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## Prayer frequency and COVID-19 vaccine hesitancy among older adults in Europe



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### ABSTRACT

**Aim:** Differences in levels of vaccine uptake have emerged across Europe, and this may partly be explained by religious beliefs. Our aim is to study the association between religiosity, measured by prayer frequency, and vaccine hesitancy, and to examine how this association varies across European countries and regions.

**Methods:** This study was based on 42,583 adults aged 50 years and above from 27 European countries in the Survey of Health, Ageing and Retirement in Europe (SHARE), waves 1–8, and the 2nd SHARE COVID-19 Survey. Logistic regression models were used to investigate the associations.

**Results:** Participants were more likely to be vaccine-hesitant when praying ‘weekly or less’ (odds ratio (OR) 1.32 95 % confidence interval (CI) 1.23–1.42) or daily (OR 1.78 95 % CI 1.65–1.92). Praying ‘weekly or less’ was associated with increased vaccine hesitancy in Southern Europe (OR 1.48 95 % CI 1.17–1.87) and Central and Eastern (OR 1.35 95 % CI 1.24–1.47) Europe, while daily praying was associated with vaccine hesitancy in Western (OR 1.77 95 % CI 1.51–2.08), Southern (OR 1.30 95 % CI 1.03–1.64), Central and Eastern (OR 1.89 95 % CI 1.73–2.06) and Northern (OR 2.75 95 % CI 1.54–4.89) Europe.

**Conclusions:** These findings provide support for an association between daily prayer frequency and COVID-19 vaccine hesitancy, with a consistent pattern across European regions.

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## 1. Introduction

As of September 2022, the Coronavirus Disease 2019 (COVID-19) has resulted in more than 600 million cases and nearly 6.5 million deaths globally [1], and the development and distribution of the vaccines have proven to be crucial in limiting the spread of the COVID-19 [2]. Despite a varying protection rate among the different vaccines, a meta-analysis of randomized controlled trials demonstrates that the vaccinations reduce the risk of severe illness and death [3]. Consequently, several European governments have lifted most of the restrictions that during two years have limited

social gatherings. However, vaccination uptake differs greatly across Europe, and vaccine hesitancy, defined as a *delay in acceptance or refusal of vaccination despite the availability of vaccination services* [4], largely explains these differences.

A recent study among Europeans aged 50+ showed that vaccine hesitant individuals are mainly adults aged 50–65 years, with lower education, and residing in Central and Eastern European countries (especially Slovakia, Croatia, Slovenia, Bulgaria, and Romania) or in the Baltic countries (especially Latvia and Lithuania) [5]. The low vaccine uptake in these countries may be explained by a higher distrust of people in medical professionals and health authorities [6]. Moreover, a recent literature review demonstrates that religious beliefs may be a determinant in the vaccine hesitancy in Eastern Europe [7].

Religion and spirituality are complex concepts to measure [8], but one way to assess people’s religiosity is by measuring how often they pray (prayer frequency) – a method that has been utilised in other studies examining the association between religiosity

**Abbreviations:** COVID-19, Corona Virus Disease 2019; SHARE, Survey of Health, Ageing, and Retirement in Europe; SCS-2, The 2nd SHARE Corona Survey.

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ity and mental health [9,10]. A systematic review found that prayer was a robust indicator of religious involvement [11]. What complicates the evaluation is that there can be different motivations for praying. For example, praying to God in thankfulness for health and wellbeing in a restful attitude (*restful religiosity*) differs markedly from supplication to God for help in an illness crisis (*crisis religiosity*) [12,13]. While religion mainly offers a source of relief for coping with uncertainty [14], relying on one's faith to look for possible explanations is in some Christian communities strongly and positively correlated with distrust in science and trust in informal sources of information [15]. This is in line with a study from the USA demonstrating that some religious fundamentalist groups, such as Christian nationalists and evangelical Protestants, were found to be more hesitant towards the COVID-19 vaccines, explained by lower levels of trust in science, a higher belief in God as their protector from illness and crisis, and associations with conservative political values such as the right of freedom to choose or decline vaccination [16]. Moreover, this study finds that Catholics, Agnostics, and atheists have significantly higher confidence towards the COVID-19 vaccine as compared to evangelical Protestants, and, they do not find associations with other religious affiliations, i.e., Muslim, Jewish, or Hindu/Buddhist.

Also, COVID-19 conspiracy beliefs have been linked to strong religious beliefs among Polish and Croatian Catholics [17,18], and, in turn, conspiracy beliefs have been associated with vaccine hesitancy [19]. However, other studies found different forms of religiosity to be equally associated with vaccine hesitancy. A study from the Czech Republic demonstrated a larger vaccine refusal among people who were identified as *spiritual* (measured by their frequency of experienced connection with transcendence) but not religiously affiliated (not members of a church or religious society) [20]. Furthermore, vaccine hesitancy among some religious groups may be explained by attitudes among leaders of the religious communities, who are seen as role models, and who do not either promote or directly discourage people from being vaccinated against COVID-19 [15,21,22].

To our knowledge, no previous studies have explored the association between religiosity and COVID-19 vaccine hesitancy comparing European countries and regions. The aim of this study is therefore to investigate the association between religiosity, measured by prayer frequency, and COVID-19 vaccine hesitancy among people aged 50+ years, and to examine how this association may vary across Europe. We hypothesise that a higher prayer frequency is associated with vaccine hesitancy, and based on recent evidence, that this is most pronounced in Central and Eastern Europe.

## 2. Methods

### 2.1. Data source

Data were drawn from the European cross-disciplinary longitudinal Survey of Health, Ageing, and Retirement in Europe (SHARE). SHARE consists of 28 European countries and Israel and provides data on Europeans aged 50+ years to understand why European populations are ageing differently [23]. SHARE is repeated biannually as personal face-to-face interviews. Data were collected at the household level with response rates varying by wave and countries ranging, for instance, between 40.3 % and 97.5 % in SHARE wave 1 and between 32.7 % and 62.0 % in SHARE wave 5 [24]. As the COVID-19 pandemic emerged in Europe in March 2020, two special COVID-19 waves using telephone interviews were planned to capture the consequences of living through the pandemic. Fieldwork of the 2nd SHARE Corona Survey (SCS-2), which captured information about the COVID-19 vaccines, took place from June to early August 2021 [25].

The study population initially comprised 115,431 respondents aged 50+ years from the 28 European countries with information on prayer frequency in SHARE waves 1 (2005) to 8 (2020). To investigate the association between prayer frequency and vaccine hesitancy, only respondents who participated in the SCS-2 and responding to items related to the relevant vaccine items [26], were kept in the sample, resulting in a final study population of 42,583 (36.9 %) participants (Fig. 1). Compared with the non-respondents to the SCS-2, the final study population were younger, included more females, had a higher education, more people had a partner in household, slightly more had three or more diseases and more people were praying weekly and daily (Supplementary Table 1). Ireland did not participate in the SCS-2 Survey, leaving 27 European countries in the study.

### 2.2. Explanatory variable

Data on the exposure variable 'prayer frequency' were obtained from the SHARE waves 1–8 and was assessed by the following question: 'Thinking about the present, how often do you pray?' with the answer categories: 'Never', 'Less than once a week', 'Once a week', 'A couple of times a week', 'Once daily' and 'More than once a day'. For our analyses we grouped the answer categories as 1) 'Never', 2) 'Weekly or less' and 3) 'Daily'. For people who responded to 'prayer frequency' in two or more waves, we used the answer from the most recent wave. The majority of the eligible participants responded to the question about 'prayer frequency' in the SHARE wave 5 survey (2013; 54.8 %) (Fig. 1).

### 2.3. Outcome variable

Information on the outcome variable 'vaccine hesitancy' was retrieved from the SCS-2 and was based on the following two questions: 1) 'Have you been vaccinated against COVID-19?' ('yes' or 'no'). In case the respondents replied 'no', they were further asked: 2) 'Do you want to get vaccinated against COVID-19?' with the following possible answer categories: 'Yes, I already have a vaccination scheduled', 'Yes, I want to get vaccinated', 'No, I do not want to get vaccinated', and 'I'm still undecided'. We generated the variable 'vaccine hesitancy', and dichotomised it into 'Yes' ('not vaccinated', 'still undecided', 'do not want vaccination') and 'No' ('vaccinated', 'vaccination scheduled', 'want to get vaccinated').

### 2.4. Sociodemographic variables

Socio-demographic characteristics included in the study were age (50–64 years, 65–79 years, 80+ years), sex (male, female), educational level according to the International Standardized Classification of Education (ISCED) (lower (0–2), medium (3–4), higher (5–6)) [27] and partner in household ('yes', 'no'). Moreover, we included the variable 'number of diseases', which was based on the question: 'Has a doctor ever told you that you had any of the conditions on this card?' with 12 options asked similarly across all eight SHARE waves, for example hypertension, stroke, diabetes and cancer. If the participants replied 'yes' they had been diagnosed with the given disease. We categorised the variable into '0', '1–2', '3 or more illnesses'. Also, as a measure for socioeconomic-status, we included the variable household net worth (wealth), which measures the sum of household net financial assets and household real assets, measured in euros [28]. Wealth was grouped into four quartiles with the highest quartile reflecting the highest wealth. For all participants, information on the sociodemographic variables was retrieved from the same wave as the last 'prayer frequency' observation (SHARE waves 1–8). See Supplementary Table 2 for more information about the covariates.

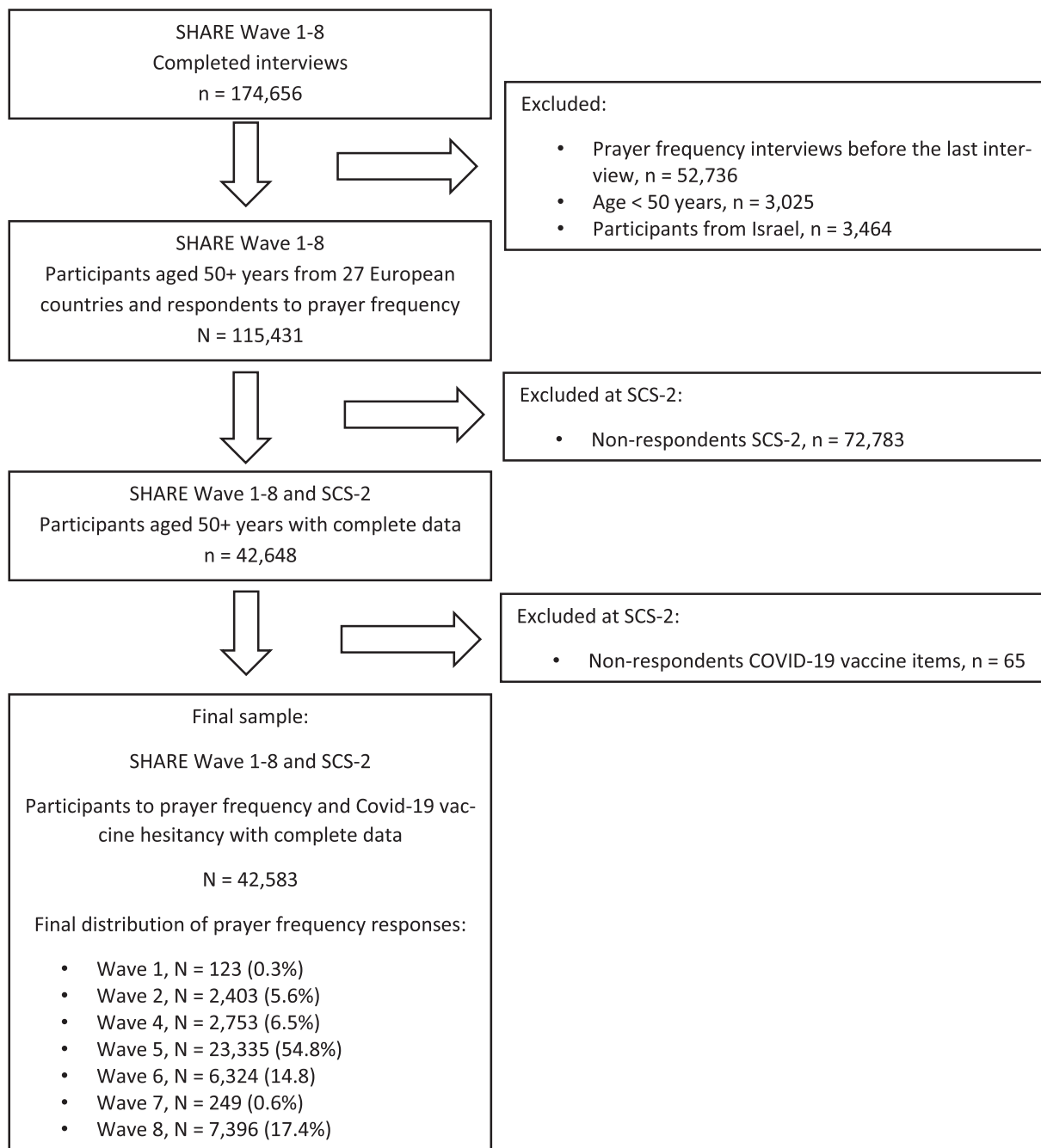


Fig. 1. Flow-chart of study inclusion of participants.

We grouped the 27 countries into four European regions, based on recent SHARE studies [29,30] and according to the European welfare regime typologies, which was first developed and classified by Esping-Andersen [31] and later redefined and extended to cover Southern Europe [32] and Central and Eastern Europe [33–36]. Thus, the countries are grouped into four regions: 1) The Western European region (Germany, The Netherlands, France, Belgium, Luxembourg, Switzerland, and Austria) referring to the Western European or Bismarckian countries, 2) the Southern European region (Spain, Portugal, Malta, Italy, Greece, and Cyprus) referring to the Southern or Mediterranean countries, 3) the Central and Eastern European region (Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Slovenia, Hungary, Croatia, Romania, and Bulgaria) referring to the Central and Eastern European or the post-communist countries, and 4) the Northern European region (Den-

mark, Sweden, and Finland) referring to the Northern European or Scandinavian countries [32,34,36]. Despite existing variations of the regions [37], these four regions are relatively homogeneous in terms of geography, institutions, economy, and culture [38–40].

### 2.5. Statistical analysis

For the descriptive analyses, a chi-squared test was used to test differences in prayer frequency by vaccine hesitancy and by each of the sociodemographic variables. Multiple logistic regression models calculating odds ratios (ORs) with 95 % confidence intervals (CIs) were conducted to investigate the association between prayer frequency and COVID-19 vaccine hesitancy. Firstly, we conducted a model adjusted for age, sex and European region (model 1). In a second model, we further adjusted for educational level, partner

**Table 1**  
Study population characteristics, overall and by prayer frequency (N = 42,583).

Variable	Total (%)	Prayer Frequency		
		Never (%)	Weekly or less (%)	Daily (%)
<b>Prayer frequency</b>	42,583 (100)	15,376 (36.1)	13,721 (32.2)	13,486 (31.7)
<b>Sex</b>				
Male	17,899 (42.0)	8,283 (53.9)	5,974 (43.5)	3,642 (27.0)
Female	24,684 (58.0)	7,093 (46.1)	7,747 (56.5)	9,844 (73.0)
<b>Age-groups</b>				
50–64 years	23,401 (54.9)	9,108 (59.2)	8,042 (58.6)	6,251 (46.3)
65–79 years	16,887 (39.7)	5,701 (37.1)	5,107 (37.2)	6,079 (45.1)
80+ years	2,295 (5.4)	567 (3.7)	572 (4.2)	1,156 (8.6)
<b>Mean age, years (SD)</b>	64.2 (8.7)	63.2 (8.2)	63.4 (8.4)	66.0 (9.2)
<b>Educational level</b>				
Higher	9,789 (23.1)	4,396 (28.7)	3,206 (23.4)	2,187 (16.3)
Medium	18,143 (42.8)	6,963 (45.5)	6,043 (44.2)	5,137 (38.3)
Lower	14,445 (34.1)	3,944 (25.8)	4,423 (32.4)	6,078 (45.4)
Missing <sup>a</sup>	206 (0.5)	73 (0.4)	49 (0.4)	84 (0.6)
<b>Partner in household</b>				
Yes	32,096 (75.4)	11,835 (77.0)	10,599 (77.2)	9,662 (71.6)
No	10,487 (24.6)	3,541 (23.0)	3,122 (22.8)	3,824 (28.4)
<b>Wealth (Euros), median (IQR)</b>	122,500 (39,100–303,500)	141,770 (44,500–344,722)	127,616 (40,836–307,147)	101,902 (30,532–254,790)
<b>Number of diseases</b>				
0	11,384 (26.7)	4,266 (27.7)	3,927 (28.6)	3,191 (23.7)
1–2	22,622 (53.1)	8,187 (53.3)	7,178 (52.3)	7,257 (53.8)
3 or more	8,577 (20.1)	2,923 (19.0)	2,616 (19.1)	3,038 (22.5)
<b>European regions</b>				
Western	12,288 (28.9)	5,263 (34.2)	4,108 (29.9)	2,917 (21.6)
Southern	9,835 (23.1)	1,654 (10.8)	3,323 (24.2)	4,858 (36.0)
Central-Eastern	17,077 (40.1)	6,722 (43.7)	5,243 (38.2)	5,112 (37.9)
Northern	3,383 (7.9)	1,737 (11.3)	1,047 (7.6)	599 (4.4)
<b>Vaccine hesitancy<sup>b</sup></b>				
Yes	6,295 (14.8)	1,832 (11.9)	1,979 (14.4)	2,484 (18.4)
No	36,288 (85.2)	13,544 (88.1)	11,742 (85.6)	11,002 (81.6)

<sup>a</sup> Missing observations are not included in the total percentages.

<sup>b</sup> Data from 2nd SHARE Corona Survey (SCS2). Data on the rest of the variables are from the time of the last prayer frequency observation (SHARE waves 1–8).

in household, wealth and number of diseases (model 2). Thirdly, we carried out separate analyses for the four European regions, by including an interaction term between prayer frequency and European region, because a significant interaction for prayer frequency by region was found. Moreover, as we also found a significant interaction for prayer frequency by country, we conducted separate analyses for the 27 countries. Interactions for prayer frequency by age, sex and educational level were not significant, and thus we did not conduct analyses with interactions between prayer frequency and these variables.

Moreover, we conducted the following sensitivity analyses: 1) we categorised “prayer frequency” as “Never”, “Less than weekly to once daily” (‘Less than once a week’, ‘Once a week’, ‘A couple of times a week’, ‘Once daily’) and “More than once a day”, 2) we categorised ‘vaccine hesitancy’ as ‘yes’ (‘does not want vaccination’) and ‘no’ (‘vaccinated’, ‘vaccination scheduled’, ‘want to get vaccinated’, ‘still undecided’), 3) we excluded individuals who answered “prayer frequency” from SHARE waves 1–4, including only the most recent data since the prayer frequency answers may have changed over time, and 4) we grouped France in Southern Europe since some studies categorise this country as a Mediterranean or ‘Latin rim’ country [41,42] rather than a Bismarckian or Western European country [32,36] (Supplementary Table 4).

Stata version 17.0 was used for the statistical analyses.

### 3. Results

#### 3.1. Descriptive results

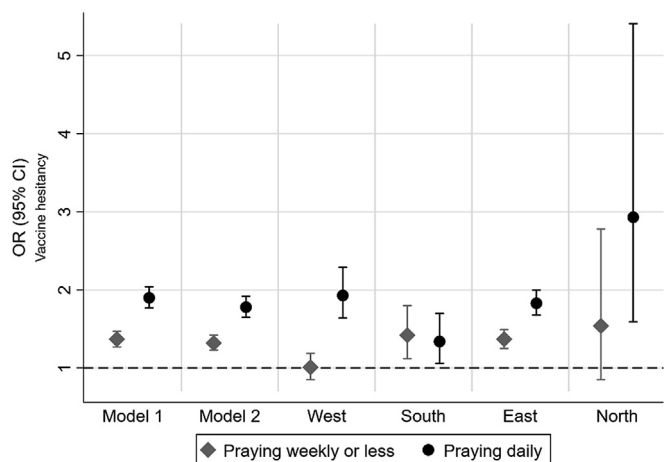
The final study population comprised 42,583 individuals, with a mean age of 64.2 years (standard deviation (SD) 8.7) and with the majority being female (58.0 %). In total, 14.8 % of the population

were vaccine-hesitant. Daily praying, as compared to praying ‘weekly or less’ or never, was mostly reported among those being vaccine-hesitant, being female, having a lower educational level, not having a partner in their household, having lower wealth, or having three diseases or more. At the regional level, the distribution of daily praying was 37.9 % in Central and Eastern Europe, 36.0 % in Southern Europe, 21.6 % in Western Europe, and 4.4 % in Northern Europe (Table 1). Characteristics by country are presented in Supplementary Table 3.

#### 3.2. Prayer frequency and vaccine hesitancy

The results of model 1 showed that praying ‘weekly or less’ (OR 1.37 95 % CI 1.27–1.47) and daily praying (OR 1.90, 95 % CI 1.77–2.04) were associated with a higher vaccine hesitancy compared with never praying. Model 2 demonstrated same results as model 1 for praying ‘weekly or less’ (OR 1.32 95 % CI 1.23–1.42) and daily praying (OR 1.78 95 % CI 1.65–1.92) which both remained associated with vaccine hesitancy after further adjustments (Fig. 2).

The results by European region demonstrated that those praying ‘weekly or less’ from Central and Eastern Europe (OR 1.35 95 % CI 1.24–1.47) and Southern Europe (OR 1.48 95 % CI 1.17–1.87) were more likely to be vaccine-hesitant. No association between a praying ‘weekly or less’ and vaccine hesitancy was found in Western Europe (OR 0.99 95 % CI 0.84–1.17) and Northern Europe (OR 1.49 95 % CI 0.84–2.66). Moreover, we found that people praying daily were more likely to be vaccine-hesitant in all four European regions, i.e., Northern Europe (OR 2.75 95 % CI 1.54–4.89), Western Europe (OR 1.77 95 % CI 1.51–2.08), Central and Eastern Europe (OR 1.89 95 % CI 1.73–2.06), and Southern Europe (OR 1.30 95 % CI 1.03–1.64). See also Supplementary Table 5.



**Fig. 2.** Logistic regression models examining the association between prayer frequency and vaccine hesitancy, overall and analysed by European regions. Model 1: Adjusted for age, sex, and European region. Model 2: Further adjusted for education, marital status, partner in household, wealth, and number of diseases. European regional models: Similar to model 2. Abbreviations: OR = odds ratio; CI = confidence interval; West = Western European region, South = Southern European region, East = Central-Eastern European region, North = Northern European region. Source: SHARE Wave 1–8, and 2nd SHARE Corona Survey.

At country level, people praying ‘weekly or less’ were more vaccine hesitant in Estonia (OR 1.50 95 % CI 1.23–1.82). When investigating daily praying, people were more vaccine hesitant in France (OR 1.87 95 % CI 1.23–2.85), Belgium (OR 1.73 95 % CI 1.15–2.61), Czech Republic (OR 1.84 95 % CI 1.29–2.62), Poland (OR 1.75 95 % CI 1.07–2.85), Slovenia (OR 1.27 (95 % CI 1.01–1.60), Estonia (OR 2.55 95 % CI 2.08–3.13), and Croatia (OR 1.39 95 % CI 1.02–1.89). Moreover, a tendency was found in Switzerland (OR 1.37 95 % CI 0.99–1.90) and Austria (OR 1.40 95 % CI 0.99–1.98), however these results were only borderline significant. Associations between praying ‘weekly or less’ and less vaccine hesitancy were found in Slovakia (OR 0.39 95 % CI 0.26–0.59) and Switzerland (OR 0.66 95 % CI 0.46–0.94) and when praying daily in Slovakia 0.42 (OR 95 % CI 0.28–0.63) and Greece (OR 0.66 95 % CI 0.46–0.94) (Fig. 3). No associations were found in the rest of the countries. See also Supplementary Table 6.

### 3.3. Sensitivity analyses

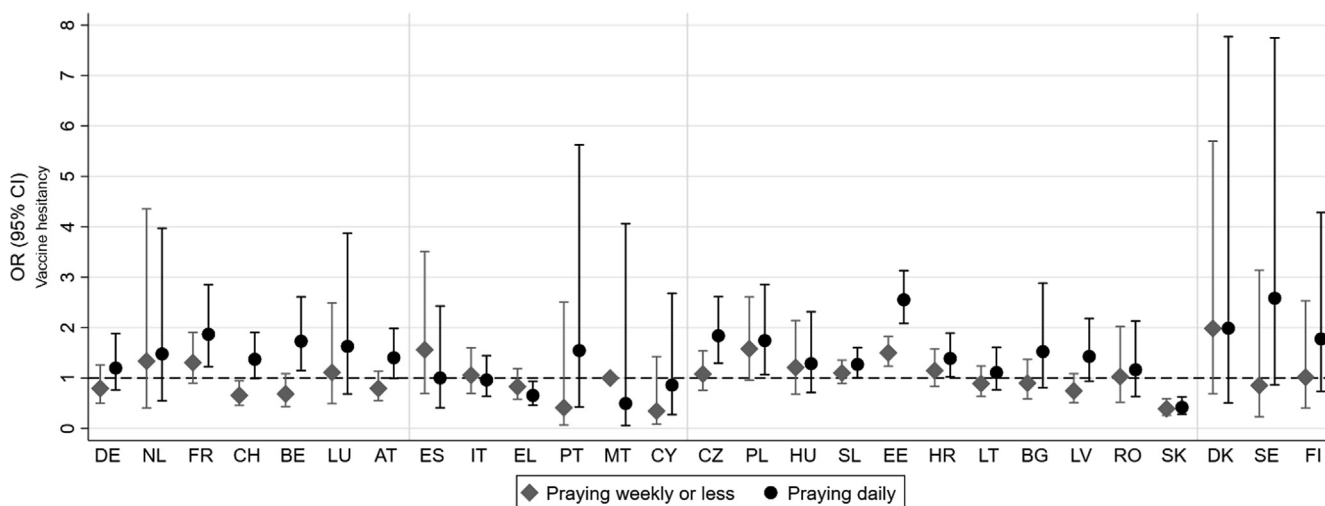
When investigating the associations with people who prayed more than once a day in a separate category, the associations became stronger than in the main analyses, except for Southern Europe where no associations were found for praying daily. When re-categorising vaccine hesitancy placing those who were “undecided” to the “no” category, excluding respondents from the earliest waves (1, 2 and 4), and grouping France as a Southern European country, respectively, we found that the results were overall consistent with the main results; however, a tendency was found towards slightly weaker associations with non-significant associations in Southern Europe (Supplementary Table 4).

## 4. Discussion

This is to our knowledge the first study to investigate the association between prayer frequency and COVID-19 vaccine hesitancy among the older European population. The main findings demonstrate that people in the European population aged 50+ years praying at least once a day are more likely to be vaccine hesitant as compared to those never praying. These findings were overall consistent across the four European regions.

Firstly, the hypothesis that frequent praying is positively associated with vaccine hesitancy for Europeans aged 50+ years was confirmed. Previous studies from Israel, Japan, and USA, in people aged 18 years or older, demonstrated that people with stronger religious beliefs are more vaccine-hesitant [16,43]. We found a similar tendency, though among a broad range of European religious strata. Possible explanations for COVID-19 vaccine hesitancy among people with a high prayer frequency may be related to their tendency towards restful or crisis religiousness. Thus, people may be vaccine-hesitant because they believe that God will protect them (*restful religious*), or because they fear both the COVID-19 disease and the vaccine (*crisis religious*).

Secondly, we found that a higher prayer frequency was associated with vaccine hesitancy in Central and Eastern Europe. This is in line with studies demonstrating an association between vaccine hesitancy and religiosity in some Central and Eastern European countries [7,18]. Moreover, we found a similar pattern across Europe, with a higher risk of vaccine hesitancy when praying daily.



**Fig. 3.** Logistic regression models examining the association between prayer frequency and vaccine hesitancy, analysed by 27 European countries. Adjusted for age, sex, education, marital status, partner in household, wealth, and number of diseases. Abbreviations: OR = odds ratio; CI = confidence interval; DE = Germany, NL = The Netherlands, FR = France, CH = Switzerland, BE = Belgium, LU = Luxembourg, AT = Austria, ES = Spain, IT = Italy, EL = Greece, PT = Portugal, MT = Malta, CY = Cyprus, CZ = Czech Republic, PL = Poland, HU = Hungary, SL = Slovenia, EE = Estonia, HR = Croatia, LT = Lithuania, BG = Bulgaria, LV = Latvia, RO = Romania, SK = Slovakia, DK = Denmark, SE = Sweden, FI = Finland. Source: SHARE Wave 1–8, and 2nd SHARE Corona Survey.

However, the results indicated a weaker association in Southern Europe supported by the sensitivity analyses re-categorising vaccine hesitancy, excluding early SHARE waves and categorising France as a Southern European country, thus no longer showing an association in Southern Europe. This may be explained by the fact that restful religiousness vis-à-vis crisis religiousness is more pronounced in Southern Europe with societies that generally have a stronger connection to religion than in other European regions such as the Scandinavian countries, where religiosity is more private and detraditionalized [44,45]. Crisis religiousness, in turn, is more frequent in secular regions such as Northern Europe [12], whereas in Western Europe and Central and Eastern Europe, there is a greater mix of religions.

Although a lower vaccine uptake is associated with an increased risk of illness and mortality from COVID-19 [2], previous studies demonstrate mixed findings on the association between prayer frequency and health, and several studies show no or weak evidence for the association between crisis religiousness and health [10,46,47]. However, a higher prayer frequency has been associated with better mental health (lower odds of having no hopes for the future and of suicidal thoughts) [10]. Furthermore, as prayer may produce its favourable effects due to its capability to generate hope and trust that a higher being is in control of the situation [48], there may exist a more critical view towards the health authorities or a fear of the vaccine itself in communities where a high prayer frequency is related with more Orthodox religiousness or with crisis religiousness.

Policy makers in the European countries should develop strategies that focus on improving the relationships between the health authorities and the religious communities [49]. A previous study, exploring factors influencing vaccination behaviors amongst Romanian communities in England found that face-to-face communication was a highly effective approach to reach these communities and gaining their trust [50], and another study from Israel examining barriers to vaccine uptake among ultra-Orthodox Jews and Israeli Arabs found partnering with religious leaders to be of high importance for building trust and confidence around the COVID-19 vaccines [51]. Thus, at a European level, such initiatives could involve an expanded outreach to faith-based communities, focusing on providing specific information about the vaccines, in several languages if needed, improving the accessibility to the vaccines and making publicity campaigns featuring religious leaders.

Also, in order to identify which religious groups that are the most hesitant towards the COVID-19 vaccine, future studies should look into differences in religious belonging across several European countries or regions, and include the role of trust in the government or in science, as this has only been done in one or few countries and mostly outside Europe [16,52,53]. Moreover, it should be explored whether interaction with religious ideas could and should be considered for vaccine-bolstering initiatives.

The strengths of our study are the large and representative sample of adults aged 50+ years in 27 European countries, and the standardised methods for data collection across the countries [26]. Also, this is the first large-scale European study to measure the association between religiousness and COVID-19 vaccine hesitancy analysing the association both within European regions and in the 27 different countries. Limitations of this study include the self-reported nature of the survey, which could imply response bias, and the cross-sectional design of the study, which does not allow for making causal explanations. However, in this study, the exposure variable was measured before the outcome, which reduces the risk of reverse causation [54]. Also, a limitation in SHARE is the relatively low response rate and attrition from the sample regarding 'prayer frequency' over the eight waves, and, moreover, the low response rate (36.9 %) for both replying to items related to 'prayer frequency' in waves 1–8 and 'vaccine hesitancy'

in SCS-2. Moreover, despite that prayer frequency is considered a relatively stable variable, it was for some participants measured more than 10 years prior to the SHARE wave 8, and some people may have changed their praying pattern over time. Another limitation is the inclusion of prayer frequency as the single measure for religiousness, which is a multidimensional construct covering religious belonging, beliefs, and practices [55], thus making us unable to distinguish between crisis and restful religiousness as in other studies [13,46,47]. However, prayer has been considered a strong indicator of religious involvement [11]. Moreover, inclusion of the religious affiliations of the participants was not possible as the SHARE does not have information on religious affiliation for the 27 countries. Questions about the religious affiliation in SHARE has only been asked in a drop off questionnaire in wave 1 (2004), where only 10 out of the current study's 27 countries were participating in SHARE. A previous study by Ahrenfeldt et al. [46] showed that out of 16,263 participants, 27.3 % were Protestants, 45.3 % were Catholics, 13.4 % were Orthodox, Muslims or other, and 14 % were not affiliated with any religion.

## 5. Conclusions

In conclusion, our study demonstrated that people who pray frequently are more hesitant towards COVID-19 vaccination than people who never pray. This association persisted across all European regions. At the individual country level, a significant association between praying frequently and vaccine hesitancy was found among people in France, Belgium, Czech Republic, Poland, Slovenia, Estonia, and Croatia, while we found an association between praying frequently and less vaccine hesitancy in Slovakia and Greece. These findings have important implications for policy and practice in Europe. Since religiosity may be related to vaccine scepticism and refusal, European countries should explore the specific motives for this type of vaccine hesitancy and how to moderate it.

## Data availability

SHARE data is free of charge for scientific use globally <http://www.share-project.org/data-access.html>.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Data availability

SHARE data is free of charge for scientific use globally <http://www.share-project.org/data-access.html>.

## ICMJE – disclosures

All authors confirm that as per ICMJE, they have no disclosures at all, even if not directly related to this study.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2022.09.044>.

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