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Rammstedt, Beatrice; Lechner, Clemens; Weiß, Bernd

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## Does personality predict responses to the COVID-19 crisis? Evidence from a prospective large-scale study

Beatrice Rammstedt, Clemens M Lechner and Bernd Weiß

### Abstract

The COVID-19 pandemic has significantly disrupted people's daily routines and infused their lives with considerable insecurity and uncertainty. However, individuals' responses to the pandemic vary widely. The present study investigates the role of personality traits for key aspects of people's responses to the COVID-19 crisis. In a prospective design using a large-scale panel study ( $N = 2217$ ) that represents the heterogeneity of the adult population in Germany, we examined whether Big Five domains and facets measured prior to the pandemic predicted individuals' responses to the pandemic in terms of: (a) perceptions of infection risks; (b) behavioral changes to prevent infection; (c) beliefs in the effectiveness of policy measures to combat the further spread of coronavirus; and (d) trust in relevant policymakers and institutions regarding the handling of coronavirus. Results revealed that personality explained only a small portion (between 0.6% and 3.8%) of the variance in the four outcomes. Nonetheless, several Big Five domains and facets had at least small-to-moderate, and theoretically plausible, associations with the outcomes. Overall, Agreeableness and its Trust facet showed the most robust associations with the four outcomes. Most trait–outcome associations were also robust to controlling for three possible confounders (sex, age, and risk-group membership).

### Keywords

Big Five, BFI-2-S, personality facets, coronavirus, COVID-19

Since early 2020, the world has been facing a coronavirus disease (COVID-19) caused by a novel coronavirus (SARS-CoV-2). Throughout the first year of the pandemic and until vaccines become widely available, only precautionary measures and effective health response from governments, frontline medical workers, and the public can prevent COVID-19 from spreading further. Measures include imposing travel restrictions, maintaining a high level of hygiene, cleaning and sanitizing household and community settings, avoiding social gatherings, using masks and protective gear, and social distancing (Srivastava & Saxena, 2020). In other words, individuals' behaviors – in particular their compliance with policy measures and experts' recommendations – are of key importance in limiting the spread of the pandemic (World Health Organization [WHO], 2020). These measures have significantly changed our daily routines. Another characteristic feature of the pandemic is the considerable insecurity and uncertainty it induces: In addition to increased economic uncertainty, many people feel uncertain about what they should do to reduce their personal risk of infection, which personal preventative measures and government policies may be effective, and how to navigate a rapidly changing information environment in the media.

To what degree do individuals differ in their perceptions of – and reactions to – this highly challenging situation? Who follows the recommendations and instructions closely, and who is somewhat more reluctant to do so? It can be assumed that personality plays a central role in handling this situation. As Caspi and Moffitt (1993) have famously argued, personality differences are accentuated during periods of environmental change and uncertainty. As the authors noted, it is under such circumstances, "where there

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GESIS – Leibniz Institute for the Social Sciences, Mannheim, Germany

### Corresponding author:

Beatrice Rammstedt, GESIS – Leibniz Institute for the Social Sciences,  
PO Box 12 21 55, 68072 Mannheim, Germany.  
Email: [beatrice.rammstedt@gesis.org](mailto:beatrice.rammstedt@gesis.org)

is a press to behave but no external information about how to behave adaptively,” that people’s dispositions become decisive in determining their behavior (Caspi & Moffit, 1993, p. 247; see also Pincus & Silbereisen, 2004). For example, one could argue that persons who are more conscientious will have a higher tendency to follow guidelines and recommendations given by policymakers and institutions. One could also assume that extraverts will suffer more from social distancing than introverts, and that a higher Openness to Experience will help people to establish a new daily routine and adapt to novel situational demands. Regarding attitudes, the Big Five trait Agreeableness will presumably play a central role in trusting information about the pandemic in the media, trusting in the effectiveness of the policy measures, and complying with recommendations and imposed restrictions. It is well-established practice to conceptualize personality in terms of the Big Five domains Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Openness to Experience (see, e.g., John et al., 2008). In recent years, however, researchers have placed increasing emphasis on examining – in addition to the Big Five domains – more specific facets of these broad domains (e.g., Möttus, 2016; Soto & John, 2017). This growing body of research suggests not only that narrow facets of a personality domain have greater predictive power than global domains but also that they exhibit differential associations with different outcome variables (e.g., Danner et al., 2020; Rammstedt et al., 2018). For example, Roberts et al. (2005) showed that of the different facets of Conscientiousness, particularly the facet Responsibility, was related to preventative health behavior. Hence, these facets may contribute to a better and more fine-grained understanding of trait–outcome associations.

### **Personality differences in dealing with the COVID-19 pandemic**

Although there is some research addressing the role of personality in dealing with rapid social change (e.g., Lechner et al., 2017; Pavlova & Silbereisen, 2013), research on the possible role of personality in the way people deal with pandemics such as the COVID-19 pandemic is – naturally – still scarce. However, several studies have recently been conducted in Germany and worldwide investigating the associations between personality and the individual management of the current coronavirus pandemic. In general, these studies indicate that personality is associated with COVID-19-related attitudes and behaviors. With regard to the impact of the different personality domains, these studies suggest that Extraversion, in particular, is related to the negative appraisal of the coronavirus crisis and the measures taken to address it (see Carvalho et al., 2020; Modersitzki et al., 2020). Moreover, Neuroticism has been found to be associated with negative affect, such as anxiety, insecurity, or lower well-being, during the COVID-19 crisis (Gubler et al., 2020; Kroenke et al., 2020; Lippold et al., 2020) and with concerns, e.g. of becoming infected by COVID-19 (Aschwanden et al., 2020).

Several studies have investigated to what degree personality is related to the adaptation of behavior during the COVID-19 pandemic. A number of these studies suggest that individuals higher in Conscientiousness show stronger COVID-19-evoked adaptations of their behaviors (Abdelrahman, 2020; Aschwanden et al., 2020; Blagov, 2020; Brouard et al., 2020; Carvalho et al., 2020; Clark et al., 2020; Garbe et al., 2020; Zettler et al., 2020). Another – partly overlapping – set of studies suggests a positive association between Neuroticism and behavioral adaptations (Abdelrahman, 2020; Blagov, 2020; Garbe et al., 2020). Bogg and Milad’s (2020) finding of higher COVID-19 guideline adherence among more conscientious individuals points in a similar direction. With regard to the other Big Five personality dimensions (Agreeableness and Openness to Experience), however, the studies conducted so far are less univocal: Some studies suggest that Agreeableness is related to behavioral adaptations (Aschwanden et al., 2020; Blagov, 2020; Clark et al., 2020; Zettler et al., 2020); the studies by Aschwanden et al., Zettler et al., as well as Clark et al. also suggest that Openness is positively linked to behavioral adaptations. However, studies have reported contradictory findings with regard to Extraversion: While Aschwanden et al.’s (2020), Zettler et al.’s (2020), and Modersitzki et al.’s (2020) studies report positive effects of Extraversion on precautionary behavior, Blagov’s (2020), Brouard et al.’s (2020), Chan et al.’s (2020), and Carvalho et al.’s (2020) studies report negative associations between these two variables. A study conducted by Shook et al. (2020) partly contradicts the findings summarized above: Their results suggest that both Conscientiousness and Openness are negatively related to one specific behavioral adaptation, namely the wearing of face masks.

To the best of our knowledge, only one study thus far has investigated personality differences in beliefs about or evaluations of different policy measures taken to combat the further spread of coronavirus: Results by Zettler et al. (2020) indicate that – across different studies – of the Big Five Dimensions Agreeableness and (partly) Conscientiousness is positively linked to a positive evaluation of the political reactions.

### **Limitations of earlier studies on the role of personality in the pandemic**

However, most of the recent studies investigating the link between personality and the appraisal of the COVID-19 crisis display several methodological shortcomings: First, most are based on ad-hoc convenience samples of students or on commercial online access panels with self-selected participants, thus failing to adequately represent the heterogeneity of the population (see Schaurer & Weiß, 2020; for exceptions see Brouard et al., 2020; Zettler et al., 2020). Second, in most cases, these studies investigated only the global Big Five domains but did not consider possible differential effects of more fine-grained facets from within the same

domain (for exceptions, see Aschwanden et al., 2020 and Modersitzki et al., 2020). Third, many of the studies concentrated on single behavioral changes, for example, toilet paper stockpiling (Garbe et al., 2020) or hand hygiene (Carvalho et al., 2020) even though the predictive power of personality is typically highest for more aggregated outcomes that reflect multiple behaviors over longer time periods. Fourth, although recent research indicates that belonging to a group at higher risk of severe COVID-19 illness is a significant driver of individual differences in responses to the pandemic (van der Velden et al., 2020), most studies conducted so far did not control for risk-group membership as a potential confounder (for an exception, see Blagov, 2020). Fifth and last, almost all of the studies assessed personality at the same time as the COVID-19-related outcome measures. Such cross-sectional (concurrent) designs cannot establish the direction of the effects and are susceptible to potential personality changes evoked by the COVID-19 pandemic (for findings supporting such changes, see Sutin et al., 2020). An exception is the study by Aschwanden et al. (2020), which assessed personality in January/February 2020, and thus a few weeks before their COVID-19 survey but after the global COVID-19 outbreak.

### **The present study**

In the present paper, we aim to overcome the aforementioned shortcomings of previous studies on the role of personality in dealing with the COVID-19 pandemic by using a large-scale panel study based on a randomly selected sample that represents the heterogeneity of the adult population in Germany. These rich data allow us to conduct a comprehensive inquiry into the potential role of personality traits (both global domains and narrow facets of personality) for four key aspects of people's responses to the COVID-19 crisis: (a) perceptions of risk of infection with COVID-19; (b) behavioral changes to prevent infection with COVID-19; (c) beliefs in the effectiveness of various policy measures to combat the further spread of coronavirus; and (d) trust in various relevant policymakers and institutions.

Because they represent the heterogeneity of the adult population in Germany, these data ensure sufficient variation both in personality traits and in the four target outcomes, and guard against possible bias from self-selection into the survey. Crucially, personality traits in these data were measured in mid-2017 – and hence almost three years prior to the outbreak of the COVID-19 pandemic. The four target outcomes were measured between 17 March 2020 and 29 March 2020, and thus before the imposition of lockdown in Germany. At the time, behaviors such as social distancing and the wearing of masks were still only recommendations that became mandatory only weeks (and sometimes months) later. Compliance with these preventative measures was therefore largely a matter of individual choice. Hence, the target outcomes were assessed under highly fluid conditions in which, following Caspi and Moffitt (1993), individual difference should have been most strongly linked to behaviors. Our study was designed as purely exploratory. Its prospective design ensured that our measurement of personality was not yet affected by the COVID-19 crisis. By controlling for key sociodemographic variables (sex and educational attainment) and risk-group membership, we aimed to account for potential confounders that may have affected personality traits in the past and may also affect responses to the pandemic as measured with the four outcome measures. Although this design is still correlational and does not allow for definitive causal inference (e.g., because unobserved confounders may influence both personality and our four target outcomes), it greatly enhances confidence that any observed predictive effects reflect causal influences of personality.

## **Method**

### **Sample**

We used data from the GESIS Panel, a probability-based mixed-mode access panel fielded every second month. The GESIS Panel comprises about 5000 active panelists aged 20+ with a mean age of 54 years (SD = 14.5). Each wave of the panel is conducted in a mixed-mode design that allows participants to choose between an online or paper-based survey (see Bosnjak et al., 2018). The "GESIS Panel Special Survey on the Coronavirus SARS-CoV-2 Outbreak in Germany" (GESIS Panel Team, 2020) was conducted between 17 March 2020 and 29 March 2020. This special survey included a wide range of questions on attitudes and behaviors regarding COVID-19 (see below). Because the survey had to be fielded in a timely manner, only the online sub-sample of GESIS Panel respondents was invited to participate. A total of 3765 panelists were invited to participate, of whom 3176 completed the survey, resulting in a completion rate of 84.36%. The GESIS Panel Special Survey can be linked to the GESIS Panel Standard Edition (GESIS, 2020a) as well as the GESIS Panel Extended Edition (GESIS, 2020b)<sup>1</sup>. This linkage allows adding a wide range of

background information, most important for our study, the Short Big Five Inventory-2 (BFI-2-S; Soto & John, 2017; German version: Danner et al., 2019). The BFI-2-S was fielded in mid-2017 (Wave ec, June–July 2017,  $N = 4,358$ ). The GESIS Panel Special Survey data were further limited to the online sample that had participated in Wave ec ( $N = 3,062$ ).

Due to panel attrition and item nonresponse, the final sample size was  $N = 2,271$ . We conducted non-response bias analyses to investigate potential systematic effects of our variables on attrition. Results indicated no systematic effects apart from the fact that comparatively younger respondents had a higher risk of panel dropout. This means that selective non-response, at least conditional on the aforementioned variables, will not bias our findings. Nonetheless, we ran all regression-based analyses using weighted and (as a robustness check) unweighted data. The weights are constructed such that they account for attrition as well as adjust for known discrepancies from the population values; the latter by using the Microcensus as reference data set (Research Data Centres of the Statistical Offices of the Federation and the Federal States, 2020). All in all, the differences between weighted as well as unweighted analyses are negligible. Therefore, we report in the following only the weighted results. The unweighted results can be reproduced with the R code for this paper (see <https://osf.io/pfu7q>).

## Measures

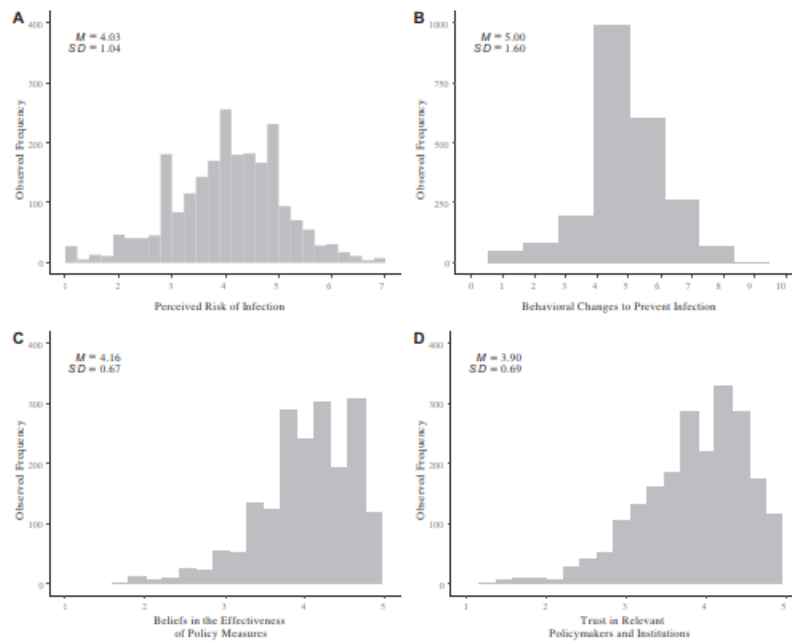
**COVID-19 questionnaire.** The questionnaire was designed in the context of the Open Probability-based Panel Association (<https://openpanelalliance.org>), especially in close cooperation with the Dutch LISS Panel, the Understanding American Study, the Department of Economics of the University of Bonn as well as the German Research Institute of the Federal Employment Agency. The selection of indicators was guided by experts in scale development as well as substantive considerations based on current knowledge about how people react to pandemics. For the present analyses, we selected all multi-item scales from this questionnaire that assessed behavior or attitudes directly related to COVID-19. We excluded items that were purely hypothetical or that did not represent individual responses to the crisis (perceptions, behaviors, attitudes). Using this rationale, we analyzed four key dimensions of people's responses to the COVID-19 pandemic: (a) the perceived risk of infection with coronavirus; (b) behavioral changes to reduce the risk of infection with coronavirus; (c) beliefs in the effectiveness of public policy measures to combat the further spread of coronavirus; and (d) trust in various relevant policymakers and institutions regarding the handling of coronavirus. For a detailed description of the measures, see the "Study Description for GESIS Panel Special Survey on the Coronavirus SARS-CoV-2 Outbreak in Germany Related to ZA5667 (1-1-0)" ([https://search.gesis.org/research\\_data/ZA5667](https://search.gesis.org/research_data/ZA5667); GESIS Panel Team, 2020). For our analyses, we used formative index scores for each of the four domains (described below). Although formative indices do not require the items to be correlated, intercorrelations of all the items contained in the indices are provided in Table S1 in the online supplement (see <https://osf.io/pfu7q>), and we report the internal consistencies of all outcomes (Cronbach's alpha) below. The distribution of the four aggregated outcome variables is depicted in Figure 1.

**Perceived risk of infection..** The scale on the perceived risk of infection with coronavirus (labeled "Probability corona infection" in the GESIS Panel codebook) comprised five questions about perceived infection risks and attendant consequences: (a) the respondent's perceived personal risk (i.e., probability) of contracting the virus; and (b) the respondent-rated risk of close contacts (friends, family, colleagues); (c) the respondent's personal risk of hospitalization due to coronavirus; (d) having to quarantine in the next two months; and (e) infecting others. Each item was to be answered on a seven-point rating scale ranging from 1 (*not at all likely*) to 7 (*absolutely likely*). The overall index was based on the mean value of these five questions ( $M = 4.03$ ,  $SD = 1.04$ ,  $\alpha = 83$ ).

**Behavioral changes to prevent infection..** The scale on behavioral changes to prevent one's risk of infection with coronavirus (labeled "Measures taken to prevent infection" in the GESIS Panel codebook) comprised 10 dichotomous (0 = no, 1 = yes) items such as "avoided certain (busy) places," "washed my hands more often and longer," and "stocked up on water and/or food supplies." We used the sum across the 10 items to form an index ( $M = 5.00$ ,  $SD = 1.60$ ,  $\alpha = 49$ ).

**Beliefs in the effectiveness of policy measures..** The scale on beliefs in the effectiveness of policy measures (labeled "Evaluation of measures" in the GESIS Panel codebook) comprised seven items addressing measures such as the closure of "day-care centers, kindergartens, and schools," "sports clubs and fitness centers," "bars, cafés, and restaurants," and "all shops except supermarkets and pharmacies." Items were to be answered on a five-point rating scale ranging from 1 (*not effective at all*) to 5 (*very effective*). The overall index was based on the mean value across these four items ( $M = 4.16$ ,  $SD = 0.67$ ,  $\alpha = 88$ ).

**Trust in relevant policy makers and institutions..** Finally, the scale on trust in policymakers and institutions comprised relevant actors and institutions dealing with COVID-19. All in all, nine different actors/institutions were presented, such as "your



**Figure 1.** Distribution of the four COVID-19-related attitudes and behaviors. *Note.* The outcomes are perceived risk of infection with coronavirus (A); individual behavioral responses to the coronavirus pandemic (B); beliefs in the effectiveness of policy measures to combat the further spread of coronavirus (C); and trust in policymakers and institutions regarding the handling of coronavirus (D). Each outcome is an index score comprising between four and 10 items.

primary care physician,” “the local health authority,” “the Federal Government,” “the Ministry of Health,” and “the World Health Organization.” The items were to be answered on a five-point rating scale ranging from 1 (*Don’t trust at all*) to 5 (*Trust completely*). Again, we formed an index by taking the mean across the nine items ( $M = 3.90$ ,  $SD = 0.69$ ,  $\alpha = .90$ ).

**BFI-2-S.** In summer 2017 (Wave *ec*) – that is, about two and a half years prior to the onset of the COVID-19 pandemic – all participants in the GESIS Panel completed the German adaptation of the BFI-2-S (Rammstedt et al., 2018; Danner et al., 2019). The BFI-2-S consists of 30 short-phrased items to be answered on a five-point rating scale ranging from 1 (*do not agree at all*) to 5 (*fully agree*). It allows the assessment of personality at the level of the broad Big Five domains and at the more-specific facet level by including three facet-level indicators within each domain (i.e., 15 facets in total).

We computed scale scores by taking the mean across the six items per domain/two items per facet. Table S2 in the online supplement (see <https://osf.io/pfu7q>) includes means, standard deviations, and internal consistencies for each domain and facet. Internal consistency estimates ranged between .63 and .80 with a mean of .71 for the domain scores and between .26 and .78 with a mean of .55 for the two-item facet scores. However, Cronbach’s alpha coefficients tend to underestimate the reliability of short-scale measures (see Rammstedt & Beierlein, 2014). Retest coefficients provide more appropriate reliability estimates for these scales. According to Rammstedt et al. (2018), the retest stability of the BF-2-S domains average at .83 and at .72 for the facets.

**Sociodemographic variables.** Some of the subsequent regression models also included two sociodemographic variables, sex (1 = *female*, 0 = *male*) and educational attainment (1 = *general higher education entrance qualification* [German Abitur], 0 = *no general higher education entrance qualification*).

With respect to sex, the distribution of the variable in the sample (48% female) corresponded roughly to that in the adult population in Germany (51% female; see Statistisches Bundesamt, 2020a). In terms of educational attainment, we observed an over-representation of highly educated respondents: Forty-three percent of the respondents had obtained the highest upper secondary leaving certificate, that is, a “general higher education entrance qualification,” compared with about 33% of the adult population in Germany (Statistisches Bundesamt, 2019, p. 88).<sup>2</sup> However, this over-representation of highly educated respondents in our sample comes as no surprise, as it is in line with findings on the demographic composition of online surveys (Antoun, 2015; Baker et al., 2010).

**Belonging to a risk group.** In addition to the aforementioned variables, some regression models also contained a dummy variable indicating whether respondents belonged to a group at higher risk of severe COVID-19 illness. This risk-group variable was defined in terms of age (55 years or older) and pre-existing conditions. Here, the choice of the age

cut-off and the selection of pre-existing conditions was limited to those mentioned by the Robert Koch Institute and the German Federal Government (Bundesregierung, 2020). The following six pre-existing conditions were included: high blood pressure/hypertension; heart disease (also cardiac insufficiency, heart failure); chronic bronchitis; diabetes; liver disease; and asthma.<sup>3</sup> Based on the age cut-off of 55 years or older and these six pre-existing conditions, a dichotomous indicator was created (1 = respondent reported at least one of the conditions; 0 = respondent did not report any of the conditions).

Based on these criteria, about 61% of the sample respondents were classified as belonging to a group at higher risk of severe COVID-19 illness. This proportion may seem high at first sight. Note, however, that according to German Microcensus data, more than 58% of the German adult population are 55 years or older (Statistisches Bundesamt, 2020b) and would hence fall under the “risk group” based on their age alone.

## Analyses

The central objective of the following analyses was to investigate the nexus between the four central outcome measures and the BFI domains and facets measured almost three years earlier. Product–moment correlations and multiple linear regression models with fully standardized variables were employed to investigate the aforementioned associations. (For the analyses, we used the statistical software package R, R Core Team, 2020.) The complete analyses code is available at <https://osf.io/pfu7q>. First, we calculated bivariate correlation coefficients for all five BFI-2-S domains and the four outcome variables. The same approach was applied to the 15 BFI-2-S facets. Next, for each of the four outcome variables, we estimated a multiple regression model containing the BFI-2-S domains and facets, respectively (“BFI only” models). In all, eight models were estimated for the four outcome variables and the two BFI-2 hierarchical levels (domains, facets). In a third step, we expanded the aforementioned “BFI only” regression models by including the sociodemographic variables (female, highest level of educational attainment) and the risk-group membership indicator (either age 55 years or older or suffering from a pre-existing condition; “BFI + Covariates” models).

We investigated the robustness of our findings in two ways: (1) To examine the stability across the different single indicators, we also repeated our correlational analyses on the level of the single items of our outcome variables. Results are displayed in Table S2 in the online supplement (see <https://osf.io/pfu7q>). (2) To investigate to what degree our findings are similar or different across different subpopulations, we repeated our regression analyses for the Big Five domains and facets separately for the two sexes, for low vs. high educated, and for persons belonging or not belonging to the risk group for a severe illness due to a COVID-19 infection. Results of these subgroup analyses are displayed in Figures S1 and S2 in the online supplement (see <https://osf.io/pfu7q>).

## Results

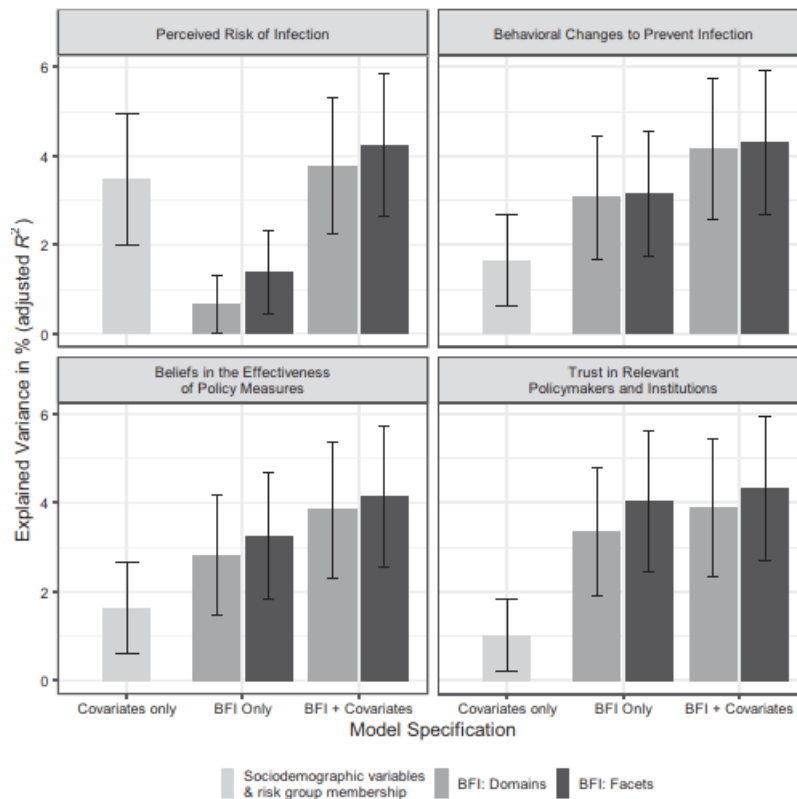
### Share of the variance in COVID-19-related attitudes and behaviors explained by personality domains and facets

To what extent do Big Five personality traits predict attitudes and behaviors related to the COVID-19 pandemic? To investigate this question, we first regressed the four COVID-19-related outcomes on the Big Five domains as well as – in separate models – on their 15 facets. It can be assumed that besides personality traits, other individual characteristics such as sex, education, and belonging to a group at higher risk of severe COVID-19 illness are relevant for COVID-19-related attitudes and behavior. Therefore, as a benchmark, we contrasted our Big Five analyses with regressions of the sociodemographic variables sex and education as well as risk-group membership on the four outcomes. We computed adjusted R<sup>2</sup> values to gauge the predictive accuracy of these models.

As can be seen from the second bars of Figure 2 (“BFI only”), the Big Five domains jointly explained for three of our four outcome measures – namely measures taken to prevent infection with coronavirus, beliefs in the effectiveness of policy measures to combat the further spread of coronavirus, and trust in policymakers and institutions regarding the handling of coronavirus – approximately 3% of the variance and by that slightly more than the sociodemographic variables and risk-group membership. For the perceived risk of infection, in contrast, the Big Five domains explained with less than 1% a lower share of the variance than the model including sociodemographic variables and risk-group membership (2%).

Predicting the four indices of attitudes and behaviors toward COVID-19 using the more fine-grained 15 Big Five facets instead of the global domains increased the amount of explained variance slightly (based on adjusted R<sup>2</sup>; see third bar in Figure 2) to 1% for the perceived risk of infection with coronavirus and to between 3% and almost 4% for the other three indices.

In addition to considering sociodemographic variables and personality effects separately, we investigated in a final step the effects of both variable groups commonly, thus controlling for possible covariations of them. The amount of variance explained increased slightly compared to the Big Five only models, reaching 4% for the behavioral changes, the beliefs in the effectiveness of policies to combat the further spread



**Figure 2.** Variance (adjusted  $R^2$ ) (95% confidence interval) in COVID-19-related attitudes and behaviors explained by the Big Five domains and facets and sociodemographic and risk-group-membership variables. *Note.* Models labeled “covariates only” contain sociodemographic and risk-group-membership variables; models labeled “BFI Only” contain the BFI domains/facets; models labeled “BFI + covariates” contain the BFI domains/facets as well as sociodemographic and risk-group-membership variables.

of coronavirus, and trust in policymakers and institutions regarding the handling of coronavirus, and reaching between 2% and 3% for the perceived risk of infection with coronavirus.

In sum, personality in terms of the Big Five explained a small portion of the variance in all investigated outcomes that is more or less comparable in size to that explained by sociodemographic variables and risk-group membership. Using the more nuanced facets of the Big Five instead of domain scores slightly increased the amounts of explained variance. The same was true for the inclusion of the sociodemographic background variables and risk-group membership.

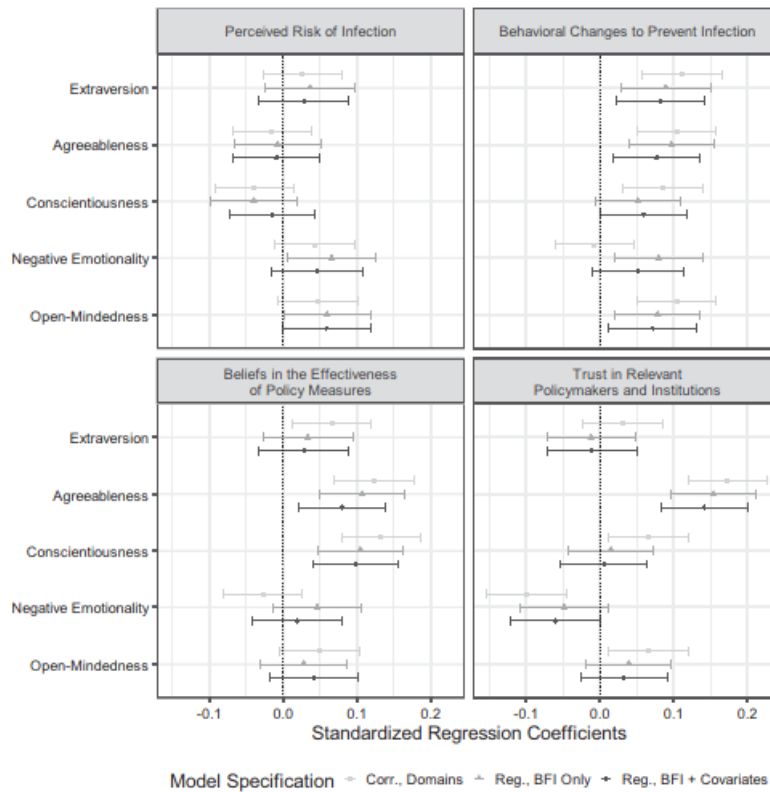
### Which personality domains and facets are most predictive of COVID-19-related attitudes and behaviors?

Whenever an attribute is multiply determined and shows large variation, the share of explained variance can be small despite some predictors showing substantial associations with the outcome. Hence, even small shares of explained variance do not preclude the possibility that some of the personality domains or facets might meaningfully predict COVID-19-related attitudes and behaviors.

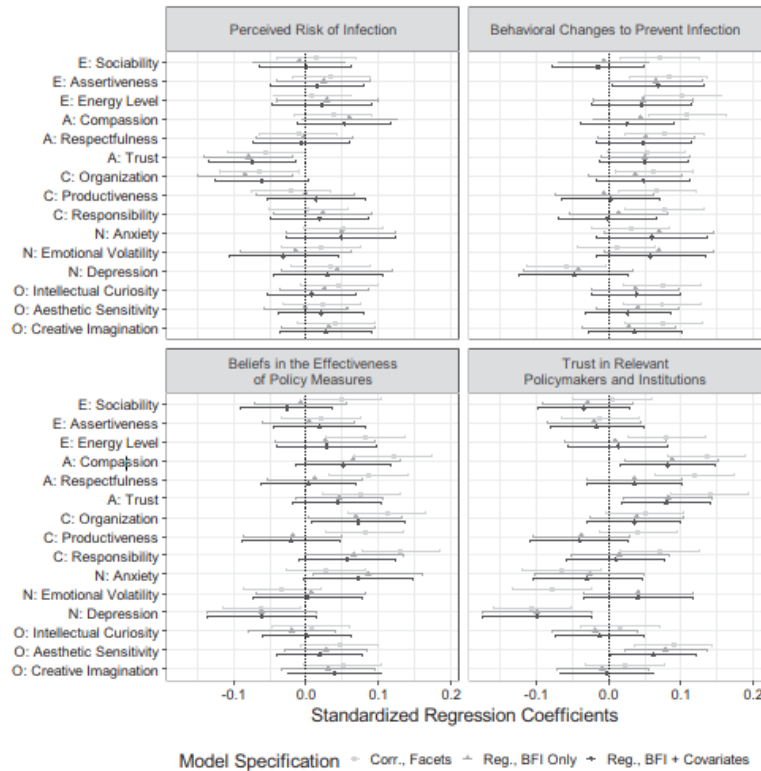
In a second step, we therefore examined more closely the single associations of the Big Five domains and their facets with the four COVID-19-related outcomes. Specifically, we investigated: (a) which of the domains and facets were predictive of the outcomes; and (b) whether all facets of one domain were related similarly to the corresponding outcome or whether differential effects for these facets could be found. For each domain and facet, we report three coefficients that provide complementary information about its association with each of the four outcomes: (a) zero-order correlations (“Corr.”); (b) standardized regression coefficients from a joint model that controls for the other domains or facets, that is, unique or “incremental” effects of each domain and facet (“BFI only” model); and (c) standardized regression coefficients from a regression model that additionally included the three covariates (“BFI + Covariates” model). These coefficients are shown in Figure 3 for the Big Five domains and in Figure 4 for the facets.

*Perceived risk of infection with coronavirus* was not substantially predicted by any of the Big Five domains, irrespective of whether sociodemographic factors and risk-group membership were controlled for or not.<sup>4</sup> However, on the level of single facets, a more nuanced picture was observed: Higher levels of Trust (Agreeableness) and Organization (Conscientiousness; for both facets  $\beta = -.08$ ) were linked to a lower perceived risk of infection with coronavirus.





**Figure 3.** Standardized regression coefficients (99% confidence interval) for the association between the Big Five domains and the four COVID-19-related outcomes for three model specifications. *Note:* “Corr., domains” = bivariate correlation; Reg., “BFI Only” = multiples regression model containing only the BFI domains; “Reg., BFI + Covariates” = multiples regression model containing BFI domains as well as sociodemographic and risk-group-membership variables.



**Figure 4.** Standardized regression coefficients (99% confidence interval) for the association between the Big Five facets and the four COVID-19 related outcomes for three model specifications. *Note:* “Corr., domains” = bivariate correlation; Reg., “BFI Only” = multiples regression model containing only the BFI domains; “Reg., BFI + Covariates” = multiples regression model containing BFI domains as well as sociodemographic and risk-group-membership variables.

The *behavioral changes to prevent an infection* were predicted by several of the Big Five domains: Individuals higher in Extraversion ( $\beta = .09$ ), Agreeableness ( $\beta = .10$ ), Negative Emotionality ( $\beta = .08$ ), and Open-Mindedness ( $\beta = .08$ ) reported a higher number of behavioral changes in response to COVID-19.

When investigating the more fine-grained facet level, we found that most facets were significantly correlated with the behavioral changes adopted. However, in the regression models, when we controlled for the effects of the other facets in parallel, none of the 15 facets emerged as strongly predictive of behavior changes ( $-.04 \leq \beta \leq .07$ ).

*Beliefs in the effectiveness of public policy measures* to combat the further spread of coronavirus were rated as more effective by respondents with higher levels of Agreeableness and Conscientiousness (for both domains  $\beta = .11$ ). In addition, on the level of single facets also the Negative Emotionality facet Anxiety was predicted the beliefs in the effectiveness of the measures ( $\beta = .09$ ). For the other facets effects ranged between  $-.06 \leq \beta \leq .07$ . However, as the acceptance of – even drastic – policy measures was generally very high at the time the survey was conducted (Blom et al., 2020), which is reflected in the high mean and low variance of this scale ( $M = 4.16$ ,  $SD = 0.67$ ), there was limited room for personality to unfold any effects on this outcome.

Finally, *trust in relevant policymakers and institutions* regarding the handling of coronavirus was best predicted by Agreeableness ( $\beta = .15$ ). Not surprisingly, this effect was due especially to the Agreeableness facets Trust and Compassion (for both facets  $\beta = .08$ ). On the level of individual facets, the Negative Emotionality facet Depression ( $\beta = -.10$ ) and the Open-Mindedness facet Aesthetic Sensitivity ( $\beta = .08$ ) also predicted higher levels of trust in policymakers and institutions.

As described above, we investigated the generalizability of our findings by repeating our correlational analyses on the level of the single items of our outcome variables (see Table S2 at <https://osf.io/pfu7q>). Results of the detailed correlations of the BFI-2 facets and domains with the single outcome indicators are mostly in line with those of the aggregated scores. However, especially the indicators for behavior changes are somewhat heterogeneous – also reflected in a lower internal consistency for this outcome scale compared to the others. This heterogeneity is also reflected in sometimes inconsistent associations with the Big Five domains. For example, the behavioral indicator hoarding shows in contrast to the other indicators a zero-association (.01) with Agreeableness (correlation of Agreeableness with the aggregated outcome “behavioral changes” .11). This finding partly supports a former study (see Zettler et al., 2020). However, in contrast to Zettler et al., we could not identify a generally diverging correlational pattern for hoarding in contrast to the other behavioral indicators.

Also, the wearing of face masks diverges from the other indicators with regard to its association with: (a) Openness in that form that it is slightly negatively related to Openness ( $-.02$  in contrast to  $.10$  for the aggregated outcome); and (b) Conscientiousness ( $.01$  in contrast to  $.09$ ).

For the other three outcomes indicators were more homogeneous (see Cronbach alpha coefficients reported above). Thus, for the indicators of these outcomes also the associations with the Big Five domains were mostly comparable to those of the aggregate score.

### **Do associations between personality and responses to the pandemic depend on age, gender, and education?**

Are the associations between the Big Five domains and facets and the four COVID-19-related outcomes robust? We investigated this crucial question in two regards: First, we examined if the predictive effects of personality on the four COVID-related outcomes changed after statistically controlling for individual characteristics, and especially membership of a group at a higher risk of severe COVID-19 illness, in a combined regression model. As can be seen from the estimates and corresponding CIs (colored in black) of Figures 2 and 3, controlling for sociodemographic variables (sex, educational attainment) and risk-group membership did not – in general – markedly affect the prediction models. In most cases, the regression coefficients did not differ considerably across both models. This indicates the robustness of the personality effects over and above sociodemographic variables and risk-group membership and suggests that the latter did not confound the personality–outcome associations.

Second, we repeated our analyses of the personality effects separately for different subpopulations, namely for males vs. females, high vs low educated and younger vs. elder respondents. In general, results of these analyses (see Figure S1 and S2 at <https://osf.io/pfu7q>) indicate no systematic moderating effects. They thus suggest that the role of personality in predicting responses to the pandemic is largely the same irrespective of gender, age, and education.

In sum, several of the personality domains and facets predicted the various COVID-19-related behaviors and attitudes. Most of these associations were small. Across the board, Agreeableness and its facet Trust emerged as most predictive of the investigated outcomes. The individual risk of infection with coronavirus was perceived as lower by trusting and organized individuals. In addition to agreeable persons, extraverted, emotionally unstable, and open-minded individuals reported greater behavioral adaptations. Like individuals higher in

Agreeableness, those higher in Conscientiousness believed more strongly in the effectiveness of the policy measures to combat the further spread of coronavirus. Finally, in addition to the respondents who scored higher on the Agreeableness facet Trust, respondents higher in the Negative Emotionality facet Depression and the Open-Mindedness facet Aesthetic Sensitivity reported greater trust in the relevant policymakers and institutions regarding the handling of coronavirus.

## Discussion

Our aim in the present study was to investigate the role of personality traits – in terms of the broad Big Five domains and their more nuanced facets – for four key aspects of people’s responses to the COVID-19 crisis, namely: (a) the perception of the risk of infection with coronavirus; (b) behavioral changes to prevent infection with coronavirus; (c) beliefs in the effectiveness of policy measures to combat the further spread of coronavirus; and (d) trust in relevant policymakers and institutions regarding the handling of coronavirus. To investigate this research question, we used a large-scale panel study based on a randomly selected sample representing the heterogeneity of the adult population in Germany. To preclude the possibility that the measure of personality might be influenced by the COVID-19 crisis (or the survey content), we chose a prospective design in which personality was assessed almost three years prior to the outbreak of the coronavirus pandemic. Thus, in contrast to the vast majority of recent studies on the role of personality in dealing with the pandemic, which used cross-sectional designs, our prospective design was not susceptible to potential bias arising from changes in personality induced by the pandemic or from time-varying confounders (e.g., job loss or social isolation in the wake of lockdown) that may have affected both people’s personality and their responses to the crisis.

Other recent studies on the link between personality and COVID-19-related outcomes suggest small to medium amounts of variance explained by personality. Also, in our study the amount of variance explained by the personality domains and facets was low. As many of the recent studies investigated specific and circumscribed behavioral adaptations, such as the wearing of masks or social distancing, the low level of variance explained by personality might, on the one hand, be due to the content of the investigated depend variable. This assumption is also supported by the fact, that the amount of variance explained by our sociodemographic variables, sex and educational attainment, as well as risk-group membership in these outcomes was comparable in size – or even slightly lower – to that explained by personality. On the other hand, our prospective research design, whereby personality was assessed almost three years prior to the outcomes, brought with it the risk that some slight personality changes may indeed have occurred in the meantime, thereby lowering the amount of explainable variance. In addition, changes in personality might have occurred as a result of the pandemic (see Sutin et al., 2020) that were directly related to the outcomes, thereby increasing the associations.

As is well known, however, small shares of variance explained (i.e.,  $R^2$ ) in regression models do not preclude the possibility that some predictors do predict the outcome with non-trivial effect sizes. Indeed, our results clearly show that for all four COVID-19-related outcomes investigated, several domains and/or facets did have relevant predictive power.

Our results reveal that in particular Agreeableness, or in some cases only its facet Trust, appears to predict individuals’ responses to the COVID-19 crisis: Individuals who scored higher on these characteristics perceived their infection risk to be lower, adapted their behavior more strongly to the new situation, rated policy measures to combat the further spread of coronavirus as more effective, and reported greater trust in the relevant policymakers and institutions regarding the handling of coronavirus. The largest associations were those of Agreeableness with trust in relevant policymakers and institutions (zero-order correlation of  $r = .17$ ). Notably, the association between Agreeableness and trust in relevant policymakers was not exclusively driven by the Trust facet of this domain ( $r = .14$ ) but applied also to its Compassion facet.

The trait–outcome relationship of  $r = .17$  over a period of almost three years is a sizeable effect, especially when taking into account that only 50% of all correlations in individual difference research are larger than  $r = .19$  (Gignac & Szodorai, 2016). These effect sizes investigated in this meta-analysis include mostly concurrent associations, whereas we looked at predictive effects over three years. This means that the associations between personality and COVID-19-related outcomes that we found, albeit mostly small, should not be dismissed as irrelevant. Moreover, sex, educational attainment, and risk-group membership also had only small-to-moderate associations with the four outcomes (strongest effect of about  $r = .20$ ), which provides another benchmark against which to interpret the effect sizes of personality domains and facets.

Earlier studies investigating associations between personality and COVID-19-related outcomes have concentrated primarily on behavioral adaptations such as social distancing. As mentioned above, findings are still scarce and sometimes contradictory. Our finding that agreeable, extraverted, and open individuals have a higher tendency to adapt their behaviors to the COVID-19 crisis are broadly in line with effects found in these earlier studies (see Aschwanden et al., 2020; Blagov, 2020; Garbe et al., 2020).

In particular the positive association between Agreeableness and coping with the COVID-19 crisis can also be interpreted as in line with earlier research indicating people with higher levels of self-interest – as indicated by lower levels of Agreeableness (or Honesty–Humility in that study) – are less willing to accept COVID-19-evoked restrictions and showed less recommended behavioral adaptations (Zettler et al., 2020; see also Volk et al., 2020).

Similar to the results reported by Zettler et al. (2020), our additional item-level analyses showed that hoarding – as one of the behavioral adaptations investigated – was independent from Agreeableness. In line with results reported by Aschwanden et al. (2020), we could show that the wearing of face masks – in contrast to other behavioral indicators – was slightly negatively associated with the degree of Openness.

Several studies (Abdelrahman, 2020; Blagov, 2020; Stadler et al., 2020) support the notion that neurotic persons have a higher tendency to adapt their behaviors to the COVID-19 crisis. However, our results also revealed that this effect of Neuroticism was affected by sociodemographic factors as well as risk-group membership. When we controlled for these factors, the effect diminished. Previous studies also suggest that COVID-19-evoked behavioral adaptations are more pronounced in conscientious individuals (Abdelrahman, 2020; Blagov, 2020; Carvalho et al., 2020; Garbe et al., 2020). Although our findings support this effect on the correlational level, when we controlled for the other Big Five domains in a regression model this effect also diminished.

To the best of our knowledge, only one study so far has investigated personality effects on the perceived effectiveness of policy measures to combat the spread of coronavirus and on trust in policymakers and institutions regarding the handling of coronavirus. In line with Zettler et al. (2020), our study provides evidence that that agreeable as well as conscientious persons rated public policy measures such as the closing of schools and kindergartens more positively thus indicating that organized individuals support such measures to prevent the pandemic from worsening.

Not surprisingly, trusting individuals (i.e., those scoring higher in the “Trust” facet of Agreeableness) reported greater trust in policymakers and institutions. This effect seems to be more a content validation of the outcome than a specific, COVID-19-evoked result. In addition, the Open-Mindedness facet Aesthetic Sensitivity and the Negative Emotionality facet Depression predicted a high level of trust in COVID-19-relevant sources of information. As reported by Modersitzki et al. (2020), these two facets, among others, “emerged as the strongest and most important correlates and predictors of most psychological outcomes” (p. 34). Hence, it can be assumed that the associations found here were more COVID-19-specific.

## **Conclusion**

In sum, our findings qualify earlier research by showing that personality has limited predictive power for COVID-19-related perceptions, attitudes, and behavioral changes. The low portion of explained variance even in models including 15 personality facets and three covariates suggests that other factors beyond those investigated in the present study (e.g., variations in social norms or role models) must lie behind the marked individual differences in people’s responses to the coronavirus pandemic.

Nonetheless, several of the Big Five domains and their facets did show robust, and theoretically plausible, associations with the four outcomes, some of which were non-trivial in size when judged against recent effect size guidelines by Gignac and Szodorai (2016). One should also bear in mind that personality was measured almost three years prior to the onset of the coronavirus pandemic, and that the strongest effects of personality rivalled those of sex, educational attainment, and risk-group membership. Moreover, the fact that short scales for the personality domains – including very brief measures for the single facets – were used might have reduced the effect sizes found in the present study because of the lower reliability of short scales (but see Rammstedt et al., 2020; and Thalmayer et al., 2011, for evidence that Big Five short scales, despite their lower reliability, often have predictive validity comparable to that of longer scales).

Overall then, our results suggest that: (a) people’s responses to the pandemic vary considerably; (b) some personality domains and facets can predict people’s responses to the pandemic; yet (c) the predictive power of personality for these responses is mostly limited. In order to inform policymakers and practitioners about possible ways of shaping public opinion and nudging individual behavior in order to control the pandemic, further research is needed to reveal the sources of individual differences in people’s responses to the pandemic.

## **Data accessibility statement**

This article earned Open Data and Open Materials badges through Open Practices Disclosure from the Center for Open Science. The data and materials are permanently and openly accessible at <https://osf.io/pfu7q>.

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## Notes

1. For the subsequent analyses, we relied on three linked GESIS Panel data sets, i.e., the GESIS Panel Special Survey as well as the GESIS Panel Standard Edition and the GESIS Panel Extended Edition. The GESIS Panel Special Survey is a public use file that can be accessed via the GESIS Data Archive, see the DOI in the references. The GESIS Panel Special Survey, however, only contains a minimum of background information. Hence, in order to conduct these analyses, we relied on a preliminary data set that links the GESIS Panel Special Survey to the GESIS Panel Standard Edition as well as the GESIS Panel Extended Edition. The data from the GESIS Panel Special Survey will, however, be incorporated in the regular GESIS Panel cumulative data set (Standard as well as Extended Version) in Spring 2021. This upcoming GESIS Panel Standard Edition is disseminated as a Scientific Use File and can also be accessed via the GESIS Data Archive. The GESIS Panel Extended Edition, though, contains sensitive information (such as data on pre-existing conditions) that can only be analyzed in the GESIS Panel Secure Data Center.
2. The Federal Statistical Office (Statistisches Bundesamt) figure for the highest upper secondary leaving certificate includes both the *Fachhochschule* (university of applied sciences) and the university entrance qualification.
3. The items on pre-existing conditions were fielded in Wave *eb*, which was conducted in April and May 2017; they are part of the study entitled "Bias in Web Surveys of the General Population."
4. Here and in the following we report only beta coefficients  $|r| \geq .08$  thus exceeding the 15. percentile of all effect sizes in individual differences research according to the meta-analysis by Gignac and Szodorai (2016).

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