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# Big Five personality traits and COVID-19 precautionary behaviors among older adults in Europe

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## ABSTRACT

**Objectives:** Taking precautions against COVID-19 is important among older adults who have a greater risk for severe illness if infected. We examined whether Big Five personality traits are associated with COVID-19 precautionary behaviors among older adults in Europe.

**Method:** We used data from the Survey of Health, Aging, and Retirement in Europe ( $N = 34\,629$ ). Personality was self-reported in 2017 using the BFI-10 inventory. COVID-19 precautionary behaviors – wearing a mask, limiting in-person contacts, keeping a distance to others, washing hands, and using a disinfectant – were assessed in the summer of 2020 through self-reports. Associations between personality and precautionary behaviors were examined with multilevel random-intercept logistic regression models. The models were adjusted for age, gender, and educational attainment.

**Results:** Personality traits were differentially associated with precautionary behaviors, with higher openness, conscientiousness, and neuroticism showing the most consistent associations. The pattern of associations between personality traits and precautionary behaviors varied depending on the specific behavior. The associations were relatively weak in comparison to those between sociodemographic factors and precautionary behaviors.

**Conclusions:** Among older adults, taking COVID-19 precautionary behaviors was most consistently related to higher openness, conscientiousness, and neuroticism, suggesting that precautionary behaviors may be motivated by multiple psychological differences.

## 1. Introduction

People differ in their adherence to various COVID-19 safety recommendations, but the origins of these differences are poorly understood. An emerging body of research suggests that personality traits capture some of the individual differences in precautionary behaviors against COVID-19 [2,10]. Studies that have considered a wide range of precautionary behaviors have found that of the so-called Big Five personality traits agreeableness is the strongest predictor of taking COVID-19 precautions ([24] [preprint]; [25]). In terms of specific precautionary measures, openness ([12] [preprint]; [16] [preprint]), conscientiousness [1,10,12,16], and neuroticism [1] have been associated with higher levels of social distancing in some, but not all studies. Extraversion, by contrast, has been associated with a lower willingness for social distancing [10], but also with a higher willingness for wearing a face mask [2,4]. In different studies, agreeableness has been associated with both lower [1] and higher [3,16] willingness to comply with social distancing recommendations.

Because older age increases the risk of hospitalization or death if infected with COVID-19 ([11]; National Center for Immunization and Respiratory Diseases [15], understanding whether personality predicts adherence to COVID-19 precautionary measures is particularly important among older individuals. The association has not, however, been studied among older adults. Furthermore, some recent evidence suggests that personality differences in COVID-19 precautionary behaviors may be more pronounced among older individuals [2], although contradictory evidence also exists [19]. We used data from a large European sample of people aged 50 or older to examine whether Big Five personality traits are associated with COVID-19 precautionary behaviors.

## 2. Methods

### 2.2. Sample

The Survey of Health, Aging, and Retirement in Europe (SHARE) is a cross-national panel study that has collected data from up to 140,000

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persons aged 50 and older from 27 European countries and Israel [9]. To date, SHARE comprises 8 study waves, including a special **SHARE COVID-19** survey that was conducted from June to July 2020 [8]. In this study, we used data from wave 7 [6,7] (conducted in 2017; personality traits and demographic characteristics) and the SHARE COVID-19 survey (summer of 2020; COVID-19 precautionary behaviors). A total of 34 629 individuals were eligible for this study, as they had data on personality traits, COVID-19 precautionary behaviors, and demographics. Depending on the country of residence, written or verbal consent was obtained from the participants.

## 2.3. Measures

### 2.3.1. COVID-19 precautionary behaviors

COVID-19 precautionary behaviors were assessed with five outcomes: 1) wearing a face mask, 2) limiting in-person contacts, 3) keeping a distance to others in public, 4) washing hands, and 5) using a disinfectant. Wearing a face mask was measured with a question asking how often the participant wore a face mask when they went outside their home to a public space, with response options “always”, “often”, “sometimes”, or “never”. Based on the responses, the participants were categorized as those who do not wear a face mask (option “never”) and those who wear a mask (“always”, “often”, or “sometimes”). Change in the frequency of social contacts was measured with two questions, the first one asking how often the participant had met with more than 5 people from outside their household and the second one asking how often they had visited other family members since the COVID-19 outbreak, with response options “not anymore”, “less often”, “about the same”, or “more often”. The participants were categorized as those who had not limited social contacts (option “about the same” or “more often” in either question) and those who had (“not anymore” or “less often”). Keeping a distance to others was measured with a question asking how often the participant kept a distance to others when they went outside their home, with response options “always”, “often”, “sometimes”, or “never”. The participants were categorized as those who did not keep distance (option “never”) and those who did (“always”, “often”, or “sometimes”). Washing hands was measured with a question asking whether the participant washed hands more frequently than usual, with response options “yes” or “no”. Using a disinfectant was measured with a question asking whether the participant used special hand sanitizer or disinfection fluids more frequently than usual, with response options “yes” or “no”. The dichotomization of the variables for wearing a mask, limiting in-person contacts, and keeping a distance was done to facilitate interpreting effect sizes and because the distribution of responses was very skewed (i.e., most respondents reported wearing a mask, limiting in-person contacts, and keeping a distance to others).

### 2.3.2. Big Five personality traits

Big Five personality traits were measured using the 10-item version of the Big Five Inventory (BFI-10; [18]). The inventory measures openness to experience (e.g., “I see myself as someone who has an active imagination”), conscientiousness (e.g., “I see myself as someone who does a thorough job”), extraversion (e.g., “I see myself as someone who is outgoing, sociable”), agreeableness (e.g., “I see myself as someone who is generally trusting”), and neuroticism (e.g., “I see myself as someone who gets nervous easily”) with two items for each trait. The items, rated on a 5-point scale ranging from 1=strongly disagree to 5=strongly agree, represent the high and the low poles of the Big Five traits (with one positively worded and one negatively worded item). The BFI-10 has demonstrated good reliability and validity across different samples [18]. Due to the brevity of the measure and because it has been developed by prioritizing content breadth over internal consistency, no Cronbach alpha was calculated [21].

### 2.3.3. Covariates

All analyses were adjusted for age, gender, and educational attainment. Country of residence was also included as a random effect (for details, see Statistical analysis). Age (continuous), gender (1=male, 2=female), and education (International Standard Classification of Education-97, coded into 0–2 = low, 3–4 = medium, 5–6 = high) were self-reported. Country of residence (Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland) was recorded as part of the data collection.

## 2.4. Statistical analysis

To account for the clustering of the respondents in countries, associations between personality and COVID-19 precautionary behaviors were examined with multilevel, random-intercept logistic regression models to avoid artificially low standard errors of estimates and potentially inflated Type 1 error rate. The random intercept for country accounted for the potential non-independence of observations from the same country. The five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness) and the five outcomes (wearing a mask, limiting social contacts, keeping a distance, washing hands, and using a disinfectant) were analyzed in separate models (a total of 25 models).

We first examined the unconditional model without predictors to determine the proportion of variance in the outcomes attributable to countries and individual-level factors. We then included the fixed effects of personality and covariates in the model. Personality variables were standardized before the analysis. All analyses and data visualizations were conducted in R Statistical Software (version 3.6.1; [17]) using the packages lme4 [5] and ggplot2 [23]. The code is freely available on GitHub, [https://github.com/Gluschko/SHARE\\_C19](https://github.com/Gluschko/SHARE_C19).

## 3. Results

**Supplementary Tables 1 and 2** present the characteristics of 34 629 SHARE participants. There were 19 882 (57%) women, and the mean age was 69.34 years (SD=8.63, range 50–100 years). A total of 28 304 (81%) participants reported wearing a face mask when they went outside their home to a public space, 27 465 (79%) had limited in-person contacts, 34 325 (99%) had kept a distance to others when they went outside their home, 31 460 (91%) washed hands and 29 989 (86%) used a disinfectant more frequently than usual.

The intraclass correlations of unconditional random-intercept models showed that country-level differences accounted for the majority (64%) of the total variance in mask wearing but only little of the variance in limiting social contacts (9%), keeping a distance to others (15%), washing hands (5%), and using a disinfectant (11%). Age and personality did not interact in predicting the outcomes (all  $p$ -values for interaction  $p > 0.05$ ).

The results from models that included the effects of personality and covariates are presented in **Figs. 1 and 2** and **Supplementary Tables 3–7**. Higher openness (OR=1.06 per 1 SD difference, 95% CI 1.02–1.10), conscientiousness (OR=1.09, CI 1.05–1.14), and neuroticism (OR=1.09, CI 1.05–1.14) were associated with a higher likelihood of wearing a face mask. Higher neuroticism (OR=1.12, CI 1.09–1.15) was associated with a higher likelihood of limiting social contacts, and higher agreeableness (OR=0.95, CI 0.92–0.98) with a lower likelihood of limiting social contacts. Higher conscientiousness was associated with a higher likelihood of keeping a distance to others (OR=1.19, CI 1.09–1.29). Higher conscientiousness (OR=1.07, CI 1.03–1.11) and higher neuroticism (OR=1.07, CI 1.03–1.12) were associated with washing hands. Higher openness (OR=1.03, CI 1.00–1.07), higher conscientiousness (OR=1.09, CI 1.05–1.12), higher extraversion (OR=1.06, CI 1.02–1.09), and higher neuroticism (OR 1.04, CI 1.00–1.07) were associated with using a disinfectant.

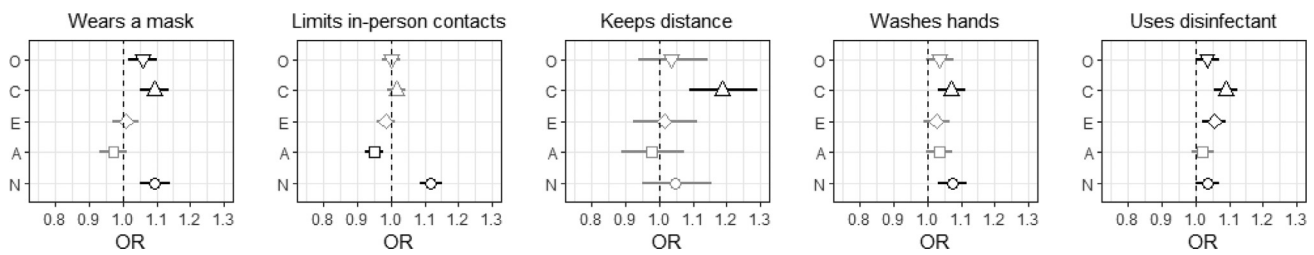


Fig. 1. The associations between Big Five personality traits and COVID-19 precautionary behaviors among older adults (odds ratios and 95% confidence intervals). O=openness; C=conscientiousness; E=extraversion; A=agreeableness; N=neuroticism.

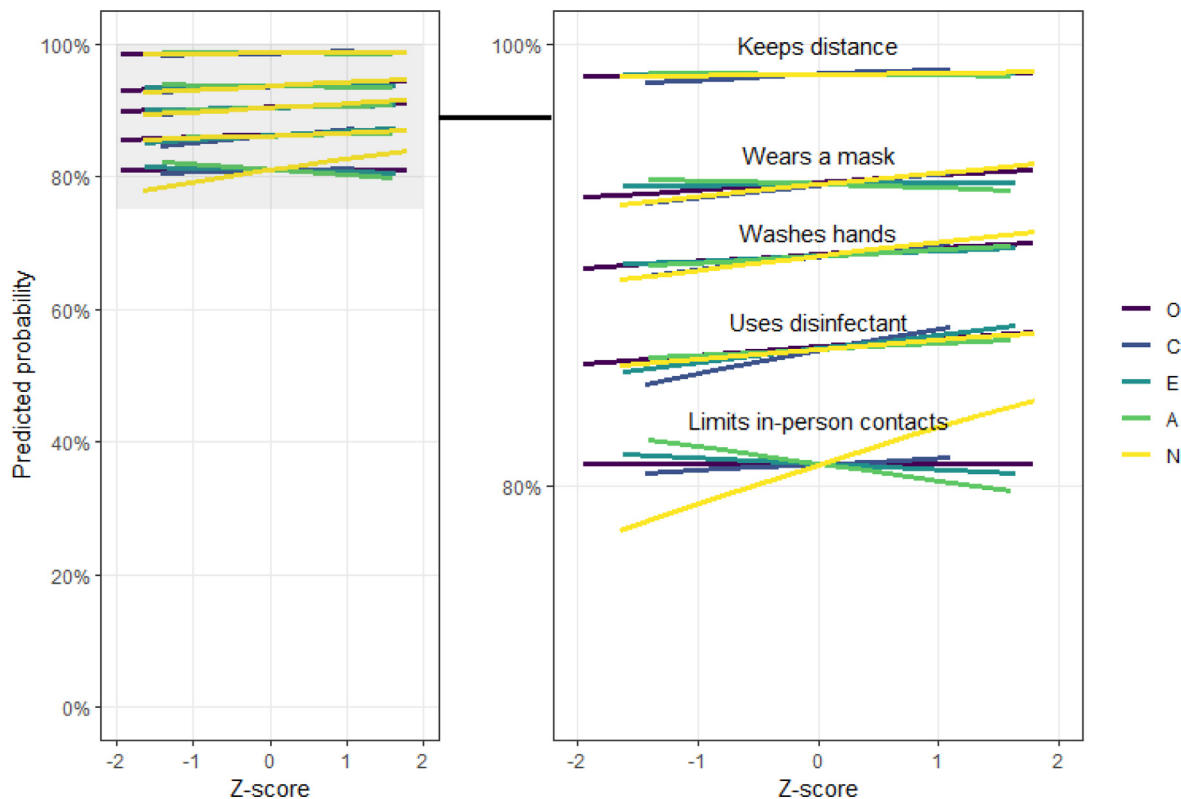


Fig. 2. The associations between Big Five personality traits and COVID-19 precautionary behaviors among older adults (predicted marginal probabilities). The figure on the left-hand side displays probabilities from 0 to 100% and the figure on the right-hand side displays only probabilities from 80 to 100%. The x-axis shows the standardized values of a personality trait. O=openness; C=conscientiousness; E=extraversion; A=agreeableness; N=neuroticism.

In general, the associations between personality and the outcomes were weaker than those between age, gender, or educational attainment and the outcomes (see **Supplementary Tables 3–7**). Higher age was associated with lower likelihood of practicing precautionary behaviors (OR ranging from 0.68 to 0.91) except for limiting in-person contacts, for which higher age increased the likelihood (OR from 1.35 to 1.36). Women were more likely to practice precautionary behaviors (OR from 1.11 to 1.47). High educational attainment increased the likelihood of all precautionary behaviors (OR from 1.20 to 1.97) except for limiting in-person contacts. The results for the association between personality and the outcomes were essentially similar regardless of whether we controlled for age, gender, and education (see **Supplementary Figure 2**). The only exceptions were that in unadjusted models, openness was significantly associated with keeping a distance (OR=1.11, CI 1.01–1.22) and washing hands (OR=1.06, CI=1.02–1.10).

As a supplementary analysis, we examined the association between personality and taking all five types of COVID-19 precautions (wearing a mask, limiting social contacts, keeping a distance, washing hands, and using a disinfectant, see **Supplementary Table 8** and **Supplementary Figure 1**). A total of 54% of participants had taken all five precautions.

Higher openness (OR=1.03, CI 1.00–1.06), conscientiousness (OR=1.06, CI 1.04–1.09) and neuroticism (OR=1.09, CI 1.07–1.12) were associated with a higher likelihood of taking all five precautions.

Finally, as a supplementary analysis at the request of a reviewer, we examined whether country-specific infection rate (see **Supplementary Table 1**) or individual-level exposure to COVID-19 modified the associations between personality traits and precautionary behaviors. Due to the high number of significance tests performed in this exploratory analysis, we set the level of significance to 0.01 to reduce the risk of false positives. We obtained infection rates for each country at the beginning of June 2020 from Our World in Data [20] and repeated the analysis with a “personality x infection rate” interaction term in the model. Higher infection rates intensified the association between higher openness and wearing a mask (OR for interaction=1.06, 99% CI 1.01–1.12) and between higher openness and keeping a distance (OR=1.17, CI 1.03–1.33), and attenuated the association between agreeableness and using a disinfectant (OR=0.95, CI 0.91–0.99). No other evidence of effect modification by country-specific infection rate was observed. For individual-level exposure to COVID-19, we used an item from the SHARE COVID-19 survey that inquired whether the respondent or anyone close to the respon-

dent had tested positive for COVID-19 (1=yes, 0=no). A total of 8% of respondents had either themselves tested positive or knew a person who had been tested positive for COVID-19. Such exposure to infection attenuated the association between higher conscientiousness and wearing a mask (OR for interaction=0.81, CI 0.67–0.98). No other effect modifications were observed.

#### 4. Discussion

In this large population-based survey among older adults in Europe, we examined the associations between personality and COVID-19 precautionary behaviors. Taken together, our results support the emerging research suggesting that personality traits influence various COVID-19 precautionary behaviors. The associations were most consistent for openness, conscientiousness, and neuroticism.

The observed associations of higher openness, conscientiousness, and neuroticism with taking precautions are in agreement with most prior studies [1,10,12,16]. These traits reflect individual differences in the ease of adapting to new circumstances or trying out new things (e.g., face masks), willingness to be responsible and comply with social norms, and the tendency to experience negative emotions such as fear and anxiety. Openness, conscientiousness, and neuroticism were also associated with taking precautions in general. The observed associations may reflect the perceived threat of contracting COVID-19 and perceived efficacy to prevent contracting COVID-19 [13].

In contrast to previous research [2,4,10], we did not observe associations between extraversion and COVID-19 precautionary behaviors (except for a weak association with using a disinfectant). The prior findings on the effects of extraversion have been mixed, with some studies reporting positive and some negative associations with taking precautions. The disparate findings might be explained by different study populations, differences in the measurement of extraversion, and variations in the operationalization of precautionary behaviors.

Our finding that individuals with high agreeableness are less likely to limit in-person contacts is in contrast with the majority of previous studies [3,16,24,25]. The only similar finding reported in the literature is from a study that also used the BFI-10 to measure agreeableness [1]. The disparate findings may thus reflect conceptual differences in how agreeableness is defined between the BFI-10 and other Big Five scales (see [18]).

The pattern of associations between personality traits and precautionary behaviors varied depending on the specific behavior. This suggests that disease avoidance among older adults may not be motivated by a single behavioral dimension that would regulate all relevant behaviors. Instead, the different precautionary behaviors seem to be differently motivated by different psychological dispositions. For example, fear of getting infected may increase the willingness to limit social contacts (associated with high neuroticism), while a sense of responsibility may motivate keeping a distance to others when in public (associated with high conscientiousness). As a practical implication of the results, such information could be useful in planning targeted behavior change interventions for older adults. For example, older adults low in openness, conscientiousness, and neuroticism can represent a target population for whom prevention strategies and communication methods could be tailored. Furthermore, individual-level factors were important for overall differences in distancing and hygiene behaviors, whereas country-level factors were important for differences in wearing a mask. This suggests that some public health guidelines can be implemented more efficiently than others throughout the whole population, irrespective of individual differences.

The current results need to be considered in relation to some limitations. First, we used self-reports, which are subject to socially desirable answers and may introduce common method bias. However, common method bias is less likely because personality was measured before the COVID-19 pandemic, not contemporaneously with precautionary behaviors. Second, personality was measured with a short BFI-10 scale and

the conceptualization of agreeableness may differ between this scale and broader Big Five scales. The short measures also did not allow a more fine-grained analysis of whether some facets might be more important than others in predicting health behaviors (e.g., [22]). Third, examining heterogeneity in effects across countries was not feasible because the data included several countries, and some country-specific samples were very small. Modeling interactions between personality traits and all countries for all outcomes would have resulted in a very high number of interaction tests and a high risk of spurious findings. Fourth, the relative rareness of individuals who reported not keeping a distance may have influenced the estimates and their precision for keeping distance. Fifth, the results may have limited generalizability outside Europe. Finally, the generalizability of the results to different stages of the pandemic is not known. There were relatively few COVID-19 cases in Europe during the data collection of the SHARE COVID-19 survey, in summer 2020. It is possible that the associations between personality and precautionary behaviors are stronger in circumstances where there is little social pressure to act in a specific way (“weak” situations; [14,25]). By contrast, personality might not predict precautionary behaviors when, due to high infection rates, behavior norms are stricter and there is substantial pressure for conformity (“strong” situations). Although the results of the supplementary analysis with country-specific infection rates suggest some effect modification by the severity of the pandemic, infection rates alone do not provide information about how strict behavior norms are within a country. Therefore, we were not able to evaluate potential effect modification by situation strength. As suggested by the results of our supplementary analysis with individual-level exposure to COVID-19, being exposed to infection might also influence the association between personality and taking precautions. Future research could further explore such possibilities of effect modification.

In conclusion, personality traits may play a part in determining whether older adults take COVID-19 precautions. Older individuals high in openness, conscientiousness, and neuroticism, in particular, might be less likely to be infected with COVID-19 due to their willingness to take protective precautions. Conversely, older adults low in openness, conscientiousness, and neuroticism could benefit from prevention strategies tailored to these personality traits. Even though the observed associations of personality traits with precautionary behaviors were weaker than those of sociodemographic factors, they may still have real-life consequences given the ubiquitous impact of COVID-19 on the world population.

#### Declaration of interests

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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### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.ahr.2021.100038](https://doi.org/10.1016/j.ahr.2021.100038).

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