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4 Who follows the rules during a crisis?
5 Personality traits and trust as predictors of compliance with
6 containment recommendations
7 during the COVID-19 pandemic in Sweden

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9 Yvonne Schmeisser¹, Emma A Renström², Hanna Bäck¹
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13 ¹ Department of Political Science, Lund University, Sweden
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15 ² Department of Psychology, Gothenburg University, Sweden
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30 * Corresponding author

31 Yvonne.Schmeisser@svet.lu.se (YS)
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Abstract

During the COVID-19 pandemic in 2020, many governments tried to contain the spread of the virus by legally restricting social life or even by imposing national lock-downs. The Swedish government on the other hand, appealed to the individual's self-responsibility to behave according to specific containment recommendations published by the Public Health Agency. It is thus important to understand which factors influence the extent to which individuals comply with recommended actions. While the Big Five personality traits may be of relevance for understanding compliance during the COVID-19 pandemic, previous studies provide mixed results. We argue that we need to consider the role of trust in authorities when analyzing the impact of personality traits on compliance. In analyses based on a large-scale representative survey (N=1034), we found that trust in the Public Health Agency is mediating the relationship between several Big Five traits and compliance, more specifically, Agreeableness, Neuroticism and Openness were only related to compliance when trust in the Public Health Agency was taken into account. This suggests that trust in authorities is an important factor to take into account when analyzing the relationship between personality traits and compliance.

Introduction

During an epidemic with an infectious disease, the behavior of each individual affects the development of the epidemic. Renouncing from behaviors that knowingly would put oneself or others at the risk of getting infected with the circulating disease is one way of contributing to the containment of this disease. In the beginning of 2020, when cases of Covid-19 were discovered in an increasing number of countries, governments developed strategies on how to slow down the spread of the virus. A central part of many of these strategies was to decrease physical closeness between individuals, also known as social distancing.

The extent to which social distancing was enforced on inhabitants by the government varied between countries. Many countries implemented stringent rules, closed schools, restrained public life, or implemented national lockdowns [1]. Sweden chose a different way and received much attention for what was internationally regarded as a lenient containment strategy [2]. Instead of imposing strict rules for social distancing and enforcing penalties for non-compliance on their inhabitants, the Swedish government appealed to the responsibility of each citizen to follow recommendations on how to behave in order to slow down the spread of the virus which were published by the Swedish Public Health Agency [3]. These recommendations were not followed by legal consequences, however, the term recommendation is heavily culturally dependent and its meaning varies with sender in Sweden. When the Swedish Public Health Agency gives a recommendation, the public is expected to comply. Even if the pressure to comply was high, each individual was still free to decide whether or to which extent they complied with the recommendations. Thus, in Sweden, the course of the pandemic might have been more dependent on self-responsibility and the decisions of each individual compared to in countries where the governments enforced specific behaviors by legislation. Sweden is therefore an interesting case for investigating what makes people comply with public health guidelines during the COVID-19 pandemic.

A fruitful approach when it comes to investigating compliance might be to look at personality traits, as compliance with rules might vary in dependence of pronouncements of specific personality traits [e.g. 4, 5]. However, previous studies investigating the relationship between personality traits and compliance during the COVID-19 pandemic have provided mixed results on which personality traits are relevant for compliance with containment recommendations. These heterogeneous results suggest that the link between personality traits and compliance might not be direct, but that there may be a variable mediating this relationship. Thus, the aim of this study is to contribute to a better understanding of *how* personality traits relate to compliance, that is, what mediates the relationship between personality traits and compliance with containment recommendations during the COVID-19 pandemic in Sweden.

A factor that has previously been shown to be linked to personality traits [6, 7], as well as to compliance with preventive behaviors during pandemics [e.g. 8, 9-11], is political trust. As the recommendations on how to prevent the spread of the virus during the COVID-19 pandemic in Sweden were developed by the Public Health Agency, trust in this specific agency may be worthy to consider when investigating the relationship between personality traits and compliance with containment recommendations in Sweden. In this study, we aim at finding out whether trust in the Public Health Agency acts as a mediator for the relationship between personality traits and compliance.

Theory and previous research

Inter-individual differences in compliance dependent on personality traits

When it comes to the explanation of behavioral decisions, personality traits are of high interest. “Personality traits are defined as the relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another.” [12]. Several models and theories have been developed and tested in order to investigate and understand these inter-individual differences. One of the most prominent and best investigated theories is the *Five-Factor Theory of Personality* [13], which claims that there are five basic personality traits, also referred to as the *Big Five*, which include *Conscientiousness*, *Neuroticism*, *Agreeableness*, *Openness to Experience*, and *Extraversion*. These traits are to be understood as five dimensions, implying that each of the traits is present in every individual, but the pronouncement of the traits varies between individuals. Thus, there are inter-individual differences in where a person would fall onto on a personality dimension.

Conscientiousness entails the striving for achievement and purpose. Persons high on this trait could be described as reliable, responsible, and thorough. Neuroticism describes the tendency to experience negative emotions. Highly neurotic persons could for example be described as anxious, tense, and worrying. Agreeableness describes the tendency to circumvent interpersonal conflict and comply with other’s ideas. Highly agreeable persons are for example described as trusting, sympathetic, and forgiving. Openness to Experience describes the need to seek out new or varying experiences. People scoring high on this trait are described as curious, insightful, and original. Extraversion describes the tendency of the need to be with others and to be social. Persons scoring high on extraversion are for example described as active, outgoing, and talkative [13, 14].

The individual scope of complying with rules often varies in dependence of pronouncements of specific personality traits, especially Conscientiousness is thought to relate to these behaviors [4]. Conscientiousness is not only characterized by impulse control that generally aids compliance to norms and rules [15], there is also evidence for the existence of a positive relationship between Conscientiousness and physical health, longevity [16], and preventative health behavior [17]. Even though some studies emphasize that personality traits alone are not reliable predictors for medical compliance [18], in a meta-analysis, Bogg and Roberts (5) came to the conclusion that higher Conscientiousness often comes with more preventative or beneficial health behaviors, while risky health behaviors are less common in people high on Conscientiousness.

Unlike with Conscientiousness, higher manifestations of Neuroticism are often connected to non-beneficial health outcomes [19] and risk behavior such as smoking and drinking [20]. This relationship between Neuroticism and risky health behaviors suggests that individuals high on Neuroticism behave in a more risk-oriented manner, and consequently less in line with the recommendations of the Public Health Agency. Furthermore, there is evidence that under some circumstances, Extraversion can also be related to non-beneficial or risky health behaviors [21]. With regard to the recommendations to prevent the spread of COVID-19, it is the inherent social aspect of Extraversion that might make it difficult for highly extraverted individuals to comply with the recommendations as the recommended social distancing would require a reduction of social contacts and changes to social life. Consequently, individuals high on Extraversion might be less prone to comply to the recommendations.

Social distancing might not per se be problematic for individuals scoring high on Openness, however, they are described as critical citizens with a strong interest for new ideas, and a comparably high tendency for non-conforming thoughts and behaviors [6, 22]. Highly open individuals might therefore also be critical towards the recommendations published by the

Public Health Agency and consequently not necessarily follow these recommendations. In contrast, individuals high on Agreeableness tend to experience a strong wish to maintain positive relations with others. Part of this is to avoid interpersonal conflicts. In order to not upset others, highly agreeable individuals tend to show higher levels of conformity and compliance with norms and rules of their community [23]. Therefore, the norm about following the recommendations established in a community could play a crucial role for whether individuals scoring high on Agreeableness decide to comply with the containment recommendations or not.

First evidence for the role of personality traits in containment behavior during the COVID-19 pandemic comes from Brouard, Vasilopoulos (24), who conducted a study on a French sample, and Clark, Davila (25) who investigated predictors of social distancing in an international sample. Brouard, Vasilopoulos (24) found that individuals who scored higher on Conscientiousness engaged more in recommended behaviors to contain the spread of COVID-19. On the other hand, Extraversion, as well as Neuroticism were negatively related to compliance with behavioral recommendations. In this French sample, Agreeableness and Openness were not found to play a significant role for compliance with the official recommendations.

In an international sample, Clark, Davila (25) investigated what factors influence the extent to which individuals engage in preventive behavior to contain the spread of the virus. While the Big Five were not correlated with compliance with legally enforced governmental rules, Conscientiousness and Agreeableness were both positively related to the explicit intention to engage in specific preventive behaviors, like social distancing and wearing face masks. Thus, personality factors seem to matter for preventive health behavior when this behavior is not enforced through legislation. If the preventive behavior is mandatory, there should be less inter-individual differences in whether the behavior is shown or not.

The two studies described above suggest that different personality traits are relevant for the extent to which individuals engage in preventive behaviors to stop the virus. One reason for these differing results could be distinctions between the samples, particularly regarding the country of residence. While one study focused on France, the other study included individuals from all over the world. As policies on containment behaviors and legal consequences of not following the behavioral recommendations varied between countries, it is possible that the importance of specific personality traits for the shown behavior also varies. If the number of social contacts is for instance reduced by law in one country, it is likely that Extraversion might not influence the extent of social distancing as much as in countries where inhabitants can decide on their own how much they engage in social contacts. Furthermore, if social norms have developed around the containment behaviors could for example play a relevant role for whether Agreeableness influences the intention to engage in containment behaviors.

A second explanation for why the relevant relationships differed between studies could be that personality traits may not be directly linked to compliance with containment recommendations. Instead, another variable could mediate the relationship between personality traits and compliance. During the pandemic with COVID-19, recommendations on how to behave in order to stop the spread were often published by public health authorities or governments. Consequently, it seems reasonable that trust in these institutions might play a relevant role for the extent to which individuals engage in the recommended behavior in order to stop the spread of the virus. We thus consider the role of trust in analyzing compliance.

Differences in compliance dependent on trust

Before outlining the possible influence of trust on behavior during the pandemic, it is important to clarify the concept trust. Trust describes the situation when a person, the trustor, makes themselves vulnerable to another entity, also referred to as the trustee. Thus, trust is relational,

meaning it involves these two specific parties. Trust can be experienced toward one specific trustee, but not towards other trustees. Furthermore, trust is domain specific, implying that trust can be put into a trustee regarding one particular task, but not regarding other tasks [26-28]. A trustee can be a person, but also a group or an institution. An example of the latter is political trust.

Political trust describes the feeling a person has towards their government and relevant state authorities that these institutions will act in a competent and righteous way in accordance with the best interests of society and its members in a particular situation. Indubitably, there is always a risk that trusted state authorities fail to act in the expected righteous way. Thus, putting trust into state authorities comes with the acceptance of this risk and with the acceptance of being vulnerable to the authorities [26, 27]. This risk acceptance and the feeling of trust towards state institutions or the government influences how legitimate inhabitants regard their government, and consequently how willing inhabitants are to stick to regulations and demands from the government [9, 29]. Therefore, political trust is discussed as a key factor in democratic systems as “the glue that keeps the system together and as the oil that lubricates the policy machine” [30].

Trust especially comes into effect in situations of high uncertainty and complexity that exceed the individual’s knowledge and ability to perform an accurate risk assessment by themselves. In order to decide on how to interpret or act in such an intricate situation, complexity of the situation can be reduced by turning to a trusted person or authority for guidance on evaluating and responding to the situation. Letting oneself be guided through an uncertain situation comes with the acceptance of the risk that the guide might not give only beneficial and correct advice. Following this, trust is a necessity for citizens to follow their government in times of crisis. When trust in the government or authorities is low, it seems unlikely that the individual turns to these institutions for guidance. According to Siegrist and

Cvetkovich (31), the extent to which people's own risk assessment of a complex situation is in line with what is proposed by authorities depends strongly on how much the individual trusts these authorities. In less complex situations, differences in trust in the authorities is not associated with differences in the individual risk assessment [31], indicating that if individuals are confident to be able to understand the situation by themselves, they tend to perform their own risk assessment instead of consulting authorities.

Pandemics with new viruses that are not sufficiently scientifically investigated constitute situations of high uncertainty. Therefore, it could be expected that individuals turn to their government for guidance during a pandemic, provided that the individuals trust their government. During previous epidemics, it has been observed that higher trust in authorities was related to a greater extent to follow official recommendations on how to react to a spreading disease. During the H1N1 pandemic lower trust in the government was for example accompanied by a decrease in the use of recommended face masks [8]. Individuals with lower trust in authorities furthermore engaged less in recommended preventive behaviors [9]. In a longitudinal study, Gilles, Bangerter (11) found that lower trust in the government led to lower willingness to follow the government's recommendation to get vaccinated for the H1N1 virus. Similar patterns were noticeable during an outbreak of Ebola in 2018, during which individuals with lower institutional trust showed less of the recommended preventive behaviors in order to counter the spread of the disease [10].

One of the first studies investigating trust in relation to the COVID-19 pandemic investigated a relationship between institutional trust before the crisis and the mortality due to COVID-19. In countries where institutional trust was high before the outbreak, mortality due to the virus was generally lower by the end of April 2020 than in countries with low institutional trust before the outbreak of COVID-19 [32]. As pointed out by Oksanen, Kaakinen (32), several factors, like sociability in different cultures, or the capacity of health care systems need to be

taken into account when trying to explain these findings. Furthermore, it is possible that governmental trust is lower in countries in which inhabitants perceive the capability of the health care system to successfully respond to a public health crisis is low. A consequence of previous negative experiences with state authorities during a health crisis could decrease public trust, whereas successful handling of a crisis could result in higher public trust [33, 34].

Clark, Davila (25) found governmental trust to be positively related to the extent of health precautions and compliance with containment recommendations during the COVID-19 pandemic, even though they emphasized that other factors, like believing in the effectiveness of the measures, were better predictors of compliance.

For a long time, trust in state authorities was thought to be mainly influenced by systemic factors like economic crises [35, 36], political scandals [37], or mismanagement in times of crisis [34]. However, more recent research suggests that even demographic factors like growing up during a specific time, or cultural factors like political socialization, but also individual personality traits could influence the level of trust [for a review see 26]. As personality traits are thought to influence how individuals perceive and process information, how they evaluate, and interact with their environment [14, 38], it is reasonable to assume that personality traits also influence political attitudes and behaviors.

Mondak and Halperin (6) created a theoretical framework in which political attitudes and behaviors are considered a result of environmental and dispositional influences and their interactions. As dispositional influences, the Big Five personality traits were included in this framework. The different personality traits were thought to be relevant for different aspects of political behaviors and attitudes. For political trust, Mondak and Halperin (6) found Openness and Agreeableness to be relevant in a sample of American citizens. While Openness was predictive for lower political trust, higher levels of Agreeableness were related to higher levels of political trust. However, in a Swiss sample, Freitag and Ackermann (7) found Neuroticism

and Extraversion to be negatively related to political trust. That the personality traits serving as best predictors vary between countries indicates that the traits relevant for political trust might not be stable and universal. Instead, the importance of single personality traits for political trust might vary as a function of relevant contextual variables, like political institutions, or the political situation in a country. This would be in line with the definition of trust as relational, situational, and domain specific [27].

Hypotheses about personality traits, trust and compliance

In conclusion, there is evidence for the influence of personality traits on compliance with public health recommendations or recommendations published by state authorities. However, the few existing studies on this relationship offered varying results, suggesting that other, unobserved factors might influence the strength and pattern of the relationship between the Big Five and compliance. As compliance was previously observed to vary with trust in authorities, whereas trust was observed to vary amongst others dependent on personality traits, we suggest a mediating effect of trust on the relationship between the Big Five personality traits and compliance with the recommendations by the Public Health Agency. Considering that the feeling of trust is not universal but depends on the specific situation, the particular topic, and the involved trustors and trustees, it is important to include trust in the specific authority relevant for the particular situation in the model to understand what factors influence compliance in this precise situation. In Sweden, the authority most relevant for the containment strategy was the Swedish Public Health Agency, as this agency developed and communicated the behavioral recommendations to limit the spreading of the virus, while the Government only encouraged citizens to follow these recommendations, but otherwise largely kept in the background. Therefore, we expect trust in the Swedish Public Health Agency to serve as a mediating variable for the relationship between the Big Five personality traits and compliance

with the containment recommendations developed by the Public Health Agency (PHA). We formulate the following hypotheses.

First, we expect a positive direct effect of Conscientiousness on compliance, as Conscientiousness was found to be positively related to containment behavior during the COVID-19 pandemic by both Brouard, Vasilopoulos (24), and Clark, Davila (25). Thus, we expect that the higher individuals score on Conscientiousness, the more compliance with the PHA recommendations they will report.

Second, we hypothesize a direct, positive relationship between trust in the PHA and compliance with the containment recommendations published by the PHA, based on previous research that indicated a positive impact of trust in authorities on preventive behavior during a pandemic [e.g. 9, 10],

Third, we expect direct effects of the Big Five on trust in the PHA. Building on the framework developed by Mondak and Halperin (6) who found Agreeableness to be a positive, and Openness to be a negative predictor of trust, we expect a direct positive relationship between Agreeableness and trust in the PHA, while a direct negative relationship is expected between Openness and trust. Furthermore, we expect direct negative relationships between Neuroticism and Extraversion and trust in the PHA, as these traits were identified as negative predictors of political trust in a study by Freitag and Ackermann (7).

Thus, we expect Agreeableness, Openness, Neuroticism and Extraversion to be related to trust in the PHA, while we expect higher trust in the PHA to be associated with higher compliance. We therefore hypothesize trust in the PHA to function as a mediator between these four Big Five traits and compliance. This means, we do not expect direct relationships between Agreeableness, Openness, Neuroticism, or Extraversion on compliance, however we expect these traits to relate to compliance through their connection to trust in the PHA. For Agreeableness, we expect this indirect relationship to be positive, while the indirect relationship

to compliance mediated through trust in the PHA is expected to be negative for Openness, Neuroticism, and Extraversion.

Research design and methods

The case –the COVID-19 Pandemic and the Swedish response

In December 2019, reports about severe cases of pneumonia of unknown cause in Wuhan, China, reached the World Health Organization (WHO). These cases would later be associated with the coronavirus disease COVID-19 which is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). On March 11, 2020, after cases of COVID-19 were detected in 114 countries around the world and community spreading was evident in several countries, the WHO declared the outbreak of COVID-19 a pandemic [39]. The WHO encouraged governments and all members of society to work together and help to contain the further spread of the virus by the implementation of hygiene and social distancing measures. How stringent and to what extent these measures were implemented varied between countries [40]. Many governments decided however, to take social distancing to the level where people were prohibited from travelling or even from leaving their homes, which is commonly referred to as “national lock-down” [2].

Sweden’s response to the outbreak of COVID-19 constitutes an exception amongst most of its European neighbors [41] as the Swedish government did not impose a lockdown or stringent prohibitions on inhabitants to reduce public life. Instead, the Swedish PHA published recommendations on how to behave in order to slow down the spread (for more details on the recommendations, see the website of the Swedish PHA “Folkhälsomyndigheten”: www.folkhalsomyndigheten.se). Inhabitants of Sweden were strongly encouraged to follow common-sense and to behave in accordance with these recommendations. However, for the

individual, the recommended behaviors were neither mandatory nor followed by fines or penalties in case of non-compliance. Thus, the social distancing measures in Sweden were not legally enforced to the same extent as in many other countries. Compared to countries that decided on more stringent strategies, the success of the Swedish containment strategy is thus more dependent on the behavioral decisions of the individual. According to the PHA, numbers of officially confirmed new infections with COVID-19 decreased by the end of June and stayed relatively low. This suggests that Sweden's inhabitants voluntarily complied to a large extent with the provided recommendations by the PHA. This leads to the question what made Swedish inhabitants decide to comply with the recommendations?

A survey study performed during the Covid-19 pandemic

Our analyses are based on a large-scale, representative survey conducted in April in Sweden, that is, during the Covid-19 crisis. In total, 1077 participants took part in this survey. Participants who did not fill in the questionnaire until the end or were exceptionally fast at finishing the survey were excluded from the analysis. After removing these, sample of 1034 participants remained for further analysis. Of the resulting sample, 567 participants were women, 455 were men. The gender of further 12 participants remained undisclosed. The age of participants ranged between 18 and 89 years ($M = 50.55$ years, $SD = 17.60$ years). The representative sample was recruited through an online polling company, Enkätfabriken, active in Sweden. Recruitment and conduction of the study took place in two rounds between the 2nd and the 26th of April 2020. Participants received a monetary reimbursement after their participation through the polling company.

The present project was evaluated by the Swedish Ethical Review Authority (number: 2020-01590). The authority deemed that the research complied with the law for

ethical approval of research with human participants. Data collection was anonymous and confidential. Written informed consent was obtained.

Material and procedure

Data was collected online as part of a larger study on COVID-19. The survey used for data collection was created on the platform Qualtrics. Participants were informed about the aim of the survey and what it entailed, and that the collection and storage of data was completely confidential and anonymous. After participants consented to participate, the different variables were accessed in the order presented in the following.

Our dependent variable in this study measures *compliance with recommendations to limit the spread of the virus*. On a 7-point Likert scale from *no, not at all (1)* to *yes, as much as I can (7)*, participants could answer the question whether they engage in specific behaviors to limit the spread of the virus. The listed behavioral options included avoiding to travel, avoiding to meet other people, keeping a distance of at least one meter to others, washing or disinfecting hands more often than usual. The internal consistency of the scale assessing behavioral measures indicated by Cronbach's alpha was .69.

To assess our main independent variables, the *Big Five personality traits*, a Swedish version of the Ten-Item Personality Inventory [TIPI; 43] was used. Each of the five personality items was measured with two items, each consisting of two adjectives. One of the according items was reverse-scored. Participants were instructed to rate on a 7 point Likert scale from *don't agree at all (1)* to *agree completely (7)* how much they see themselves reflected in the adjectives included in the items. Openness was assessed with the pairs "open to new experiences, complex" and the reverse scored "conventional, uncreative". Conscientiousness was represented by "dependable, self-disciplined" and the reverse scored "disorganized, careless". The items measuring Extraversion were "extraverted, enthusiastic" and the reverse

scored “reserved, quiet”. Agreeableness was assessed with “sympathetic, warm” and the reverse scored “critical, quarrelsome”. Neuroticism was measured with the item “anxious, easily upset” and the reverse scored “calm, emotionally stable”. The items were presented in randomized order. The reliability of this short instrument with a retest interval of 6 weeks was found to be between .62 and .76 for the 5 scales. Internal consistencies were measured with Cronbach’s alpha between .40 to .73 [43]. In the current study, internal consistency determined by Cronbach’s alpha was slightly lower. For the Extraversion scale Cronbach’s alpha was .69, for the Neuroticism scale we found $\alpha = .60$, for Conscientiousness $\alpha = .53$, for Openness $\alpha = .39$, and for Agreeableness Cronbach’s alpha reached .34. After reverse coding, the Spearman correlation coefficient between the two items assessing Neuroticism was $r_s = .43$, $p < .001$, $N = 1022$. For Extraversion a correlation of $r_s = .53$, $p < .001$, $N = 1023$ was reached. The items assessing Agreeableness correlated to $r_s = .21$, $p < .001$, $N = 1026$. The two Conscientiousness items correlated to $r_s = .41$, $p < .001$, $N = 1025$, and the items concerning Openness to $r_s = .27$, $p < .001$, $N = 1021$.

Trust in Institutions was measured on a 7-point Likert scale from *none at all (1)* to *a great deal (7)*, participants were asked to indicate how much confidence they have in 18 different institutions, for example the press, political parties, the government, scientists, or the PHA. The order of the institutions was randomized for each participant. For the current study, only trust in the government and trust in the PHA were considered.

Political Orientation was assessed on a 10-point Likert-scale ranging from *Left (1)* to *Right (10)*. The question was “Sometimes political perspectives are described on a scale from left to right. What would you say, where are you located on such a scale?”. This variable was included as a control variable in our analyses.

We also included a number of control variables measuring various *demographics*. Participants received a question about their gender and age, which both could be answered with

a free text entry. Participants were asked to choose their highest level of education out of six options, which ranged from “not completed primary school”, “primary school”, “high school”, “polytechnical school or similar”, “higher education, for example from a university” to “Doctoral degree or similar”. Furthermore, participants were asked whether they belong to a group with a higher risk to fall seriously ill from COVID-19. If so, they could choose from the options that their heightened risk stems from their age or from a preexistent health condition.

Empirical results

Descriptive results

Data analysis was conducted in IBM SPSS Statistics 25. A significance level of $\alpha = .05$ was chosen for all parts of the analyses. Our main dependent variable was compliance with the PHA recommendations, which was measured by four single items. Means, and standard deviations of these items, as well as correlations between the items are shown in Table 1. To create a compliance measure, the average of these four items regarding the single behaviors was calculated for every participant. Considering that compliance was assessed on a 7-point scale where higher values represent a greater extent of compliance with the recommended behavior, general compliance with the PHA recommendations can be regarded as high ($M = 6.20$, $SD = 0.92$).

Table 1. Correlation coefficients of the items to assess compliance with the PHA recommendations.

Item	<i>M (SD)</i>	1	2	3
1 Avoid travelling	6.47 (1.09)			
2 Avoid meeting others	5.75 (1.50)	.50***		
3 Keeping distance	6.31 (1.21)	.39***	.54***	
4 Hand Hygiene	6.27 (1.27)	.32***	.30***	.37***

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Measure	<i>M</i> (<i>SD</i>)	1	2	3	4
1 Conscientiousness	5.36 (1.13)				
2 Agreeableness	5.38 (1.00)	.31***			
3 Neuroticism	2.82 (1.21)	-.36***	-.31***		
4 Openness	5.10 (1.06)	.18***	.27***	-.20***	
5 Extraversion	4.60 (1.37)	.14***	.27***	-.15***	.38***
6 Trust in govern ^c	4.50 (1.70)	.06*	.10**	-.09**	.05
7 Pol Orientation ^c	5.28 (2.32)	.14***	-.05	.13***	-.05
8 Risk group ^c		.04	.03	-.02	-.00
9 Gender ^c		-.08**	-.16***	-.10**	-.10**
10 Age ^c	50.55 (17.60)	.19***	-.10**	-.17***	.04
11 Education ^c		.01	.04	-.05	.14***
12 Trust in PHA ^m	5.46 (1.46)	.08**	.15***	-.14**	.04
13 Compliance ^d	6.20 (0.92)	.21***	.13***	-.10**	.90**

Coefficients were calculated through Spearman correlation ($N=1011$).

^c marks variables that served as control variable, ^d marks the dependent variable in our study design, ^m marks the mediating variable.

* $p < .05$. ** $p < .01$. *** $p < .001$.

With an average of 4.50 ($SD = 1.70$), trust in the government, which was used as a control variable, was lower than trust in the PHA. Another control variable was political orientation. On a scale from 1 (left) to 10 (right), the average of the reported political orientation was 5.28 ($SD = 2.32$) and balanced over politically left and politically right orientations. Furthermore, the majority of participants (61.5%) reported not to be a part of a risk group regarding COVID-19. A last control variable was education. Percentages of participants' education levels are reported in the following from lowest to highest degree: 0.4% of participants reported that they have no school degree, 5.8% reported to have a degree from a primary school, whereas 31.4% reported that their highest education was a high school degree. 10.1% of the participants

reported to have completed a degree from a poly-technical school. The majority of participants reported their highest degree to be from a university (50.8%), while 1.5% reported a doctoral degree to be their highest education. Categorical control variables were dummy coded for the analysis. Not being a part of a risk group was coded with 0 while being a part of a risk group was coded with 1. For the analysis, it was not differentiated between the reasons why participants belonged to a risk group. The gender variable was coded with 0 for women and 1 for men. For the main analysis, the variable assessing education was broken down into six single dummy variables, each representing one answer option to the question, i.e. one level of education. Each education level dummy variable was coded with 1 when participants answered that this level was their highest level of education. Each education dummy variable was coded with 0 when another level was chosen. Correlations between all variables included in the analysis are found in Table 1. For the calculation of correlations, Education was not dummy coded, but entered as ordinal variable ranging from the lowest level of education (1 = “not completed primary school”) to the highest level of education (6 = “doctoral degree or similar”).

Multivariate regression results

In order to investigate the relationship between the Big Five personality traits and compliance, with the particular aim to test the hypothesis concerning the relationship between Conscientiousness and compliance, a linear regression model was calculated. This model included the five personality traits as predictors. Furthermore, gender, age, education level, whether participants belong to a risk group, political orientation, and trust in the government were included as control variables. The model turned out to be significant, $F(15, 976) = 9.53$, $p < .001$, with an adjusted R^2 of .11. In line with predictions, Conscientiousness was a positive predictor of compliance, such that higher levels of Conscientiousness were associated with higher compliance to the PHA recommendations. Furthermore, we observed a trend of

Agreeableness to be positively associated with compliance. Neuroticism, Extraversion, and Openness did not significantly predict compliance. See Table 3 for a complete overview of the model coefficients.

Table 3. Regression coefficients of the model predicting compliance from the Big Five.

Predictor	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
Conscientiousness	.10	.03	.12	3.64	<.001
Agreeableness	.05	.03	.06	1.65	.099
Neuroticism	-.00	.03	-.00	-0.06	.956
Openness	.02	.03	.02	0.67	.506
Extraversion	.01	.02	.02	0.46	.649
Trust in government	.01	.02	.01	0.33	.745
Political orientation	.00	.01	.00	0.02	.981
Risk group	.10	.06	.05	1.71	.087
Gender	-.31	.06	-.16	5.79	<.001
Age	.01	.00	.20	5.79	<.001
Education – no degree	.29	.62	.01	0.46	.643
Education – primary school	.09	.13	.02	0.68	.499
Education – high school	-.06	.06	-.03	-0.93	.351
Education – polytechnical school	.10	.10	.03	1.00	.318
Education - PhD	.18	.23	.02	0.79	.428

Overall model significance $F(15, 976) = 9.53, p < .001$.

Mediation model

To assess our hypotheses further, a mediation model was calculated. The model was calculated with the help of the PROCESS macro for SPSS by Hayes (44). It included the Big Five personality factors as predictors. Gender, age, education level, whether participants belong to a risk group, political orientation, and trust in the government were included as control factors.

Trust in the Swedish PHA was included as a mediator. Continuous variables in the model were mean centered. Missing values were excluded pair-wise. Heteroskedasticityconsistent estimators after Hubert-White were applied. See Fig 1 for a graphical depiction of the paths included in the model and the regression coefficients. This mediation model accounted for 13.34% (R^2) of the variance in reported compliance. See Table 4 for the resulting coefficients of the model.

Fig 1. Path diagram of the calculated mediation model with the according, mean centered regression coefficients. Coefficients stem from a mediation model predicting compliance to the recommendations published by the PHA mediated by trust in the PHA. For simplification purposes, the control variables gender, age, education level, belonging to a risk group, political orientation, and trust in the government are not included in this graph. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4. Regression coefficients of the mediation model predicting compliance from the Big Five and control variables, mediated by trust in the PHA.

Antecedent	Consequent							
	M (Trust in PHA)				Y (Compliance)			
		Coeff	SE	<i>p</i>		Coeff	SE	<i>p</i>
X (Conscientiousness)	a ₁	- 0.03	.04	.489	c ₁	0.10	.03	.002
X (Agreeableness)	a ₂	0.12	.04	.007	c ₂	0.05	.04	.209
X (Neuroticism)	a ₃	- 0.09	.04	.013	c ₃	0.01	.03	.862
X (Openness)	a ₄	- 0.10	.04	.009	c ₄	0.03	.03	.411
X (Extraversion)	a ₅	0.02	.03	.491	c ₅	0.01	.02	.700
C (Trust Gov)		- 0.19	.08	< .001		- 0.03	.02	.243
C (Pol Orien)		- 0.16	.07	.613		0.00	.01	.920
C (Riskgroup)		- 0.00	.00	.013		0.12	.06	.037
C (Gender)		- 0.52	.46	.031		- 0.29	.06	< .001

C (Age)	- 0.22	.16	.205	0.01	.00	< .001
C (Edu - no degree)	- 0.08	.08	.258	0.32	.31	.294
C (Edu - primary)	- 0.12	.20	.181	0.10	.11	.386
C (Edu - high school)	- 0.03	.13	.318	- 0.06	.07	.380
C (Edu – polytechnic)	- 0.19	.08	.564	0.19	.17	.258
C (Edu – PhD)	- 0.16	.07	.806	0.10	.09	.291
M (Trust PHA)			b	0.06	.03	.022
Constant	3.45	.39	<.001	4.58	.33	<.001

$$R^2 = 40.89$$

$$F(15, 975) = 30.84, p < .001$$

$$R^2 = 13.34$$

$$F(16, 974) = 8.08, p < .001$$

Coefficients of continuous variables are mean centered.

Gender was dummy coded, women were coded as 0, men as 1; education level of the majority (university degree) was chosen as reference category for the education variable.

Second, we predicted, and found that trust in the PHA was positively related to compliance, meaning that higher levels of trust in the PHA, was related to higher tendencies to follow the PHA recommendations; $B = 0.06$, $t(975) = 2.29$, $p = .022$. Regarding trust in the PHA, the predictors included in the model accounted for 40.89% (R^2) of the variance.

Third, we predicted and found support for, effects of Openness, $B = -0.10$, $t(976) = -2.64$, $p = .009$, Agreeableness, $B = 0.12$, $t(976) = 2.70$, $p = .007$, and Neuroticism, $B = -0.09$, $t(976) = -2.49$, $p = .013$, on trust in the PHA, such that higher levels of Openness and Neuroticism led to lower trust, while higher levels of Agreeableness were related to higher trust in the PHA. No evidence was found for the predicted negative relationship between Extraversion and trust in the PHA, $B = 0.02$, $t(975) = 0.69$, $p = .491$.

To investigate the final prediction, that trust in the PHA serves as a mediating variable between the Big Five and compliance with the recommendations published by the PHA, possible indirect effects in the mediation model were considered. For these effects, 95%

confidence intervals were calculated. Each confidence interval was calculated on the basis of 5000 bootstrap samples. Table 5 contains an overview of all effects within the calculated model and the according bootstrapped confidence intervals. Several indirect effects turned out to be significant, indicating that for particular personality traits, trust in the PHA mediated the relationship to compliance. Trust in the PHA significantly mediated the effect of Neuroticism on compliance, indicating that the higher individuals score on Neuroticism, the lower their levels of trust in the PHA, which in turn is associated with less compliance, 95% CI [- .013, -.000], even though Neuroticism was not directly associated with compliance, 95% CI [- .052, .057].

A similar pattern was observed for Openness. Openness was not directly related to compliance, 95% CI [- .034, .084], however, when trust in the PHA was considered as a mediating variable, there was a negative indirect relationship between Openness and compliance. The higher individuals scored on Openness, the lower was their reported level of trust in the PHA and thus the lower were the levels of compliant behavior they reported, 95% CI [- .015, -.001]. Furthermore, trust in the PHA served as a mediating variable in the relationship between Agreeableness and Compliance. The higher individuals scored on Agreeableness, the more they trusted the PHA which in turn was associated with more compliance to the PHA recommendations; 95% CI [.001, .017]. Higher Agreeableness was however not directly linked to more compliance, 95% CI [-.026, .117]. For Conscientiousness, 95% CI [-.008, .003], and Extraversion, 95% CI [-.003, .006], trust in the PHA did not serve as a mediating variable on compliance.

Table 5. Total, direct, and indirect effects of the Big Five personality traits on compliance and according 95% confidence intervals. Trust in PHA was included as mediator.

Personality Traits	Effecttype	Effect	<i>SE</i>	<i>LCI</i>	<i>UCI</i>
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Conscientiousness	Total	.100	.032	.037	.163
	Direct	.102	.032	.039	.164
	Indirect	- .002	.003	- .008	.003
Agreeableness	Total	.053	.036	- .019	.124
	Direct	.046	.036	- .026	.117
	Indirect	.007	.004	.001	.017
Neuroticism	Total	- .000	.029	- .057	.057
	Direct	.005	.029	- .052	.063
	Indirect	- .005	.003	- .013	- .000
Openness	Total	.018	.030	- .040	.076
	Direct	.025	.030	- .034	.084
	Indirect	- .006	.004	- .015	- .000
Extraversion	Total	.010	.023	- .035	.055
	Direct	.009	.023	- .036	.054
	Indirect	.001	.002	- .002	.006

95% Confidence Intervals are based on 5000 bootstrap samples.

Discussion

During the COVID-19 pandemic, the Swedish government attempted to contain the spread of the newly discovered virus by advising inhabitants to behave according to containment recommendations published by the Swedish Public Health Agency that were not legally enforced. Hence, compared to countries where inhabitants were legally enforced to show or refrain from specific behaviors in order to contain the spread, inhabitants of Sweden were relatively free to decide for themselves if and to what extent they complied with the containment recommendations. This freedom of choice allows individual and contextual factors to influence the extent of compliance to containment behavior. Even though the more lenient Swedish containment strategy was widely discussed as risky or faulty [e.g. 45, 46, 47], model calculations suggest that albeit stricter and earlier measures might have prevented more infections, the Swedish approach was still successful in substantially reducing the numbers of

new infections. The Swedish population largely adhered to the recommendations and engaged in voluntary social distancing and self-isolation [48]. In this study we sought to understand better why the Swedish population did so.

For this purpose, we investigated the Big Five personality traits, as these are often regarded as relevant predictors of behavior, whereby compliant behavior regarding health recommendations is no exception. Previous studies conducted on the relationship between personality traits and compliance in the context of COVID-19 are however scarce and have yielded mixed results. The specific personality traits relevant for compliant behavior have differed between studies. These ambiguous findings point to the possibility that the relationship between Big Five and compliance to containment recommendations might not be direct, but instead may be mediated by a variable that has not been considered in the previous studies. The main goal of the current study was to find out more about *how* the Big Five personality traits relate to compliance with the Public Health Agency's recommendations.

As trust in governments and state institutions has been observed to be of considerable importance for the extent to which individuals engage in recommended preventive behavior during previous public health crises [8, 10, 11], and trust itself in turn has been found to be depended on personality traits [6, 7], we expected trust to act as a mediating variable between the Big Five and compliance with containment recommendations. As the responsible Agency for the containment recommendations in Sweden is the Public Health Agency, we expected trust in this Agency to be the relevant trust variable that mediates the relationship between the Big Five personality traits and compliance to the containment recommendations.

With data from a large-scale, representative survey conducted in April in Sweden, we investigated the proposed mediation model including the Big Five as predictors of compliance and trust in the Public Health Agency as mediator. Of the Big Five personality traits, we found solely Conscientiousness to be directly linked to compliance. The higher individuals scored on

Conscientiousness, the greater the extent to which they reported to comply with the recommendations published by the Public Health Agency. This is in line with the findings of previous studies conducted in different countries during the COVID-19 pandemic [e.g. 24, 25]. It seems plausible that Conscientiousness takes on a special role among the Big Five traits in the context of compliance to containment behavior, as Conscientiousness, is the trait most closely connected to rule following and compliant behavior [13, 14]. That Conscientiousness was directly linked to compliance in our model could also explain why Conscientiousness was the only Big Five trait reliably found to influence compliance positively during the COVID-19 pandemic in previous studies, while findings on the other personality traits were more inconsistent.

By including trust in the Public Health Agency as a mediating variable in our analyses, Agreeableness, Neuroticism, as well as Openness turned out to be indirectly linked to compliance. Trust in the Public Health Agency itself was positively related to compliance. Following this, participants with higher trust in the Public Health Agency was associated with higher reported compliance to the containment recommendations. This finding is in line with observations during previous public health crises, where trust in authorities often have been found to have a promoting influence on the willingness to engage in preventive behaviors in order to stop the spread of a disease [8, 10, 11]. Our findings indicated that the higher individuals score on Neuroticism or Openness, the less trust they put into the Public Health Agency, which is accompanied by less compliance with the containment recommendations. On the other hand, the higher individuals scored on Agreeableness, the more trust they put into the government which is associated with more compliance. These findings emphasize the importance of considering a mediating factor when trying to investigate the relationship between the Big Five personality traits and compliance. Thus, our findings indicate not only that personality traits are associated with the extent to which individuals comply to containment

recommendations, but they also shed light on *how* personality traits and compliance relate to each other, namely through trust.

The indirect effects of the Neuroticism, and Agreeableness are overall in line with studies that previously have been conducted on the relationship between the Big Five personality traits and compliance with containment recommendations during the COVID-19 pandemic (see e.g. Brouard, Vasilopoulos (24), Clark, Davila (25). A negative indirect effect of Openness on compliance, mediated by trust in the Public Health Agency we found in this study, is in line with previous research, as individuals scoring high on Openness were described to be critical citizens who think or behave in unconventional and non-conforming ways which might as a consequence also come with lower trust into state authorities [6, 22]. Considering that trust in the Public Health Authority was positively related to compliance, the negative indirect effect of Openness on compliance, mediated by trust in the Public Health Agency is thus consistent with previous findings.

As there was no direct effect of Openness on compliance, individuals high on Openness do not seem to engage less in containment behavior in general, which we expected. However, highly open individuals tend to have lower trust in the Public Health Agency, which in turn is connected to less in compliant behavior. Hence, only when including trust in the Public Health Agency into the model, the relationship between Openness and compliance becomes visible. This could amongst other things explain why previous findings that have not consider the mediating influence of trust, also did not find Openness to be of relevance for compliance.

Similar patterns were found for Neuroticism in our study. Even though some previous studies found direct connections between Neuroticism and less beneficial or risky health behaviors [19, 20], even specifically between Neuroticism and compliance with COVID-19 containment recommendations [24], we found no direct effect of Neuroticism on compliance. There was however an indirect effect of Neuroticism on compliance. Individuals higher on

Neuroticism tended to put less trust in the Public Health Agency, which in turn was associated with lower compliance. The negative relationship between Neuroticism and trust is partly in line with previous research. Individuals high on Neuroticism are often described as having a stronger tendency than individuals low on Neuroticism to worry and to feel anxious [13]. In line with findings by Freitag and Ackermann (7) who found Neuroticism linked to less political trust, our study results suggest that highly neurotic individuals tend to be more careful about who to trust to which extent. Considering the circumstances of our study, it seems reasonable that individuals high on Neuroticism worry more than others about the pandemic, which might affect the trust they have in the Authorities responsible for the crisis strategy. Lower trust in return was connected to less compliance with the containment recommendations.

As indicated by our study results, the majority in our representative sample of the Swedish population reported to try to follow the containment recommendations to a great extent. As a consequence, following these recommendations could be regarded as a norm, which should make it more likely that individuals high on Agreeableness also follow the recommendations. However, the results of the current study suggest that the relationship between Agreeableness and compliance might be more complex than that. While we found no direct link between Agreeableness and compliance, we found higher values on Agreeableness to be associated with higher trust in the Public Health Agency, which in turn was associated with higher compliance. The positive relationship between Agreeableness and trust is in line with early work on the Big Five of McCrae and John (13), where highly agreeable persons were described as generally more trusting. Furthermore, Mondak and Halperin (6) described agreeable individuals to be higher in political trust. This in line with our findings on Agreeableness.

Regarding the role of political trust during the COVID-19 pandemic, studies often focus on institutional trust in general or specifically on trust in the government [e.g. 25, 32, 49]. Clark, Davila (25) found governmental trust to be weakly related to compliance with containment

behavior regarding COVID-19 in an international sample. In the current study, governmental trust was included as a control variable. Similar as in the findings of Clark, Davila (25), governmental trust was not a strong predictor of compliance, whereas trust in the Public Health Agency was. This indicates that when investigating the effect of trust on behavior during the COVID-19 pandemic, it is crucial to look at trust in the particular state authority that is most relevant in this context.

Limitations of the study

The possibility to generalize the results of this study to other countries is somewhat limited, as the measures taken by other countries and the actors involved in the development of the measures differed between countries. While in many countries, governments were the most prominent state institutions in handling the pandemic, in Sweden, it was the Public Health Agency that designed and communicated the containment recommendations. As the extent of trust changes with variations in situation, relation or domain, trust in a government in a country other than Sweden might relate to compliance differently than trust in the Public Health Agency in Sweden. However, we believe that the general findings of our analyses, that certain Big 5 traits only influence compliance through trust, should be generalizable to other cases.

Furthermore, compliance in the current study is assessed through self-report. It is therefore possible that the results are influenced by answers biased through social desirability. Considering compliance, our findings seem nonetheless not only occur due to social desirability, as studies analyzing behavioral data, like movement data from phones, also indicate that the public followed the recommendations on travelling and staying at home [50, 51].

The Ten-Item Personality Inventory [43] is a time-efficient way to assess the Big Five on the cost of more detailed and nuanced assessment of different aspects of the five personality

traits. Single facets of the Big Five factors might be better predictors of specific behaviors than the five complete factors [52]. Future studies could therefore include a more nuanced measure of the Big Five in order to better understand the relationship between personality, trust in the Public Health Agency and compliance.

Conclusions and implications

In this study, we aimed at better understanding *how* personality traits influence compliance. We presented evidence for the influence of personality traits on compliance with containment recommendations during the COVID-19 crisis in Sweden, and showed that this relationship is more complex than often assumed as trust in the Public Health Agency was found to be an important mediator in this relationship. While individuals scoring high on Conscientiousness seem to follow the containment recommendations regardless, individuals scoring high on Openness, Agreeableness, or Neuroticism, need to feel that they can trust the Public Health Agency in order to follow the recommendations. Keeping the level of public trust in the Public Health Agency high, especially amongst individuals scoring high on Openness or Neuroticism, is thus be crucial for whether inhabitants of Sweden comply with the containment recommendations or not, and hence determines the success of the containment strategy.

While at the beginning of the pandemic of COVID-19, Sweden was one of the few countries in Europe that responded to the crisis in a more lenient way, with some time into the pandemic and decreasing infection rates, many countries started to loosen their restrictions and started to open up again. The transformation from lock-downs to more lenient strategies also hands over more responsibility to the individual inhabitant to behave in a way that limits the risk for a spread of the virus. Thus, personality traits and trust in relevant authorities could also play a tremendous role for the success of the new, more lenient containment strategies of countries with initially more restrictive strategies.

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