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Determinants of SARS-CoV-2 vaccinations in the 50+ population

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Determinants of SARS-CoV-2 vaccinations in the 50+ population

A first overview across Europe and Israel using the Survey of Health, Ageing and Retirement in Europe

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Abstract

With the arrival of effective COVID-19 vaccines, the main issue in the fight against the pandemic became how to quickly vaccinate as many people as possible to contain the pandemic and especially to protect those most at risk, e.g. the older population. After initial problems with vaccine supply have been overcome, the focus now is on a slowdown in vaccination uptake. The Survey on Health, Ageing and Retirement in Europe (SHARE) is in a unique position to provide insights into the reasons for vaccination hesitancy, as it very recently collected data on vaccination uptake and a number of influential factors from about 47,000 individuals in the high-risk 50+ age group across Europe and Israel. In this paper we will look at the interrelation of a willingness to get vaccinated with socio-demographic and health factors as well as living conditions and economic situations. The subjective and objective economic situtation as well as diagnosed physical illnesses and education show the strongest relation to vaccination hesitancy. The results in this paper provide a comprehensive picture of influential factors that might be helpful to further the success of the immunization campaigns in Europe.

***K**eywords* COVID-19 · vaccination · SHARE · Europe

1 Introduction

As the novel coronavirus has affected daily life in a severe and lasting way, vaccination programmes have been underway in most European countries in an attempt to curb the spread of COVID-19. They have been especially important for older individuals, as they are at higher risk for severe infection outcomes (see, e.g., CDC, 2020; WHO, 2020; Williamson et al., 2020; Zhou et al., 2020).

The Survey on Health, Ageing and Retirement in Europe (SHARE) has conducted telephone interviews supplementary to the regular panel survey with respondents 50+ which addressed health, employment, care, and life adjustments during the current pandemic across 27 European countries and Israel. During the second iteration of the corona-specific interviews conducted between July and August 2021, respondents were asked whether they had been or intended to be vaccinated against the virus. In addition, a broad range of respondent characteristics can be used to shed light on the question of who has actually been vaccinated or not, as well as who had the intention to get vaccinated in the weeks after the interview.

With the arrival of effective COVID-19 vaccines in late 2020 the fight against the pandemic entered a new stage: How to quickly vaccinate as many people as possible to reduce individual infection risks, as well as to contain the pandemic to a degree that allows for a (new) normal extent of social interaction. While at first the process was hindered in many countries by insufficient vaccine production capacities, in the second half of 2021 the focus of public and scientific discourse shifted more towards a slowdown in vaccination uptake in spite of the supply issues being resolved.

Research on the reasons people get vaccinated, or rather refuse to, is picking up speed quickly. But while there are a number of single country studies (e.g. Betsch et al., 2020; Detoc et al., 2020; Dror et al., 2020; Galanis et al., 2021; Holzmann-Littig et al., 2021; Kühne et al., 2020; Malik et al., 2020; RKI, 2021; Soares et al. 2021; Ward et al., 2020) and first international analyses (e.g. Lazarus et al., 2020; Lindholt et al., 2020) comprehensive European comaprisons are still scarce. At the moment, SHARE's second Corona Survey remains the only large-scale study that covers most European countries and has collected data on individuals' situation during the pandemic, including their intention to receive a vaccination and vaccination status, respectively.

This paper will give an overview of some of the most important variables related to the (un)willingness to be vaccinated against COVID-19. After a brief description of the dataset, we will look at three domains of potentially influential factors:

- Socio-demographics, namely age, gender and education

- Health, including

  - physical health measured by subjective as well as objective conditions,

  - mental health indicators like feelings of loneliness, and

  - having people in ones's social vicinity affected by a COVID-19 infection

- Living conditions and economic situation, specifically living in rural vs. urban areas, living in a nursing home, household size, the ability to "make ends meet," household income, and employment status

We will conclude with a discussion of these results in the context of the ongoing pandemic and stagnating vaccination rates—in some European countries on a rather low level—and will finish with some ideas for further analyses of the reasons influencing the willingness to get vaccinated.

2   Data

The following analyses used preliminary data from the second SHARE Corona Survey (Börsch-Supan, 2021c), fielded from June to beginning of August 2021 in all 28 countries participating in SHARE. The SHARE Corona Survey is a special study, which has been designed as a reaction to the COVID-19 crisis last year and was conducted by telephone (Computer-Assisted Telephone Interview; CATI; see Scherpenzeel et al., 2020 for further information). It is targeted specifically at collecting data on the living situation of people who are 50 years and older during the pandemic across Europe and Israel.

The second SHARE Corona Survey (Börsch-Supan, 2021c) re-interviewed respondents of the first SHARE Corona Survey (Börsch-Supan, 2021b), enabling the examination of (intra-individual) changes between the start of the pandemic and the situation one year later in a cross-national perspective. As such, it adds valuable insights to recent studies, which are frequently restricted to the national level. Moreover, the SHARE Corona Survey can be complemented with background information from the regular SHARE panel study, providing a wealth of information on health, socioeconomic status, and social and family networks of respondents aged 50 and over since 2004 on a biannual basis (see Börsch-Supan et al., 2013).

The SHARE data are without exception based on full probability samples (Bergmann et al., 2019a, 2019b), providing internationally comparable data that allow for the comparison of how national governments, health care systems and individuals responded to the pandemic, and which lessons should be drawn for the future from the divergence between countries. Both the methodological rigor and the cross-country harmonization of SHARE are hence prerequisites to properly investigate the effects of a global pandemic like COVID-19 and further support evidence-based policy making in Europe and beyond.

Our analyses are based on data from 46,989 respondents aged 50 years and older. The preliminary individual retention rate based on eligible participants of the first SHARE Corona Survey was, on average, 85%, ranging from 67% (Denmark) to 96% (Romania). Data for all variables used were collected during the second SHARE Corona Survey in summer 2021, except data on household income, which was taken from the first SHARE Corona Survey (Börsch-Supan, 2021b), and data on educational level and rural or urban housing, which both were based on data collected in Wave 8 of the regular SHARE face-to-face questionnaire in late 2019 to early 2020, as well as previous SHARE waves to impute stable information (Börsch-Supan, 2020a-g; 2021a).

2.1   Vaccination against SARS-CoV-2

Vaccination status and intent to get vaccinated were examined in two consecutive steps: First, respondents answered whether they had been vaccinated against COVID-19 at least once. Of those who had not yet been vaccinated, information on their intention to do so was requested—inquiring whether they already had scheduled an appointment for vaccination, wanted to get vaccinated, did not want to get vaccinated, or were still undecided.

In our analyses, we used these two questions in three separate combinations: The first question alone was sufficient to describe the respondents' vaccination status (step 1). For a general picture of vaccination intent, we split the two variables into four categories: already vaccinated, wants to get vaccinated (combining scheduled appointments and sole intent), still undecided, and does not want to get vaccinated. Respondents who answered "Don't know" in the question on vaccination intent were categorized as undecided (step 2). Finally, for a more detailed look at those sceptical towards vaccination, we used a binary variable distinguishing those who are vaccinated or want to be from those who are undecided or do not want to get the vaccine (step 3).
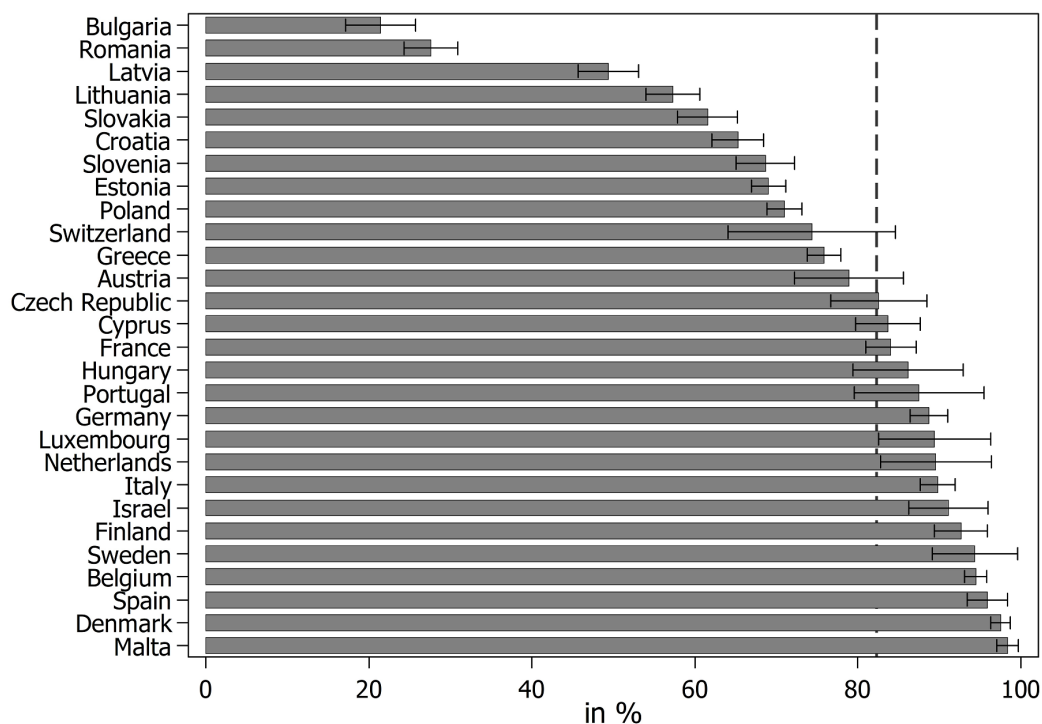
Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (n=46,989; weighted) with 95%-confidence intervals.

Figure 1: Proportion of actually vaccinated respondents accross countries

3   Analysis

In the following, we put emphasis on the most crucial differences with respect to socio-demographic and economic characteristics, respondents' living situation, as well as respondents' health condition and personal exposure to COVID-19, shedding light on country differences regarding vaccination across Europe and Israel.

3.1   Country Differences in Vaccination Rates and Attitudes

Among SHARE's 50+ population about 82% of the respondents reported—by the survey period in summer 2021—already having been vaccinated. While this is a fairly high number, there was great variation accross countries. As shown in figure 1, Malta, Denmark and Spain were in the lead with over 95% of respondents vaccinated and Romania and Bulgaria trailing behind with about 28% and 21% respectively.

These numbers correspond rather well with the country level vaccination rates reported by the European Centre for Disease Prevention and Control for the 50+ poulations in a similar timeframe (see ECDC, 2021). Even though SHARE is a long running panel study, we are confident that by using survey weights we are able to make sufficiently precise and unbiased projections that reflect the state of our population of interest and can safely go into more detailed analyses.

The low vaccination rates in Romania and Bulgaria seem even more severe when considering the intention to get vaccinated more closely, as depicted in figure 2. In addition to 29% of the Romanian and 33% of the Bulgarian SHARE respondents having been undecided about the vaccination, 39% and 35%, respectively, stated that they did not want to get vaccinated at all. Even if a considerable number of the undecided could be swayed to get the vaccination shot, the high number of vaccination refusers will make it very hard to reach herd immunity via vaccination in these two countries. The same applies to other countries, in which the
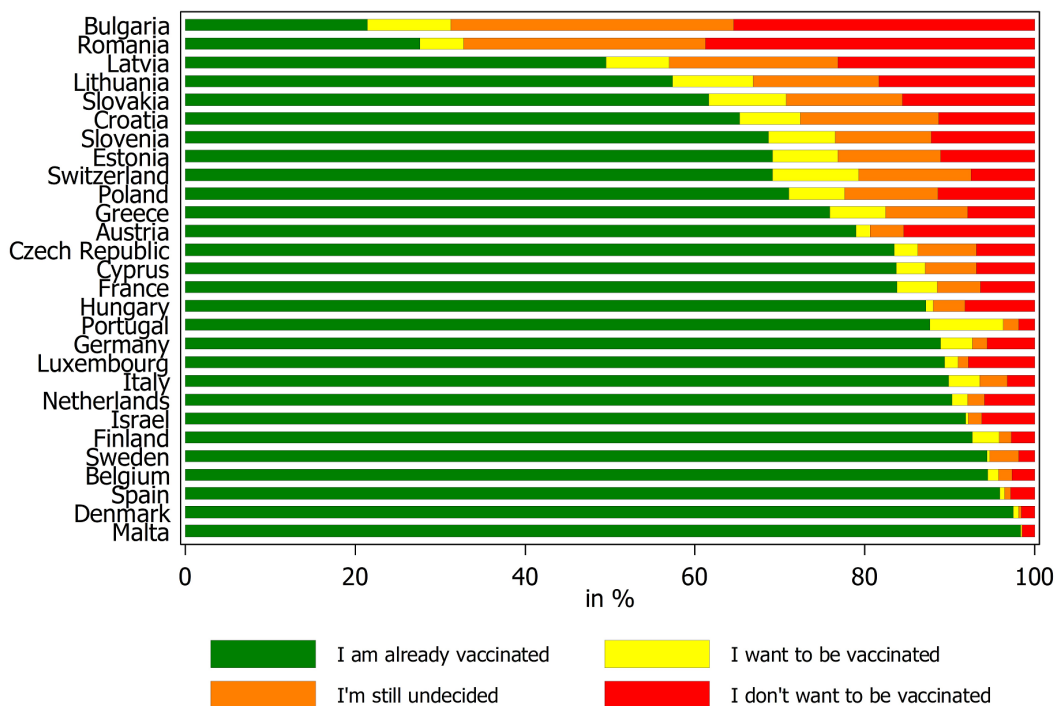
Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (n=46,968; weighted).

Figure 2: Vaccination status and intentions accross countries

group of vaccination refusers is rather large, such as in Latvia (23%), Lithuania (18%), Slovakia (16%), or Austria (15%).

When additionally exploring the proportion of respondents who were still undecided and thus might be convinced in the middle or long run to get the vaccination, there was also a huge variation across countries: While almost no one was still undecided in Malta (however, based on a very small number of unvaccinated individuals), the ratio based on those respondents who were not vaccinated ranged from 11% in Luxembourg to about 30% in Italy, France, Belgium, or Hungary and nearly 50% in Croatia (see Table A1 in the Appendix for more information). The weighted average across all countries was 33%.

What is also striking is the high rate of vaccination refusals accross most of the Eastern European and Baltic states and the clear and significant distinction from the other European regions in the West, South and North of Europe. Figure 3 illustrates this West-East gradient. On average, 45% of all unvaccinated respondents, across all countries, stated that they did not want to get vaccinated.

3.2 Socio-demographic differences

In the following analyses, we will focus on those respondents who are not yet vaccinated, either because they are still undecided or indicated that they do not want to get the shot. In the current situation, where vaccination rates are stagnating in most European countries, this is certainly the most debated group of people. Against the background of incidence rates likely rising again in autumn/winter 2021, it is crucial to know more about the characteristics of these people in order to design appropriate strategies on how to reach and ultimately convince them to get vaccinated.

With respect to socio-demographic characteristics, we primarily explored age, gender and education. Age was recoded to three categories with ranges for the older working age population (50-64 years), the young
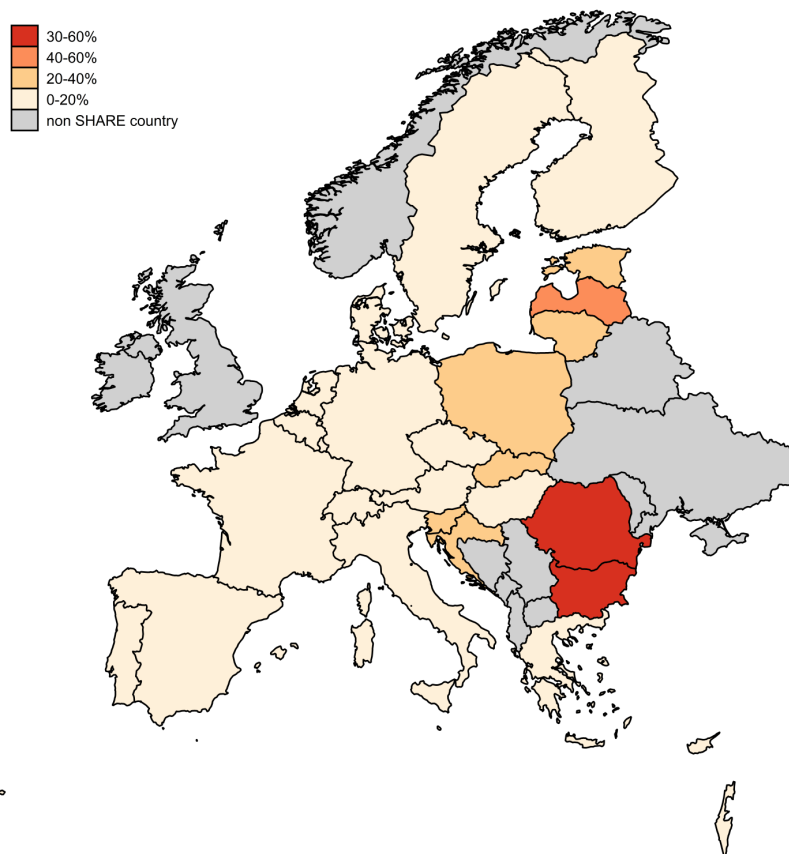
Figure 3: Prevalence of respondents that have not been vaccinated/do not intend to get vaccinated by country

retiree age group (65-79 years) and the oldest old (80 years and over). Gender was recoded to a dichotomous variable with "1" being female participants.

Data on education were derived from the regular Wave 8 questionnaire, with stable information imputed from previous waves. We coded the level of education attained based on the Internal Standard Classification of Education 1997 (ISCED-97). Respondents were then grouped into three categories (see, e.g., Avendano et al., 2009): primary education (ISCED-97 score: 0–2), secondary education (ISCED-97 score: 3), and post-secondary education (ISCED-97 score: 4–6).

Previous studies have found that the risk of a severe adverse outcome of a COVID-19 infection increases with age (e.g. CDC, 2020; Davies et al., 2020; Palmer et al. 2021). We assume that this higher risk might translate into less vaccination hesitancy. Even within the SHARE sample, which is restricted to the 50+ population, there were clear age group differences (see figure 4). Of the group considered to be of working age for the purpose of our analysis (50-64 years of age), a far larger number (16.4%) was undecided about or critical of being vaccinated than of the young retirees (65-79, 11.1%) or the oldest old (80+, 11.0%). The latter two groups showed no significant differences. However, it has to be noted that many of the refusals among respondents of working age are in fact not gainfully employed, as will be shown below.

The age pattern was similar in most participating countries, although the absolute differences between younger (50-64) and older respondents (65-79 and 80+ combined) varied somewhat (detailed information on country-specific differences can be found in the appendix). The only—however, statistically insignificant— exception was Romania, where older respondents stated being undecided or opposed to getting vaccinated more frequently than younger respondents.

We also saw a rather clear gender divide with 14.5% of the women being undecided or refusing the vaccination, as opposed to 12.8% among men. However, there was some variation across countries, both regarding the
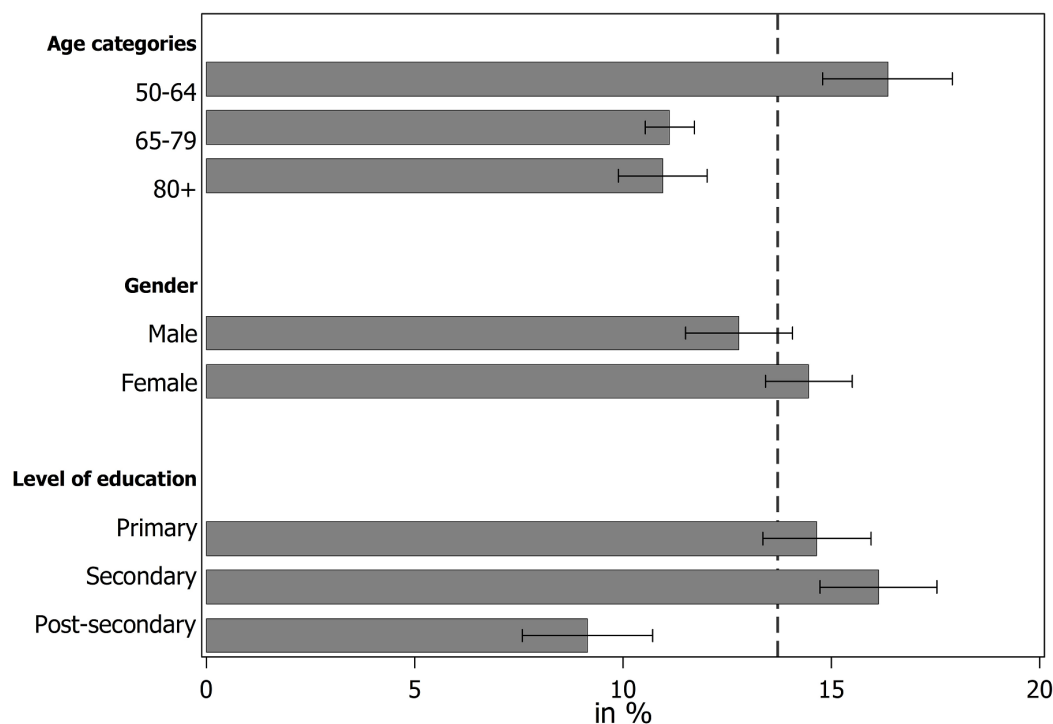
Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (n=46,111-46.968; weighted) with 95%-confidence intervals.

Figure 4: Proportion of undecided/refusals by demographic groups

proportion of respondents reporting to be still undecided or unwilling to be vaccinated and the ratio of male and female respondents within a specific country. For example, in Hungary, Portugal and Switzerland there were more males—although not a statistically significant difference—who were still undecided or didn't want to get vaccinated.

The level of education showed a non-linear relationship with being undecided or refusing vaccinations: While among respondents with only primary education the proportion was about 14.7%, it was 16.1%—a small, but statistically significant difference—in the group with secondary education, but only around 9.2% among individuals with post-secondary education, an even larger difference. This latter finding of higher educated respondents having a, vice versa, higher probability of being vaccinated compared to less educated was strongest in Bulgaria, Romania and Slovakia.

3.3 Health-related differences

Health issues might influence the decision to be vaccinated against SARS-CoV-2. The likelihood to get vaccinated might be increased for individuals with pre-existing conditions wanting to decrease their risk for severe consequences of an infection. In contrast, some might also fear adverse reactions to the vaccination and would therefore be less likely to get vaccinated.

To address this issue, we first used the reversed 5-point scale on respondents' self-rated health (0: poor, 1: fair, 2: good, 3: very good, and 4: excellent) as a subjective health indicator. As a more objective measure, we classified respondents with at least one diagnosed illness in a binary variable. In another binary variable, we categorized all those respondents who reported feeling depressed or anxious in the previous month or having had trouble sleeping recently as affected by mental health issues. Further, indications of loneliness were measured by a question differentiating between feeling lonely "often," "some of the time," or "hardly ever or never."

7

Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (n=46,880-46,968; weighted) with 95%-confidence intervals.
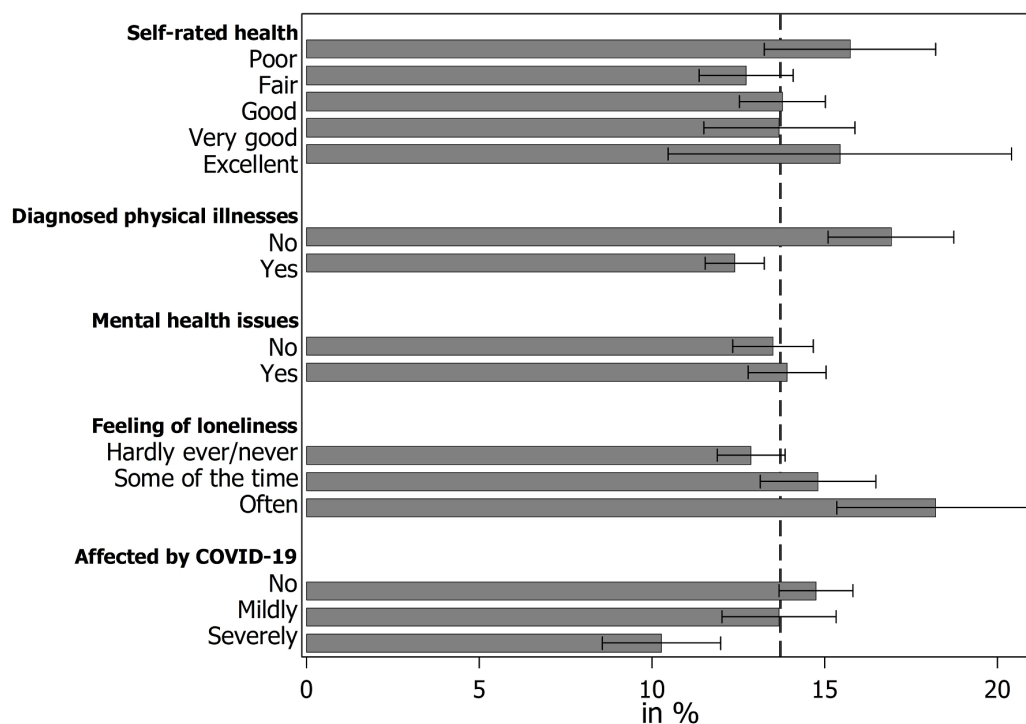
Figure 5: Proportion of undecided/refusals by health indicators

To assess how respondents had been affected by the COVID-19 disease, we distinguished three categories: Firstly, we rated those cases who had been hospitalized for COVID-19 themselves, or knew people close to them (e.g. spouse/partner, parent, child, neighbor, friend or colleague) that had been hospitalized or died from COVID-19 as "severely affected." We rated as "mildly affected" those cases in which the respondents themselves or people close to them had had COVID-19 symptoms or had been tested positive for SARS-CoV-2. Finally, cases in which no positive tests or symptoms had occured among the people close to the respondent were categorized as "not affected."

Looking at respondents' self-rated health, there was no clear pattern to the proportion of individuals undecided or unwilling to get vaccinated (see figure 5). The proportion of undecided and unwilling to get vaccinated was highest amongst the respondents that rated their health as poor, as well as those considering it to be excellent, as opposed to the respondents that rated their health as fair to very good. However, the confidence intervals are very large indicating a potential contrast between different perceptions regarding the risk of being infected with SARS-CoV-2 for people without any (subjective) health conditions. In addition, country differences might also play a role. In this respect, there were some hints that respondents reporting poor health more frequently stated to be undecided or unwilling to be vaccinated. This pattern was significant in Bulgaria, Estonia, Latvia and Slovenia. The opposite, however, was found in Finland, where respondents with poor health were significantly more likely to be vaccinated.

When considering more objective health measures like the presence of diagnosed physical illnesses, the interpretation is more straightforward: Respondents without such illnesses had a significantly higher probability of being undecided or unwilling to be vaccinated (16.9%) compared to respondents with at least one diagnosed illness (12.4%). This difference was strongest in Hungary, Lithuania, Luxembourg and Switzerland.

In contrast, there was no strong difference between respondents with mental health issues, such as feeling depressed and anxious or having sleeping problems, with respect to being vaccinated or not. A more clear-cut

pattern emerged from the question about feelings of loneliness. Here, we found that it related fairly linearly to the proportion of respondents reporting indecision or unwillingness to get vaccinated. The smallest proportion of undecided or unwilling respondents was found in those stating to hardly ever or never feeling lonely (12.9%). This number was significantly higher when respondents answered "some of the time" (14.8%) or "often" (18.2%). This pattern was most visible and statistically significant in Latvia, Lithuania and Romania.

Even if respondents themselves were not infected they might have known somebody who was, which in turn may have influenced their attitudes towards the COVID-19 vaccination. There was indeed a difference between respondents who stated that they didn't know anyone physically affected by COVID-19 and those who did. Of the former, 14.7% reported to be undecided or unwilling to get vaccinated. In contrast, this number was 13.7% for SHARE respondents that knew somebody mildly affected (any symptoms or positive test) and only 10.3% for those who knew somebody severely affected (hospitalization or even death in close vicinity). This latter difference was most pronounced in Eastern Europe (esp. Poland, Romania and Slovakia) and the Baltic States.

3.4   Differences related to living conditions and economic situation

Data on the respondents' area of living was retrieved from SHARE Wave 8, using stable information from previous waves and additional information from the second SHARE Corona Survey in case of moves, where available. The variables' values were categorized to "rural" for rural areas or villages as well as small towns, and "urban" for large towns, suburbs and big cities. We further used information on the respondents' household size (single households, 2-person households, households with more than 2 persons) and whether the individual was living in a nursing home.

We measured each respondent's (subjective) economic situation by a question that asked for the degree to which respondents could make ends meet (with great difficulties, with some difculties, fairly easily, or easily). In addition we used the respondent's household income as a second more objective economic measure. Because respondents in the second SHARE Corona Survey were only asked whether their income increased, decreased, or stayed the same compared to one year before, we used information form the first SHARE Corona Survey, which asked for each respondent's household income before the outbreak of the pandemic. Incomes were then PPP-adjusted and categorized into country-specific income quartiles. Finally, we included a measure related to whether the respondent was currently retired, employed or self-employed, or had another working status, such as unemployed, permanently sick or disabled, or homemaker.

Figure 6 below first shows that respondents living in urban areas were considerably less likely to state that they were undecided or did not want to get vaccinated (10.2%) than those in rural areas (15.4%). This finding illustrates a clear urban-rural gap possibly due to better or more comprehensive medical services in urban areas. Such a pattern was evident in most SHARE countries, with Austria, Croatia, Romania, Slovakia and Switzerland exhibiting the strongest divide. In contrast, in Estonia the opposite was found, i.e. significantly more undecided and unwilling respondents towards the vaccination were living in urban areas.

Likewise, with respect to living in a nursing home, the pattern was as expected: Throughout Europe, nursing home respondents were among the first to receive a vaccination, which translated into the very low proportion of non-vaccinated respondents living in nursing homes, that can be seen in figure 6. Although standard errors were very large due to the small sample size in some countries, the difference was significant when not distinguishing between countries.

Looking at household size, there was a non-linear effect, with single households and, in particular, households with more than two persons exhibiting a somewhat larger proportion of not being vaccinated compared to two-person households. This finding might, however, be related to the economic situation of the households. In this respect, the subjective economic situation, measured via respondents' reports of how hard it was to "make ends meet," had a very pronounced relation to the percentage of respondents who were undecided about the vaccination or did not want to get it. On the far end there was the group of respondents who could
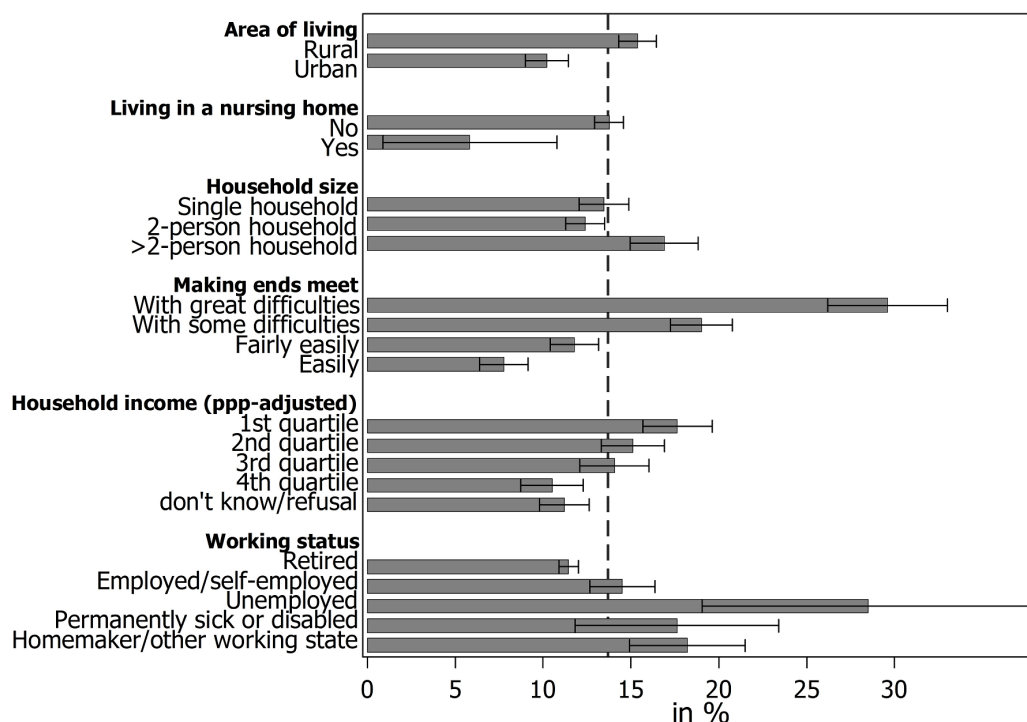
Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (n=45,206-46,968; weighted) with 95%-confidence intervals.

Figure 6: Proportion of undecided/refusals by living conditions and economic situation

make ends meet only "with great difficulties." For them the percentage was nearly 30%, while it was only 7.8% for those that reported they were able to make ends meet "easily." This clear pattern remained when looking at country differences, with Estonia, Latvia, Lithuania, Poland, Romania and Slovakia showing the largest significant differences.

When further comparing the different country-specific household income quartiles as a more objective measure of respondents' economic situation, a very similar pattern emerged. Again, the lower quartiles of the income distribution more frequently did not want to be vaccinated or were undecided to do so, while the opposite was true for higher income quartiles.

Finally, being retired, as opposed to employed or self-employed and especially being unemployed did make a significant difference for being undecided or unwilling to get vaccinated. While the latter particularly adds to the picture of a higher probability of not yet having been vaccinated amongst unemployed respondents (28.5%), the significantly lower proportion of retired respondents (11.5%) who were undecided or against getting vaccinated could be explained by both an age effect (retired people are older on average) and being more flexible in their time. This general pattern holds for esentially all countries in SHARE, with France, Germany, Greece and Poland exhibiting the largest significant differences between retired and (self-)employed respondents and Austria, Germany, Lituania, the Netherlands and Switzerland showing the largest significant differences between retired and unemployed repondents.

3.5   Multivariate model with all predictors

To take into account possible correlations between the different predictors depicted so far, we finally ran a multivariate logistic model with country predictors as controls to explain why respondents at the time of fieldwork were still undecided or did not want to be vaccinated. The model hence included all predictors
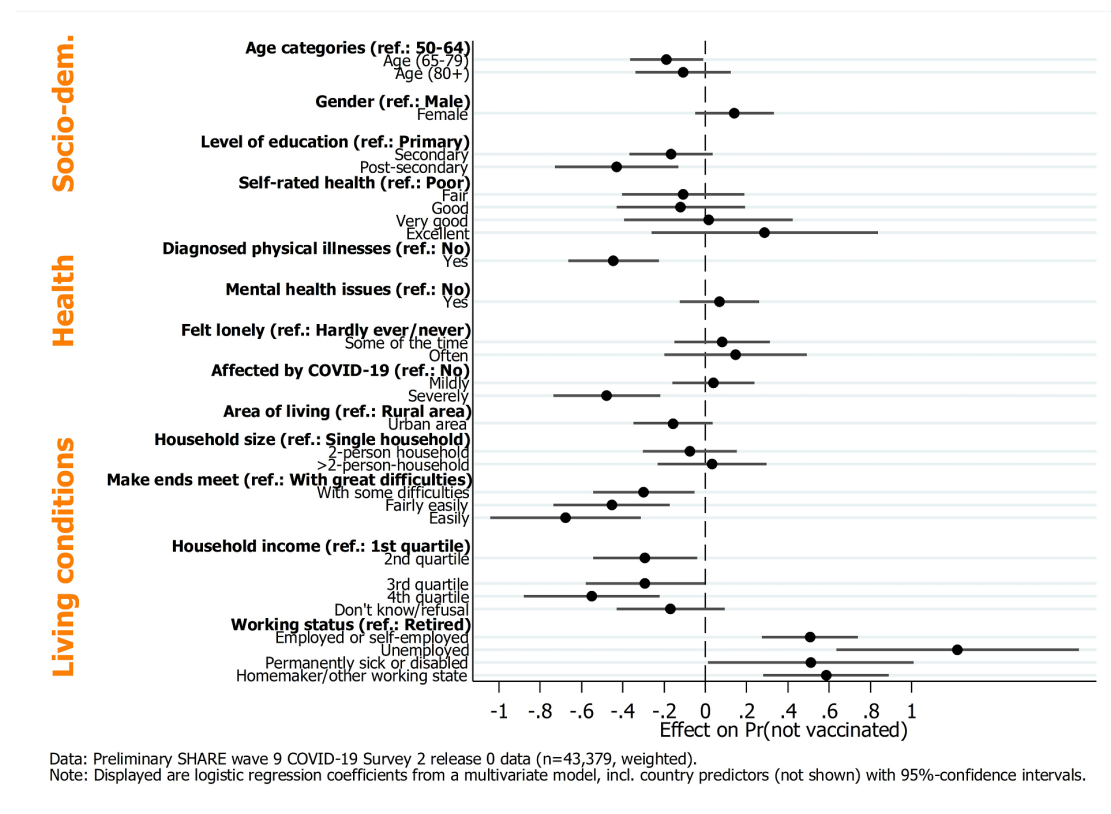
Figure 7: Multivariate logistic regression coefficients of respondent characteristics on being undecided/unwilling to be vaccinated

from the previous sections, apart from living in a nursing home, which was excluded on the basis of very large standard errors due to the small overall number of nursing home respondents.

As can be seen in figure 7, the same picture derived from the bivariate analyses largely holds true for the multivariate anlysis: Younger respondents, female respondents and respondents from rural areas still had a higher probability of being unvaccinated. However, only the age effect still reached a significant level when controlling for other characteristics, such as education. The latter was a key driver for getting the vaccine, as respondents that reported post-secondary education had been vaccinated more frequently, to a statistically singificant extent. While self-rated health did not have a significant impact on being vaccinated or not, diagnosed physical illnesses as well as affectedness with a severe COVID-19 infection within the close vicinity both significantly decreased the likelihood of not being vaccinated. Further, the economic status of respondents was another key predictor. Respondents who reported more difficulties in making ends meet, had a lower household income, or reported unemployment had a significantly higher probability of not having been vaccinated. These findings confirmed a recent study regarding the relation between socio-economic position and testing, hospitalization as well as mortality (Riou et al., 2021) and adds further evidence also with respect to vaccination.

4   Conclusion

The stagnation of the COVID-19 vaccination process jeopardizes the attempt to contain the pandemic in many European countries. While some countries have progressed rather far (e.g. Malta, Denmark, Spain, Belgium, Sweden), prompting governments to lift corona restrictions, others are still far away from sufficient vaccination rates, especially Bulgaria and Romania, but also other Eastern European and Baltic Countries, like Latvia, Lithuania or Slovakia.

In this paper we tried to shed some light on possible reasons why people across Europe might be hesitant to get vaccinated. Country differences in vaccination rates seem to be in large parts driven by scepticism towards the vaccine, as the share of willing respondents who have not yet been vaccinated is low in most countries, while the share of undecided and refusing respondents is very high in countries with low vaccination rates, especially in Bulgaria and Romania. We are however unable to tell to what extent that relation is reciprocal, i.e. whether a progressing immunization campaign can persuade erstwhile sceptics.

Regarding socio-demographics we found that age seems to be a significant factor in respondents' willingness to receive the vaccine, with the population below the age of 65 more likely to refuse than older respondents. We suspect this is due to their lower priority in vaccination campaigns and their lower risk for a severe progression of the COVID-19 disease. This squares in part with the result that diagnosed health conditions, which are more prevalent in older populations, are connected to a lower likelihood to refuse the vaccine. Gender is another factor that plays a role in attitudes towards immunization, as we found that women were more likely to be hesitant than men, although the effect did not reach a significant level anymore when controlling for other important characteristics. A possible explanation for the bivariate difference could be the—in some countries at times heated—debate about potential negative side effects of vector vaccines, like the ones by AstraZeneca or Johnson & Johnson, for (younger) women. However, this debate, although still visible to some extent, has largely subsided, which could also reflect an underlying correlation with education. As such, educational differences were particularly prominent when comparing the highest level of education with the two other groups, showing that the latter were substantially more sceptic towards the vaccination.

As stated above, prior illnesses as an objective health indicator were associated with a higher willingness to get vaccinated. Yet, subjective, self-rated health did not seem to have a clear and significant effect. We also did not see strong effects with regards to reported mental health issues. In contrast, close contact with COVID-19 patients—or having been infected oneself—had an effect under limited conditions: While it could be argued that knowing someone mildly affected by COVID-19 did not make a huge difference regarding the probability of being vaccinated or not, severe outcomes of a COVID-19 disease in the vicinity substantially reduced the proportion of being undecided or not willing to be vaccinated.

Respondents' living conditions exhibited substantial effects on their vaccination scepticism—at least for some variables. On average, respondents from urban areas were less likely to be sceptical towards vaccination, possibly due to differences in health care coverage. Further, households with more than two members were slightly more likely to be hesitant to get vaccinated. However, both predictors did not show a significant effect when controlling for other respondent characteristics. Much more influential is the economic situation, especially the ability to make ends meet as well as the respondents' working status. These were the strongest predictors of vaccination refusals, with respondents in financially deprived households or facing unemployment being least likely to agree with vaccination. Together with a similar finding for the income situation and the effect of education this highlights the importance of socio-economic circumstances in the context of vaccination hesitancy. These results would support the assumption that mobility, health education and general access to health care are important influences on the willingness to get vaccinated. This in turn points to strategies to convince current vaccination sceptics.

4.1   Limitations

Some caveats apply to the results presented here. For one, our results can only hold for the 50+ population included in SHARE. Further, panel attrition could have skewed the representativity of our analysis. However, since the vaccination rates from our survey data match official statistics, we are quite confident that our further analyses are equally representative.

While the cross-country dimension of the SHARE Corona Survey is a great advantage of our study, we have not yet been able to establish in detail the specific challenges of the immunization campaigns in all 28 participating countries. A more detailed look at the circumstances on a national level will take more time, but will certainly be beneficial for the understanding of the specific issues.

It is furthermore important to stress that our results have to be interpreted carefully when it comes to causal interpretations. Our data on vaccination rates and willingness is strictly cross-sectional and can therefore not depict changes over time that are often vital for causal analyses. Nevertheless, we hope to have provided a sound overview of country differences in vaccination rates and refusal as well as groups that are especially sceptical of the immunization efforts, thereby supporting some first ideas of the reasons behind that scepticism. Previous research has already shown the importance of pandemic severity and perceived governmental protection against COVID-19 for the adoption of preventive behaviour (Sand/Bristle, 2021). Further work will thus have to include indivual and country-level indicators, such as trust in government and health care systems, stringency of lockdown measures and pandemic severity to draw comprehensive conclusions.

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6 Appendix

Table A1: Distribution of not vaccinated respondents across countries

Country	Number of not vaccinated respondents	I want to be vaccinated (in %)	I'm still undecided (in %)	I don't want to be vaccinated (in %)
Austria	286	8.1	18.5	73.3
Belgium	164	23.6	28.0	48.4
Bulgaria	524	12.5	42.5	45.1
Croatia	537	20.4	47.1	32.4
Cyprus	91	21.0	37.0	42.0
Czech Republic	342	16.5	41.9	41.5
Denmark	29	23.7	12.1	64.3
Estonia	1086	24.8	39.3	35.9
Finland	74	43.4	19.2	37.4
France	246	29.4	31.1	39.5
Germany	183	33.4	16.2	50.4
Greece	755	27.0	40.3	32.7
Hungary	94	6.9	28.6	64.4
Israel	74	3.8	19.2	77.0
Italy	305	36.1	31.7	32.2
Latvia	435	14.7	39.4	45.8
Lithuania	450	22.4	34.6	43.0
Luxembourg	56	14.9	11.3	73.8
Malta	8	7.3	0.0	92.7
Netherlands	30	19.3	20.1	60.6
Poland	707	22.9	37.9	39.3
Portugal	67	70.1	14.9	15.0
Romania	941	7.1	39.4	53.5
Slovakia	303	23.6	35.8	40.6
Slovenia	805	25.0	36.1	38.9
Spain	52	13.4	16.7	70.0
Sweden	23	6.3	59.6	34.1
Switzerland	290	32.9	42.8	24.3
Avg.	-	22.8	32.7	44.5
N	8957	1834	3158	3944

Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (weighted).

Table A2: Socio-demographic differences of respondents undecided/unwilling to be vaccinated by country

Country	Difference in percentage points (standard errors in parentheses)			
	65+ vs. 50-64 years	Male vs. female	Primary vs. secondary education	Primary vs. post-secondary education
Austria	17.0**	2.9	-21.3*	-27.8**
	(6.5)	(6.9)	(10.4)	(10.7)
Belgium	1.3	0.4	-0.8	-1.2
	(0.9)	(1.0)	(1.5)	(1.3)
Bulgaria	1.0	3.0	-14.9**	-37.1***
	(5.0)	(4.9)	(4.7)	(6.8)
Croatia	9.2**	3.7	-2.5	-16.4***
	(3.1)	(3.2)	(3.4)	(3.9)
Cyprus	2.4	5.9	-0.1	-8.0
	(3.6)	(3.5)	(4.6)	(3.6)
Czech Republic	7.2	9.5	8.3	4.9
	(6.1)	(5.3)	(4.6)	(8.5)
Denmark	1.6	0.6	-1.8	-1.8
	(1.2)	(1.1)	(2.7)	(2.6)
Estonia	3.4	-0.4	-2.6	-10.2***
	(2.0)	(2.0)	(2.7)	(2.5)
Finland	1.6	-0.3	-5.1	-4.9
	(1.9)	(1.8)	(3.0)	(2.9)
France	5.6*	3.6	0.2	-6.2*
	(2.7)	(2.8)	(3.5)	(2.9)
Germany	6.7***	3.1	1.1	-0.9
	(1.9)	(1.9)	(2.7)	(2.7)
Greece	6.2**	-0.7	6.0*	0.5
	(2.0)	(2.0)	(2.4)	(2.4)
Hungary	11.9	-10.2	9.8	-0.4
	(8.4)	(8.2)	(6.4)	(3.5)
Israel	0.3	7.3	-15.5*	-15.8*
	(5.3)	(4.4)	(7.4)	(7.3)
Italy	3.2	1.7	-2.3	4.0
	(1.7)	(1.8)	(1.6)	(5.1)
Latvia	5.9	-4.4	-3.4	-11.6*
	(3.8)	(4.0)	(5.8)	(5.5)
Lithuania	15.9***	-2.2	0.1	-11.5*
	(3.2)	(3.5)	(5.0)	(4.5)
Luxembourg	8.0	-2.5	1.2	7.9
	(6.0)	(7.1)	(4.9)	(8.6)
Malta	1.9	1.3	2.3	0.3
	(1.4)	(1.3)	(1.4)	(0.8)
Netherlands	10.0	1.5	-4.5	-9.7
	(6.5)	(6.6)	(8.6)	(6.7)
Poland	5.9**	0.3	-8.5**	-20.2***
	(2.0)	(2.1)	(2.6)	(2.7)
Portugal	8.6	-5.8	11.6	5.7
	(4.9)	(4.3)	(11.2)	(8.1)
Romania	-5.0	2.6	-12.8***	-34.6***
	(3.6)	(3.7)	(3.9)	(5.5)
Slovakia	2.1	-1.5	-29.7***	-43.1***
	(3.5)	(3.6)	(6.1)	(7.7)
Slovenia	2.5	7.2*	-2.0	-17.3***
	(3.1)	(3.0)	(3.8)	(3.3)
Spain	4.0	1.5	1.5	4.4
	(2.5)	(2.3)	(3.6)	(6.4)
Sweden	7.3	-3.5	0.9	2.3
	(5.7)	(5.4)	(4.0)	(4.7)
Switzerland	10.2	-5.7	-2.0	2.7
	(8.7)	(9.2)	(6.4)	(11.8)

Reading example: In Austria, significantly more younger respondents (50-64 years), compared to older respondents (65+ years), are still undecided or unwilling to be vaccinated; the difference between these two groups is 17.0 %-points. Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (weighted).

Table A3: Health-related differences of respondents undecided/unwilling to be vaccinated by country

Country	Difference in percentage points (standard errors in parentheses)					
	Better than poor vs. poor health	Not having vs. having physical illnesses	Not having vs. having mental health issues	Hardly ever/never vs. often feeling lonely	Not vs. mildly affected	Not vs. severely affected
Austria	-2.4	-12.2	-4.5	-6.8	7.2	2.6
	(8.8)	(8.3)	(6.7)	(6.7)	(7.9)	(8.6)
Belgium	2.6	-1.9	1.8	1.2	-1.5	-3.3**
	(3.1)	(1.2)	(1.0)	(1.1)	(1.2)	(1.2)
Bulgaria	11.8*	5.3	12.0*	4.8	1.0	-12.4*
	(5.9)	(6.2)	(4.9)	(4.7)	(5.7)	(5.8)
Croatia	5.7	-3.1	-1.1	5.2	0.2	-8.7
	(4.1)	(4.0)	(3.1)	(3.1)	(3.4)	(4.6)
Cyprus	12.3	-0.6	0.02	0.4	-4.4	-2.1
	(7.7)	(3.8)	(3.5)	(3.8)	(3.8)	(4.9)
Czech Republic	-2.8	-9.2	-6.5	-5.3	-5.1	-7.9
	(7.3)	(7.2)	(5.5)	(4.7)	(6.7)	(7.3)
Denmark	1.1	-3.4*	-0.2	1.4	2.1	
	(2.2)	(1.5)	(1.1)	(2.1)	(1.3)	
Estonia	8.5**	-2.9	-2.7	-0.3	-4.4*	-10.1**
	(2.6)	(2.4)	(2.0)	(2.0)	(2.1)	(3.1)
Finland	-3.2*	-1.6	-2.0	4.0	-1.5	-0.1
	(1.3)	(2.3)	(1.9)	(2.6)	(1.9)	(3.3)
France	-5.2	-9.2**	6.3*	4.0	6.8*	1.8
	(2.7)	(3.3)	(2.4)	(3.1)	(3.4)	(3.5)
Germany	2.5	-5.6*	2.0	1.1	0.9	-1.1
	(4.6)	(2.6)	(1.9)	(2.2)	(2.2)	(3.6)
Greece	-0.8	-7.9***	-0.6	1.1	0.3	-3.4
	(3.2)	(2.3)	(1.9)	(1.9)	(2.6)	(2.6)
Hungary	-7.5	-21.8	-15.9*	-0.7	-7.1	-13.8*
	(4.4)	(10.8)	(6.7)	(7.4)	(6.1)	(5.4)
Israel	4.5	2.5	8.8*	11.1	-6.1	-7.8
	(4.8)	(5.3)	(4.1)	(5.8)	(4.3)	(4.2)
Italy	1.4	-0.5	-1.2	-2.0	-0.0	-4.5**
	(3.2)	(1.8)	(1.8)	(1.7)	(2.2)	(1.6)
Latvia	18.7***	-0.8	-0.3	12.6***	-10.1*	-22.3***
	(5.0)	(4.9)	(3.9)	(3.8)	(4.1)	(5.8)
Lithuania	4.6	-11.4**	-1.7	9.5**	-5.7	-11.8**
	(5.1)	(4.2)	(3.4)	(3.6)	(3.6)	(4.4)
Luxembourg	-4.1	-14.1*	9.4	-7.1	8.3	7.4
	(4.5)	(7.3)	(5.8)	(4.7)	(7.3)	(5.8)
Malta		1.5	0.7	1.4	0.1	6.3
		(1.0)	(1.1)	(1.7)	(0.8)	(4.9)
Netherlands		2.1	4.4	9.9	0.9	
		(5.9)	(6.9)	(10.8)	(7.3)	
Poland	3.2	-3.9	2.4	2.0	-5.7*	-10.5***
	(3.1)	(2.7)	(2.1)	(2.2)	(2.3)	(2.7)
Portugal	2.9	-7.6	-10.6	4.00	0.7	-4.8
	(5.7)	(6.7)	(6.3)	(4.0)	(4.7)	(2.9)
Romania	4.5	-5.3	3.6	7.2*	-10.7*	-12.1*
	(4.0)	(4.0)	(3.5)	(3.5)	(4.5)	(5.5)
Slovakia	13.6	-2.3	0.6	4.04	1.5	-16.8***
	(10.4)	(3.7)	(3.6)	(3.6)	(4.5)	(4.2)
Slovenia	9.2*	1.4	-1.4	2.1	0.4	-5.5
	(4.7)	(3.3)	(3.0)	(3.1)	(3.3)	(4.6)
Spain	-1.8	-3.2	-2.9	3.1	-4.3*	-3.5
	(1.7)	(3.5)	(2.3)	(3.0)	(2.0)	(2.3)
Sweden	0.02	3.8	-5.7	-3.9	6.1	-1.2
	(4.6)	(4.0)	(4.4)	(3.4)	(4.9)	(1.1)
Switzerland	-4.4	-17.5*	-6.9	-1.1	1.6	-7.0
	(6.7)	(7.7)	(7.5)	(6.5)	(9.2)	(4.9)

Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (weighted).

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Table A4: Differences related to living conditions and economic situation of respondents undecided/unwilling to be vaccinated by country

Country	Difference in percentage points (standard errors in parentheses)					
	Rural vs. urban	Single vs. 2-person hh	Single vs. >2-person hh	(Fairly) easily vs. with (great) difficulties making ends meet	Retired vs. (self) employed	Retired vs. unemployed
Austria	-15.0*	8.1	5.4	12.4	9.9	70.7***
	(5.7)	(5.3)	(8.7)	(9.4)	(8.3)	(18.0)
Belgium	2.1	-4.5***	-3.7*	5.4**	0.5	5.4
	(1.1)	(1.3)	(1.5)	(1.8)	(1.1)	(4.6)
Bulgaria	-7.3	3.2	0.3	7.1	-9.5	19.8***
	(5.5)	(5.3)	(7.9)	(5.3)	(5.7)	(5.9)
Croatia	-12.9***	-3.7	3.8	9.6**	2.1	16.1
	(3.3)	(3.6)	(4.3)	(3.2)	(4.6)	(9.4)
Cyprus	2.6	-0.8	-7.2	-0.8	2.8	16.3
	(3.7)	(5.7)	(5.5)	(4.0)	(4.1)	(21.8)
Czech Republic	-5.1	-1.0	-1.6	5.9	10.6	5.3
	(5.5)	(5.4)	(7.7)	(6.8)	(8.0)	(17.5)
Denmark	-0.4	0.4	-1.4	9.7	2.1	
	(1.1)	(1.1)	(0.7)	(6.2)	(1.3)	-
Estonia	8.3***	-2.5	-5.1	12.2***	-2.2	5.8
	(2.0)	(2.1)	(3.2)	(2.1)	(2.0)	(8.4)
Finland	3.1	-4.7	4.3	6.5	1.5	33.8*
	(2.4)	(2.1)	(5.7)	(3.7)	(1.8)	(15.4)
France	-0.3	-3.6	-3.4	5.3	8.7*	-1.8
	(3.4)	(3.0)	(4.2)	(3.9)	(3.7)	(4.9)
Germany	-0.7	-1.3	0.5	7.1*	5.6**	43.3**
	(2.0)	(1.9)	(4.3)	(3.5)	(1.9)	(13.2)
Greece	0.9	-3.3	1.4	2.8	8.9***	15.7
	(2.3)	(2.2)	(2.9)	(3.0)	(2.6)	(8.5)
Hungary	-6.0	11.1	2.3	8.8	18.1	1.8
	(5.7)	(7.1)	(4.3)	(5.6)	(11.5)	(10.3)
Israel	-4.4	-5.6	4.8	0.8	-2.4	
	(4.6)	(3.0)	(8.2)	(5.5)	(1.5)	
Italy	1.6	-2.5	-0.4	3.9*	1.0	19.4
	(2.4)	(2.6)	(2.9)	(1.8)	(1.3)	(12.9)
Latvia	2.7	0.4	-6.8	13.1***	-2.0	15.4
	(4.0)	(4.2)	(5.9)	(3.8)	(4.1)	(12.1)
Lithuania	-1.3	1.1	3.5	17.9***	6.5	46.4***
	(3.5)	(3.6)	(5.0)	(3.3)	(3.4)	(6.8)
Luxembourg	-6.0	-5.5	1.8	-3.7	13.3	
	(5.7)	(5.8)	(9.3)	(4.9)	(8.6)	
Malta	0.3	-1.0	-0.5	-0.8	2.3	
	(0.9)	(2.0)	(1.9)	(1.3)	(2.3)	
Netherlands	-5.6	-6.1	-11.7*	5.4	1.7	82.9***
	(6.7)	(7.3)	(5.4)	(7.1)	(4.1)	(11.8)
Poland	-8.4***	0.4	7.4*	11.4***	5.9*	18.0*
	(2.0)	(2.5)	(2.9)	(2.0)	(2.5)	(8.3)
Portugal	-2.3	4.2	5.2	-2.4	7.9	
	(4.1)	(2.8)	(3.3)	(3.7)	(5.2)	
Romania	-18.9***	-11.9**	0.7	15.0***	-4.2	-37.0
	(5.2)	(4.3)	(4.8)	(3.8)	(5.4)	(24.9)
Slovakia	-13.8***	-12.5**	-6.9	14.6***	-2.3	4.5
	(4.0)	(4.5)	(5.4)	(3.7)	(3.9)	(12.0)
Slovenia	-6.1*	-4.9	-1.6	7.7*	0.8	12.3
	(2.9)	(3.2)	(4.0)	(3.1)	(4.4)	(11.8)
Spain	2.4	-0.7	3.0	-2.1	5.9	7.4
	(2.2)	(2.0)	(3.8)	(2.0)	(4.4)	(6.2)
Sweden	4.2	4.2		-4.3	7.5	
	(2.6)	(4.2)		(3.2)	(5.6)	
Switzerland	-12.9*	5.6	-4.1	-6.3	12.7	49.6
	(5.6)	(6.9)	(6.1)	(7.1)	(9.2)	(22.2)

Data: Preliminary SHARE wave 9 COVID-19 Survey 2 release 0 data (weighted).

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