunity will not just be a bonus that comes on top of individual vaccine protection. It will be an essential layer of Covid-19 prevention on which many people will depend as none of the vaccines will be 100% effective, it remains to be seen whether they will be equally effective in all individuals and some population subgroups cannot receive vaccination (e.g. for medical reasons).

The most optimal mechanism to rapidly achieve herd immunity will be mass vaccination. However, apart from the logistic challenge of reaching sufficient numbers of individuals, there is an even bigger challenge in convincing vaccine hesitant individuals to become vaccinated (McAteer et al. 2020). Vaccination has always been controversial and throughout history a part of the population has always resisted it (Marshall 2019). Over the past years, researchers have observed substantial and increasing levels of vaccine hesitancy in the population, often linked to the fact that infectious diseases and their consequences are fading from public memory but also in part through misinformation propagated on the internet (Horne et al. 2015, Luyten, Bruyneel, and van Hoek 2019). The World Health Organization (WHO) labelled vaccine hesitancy one of the top ten threats to global health in 2019, next to e.g. antimicrobial resistance or air pollution and climate change. Also with the COVID-19 vaccine, policy makers dealing with vaccine hesitancy and scepticism will be a critical success factor (WHO 2018). Therefore, it is important that policy makers have a good view on the people profiles who are likely to refuse or delay vaccination. This will enable them to target communication campaigns and to devise vaccination strategies that take into account the clustering of susceptibility in profiles that are likely to refuse.

This paper aims to identify among a representative sample of the Belgian population the predictors associated with the willingness to become vaccinated against Covid-19 and investigate whether these coincide with predictors of attitudes towards vaccination in general.

## **2. Methods**

### **2.1. Survey**

We invited a sample of people drawn from a nationally representative panel of the market research agency SSI to complete a survey between 6 and 16 October 2020. The continuously updated panel includes 5,500 selected members that mirror the Belgian population (aged 18 – 80 years) as well as possible. Our study sample was drawn randomly, fulfilling pre-determined Belgium quota for age, gender, level of education and province. The main objective of the survey was to carry out an experiment to elicit individual preferences on who should get vaccinated first in the population; the results of the experiment are reported elsewhere (Luyten, Tubeuf, and Kessels 2020). In this paper we focus on two specific questions about attitudes toward vaccination. Before participants took the experiment, we asked them to answer the question “Would you say that vaccination for infectious disease is... very useful, rather useful, rather useless, very useless”. Then, at the end of the experiment, we asked the question “Once there is a safe and effective Covid-19 vaccine, will you get vaccinated?” and the four responses items were “definitely”, “probably”, “probably not”, “definitely not”. The survey also asked respondents for a range of sociodemographic characteristics along with their attitudes toward the government’s dealing with the corona crisis, whether they had had Covid-19, whether someone they knew had it, was hospitalized because of it and had died because of it. Respondents were also asked whether their profession was among the “essential professions” (i.e. those that were obliged to keep working during the first “lockdown” in March/April 2020) and whether they considered themselves to be part of a risk group for Covid-19 and if so, which group they belonged to (old age, chronic illness, obesity, or other). Respondents were asked about whom should decide who gets the Covid-19 vaccine first (government, scientists or the population), whether they would choose to be vaccinated themselves once a vaccine becomes available, and how easy they found answering the survey.

## **2.2. Data analysis**

We considered willingness to get Covid-19 vaccinated as a binary variable grouping the answers “definitely” against “probably”, “probably not” and “definitely not”. We determined the factors significantly associated to this response using a multivariate regression model with as dependent variable whether an individual intends to become vaccinated or (s)he still doubts or refuses to become vaccinated. We estimated adjusted and unadjusted odds ratios of willingness to be Covid-19 vaccinated using all the variables that showed significance ( $p < 0.05$ ) in a univariate analysis. We repeated the same analysis for attitudes toward infectious disease vaccination grouping “very useful” against “rather useful”, “rather useless” and “very useless”.

We then studied the sub-sample of people who exhibited a seemingly inconsistent opinion of being pro vaccination in general but being unwilling to take the Covid-19 vaccine once available. We used basic descriptive statistics and frequencies to describe all variables, comparing the full sample of survey data with the smaller sample of inconsistent individuals. We used chi-square tests to indicate significant

differences in proportions between the two samples. We performed all analyses using the JMP Pro 15 statistical software.

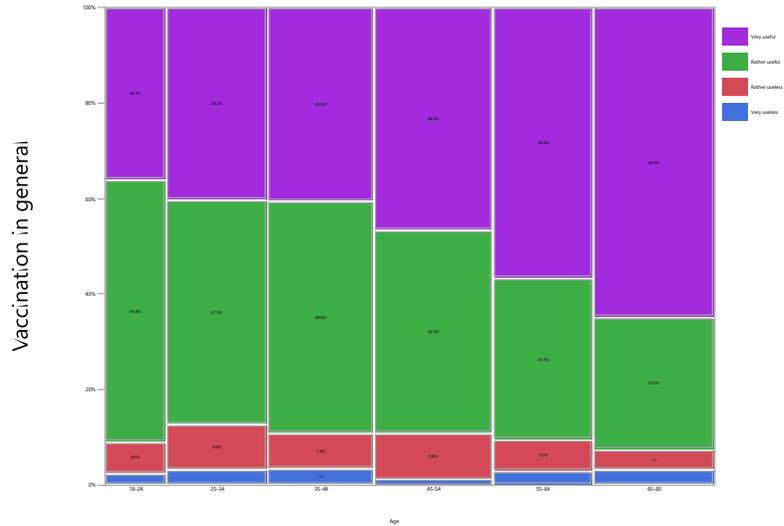
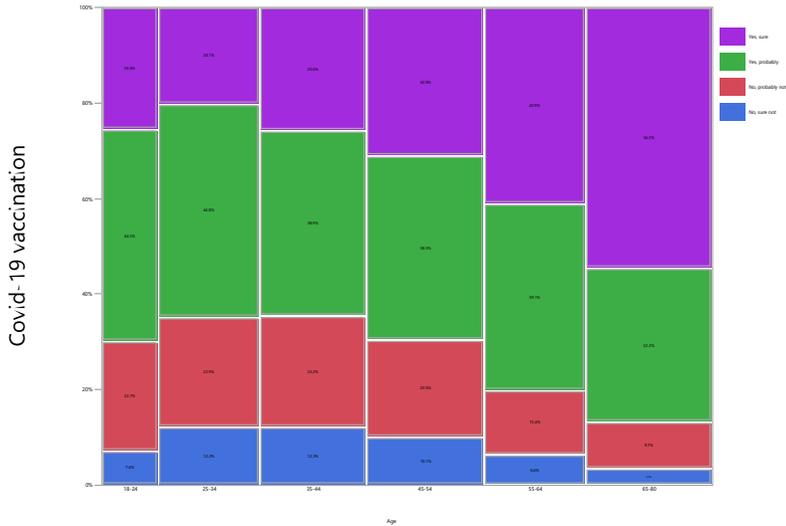
### 3. Results

A total of N=2,060 surveys were completed and checked for quality based on respondents' answers to several comment boxes. None were excluded. Overall, 34% (N=651) indicated that they would "definitely" become vaccinated with a Covid-19 vaccine and 39% (N=742) stated that they would "probably" become vaccinated with a Covid-19 vaccine, 18% (N=346) said "probably not" and 9% (N=165) said "definitely not". The numbers of sceptical answers to Covid-19 vaccination were substantially higher than the sceptical answers to the usefulness of vaccination in general. Whereas 73% stated to be willing to become vaccinated with the Covid-19 vaccine, 90% stated to think that vaccination is useful to protect against infectious diseases. 49% (N=1002) stated that vaccination is "very useful" and 41% (N=848) stated it to be "rather useful". 7% (N=153) said "rather useless" and 3% (N=57) said "very useless".

When carrying out univariate analyses, we found larger discrepancies in different age groups' willingness to be Covid-19 vaccinated compared to their attitude toward vaccination in general. While at most 12% of the population across all age groups found vaccination useless (See **Figure 1**), Covid-19 vaccine scepticism represented between 30% and 36% among people younger than 54 years old with the largest share of sceptics in the 25-34 and 35-44 years old. While there were less Covid-19 vaccine sceptics in the older age groups (20% in 55-64 and 13.3% in people above 65), these shares were still larger than the shares of people reporting vaccination in general to be useless across any age groups.

The multivariate logistic regression analyses (**Table 1**) revealed that factors predicting willingness to vaccinate against Covid-19 were being male (Odds Ratio (OR) = 1.53, 95% confidence interval (CI) 1.25–1.89,  $p < 0.0001$ ), being Dutch-speaker (OR = 2.37 (1.89-2.95,  $p < 0.0001$ ), knowing someone who was hospitalised for Covid-19 (OR = 1.78 (1.16-2.71),  $p = 0.0083$ ), and belonging to a medically vulnerable group (OR = 1.71 (1.35-2.17),  $p < 0.0001$ ). The willingness to get Covid-19 vaccinated also gradually increased with age groups from age 45 when compared to the younger age category of 18-24 (45-54 OR = 1.16 (0.75-1.77), 55-64 OR = 1.72 (1.11-2.66), 65 and above OR = 2.26 (1.45-3.53),  $p < 0.0001$ ) and with satisfaction toward the government's response to the health crisis (satisfied OR = 2.94 (1.61-5.37), rather satisfied OR = 1.55 (1.15-2.10), rather dissatisfied OR = 1.17 (0.87-1.58),  $p = 0.0003$ ). When asked about who should decide about priority access to the Covid-19 vaccine, people willing to get vaccinated were more likely to reply government or scientists (respectively OR = 1.58 (1.00-2.51), OR = 2.14 (1.50-3.06),  $p < 0.0001$ ) versus the population.

**Figure 1: Willingness to be Covid-19 vaccinated and attitude toward infectious disease vaccination according to age groups.**



**Table 1: Unadjusted and adjusted odds ratios of willingness to get Covid-19 vaccinated and of having a non-hesitant attitude towards vaccination in general.**

Characteristic	Covid-19 vaccine acceptance			General vaccine acceptance		
	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P-value (adjusted)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	P-value (adjusted)
<b>Male gender</b>	1.55 (1.28-1.87)	1.53 (1.25-1.89)	<0.0001	1.26 (1.06-1.50)	1.32 (1.08-1.61)	0.0058
<b>Dutch language</b>	2.33 (1.90-2.85)	2.37 (1.89-2.95)	<0.0001	1.68 (1.41-2.00)	1.54 (1.25-1.90)	<0.0001
<b>Age</b>						
18-24	1.00 (reference)	1.00 (reference)	<0.0001	1.00 (reference)	1.00 (reference)	<0.0001
25-34	0.73 (0.47-1.13)	0.69 (0.44-1.09)		1.19 (0.83-1.70)	1.28 (0.86-1.91)	
35-44	1.00 (0.66-1.52)	0.95 (0.61-1.47)		1.21 (0.85-1.72)	1.29 (0.86-1.93)	
45-54	1.30 (0.87-1.95)	1.16 (0.75-1.77)		1.54 (1.09-2.18)	1.59 (1.07-2.36)	
55-64	2.02 (1.35-3.03)	1.72 (1.11-2.66)		2.31 (1.62-3.30)	2.31 (1.53-3.49)	
65-80	3.48 (2.35-5.16)	2.26 (1.45-3.53)		3.27 (2.31-4.64)	2.45 (1.59-3.76)	
<b>Education</b>						
Basic	1.00 (reference)	1.00 (reference)	0.1705	1.00 (reference)	1.00 (reference)	0.0002
Third degree sec school	1.18 (0.93-1.51)	1.11 (0.84-1.45)		1.31 (1.05-1.64)	1.35 (1.04-1.75)	
Higher	1.09 (0.85-1.38)	1.28 (0.98-1.68)		1.52 (1.22-1.90)	1.71 (1.32-2.22)	
<b>Have children</b>	1.22 (1.00-1.49)		NS	1.30 (1.09-1.56)		NS
<b>Profession</b>						
Working	1.00 (reference)		NS	1.00 (reference)		NS
Homemaker	0.97 (0.58-1.62)			1.05 (0.68-1.63)		
Student	0.98 (0.66-1.46)			0.76 (0.54-1.06)		
Unemployed	1.02 (0.68-1.54)			1.01 (0.70-1.44)		
Disabled	1.87 (1.27-2.76)			1.04 (0.72-1.50)		
Retired	2.93 (2.33-3.69)			2.06 (1.66-2.57)		
<b>Profession is not 'essential'</b>	1.40 (1.09-1.81)		NS	1.24 (1.00-1.55)		NS
<b>Financial difficulties</b>						
Never	1.41 (1.08-1.86)		NS	1.84 (1.43-2.36)	1.33 (1.00-1.79)	0.1095
Once a year	1.04 (0.77-1.42)			1.27 (0.96-1.69)	1.09 (0.79-1.50)	
Once every three months	0.89 (0.65-1.23)			1.08 (0.81-1.44)	1.01 (0.73-1.39)	
Every month	1.00 (reference)			1.00 (reference)	1.00 (reference)	

<b>Satisfaction with government's approach to Covid-19 pandemic</b>						
Very satisfied	3.69 (2.12-6.43)	2.94 (1.61-5.37)	0.0003	5.28 (2.87-9.71)	4.14 (2.13-8.04)	<0.0001
Rather satisfied	1.66 (1.26-2.19)	1.55 (1.15-2.10)		1.74 (1.36-2.23)	1.53 (1.16-2.04)	
Rather dissatisfied	1.23 (0.94-1.63)	1.17 (0.87-1.58)		1.37 (1.07-1.75)	1.24 (0.94-1.64)	
Very dissatisfied	1.00 (reference)	1.00 (reference)		1.00 (reference)	1.00 (reference)	
<b>Has had a Covid-19 infection</b>						
Yes, confirmed with a test	1.34 (0.70-2.54)		NS	1.60 (0.90-2.86)	1.07 (0.56-2.05)	0.1145
Probably, but not confirmed with a test	1.00 (reference)			1.00 (reference)	1.00 (reference)	
No	1.43 (0.99-2.06)			1.47 (1.07-2.02)	1.45 (1.00-2.12)	
<b>Know personally someone who has had Covid-19</b>						
Yes, confirmed with a test	1.35 (0.90-2.04)		NS	1.31 (0.91-1.88)	1.13 (0.74-1.71)	0.0036
Probably, but not confirmed with a test	1.00 (reference)			1.00 (reference)	1.00 (reference)	
No	1.28 (0.90-1.82)			1.06 (0.78-1.44)	0.71 (0.49-1.04)	
<b>Know personally someone who was hospitalized for Covid-19</b>	1.60 (1.09-2.35)	1.78 (1.16-2.71)	0.0083	1.04 (0.73-1.49)		NS
<b>Know personally someone who died of Covid-19</b>	1.31 (0.85-2.04)		NS	1.21 (0.80-1.85)		NS
<b>Medically vulnerable group</b>	2.61 (2.15-3.18)	1.71 (1.35-2.17)	<0.0001	2.34 (1.95-2.81)	1.83 (1.45-2.30)	<0.0001
<b>Determination vaccine prioritization</b>						
Population	1.00 (reference)	1.00 (reference)	<0.0001	1.00 (reference)	1.00 (reference)	<0.0001
Government	2.35 (1.53-3.60)	1.58 (1.00-2.51)		2.84 (1.90-4.23)	1.94 (1.26-2.97)	
Scientists	2.30 (1.64-3.20)	2.14 (1.50-3.06)		2.84 (2.10-3.85)	2.57 (1.86-3.55)	
<b>Covid-19 vaccine acceptance</b>				16.44 (12.72-21.24)		
<b>General vaccine acceptance</b>	16.44 (12.72-21.24)					

Note: NS stands for "highly non-significant" (p-value > 0.2)

The predicting factors of the willingness to get vaccinated against Covid-19 were mostly similar to the predicting factors of reporting that infectious disease vaccination is very useful as illustrated by the strong correlation with the very high odds ratio of being both willing to take the Covid-19 and finding infectious disease vaccination very useful (OR = 16.44 (12.72-21.24)). While socioeconomic characteristics were not identified as predictors of the willingness to vaccinate against Covid-19, educational attainment is significantly and increasingly associated with positive opinion about vaccination in general (secondary school OR = 1.35 (1.04-1.75), higher education OR = 1.71 (1.32-2.22),  $p = 0.0002$ ).

A sample of N=349 individuals (17%) exhibited an interesting opinion toward vaccination. They consider vaccination against infectious diseases very useful (15%, N=52) or rather useful (85%, N=297), but report they would definitely not (24%, N=85) or rather not (76%, N=264) vaccinate against Covid-19. We investigated further who those people were (**Table 2**). Compared to the main sample, they were more likely to be women ( $p = 0, 0067$ ), younger than 54 years old ( $p < 0.0001$ ), French speaking ( $p < 0.0001$ ), with first or second degree secondary school ( $p = 0.0714$ ), working ( $p < 0.0001$ ), and to believe that the population should determine the vaccination priority strategy ( $p = 0.1030$ ). They were also less likely to belong to a Covid-19 risk group ( $p < 0.0001$ ), to have known someone who was hospitalised because of Covid-19 ( $p = 0.0314$ ), and they were rather or very dissatisfied with the government's dealing with the Covid-19 crisis ( $p < 0.0001$ ).

**Table 2: Descriptive statistics of the full sample and the subsample of contradictory respondents who believe vaccination is useful, but who do not wish to become vaccinated against Covid-19.**

Characteristic	Responses item	Full sample (n=2,060)		Subsample (n=349)		P-value of difference <sup>s</sup>
		N	%	N	%	
<b>Respondents' general background</b>						
Gender	Female	1055	51%	206	59%	$p = 0.0067$
	Male	1005	49%	143	41%	
Age	18-24	208	10%	41	12%	$p < 0.0001$
	25-34	346	17%	76	22%	
	35-44	358	17%	83	24%	
	45-54	400	19%	79	22%	
	55-64	341	17%	38	11%	
	65-80	407	20%	32	9%	
Language	Dutch	1174	57%	156	45%	$p < 0.0001$
	French	886	43%	193	55%	
Education	None	8	0%	0	0%	$p = 0.0714$
	Primary school	65	3%	6	2%	
	First degree secondary school	208	10%	43	12%	
	Second degree secondary school	262	13%	53	15%	
	Third degree secondary school	715	35%	120	35%	
	Higher education (non-university)	495	24%	81	23%	
	University or post-university education	278	14%	45	13%	
	PhD	21	1%	0	0%	
Other	8	0%	1	0%		
Have children	Yes	1283	62%	208	60%	$p = 0.3414$
	No	777	38%	141	40%	

Profession	Working	1039	51%	216	62%	p < 0.0001
	Homemaker	87	4%	14	4%	
	Student	168	8%	28	8%	
	Unemployed	138	7%	30	8%	
	Disabled	131	6%	20	6%	
	Retired	497	24%	41	12%	
Difficulties with monthly expenses	Never	847	41%	124	35%	p = 0.2371
	Once a year	447	22%	79	23%	
	Once every three months	413	20%	77	22%	
	Every month	353	17%	69	20%	
<b>Respondents' Covid-19 related background</b>						
Self-reported membership of a Covid-19 risk group	No	1261	61%	265	76%	p < 0.0001
	Yes, elderly	384	19%	28	8%	
	Yes, chronically ill	424	21%	52	15%	
	Yes, severe obesity	133	6%	14	4%	
	Yes, other	69	3%	6	2%	
Self-reported profession is labelled as 'essential'	Yes	393	19%	74	21%	p = 0.3575
	No	1667	81%	275	79%	
Has had a Covid-19 infection	Yes, confirmed with a test	64	3%	8	2%	p = 0.4110
	Probably, but not confirmed with a test	173	8%	24	7%	
	No	1823	89%	317	91%	
Know personally someone who has had Covid-19	Yes, confirmed with a test	314	15%	49	14%	p = 0.7480
	Probably, but not confirmed with a test	187	9%	35	10%	
	No	1559	76%	265	76%	
Know personally someone who was hospitalized for	Yes	127	6%	12	3%	p = 0.0314
	No	1933	94%	337	97%	
Know personally someone who died of Covid-19	Yes	92	4%	13	4%	p = 0.5222
	No	1968	96%	336	96%	
Satisfaction with government's approach to Covid-19 pandemic	Very satisfied	66	3%	2	1%	p < 0.0001
	Rather satisfied	774	38%	92	26%	
	Rather dissatisfied	827	40%	158	45%	
	Very dissatisfied	393	19%	97	28%	
Determination of the vaccine prioritization strategy	Population	242	13%	58	17%	p = 0.1030
	Government	196	10%	29	8%	
	Scientists	1466	77%	262	75%	
§ Chi-square test to indicate significant differences in proportions between the two samples.						

#### 4. Discussion

The majority of Belgians intend to vaccinate against Covid-19, though uptake is lower in groups that are at lower risk of severe forms of Covid-19. However, the vaccine hesitant group may be a key factor in whether herd immunity against Covid-19 can be achieved within the population. According to Anderson et al. (2020), if a vaccine has approximately 80% efficacy, it is between 75 and 90% of the population who needs to be vaccinated and so, the observed share of the population willing to get Covid-19 vaccinated in this representative sample is not sufficient.

Some of the many reasons behind vaccine hesitancy are related to the success of vaccines to slowing down once devastating diseases have eradicated and as a result, people focus on the perceived risks of vaccination as they are less aware of the consequences of not vaccinating (McAteer et al. 2020, Luyten et al. 2014). Similarly in the case of Covid-19, hesitancy may be caused by individuals having no personal experience of people in their proximity having been critically ill or passing away as a result of Covid-19 (Davies 2020). Our results support such statement as we observe that people who know

someone who has been hospitalised because of Covid-19 are almost twice more likely to be willing to get vaccinated.

Since there is a clear support for the usefulness of vaccination against infectious diseases in this representative sample, we can assume that most of the population is already aware of the collective benefit of vaccination. The larger hesitancy toward Covid-19 might therefore be explained by particular concerns about the Covid-19 vaccine, e.g. that it has been developed too fast and that the full safety profile of the vaccine is not (yet) entirely understood. As such a larger than usual share of the general public may prefer not to vaccinate until they feel they can make a more informed vaccination decision. If anything, this result calls for communication campaigns that comfort people on the safety and efficacy of Covid-19 vaccination to encourage uptake.

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