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Published online: 02 Aug 2021.

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Viral mitigation and the COVID-19 pandemic: factors associated with adherence to social distancing protocols and hygienic behaviour

Omid V. Ebrahimi[a,b], Asle Hoffart[a,b] (ID) and Sverre Urnes Johnson[a,b]

[a]Department of Psychology, University of Oslo, Oslo, Norway; [b]Modum Bad Psychiatric Hospital, Vikersund, Norway

ABSTRACT

Objective: To investigate the factors associated with adherence to viral mitigation protocols during the COVID-19 pandemic.
Design: This epidemiological cross-sectional study examines adherence to behaviour in 4158 adults and its relationship with sources of information.
Main outcome measures: Adherence to social distancing protocols (SDPs) and adherence to hygienic behaviour (HB) recommendations.
Results: Individuals aged 18–30 reported lowest adherence to SDPs and HB. Alcohol consumption was associated with lower adherence. Increased risk perception, fear of infection and altruistic attitude were associated with greater adherence. Males, single and childless individuals reported lower adherence. Extroverts and urban residents reported lower adherence to SDPs, but not HB. In contrast to earlier stages of the pandemic, voluntary social distancing was associated with greater adherence to SDPs as opposed to rule-enforced social distancing. Regarding information obtainment, increased time spent acquiring information from recognised newspapers had the strongest favourable association with adherence. Relying on information from friends and family was associated with decreased adherence to SDPs. Sensitivity analyses replicated the findings, supporting the stability and robustness of the proposed models.
Conclusion: This study identifies factors associated with favourable and detrimental adherence behaviour along with substantial dissemination routes, presenting strategies that may be of utility towards fostering adherence to contemporaneously implemented mitigation protocols.

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) continues its rapid global spread surpassing 52 million confirmed infectious cases and more than 1.2 million corona-related deaths, as of 12 November 2020 (Dong et al., 2020). The sudden emergence of the COVID-19 pandemic early in 2020 has left the world unprepared and pending the successful implementation of an efficacious vaccine. Meanwhile,

CONTACT: Omid V. Ebrahimi ✉ omideb@uio.no ✉ Department of Psychology, University of Oslo, Forskningsveien 3A, Harald Schjelderups hus, Oslo, 0373, Norway; Modum Bad Psychiatric Hospital, Vikersund, 3370 Norway.

countries are left with behavioural interventions as their main instruments to impede the infectious spread of the virus (e.g. Ferguson, 2020). Towards this aim, the use of mainly two central categories of viral mitigation strategies has been recommended by the World Health Organization (WHO, 2020). This includes the implementation of 1) physical distancing protocols (e.g. reduced activity among peers and public activity, lockdowns, quarantine and isolation), more commonly referred to as social distancing protocols (SDPs). The second recommended behavioural strategy involves 2) enhancing the efficiency and increasing the frequency of hygienic behaviour (HB) (e.g. establishing effective hand-washing routines and disinfection procedures). In their efforts towards reducing infectious spread and the death toll caused by the virus, numerous countries have implemented these two behavioural strategies across the globe (e.g. Dalton et al., 2020). Nonetheless, the aforementioned behavioural paradigms are ineffective in impeding infectious spread if not adhered to (e.g. Asmundson & Taylor, 2020; West et al., 2020). Failures to adhere to social distancing and hygienic protocols are thought to substantially and negatively impact mitigation efforts (e.g. Asmundson & Taylor, 2020; West et al., 2020). Consequently, the identification of factors related to impediments and facilitations of adherence has been deemed as crucial in the time-sensitive in the battle against the virus (e.g. Asmundson & Taylor, 2020; West et al., 2020).

To date, much remains unknown concerning the factors associated with adherence to pandemic protocols. Several gaps are left in the literature with regard to the associations between adherence and risk perception (e.g. Asmundson & Taylor, 2020; Bansal et al., 2020; Holmes et al., 2020), altruistic attitude (e.g. Brooks et al., 2020; Holmes et al., 2020), governmental trust (e.g. Bansal et al., 2020; Van Bavel et al., 2020; Webster et al., 2020) and self-chosen (i.e. voluntary) versus mandatory (i.e. rule-enforced) adherence to pandemic protocols (e.g. Brooks et al., 2020; Holmes et al., 2020). Researchers further draw attention to other gaps left in the pandemic literature concerning the relationship between adherence and personality traits (e.g. West et al., 2020), beliefs about the efficacy of pandemic protocols and collective mitigation behaviour (e.g. Webster et al., 2020), and fear of being infected and transmitting others (e.g. Webster et al., 2020). Additionally, the associations between alcohol consumption and adherence to pandemic protocols remain uninvestigated in a general adult population, previously being associated with suboptimal adherence in a population of teenagers and young adults (Suffoletto et al., 2020). More research is needed on the demographic characteristics of individuals and adherence levels, including differences in age, gender, education and residency in urban versus rural areas. Moreover, the association between adherence and the use of various media sources to obtain news about the pandemic (e.g. newspapers, television and social media) remains unclear (e.g. Holmes et al., 2020).

Against this backdrop, the present pre-registered investigation aims to empirically clarify the relationship between these theorised and called for factors and a) adherence to SDPs as well as b) adherence to WHO-recommended HB. Additionally, this research seeks to investigate to what extent different sources of information are associated with adherence to SDPs and HB. The study employs a multifactorial approach in studying adherence through the involvement of a multitude and wide range of relevant factors, including demographic, situational, cognitive, behavioural, affective and trait-based variables. All components thus compete for the same pool

of variance while controlling for all other factors in the model, revealing the most robust and central factors associated with adherence.

Methods

This report is carried out in conformity with the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology statement (STROBE; Von Elm et al., 2007). Its pre-registered protocol may be found on Clinicaltrials.gov (Identifier: NCT04442217) where the study was pre-registered prior to data collection. All components of the submitted study adhere to its pre-registered protocol.

Participants and procedure

This research is part of The Norwegian COVID-19, Mental Health and Adherence Project. Ethical approval of the study was granted by The Regional Committee for Medical and Health Research Ethics and the Norwegian Centre for Research Data (reference numbers: 125510 and 802810, respectively). This article involves the second wave of data collection, obtained between 22 June to 13 July 2020. At the first wave of data collection, the dissemination procedure involved providing information about the survey through broadcasting on national, regional and local information platforms (i.e. television, radio and newspapers), in addition to dissemination of the online survey to a random selection of Norwegian adults through a Facebook Business algorithm. This procedure is elaborated and depicted in detail elsewhere (Ebrahimi et al., 2020).

Data were obtained from 10,061 adults at the first wave of data collection. All participants were re-invited to participate in the second wave of data collection, involving measures of novel and modified viral mitigation protocols since the onset of the pandemic and the first data collection. The survey was subsequently administered in a random order to all adults who had provided informed consent to partake in the second wave of the study. Overall, 4936 participants provided responses for the second wave of data collection. Eligible participants for this study involved a) adults (i.e. age including 18 years and above), b) currently residing in Norway and thus experiencing identical SDPs and HB recommendations, who provided c) consent to take part in the study and d) who had provided a response to the question concerning whether they had socially distanced themselves or not since the onset of the pandemic. Among the respondents at the second wave, 4158 individuals provided a response to the question concerning whether they had socially distanced themselves or not since the onset of the pandemic. Consequently, this study involves a sample of 4158 adults.

Study design

The design of this cross-sectional study gave importance to the timing of measurement and elimination of expectation effects with regard to the criterion variables (i.e. adherence to SDPs and HB). Consequently, a stopping rule for data collection was

construed to end collection immediately if viral mitigation protocols (i.e. SDPs or HB recommendations) were changed or if new information about forthcoming modifications was provided. The time of data collection for this study (i.e. between 22 June 2020 and 13 July 2020) comprised a period where all national viral mitigation protocols and guidelines were held constant and no novel information was provided by the government regarding changes to these protocols. Expectation effects were thus controlled for and held constant during the entire data collection period. All viral mitigation protocols implemented and in-practice during the study period are presented in Supplementary Table S4.

Measurement

Demographic characteristics
The participants reported their age, sex, education, ethnic background (with domestic-born coded as natives and immigrated individuals coded as non-natives), employment status and residency in urban versus rural areas. Participants were further asked whether they had socially distanced themselves voluntarily (i.e. through their own choice) or whether they had socially distanced themselves mandatorily (i.e. through demanded isolation upon infection or quarantine through potential contact with an infected person).

Adherence to SDPs
Adherence to SDPs was measured by asking the respondents how well they were able to adhere each of the SDPs recommended by the WHO, all employed nationally by the Norwegian government at the time of measurement. The questions queried about how well the respondents were able to adhere to the specific pandemic mitigation protocols employed in Norway for the past month, such as staying at home and self-isolating when experiencing specific symptoms, maintaining one-metre distance to individuals not in one's household and avoiding crowded places. Scores ranged from 0 to 20, consisting of five items measuring the frequency of adherence to behaviour on a five-point Likert scale (0: Never; 1: Rarely; 2: Sometimes; 3: Often; 4: Always). A full list of the items may be found in the Supplementary Table S1. Internal consistency was acceptable for this scale, with a Cronbach's α of .62.

Adherence to HB
Adherence to WHO-advised HB, also implemented by Norwegian national guidelines, was measured by asking the participants to what degree they were able to comply to hygienic advice for the past month, such as covering mouth and nose with a tissue or elbows when coughing and sneezing, and avoidance of touching the eye, nose and mouth area. A list of the specific HBs may be found in the Supplementary Table S2. Scores ranged from 0 to 28, encompassing seven items measuring the frequency of adherence to advised HB on a five-point Likert scale (0: Never; 1: Rarely; 2: Sometimes; 3: Often; 4: Always). Internal consistency was acceptable for this scale, with a Cronbach's α of .67.

Pandemic-specific psychological and situational variables

Fear of being infected was measured with six items querying whether the participant was afraid of becoming infected by the coronavirus, whether they feared dying from the virus, recurrent thoughts about being infected by the virus, fear and tension experienced concerning one's own health when not maintaining disinfection activities, in addition to using a lot of time to thinking about one's health, and often imagining oneself becoming sick from the virus, as adapted from the Health Anxiety Inventory (HAI; Salkovskis et al., 2002) on a four-point Likert scale (0–3; 0 = Never, 3 = Nearly every day). Internal consistency was good for this scale, with a Cronbach's α of 0.79. Fear of infecting others was measured with an item querying whether the participant was afraid that they had would transmit the coronavirus to others.

Governmental trust was measured with a single item adapted for the COVID-19 pandemic, querying about the degree of trust placed in the judgements and decisions of governments concerning the handling of the pandemic. Beliefs about protocol efficacy and beliefs about collective mitigation behaviour are both measured with single items adapted for the COVID-19 pandemic, querying about beliefs concerning the efficacy of initiated viral mitigation protocols against the pandemic and beliefs about perceived usefulness of adhering when there may be peers that do not adhere to such protocols. These items were measured on a five-point Likert scale (1–5; 1 = Completely disagree, 5 = Completely agree).

Participants were further asked to report their extent of use of six information sources to obtain information concerning the coronavirus and pandemic protocols, including a) recognised (i.e. source-verified) newspapers, b) television channels, c) social media, d) forums, blogs, podcasts and other online outlets (excluding online newspapers), e) family and friends and f) active avoidance of information, measured on an eight-point Likert Scale (0–7; 1 = Never, 7 = Multiple times per hour).

Altruistic attitude was measured with a single item adapted for the pandemic, querying about personal importance given to helping society and peers. Risk perception was measured with three questions adapted for the COVID-19 pandemic developed by the National Institute for Public Health and Environment in the Netherlands (Rijksinstituut voor Volksgezondheid en Milieu, 2020). The questionnaire queried about the perceived seriousness of the risks associated with the COVID-19 virus for oneself, other individuals and society at large on a five-point Likert scale (1–5; 1 = No risk at all, 5 = Extreme risk).

Personality traits

Personality traits were measured with the Brief Version of the Big Five Personality Inventory (BFI-10; Rammstedt & John, 2007), consisting of 10 items scored on a five-point Likert scale (1–5).

Statistical analyses

The descriptive analyses of this research were reported using means and standard deviations. Differences between subgroups were calculated using *t*-tests and ANOVAs.

In evaluating the factors associated with adherence to SDPs and adherence to HB, two hierarchical regression analyses were performed: one with adherence to SDPs as the criterion variable and the second with adherence to HB as the criterion variable. In both hierarchical regression analyses, the first step of the model included the demographic characteristics (control variables), encompassing of age, gender, education and urban versus rural residency. The second step of these analyses included the hypothesised correlates, namely risk perception, altruism, governmental trust, personality traits (i.e. neuroticism, extroversion–introversion, openness, conscientiousness, agreeableness), beliefs about pandemic protocol efficacy and beliefs about collective mitigation behaviour. Additionally, the association between adherence with fear of being infected, fear of transmitting others and alcohol consumption was exploratively assessed in this step. The association between mandatory (i.e. rule-enforced) versus voluntary (i.e. self-chosen) social distancing was investigated with regard to adherence to SDPs.

To investigate the research questions concerning relationship between information sources and adherence, two hierarchical regressions were conducted using age, gender, education and urban versus rural residency as control variables, while examining the extent different sources of information were associated with adherence to SDPs and HB.

In all regression analyses, part (semi-partial) correlations were reported to investigate the relative importance and strength of all variables compared to one another. Part correlations represent the least biased estimates a predictive relationship (Dudgeon, 2016), revealing the correlation between the criterion variable and the aspect of the predictive variable that is unique when accounting for all other predictors. They are evaluated in accordance with the standards provided by Cohen (1988), with small effects >= .10, medium effects => .30 and large effect sizes => .50. The assumptions of hierarchical regression models were checked, and multicollinearity diagnostics were assessed consistent with common guidelines (VIF < 5 and Tolerance > .20; Hocking, 2013). Given the large sample of the study, significance was pre-defined at the .01 level. The statistical analyses were carried out in R Software (version 4.0.2). All elements of this study and statistical analyses adhere to its pre-registered protocol.

Sensitivity analyses

This study involved voluntary participation, therefore being susceptible to oversampling and undersampling of certain subgroups of participants. To deal with this issue and take the most conservative and accurate approach concerning inference to the adult population, all overrepresented and underrepresented subgroups were assigned appropriate post-stratification weights proportionate to the exact distribution of each subgroup in the Norwegian population. These were used in sensitivity analyses to assess the replicability of the results revealed by the main unadjusted sample. Only results replicating the main findings were deemed as sufficiently stable and robust to be discussed and presented in their association with the criterion variables. In this research, the sampled gender, age and education distribution deviated somewhat from the population parameters and were thus weighted and adjusted. Minor deviations further existed for ethnic distribution, geographic region, and the percentage

of healthcare and social workers, which were all weighted to represent their exact distributions and frequencies in the population. More weight was assigned to under-represented units and less weight to overrepresented units. Post-stratification weights were assigned using the R-package 'survey' (Version 4.0; Lumley 2020). To avoid that the matching of the distribution of one factor unmatches the distribution of other variables, an iterative algorithm (i.e. raking ratio estimation) was utilised. This iterative algorithm post-stratifies variables by turn, leading to a converging set of weights for each factor that matches the population distribution.

Results

Sample descriptives

The sample consisted of 4158 individuals. All 4158 participants (i.e. 100% of the sample) were included in all descriptive analyses. A total of 4143 (i.e. 99.64% of the participants) were included in the regression analyses, as two levels of the sex variable (i.e. intersex and transgender) contained too few participants to be included as sep-arate factors in the regression analyses (2 and 13 participants, respectively). The age of the respondents ranged from 18 to 86 with a mean age of 38.72 years (SD = 13.56). The sample was geographically representative of Norway, with the ratio of individuals from each region approximating the population distribution. Specifically, 64.01% of the sample (as compared to 58.32% in the population) were from Eastern Norway, 22.85% of the sample (versus 20.28% in the population) were from Western Norway, 9.64% of the sample (compared to 15.95% in the population) were from Mid-Norway and 3.42% of the sample (versus 5.45% in the population) were from Northern Norway. These minor deviations were further corrected for through assignment of post-stratification weights. Table 1 presents the full demographic characteristics of the participants. All demographic subgroups were given appropriate weights (see Methods section) to match their exact distribution in the population to be used in sensitivity analyses.

Out of the 4158 participants, 501 (12.05%) reported that they found adhering to pandemic protocols was pointless given that there are individuals (i.e. other societal members) who do not comply to these protocols. A total of 3370 (81.05%) participants reported that individual adherence to pandemic protocols was important regardless of whether societal peers adhered to such protocols, while the remaining 287 (6.90%) reported this as neither important nor unimportant.

Information obtainment concerning the virus and pandemic protocols

To obtain information concerning the pandemic in general and pandemic protocols, the average participant reported using newspapers multiple times per week to nearly every day of the week, whereas television was on average used between once to multiple times per week. Social media was on average used once per week to acquire information about the pandemic and its protocols, whereas participants reported rare use of forums, blogs, podcasts and other digital platforms. On average, the respondents reported acquiring information from friends and family concerning the pandemic and its protocols less than once per week, and reported seldom use of

Table 1. Demographic information of the participants in the present sample.

Subgroups	N (%)
Age group, years	
18–30	1453 (34.95%)
31–44	1380 (33.19%)
45–64	1117 (26.86%)
65+	208 (5.00%)
Sex	
Female	3318 (79.80%)
Male	825 (19.84%)
Intersex	2 (0.05%)
Transgender	13 (0.31%)
Self-identifies with biological sex	
Yes	4131 (99.35%)
No	27 (0.65%)
Civil status	
Single or divorced	1956 (47.04%)
Married or in a civil union	2202 (52.96%)
Education Level	
Did not complete Junior High School	6 (0.14%)
Completed Junior High School	152 (3.66%)
Completed High School	608 (14.62%)
Currently studying	674 (16.21%)
Completed University Degree	2718 (65.37%)
Currently Employed	
Employed	3147 (24.31%)
Unemployed	1011 (75.69%)

other information sources than those mentioned. In sum, sorted from the most to least frequent, the participants used 1) newspapers; 2) television and radio; 3) social media; 4) friends and family and 5) forums, blogs, podcast and other digital platforms, respectively. The percentage of use for each medium of information is presented in Supplementary Table S3.

With regard to perceived usefulness of different information mediums, a total of 2377 (57.17%) of the 4158 participants reported that recognised national, regional and local newspapers were the most helpful information platforms concerning obtainment of information about pandemic protocol and how to most effectively cope with the pandemic. About 28.11% reported that they preferred obtaining such information through TV and radio, and 5.46% through social media and digital platforms such forums, blogs and podcasts, while 1.64% preferred obtaining information through friends and family, and 7.62% preferred other sources. A total of 5.17% of the respondents expressed that information provided by health policy makers and government officials pertaining the pandemic had affected them negatively.

Differences in adherence levels among subgroups of adults

Differences in adherence levels across different subgroups in the adult population are provided in Table 2. The correlation between adherence to SDPs and HB recommendation was moderate ($r = .40$).

For adherence to SDPs, medium-to-large differences were found in adherence levels between those having children in comparison with those who did not (Cohen's $d = -.43$) and those in a relationship (i.e. married or in a civil union) in contrast to single

Table 2. Differences in adherence levels among subgroups in the general adult population.

	N	Mean (SD)	t or F	p	d
Adherence to social distancing protocols (SDPs)	4158	15.72 (2.86)			
Age group, years			$F = 79.44$	< .001	NA
18–30	1453	14.87 (2.77)			
31–44	1380	15.91 (2.70)			
45–64	1117	16.37 (2.92)			
65+	208	16.88 (2.72)			
Civil status			$t = -10.05$	< .001	− .31
Single or divorced	1956	15.25 (2.99)			
Married or in a civil union	2202	16.13 (2.68)			
Ethnicity			$t = 1.26$	.208	.08
Native	3887	15.73 (2.85)			
Non-native	271	15.21 (3.10)			
Employment status			$t = 8.41$	< .001	.30
Currently employed	3147	15.51 (2.81)			
Currently unemployed	1011	16.37 (2.92)			
Have children			$t = -13.72$	< .001	− .43
Yes	2016	16.33 (2.78)			
No	2142	15.14 (2.82)			
Adherence to hygienic behaviour (HB) recommendation	4158	18.88 (3.96)			
Age group, years			$F = 21.25$	< .001	NA
18–30	1453	18.32 (3.79)			
31–44	1380	18.87 (3.97)			
45–64	1117	19.55 (4.04)			
65+	208	19.19 (4.01)			
Civil status			$t = -6.47$	< .001	− .20
Single or divorced	1956	18.46 (4.01)			
Married or in a civil union	2202	19.25 (3.88)			
Ethnicity			$t = -1.37$	.170	− .09
Native	3887	18.85 (3.95)			
Non-native	271	19.20 (4.03)			
Employment status			$t = 1.32$	.186	.04
Currently employed	3147	18.83 (3.88)			
Currently unemployed	1011	19.02 (4.20)			
Have child(ren)			$t = -7.68$	< .001	− .24
Yes	2016	19.36 (3.91)			
No	2142	18.42 (3.96)			

or divorced individuals (Cohen's $d = -.31$), and employed compared to unemployed individuals (Cohen's $d = .30$). Among these subgroups, higher adherence levels were observed for individuals with children, individuals in a relationship and unemployed individuals. Significant differences were observed between different age groups with regard to adherence to SDPs, revealing a general trend that older aged individuals adhered more to such physical distancing protocols. Thus, the younger the individuals, the poorer was adherence to SDPs.

Table 3. Two hierarchical regression models presenting the predictors of adherence to social distancing protocols and adherence to hygiene-related advice during the COVID-19 pandemic respectively, along with the effect sizes of each predictor.

	Unstandardised regression coefficient, B	Standard Error (SE B)	p	Part correlation, r	Finding replicated in sensitivity analysis[d]
Predictors of social distancing protocols, N = 4143, R^2 = .20					
Step 1. R^2 = .07					
Age	.05	.00	<.001	.23	Yes
Sex[a]	−.72	.11	<.001	−.10	Yes
Education	.12	.05	.02	.04	Yes
Urban versus rural area[b]	−.32	.13	.01	−.04	Yes
Step 2. R^2 = .20					
Risk perception	.26	.02	<.001	.15	Yes
Altruistic attitude	1.04	.07	<.001	.20	Yes
Governmental trust	−.11	.05	.02	−.03	Yes
Openness	−.02	.02	.30	−.01	Yes
Conscientiousness	.14	.03	<.001	.08	Yes
Extroversion	−.08	.02	<.001	−.06	Yes
Agreeableness	.04	.03	.16	.02	Yes
Neuroticism	−.03	.02	.16	−.02	Yes
Beliefs about pandemic protocol efficacy	.22	.09	.01	.04	No[f]
Beliefs about collective mitigation behaviour	−.07	.04	.07	−.03	Yes
Voluntary social distancing[c]	.30	.10	< .01	.04	Yes
Fear of being infected	.09	.02	<.001	.06	Yes
Fear of transmitting others	−.20	.06	<.001	−.05	Yes
Increased alcohol consumption	−.17	.07	0.01	−.03	Yes
Predictors of adherence to WHO-advised hygienic behaviour, N = 4143, R^2 = .20					
Step 1. R^2 = .04					
Age	.05	.00	<.001	.15	Yes
Sex[a]	−1.41	.16	<.001	−.14	Yes
Education	−.17	.07	.02	−.04	Yes
Urban versus rural area[b]	.31	.18	.08	.03	Yes
Step 2. R^2 = .20					
Risk perception	.30	.03	<.001	0.13	Yes
Altruistic attitude	1.49	.10	<.001	0.21	Yes
Governmental Trust	−.01	.06	.85	−.00	Yes
Openness	.04	.03	.17	.02	Yes
Conscientiousness	.36	.04	<.001	.14	Yes
Extroversion	−.04	.03	.16	−.02	Yes
Agreeableness	.08	.04	.03	.03	Yes
Neuroticism	−.08	.03	< .01	−.04	No[f]
Beliefs about pandemic protocol efficacy	−.10	.12	.39	−.01	Yes
Beliefs about collective mitigation behaviour	−.06	.05	.29	−.02	Yes
Fear of being infected	.20	.03	<.001	.11	Yes
Fear of transmitting others	.22	.08	< .01	.04	No[f]
Increased alcohol consumption	−.37	.09	<.001	−.06	Yes

[a]Male (1), female (0); [b] resident of urban area (1), resident of rural area (0); [c] voluntarily socially distanced (1), mandatory socially distanced (0). [d] A sensitivity analysis (see Methods section) was conducted to examine the robustness of the results using post-stratification weights to adjust over and undersampled subgroups to their exact known distributions in the Norwegian population. [f] Finding no longer significant in the adjusted and weighted sample that accurately reflects population parameters.

Concerning HB recommendation, small-to-medium differences were found in adherence between those having children compared to those who did not (Cohen's $d = -.24$) and those in a relationship (i.e. married or in a civil union) in contrast to single or divorced individuals (Cohen's $d = -.20$), with those in a relationship as well as those having children revealing higher adherence to HB. Once again, a general trend was unveiled showing that older aged individuals report greater adherence to HBs, while younger individuals reported poorer adherence to HB. Unlike for adherence to SDPs, no differences were found between employed and unemployed individuals with regard to adherence to HB. There were no significant differences between natives and non-natives with regard to adherence to either SDPs or HB.

Factors associated with adherence to SDPs

The hierarchical regression model investigating the factors associated with adherence to SDPs is presented in Table 3, explaining 20.20% of the variance. With regard to demographic variables, the respondents' sex was a significant predictor of adherence to SDPs, with females being associated with higher levels of adherence to SDPs. Older aged individuals were associated with greater adherence to SDPs, with increases in age being related to increases in adherence. Living in an urban area was borderline significant ($p = .01$), with individuals residing in urban areas being associated with lower adherence to SDPs. Education was unrelated with adherence to SDPs.

Higher risk perception and altruistic attitude were associated with increases in adherence to SDPs. Governmental trust was unrelated to adherence to SDPs at the pre-specified 0.01 level. Out of the examined personality traits, conscientiousness and extroversion were significantly associated with adherence to SDPs, with extroverts being associated with lower adherence to SDPs and individuals reporting higher conscientious traits reporting greater adherence to SDPs. Beliefs about collective mitigation behaviour was unrelated to adherence to SDPs. Voluntary social distancing was associated with greater adherence to SDPs. Fear of being infected by the coronavirus was associated with increased adherence to SDPs. Fear of transmitting others was negatively associated with adherence, with increases in fear of transmitting others being associated with less adherence to SDPs. Increases in alcohol consumption were associated with lower adherence to SDPs. Beliefs in the efficacy of pandemic protocol were significantly associated with adherence to SDPs in the main sample, but were not robust enough to be replicated in the sensitivity analysis. All other predictors (i.e. 17 out of 18) were robust and stable, being replicated in this sensitivity analysis to yield indistinguishable results as the main findings.

The most important factors associated with adherence to SDPs were age (part correlation = .23), altruistic attitude (part correlation = .20), risk perception (part correlation = .15) and sex (part correlation = .10), respectively, all revealing small-to-medium effects. Smaller effects associated with adherence to SDPs further emerged for residential status in urban versus rural areas, conscientious and extroverted personality, in addition to fear of being infected, transmitting others and voluntary versus mandatory social distancing.

Factors associated with adherence to WHO-advised hygienic behaviour

The hierarchical regression model examining the factors associated with adherence to WHO-advised HB can be found in Table 3, with the model explaining 20.00% of the variance in adherence to HB. Females were associated with higher levels of adherence to HB than males, and increased age was further associated with greater adherence to HB. Education and residency in urban versus rural areas were both unrelated with adherence to HB. Both higher risk perception and altruistic attitude were associated with greater adherence to the WHO-recommended HBs. Governmental trust was unrelated to adherence to HB. With regard to personality traits, conscientiousness was significantly associated with adherence to HB, with more conscientious individuals reporting higher adherence to HB. Neither beliefs in the efficacy of pandemic protocols nor beliefs about collective mitigation behaviour were significantly related to adherence to HB. Increases in fear of being infected were significantly associated with higher adherence to HB. Increases in alcohol consumption were associated with lower adherence to HB. Neuroticism and fear of transmitting others were both significantly associated with adherence to HB in the main analysis, findings that were not stable enough to be replicated in the sensitivity analysis. All other predictors (i.e. 15 out of 17) were revealed as robust and were replicated in this sensitivity analysis to yield identical results as the main findings.

As presented in Table 3, the most substantial factors associated with adherence to the WHO and governmental-recommended HBs were altruistic attitudes (part correlation = .21), age (part correlation = .15), conscientiousness (part correlation = .14), sex (part correlation = .14), risk perception (part correlation = .13) and fear of being infected (part correlation = .11), respectively, all revealing small-to-medium effect sizes. Additionally, smaller effects associated with adherence to HB emerged for alcohol consumption.

Sources of information and adherence

To test whether various sources of obtaining information concerning the coronavirus and the pandemic were related to the adherence, two hierarchical regression models were conducted with adherence to HB and adherence to SDPs as the criterion variables, as presented in Table 4. Both of these analyses controlled for age, gender, education and residency in urban versus rural areas.

With regard to adherence to SDPs, the amount of time spent obtaining information about the virus and pandemic situation from recognised newspapers and television channels was significantly associated with adherence to SDPs. Increased time spent obtaining information from newspapers and television was associated with higher adherence to SDPs. Obtaining information from friends and family was associated with lower adherence to SDPs. Time spent obtaining information about the pandemic from social media, forums, blogs and other digital outlets, as well as actively avoiding information, was unrelated to adherence to SDPs. Gathering information from recognised newspapers (i.e. national, regional and local newspapers) was the medium with the highest association with adherence to SDPs (part correlation = .10), while obtaining information from television as well as friends and family revealed smaller effects.

Table 4. Two hierarchical regression models presenting different mediums used to obtain information about the pandemic and its association with adherence to social distancing protocols and adherence to hygiene-related advice. The strength of associations is revealed through part correlations.

	Unstandardised regression coefficient, B	Standard Error ($SE\ B$)	p	Part correlation, r	Finding replicated in sensitivity analysis[d]
Predictors of social distancing protocols, $N = 4143$, $R^2 = .09$					
Step 1. Control variables					
Age	.05	.00	<.001	.23	Yes
Sex[a]	−.72	.11	<.001	−.10	Yes
Education	.11	.05	.02	.04	Yes
Urban versus rural area[b]	−.32	.13	.01	−.04	Yes
Step 2. Time spent obtaining information on medium					
Newspapers	.22	.03	<.001	.10	Yes
TV	.08	.03	< .01	.04	Yes
Social Media	−.04	.03	.20	−.02	Yes
Forums, blogs, podcasts and other online outlets	−.03	.04	.51	−.01	Yes
Friends and family	−.2	.04	< .01	−.04	Yes
Active avoidance of information	.02	.04	0.58	.01	Yes
Predictors of adherence to hygiene-advice, $N = 4143$, $R^2 = .06$					
Step 1. Control variables					
Age	.05	.00	<.001	.15	Yes
Sex[a]	−1.41	.16	<.001	−.14	Yes
Education	−.16	.07	.02	−.04	Yes
Urban versus rural area[b]	.31	.18	.08	.03	Yes
Step 2. Time spent obtaining information on medium					
Newspapers	.23	.04	<.001	.08	Yes
TV	.20	.04	<.001	.07	Yes
Social Media	−.01	.04	.77	−.01	Yes
Forums, blogs, podcasts and other online outlets	.05	.06	.35	.01	Yes
Friends and family	.01	.06	.85	.01	Yes
Active avoidance of information	.05	.05	.32	.02	Yes

[a] Male (1), female (0); [b] resident of urban area (1), resident of rural area (0). [d] A sensitivity analysis (see Methods section) was conducted to examine the robustness of the results using post-stratification weights to adjust over and undersampled subgroups to their exact known distributions in the Norwegian population.

Concerning adherence to HB, only obtaining information about the pandemic and the coronavirus from recognised newspapers and television channels was significantly associated with adherence to HB, with increases in time spent

gathering information from both newspapers and television being associated with greater adherence to WHO-recommended HBs. Actively avoiding information, using friends and family as sources of information, and using digital outlets such as social media as well as forums, blogs or podcasts were unrelated to adherence to HB.

Discussion

This article investigated the factors associated with adherence to SDPs and adherence to WHO-advised HB. In addition to filling important gaps identified in the literature, this research took a multifactorial approach in assessing the relative importance of each factor while controlling for all other variables, thus assessing the unique contribution of each factor to adherence.

Factors associated with adherence to SDPs

Among the factors associated with adherence to SDPs, the age of the participants revealed its substantial importance, with older individuals being associated with greater adherence to SDPs. Females further revealed greater adherence to SDPs than males in this sample as found in an Italian sample during the present pandemic (e.g. Carlucci et al., 2020). These findings are further consistent with a study on adherence and demographic variables in an American sample (Park et al., 2020), and identify in-risk demographic groups with regard to the lowered adherence to SDPs. Moreover, similar to this study, Park et al. (2020) found that younger individuals, particularly individuals in the age group of 18–30, reported the lowest adherence rates among all age groups, further highlighting the vulnerability of this age group breaking pandemic protocol. One possible reason that could underlie the greater adherence to SDPs among older aged adults may include their increased vulnerability to the virus. Education levels were unrelated to adherence to SDPs. Individuals' residing in urban area as opposed to those in rural areas were associated with lower adherence to SDPs. As multiple SDPs concern the avoidance of crowded places and the maintenance of distance between individuals outside one's household, this finding may possibly be explained by the fact urban areas are more densely populated than rural areas, making it more difficult to fully adhere to such protocols. These findings highlight the importance of government officials directing additional public health messaging efforts towards groups of individuals with experiencing greater difficulties with adherence to SDPs, including younger individuals (i.e. those in the age group of 18–30), males and individuals residing in urban areas. One potentially utile way to foster behaviour change in such in-risk groups towards more favourable adherence to behaviour may be through the use of nudging. A recent paper by Kim et al. (2020) during the present pandemic found that nudging proved beneficial in reducing stock-piling intention through manipulations of threat perception. Investigations of whether such manipulations of threat perceptions through nudging may further influence adherence to pandemic protocols are warranted and would greatly benefit the pandemic literature.

Following individuals' age, this study discovered that the two most important factors associated with adherence to SDPs were altruistic attitude and risk perception, thus advancing the literature by filling two important gaps (e.g. Asmundson & Taylor, 2020; Bansal et al., 2020; Brooks et al., 2020; Holmes et al., 2020). Increased altruistic attitude was associated with greater adherence to SDPs, suggesting that appeals to altruism may be a beneficial strategy in increasing adherence to SDPs. Health policy makers may reinforce altruistic behaviour by reminding the citizens that adherence aids in protecting community members in addition to oneself, one's family and friends. Furthermore, public health officials may enhance altruism and helping behaviour by presenting such behaviours as a norm in the current pandemic situation, as presentation of behaviours as normative has previously been revealed to enhance helping behaviour through subsequent reinforcement of norms by peers in society, as well as by providing cues for how to behave in a certain situation (e.g. Bendapudi et al., 1996; Gouldner, 1960). Possible utile ways of to introduce novel normative behaviours may involve the use of posters in public spheres (e.g. poster of individuals wearing masks placed at subway stations) or government-sponsored advertisements modelling beneficial behaviours with regard to SDPs (e.g. with of individual maintaining a safe distance from others in public spheres).

Additionally, this study revealed that adults with lower estimations of the individual, collective and societal risks concerning the coronavirus reported less adherence to SDPs. This finding is consistent with the protection motivation theory (Rogers, 1975), which proposes that high level of risk perception influences adaptive risk behaviour based on a desire to protect oneself against health threats. A previous study on Lyme disease (Brewer et al., 2004) found that individuals were more likely to engage in adaptive risk behaviour (e.g. adhering to vaccination recommendations) when risk perception was high as compared to low. This highlights the importance for health policy makers to divert efforts towards increasing knowledge about the risks related to the coronavirus for the individual, others and the societal risk as a whole, as this may prove beneficial in increasing adherence to SDPs. However, to successfully increase adherence rather than trigger avoidance or reactance, government officials are advised to combine health messages concerning the risks of the virus with the so-called high-efficacy messages communicating both the efficacy of the advised protocol and suggesting strategies that promote self-efficacy by highlighting the individuals' ability to adhere such protocols, a strategy previously related to beneficial behaviour change (e.g. Witte & Allen, 2000).

Among personality traits, only conscientious and extroversion were of importance in association with adherence to SDPs. Extroverted individuals revealed reduced adherence rates, whereas conscientious individuals were associated with greater adherence to SDPs. Both these findings adhere to the nature of extroversion and conscientiousness, where it may appear that extroverts reveal reduced adherence to SDPs due to problems with social distancing in relation to their needs for social proximity, whereas conscientious individuals are associated with greater adherence perhaps due to thoroughness and greater concerns with details. In the light of this finding, a possibly utile way to enhance adherence may involve optimisation of health messaging to increase awareness among extroverted individuals with regard to

increased susceptibility to break pandemic protocol. A previous study has suggested the important role of health education and awareness with regard to precautionary behaviour (Johnson & Hariharan, 2017). Moreover, as previously described, the use of nudging techniques may provide utile in this matter, which future studies are urged to investigate empirically in pandemic settings.

Governmental trust, beliefs about collective mitigation behaviour and agreeableness were unrelated to adherence to SDPs at the 0.01 level. The Trust and Confidence Model (Siegrist et al., 2003) theorises the importance of trust with regard to acceptance of recommended protocols in risk management, emphasising that high trust is important for such acceptance. However, when controlling for all other included variables, this study did not find any strong association between governmental trust and adherence to SDPs. A possible explanation of this finding may include the small magnitude of association between governmental trust and adherence to SDPs when taking into account and controlling for all other variables in the present analyses. However, another possible explanation may be that governmental trust is more strongly tied to adherence to behaviour across time rather than cross-sectionally. A study by Wright et al. (2021) lends support to this interpretation, finding small associations between self-reported adherence to pandemic protocols and governmental trust cross-sectionally when exploring between-subject variation, while finding stronger associations across time between governmental trust and adherence. Thus, these differences may also be due to different study designs, in addition to the fact that the adherence measures vary across countries due to differences between mitigation strategies and adherence to guidelines.

Additionally, individuals with greater fear of being infected by the coronavirus reported increased adherence to SDPs. This finding is consistent with protection motivation theory (Rogers, 1975), emphasising increases in adaptive danger control behaviour based on a desire to protect oneself against health threats. This finding further accentuates the potential benefits of appropriate fear appeal in public health messaging to increase adherence to SDPs, with appropriate referring to simultaneous presentations of realistic and suitable strategies for the individual to avert themselves from such dangers (Witte & Allen, 2000). With regard to fear of transmitting others, this study found this variable to be inversely related with adherence to SDPs. A possible explanation for this finding may be that individuals fear transmitting others subsequent to breaking physical distancing protocols, rather than the other way around which would indicate that an increased fear of transmitting others may result in lower adherence to SDPs, seeming less plausible. The directional relations of such associations are unclear and should be investigated in forthcoming studies.

Moreover, this investigation found that increases in alcohol consumption are associated with lower adherence to SDPs. This finding is consistent with the literature linking alcohol consumption to reduced self-regulatory abilities and inhibitory control (e.g. De Wit, 2009; Suffoletto et al., 2020). The finding is further in accordance with a recent study by Suffoletto et al. (2020), revealing associations between alcohol use and suboptimal adherence in a population of teenagers and young adults. This study extends the literature by empirically unveiling the association between alcohol consumption and adherence to pandemic protocols in a general adult population.

Finally, this study filled an important gap concerning whether greater adherence is associated with voluntary (i.e. autonomous or self-chosen) social distancing versus mandatory (i.e. instructed or rule-enforced) social distancing (e.g. Brooks et al., 2020). In contrast to the first weeks following implementation of pandemic protocols (i.e. March) where those who were enforced to socially distanced revealed greater adherence (i.e. Ebrahimi et al., 2020), this study investigating adherence to three months following the implementation of such protocols (i.e. June) found that those who voluntary socially distanced themselves revealed greater adherence to SDPs. This pattern of findings seems to suggest that enforced social distancing is associated with most beneficial adherence rates during the early stages of pandemic protocol initiation, while prompting voluntary social distancing seems to be associated with greater adherence after a certain period of time involving pandemic protocols. This finding is consistent with the theory of intrinsic motivation and self-determination (Deci & Ryan, 1985), highlighting that with regard to sustained behaviour change, external strategies and motivators have reduced efficiency in the long term. The finding is further consistent with investigations of voluntary versus forced behaviour in environmental protection behaviour (e.g. Bai & Bai, 2020), identifying that voluntary behaviour based on personal norms and choice has a greater impact on environmental protection behaviour than mandated behaviour. Consequently, the presentation of behaviours as norms combined with nudging techniques may prove useful as an additional technique next to rule-based strategies in increasing adherence. However, the cross-sectional nature of this study and the fact that minor deviations existed between the SDPs in practice during the early stages of the pandemic (i.e. Ebrahimi et al., 2020; March to April) and the time period of this study (June to July), suggests that these findings must be interpreted with caution.

Factors associated with adherence to WHO-advised HB

The most substantial variables, associated with adherence to WHO-advised HB, were altruistic attitude, age, conscientiousness, sex, risk perception and fear of being infected by the coronavirus, respectively, highlighting factors that may be of the highest utility for modification and awareness strategies aimed at increasing adherence to HB. In common with adherence to SDPs, increases in altruism, conscientious traits, risk perception and fear of being infected were associated with greater adherence to HB. These findings fill important gaps in the literature (e.g. Asmundson & Taylor, 2020; Bansal et al., 2020; Brooks et al., 2020; Holmes et al., 2020), describing how appeals to altruism through the aforementioned emphasis on novel normative behaviours (e.g. Bendapudi et al., 1996; Gouldner, 1960), appropriate to the pandemic, and appropriate risk-messaging promoting self-efficacy (i.e. Witte & Allen, 2000) may be useful strategies in increasing adherence to HB. Furthermore, it accentuates the potential utility of appropriate fear appeal in health messaging, as previously discussed in this article. Additionally, the present findings reveal that greater adherence to HB may be achieved by informing individuals about the personal risk associated with contracting the virus, as consistent with protection motivation theory by Rogers (1975).

As with adherence to SDPs, increases in alcohol consumption were associated with lower adherence to HB. Once again, this finding is in line with a recent study linking

alcohol use to lower adherence levels in teenagers (Suffoletto et al., 2020) and further consisting with studies finding alcohol use predicts lower inhibitory control and poorer self-regulation (e.g. De Wit, 2009). Also common with adherence to SDPs, female gender and increased age were associated with greater adherence to HB. Furthermore, education level was unrelated to adherence to HB. These demographic findings are consistent with a study investigating adherence and demography related to the present pandemic (i.e. Park et al., 2020). Strategies with the potential utility of increasing awareness among these individuals (i.e. males and younger individuals) concerning their vulnerability towards adherence difficulties have been previously elaborated in detail, including appropriate risk messaging providing information concerning strategies aiding adherence as well as the use of nudging techniques, the impact of which should be investigated in forthcoming studies.

In contrast to adherence to SDPs, urban or rural residency was not related to adherence to HB. This finding seems to be in line with the aforementioned interpretation that differential adherence rates between individual's residing in rural and urban areas may simply be related to contextual and environmental factors (i.e. spatial density), rather than a divergent willingness to adhere. Moreover, unlike with adherence to SDPs, fear of transmitting others (i.e. unrelated and not replicated in sensitivity analysis) and extroverted personality were not associated with adherence to HB. These findings seem reasonable, as extroversion and the fear of transmitting others both depend on interpersonal contexts, with SDPs being more strongly connected to such contexts than HBs (e.g. maintaining distance from other individuals requires an interpersonal context while hand washing does not necessitate such a context).

Sources of information and adherence

For both adherence to SDPs and adherence to the WHO-advised HB, the most substantial information platforms associated with increases in adherence was through recognised national, regional and local newspapers, as well as recognised television channels. Obtaining information about the pandemic and pandemic protocols from newspapers and television was associated with greater adherence, providing government officials with timely information about information platforms through which they may effectively inform the public about the pandemic and its protocols. Obtaining information from friends and family was associated with lower adherence to SDPs, but was unrelated adherence to HB. A possible interpretation of this finding may be that that myths and alternative information that could be unfavourable towards adherence levels may more easily develop in smaller assemblies of individuals, which family and friends typically include. Furthermore, social media and digital outlets such as forums and blogs, in addition to active avoidance of information, were unrelated to either type of adherence. In the era of fake news, this finding seems to highlight a potentially greater confidence placed in officially recognised information platforms to obtain news about the pandemic, rather than platforms subject to less formal control (e.g. digital sources such as social media, forums and blogs as well as societal peers), which have previously been found to contain large extents of misinformation with regard to information related to public health issues (Waszak et al., 2018). In this context, a possibly utile strategy for health policy makers

that may increase adherence could involve nudging individuals towards trusted information sources, which further provides additional aid against the impact of misinformation (e.g. Wiederhold, 2020). Aside from the relationship between information sources and adherence levels covered in this investigation, it would be of benefit for the pandemic literature for forthcoming studies to examine the association between the use of different information platforms and psychological symptoms.

Other notable findings

Among subgroups in the adult population, males and younger individuals include already mentioned subgroups at greater risk of adhering to both SDPs and adherence to HB recommendations. As discussed, urban area residency is further another risk factor for reduced adherence to SDPs, but not for adherence to HB. Additionally, notable differences were found between individuals in a relationship in comparison with single individuals, and those with and without children. Adults with children and adults in relationships reported substantially higher levels of adherence to SDPs and HB, revealing single individuals and those without children as groups with greater risk of having adherence difficulties. These findings are consistent with protection motivation theory, which has been found to expand beyond self-protection to encompass the protection of others including one's children (e.g. Westcott et al., 2017). It may thus seem that individuals that are in a relationship and have children report greater adherence as they have a double protection motivation, being both motivated to protect themselves and their children and/or partners from the virus. Moreover, no differences existed between natives and non-natives with regard to any measure of adherence. At the start of the pandemic, government officials were concerned with not efficiently being able to reach non-native populations due to linguistic barriers, thus increasing their efforts to translate crucial information concerning pandemic protocols for non-native populations to their native languages. These efforts seem to have been of utility.

Finally, although no differences were revealed between employed and unemployed individuals with regard to adherence to HB, unemployed individuals revealed greater adherence to SDPs. This finding seems reasonable, as it is possible that employed individuals are more prone to breaking SDPs (e.g. keeping one-metre distance from peers) through interactions with colleagues or increased chances of interacting with other societal members through their commute to work.

Strengths and limitations

This pre-registered study conducted an investigation of a multitude of demographic, situational, cognitive, affective, behavioural, and personality-based variables and their association to adherence to two vital strategies in the battle against viral mitigation, namely adherence to SDPs and adherence to HBs. Thus, this research fills several important gaps identified in the adherence literature. Another strength of this investigation involves the multifactorial investigation of these called for predictors. In contrast to unidimensional investigations that involve few examined components, multifactorial approaches may unveil more accurate representations of the association between

variables, as they control for a greater extent of relevant variables. Consequently, they provide more robust information concerning central factors associated with each phenomenon, as all factors compete for the same pool of variance, allowing for more precise understanding of adherence in pandemic settings. The findings thus reveal the most important variables associated with adherence. Another strength of the study is the conduction of measurement during a period where government-imposed viral mitigation protocols were identical and where no novel information was given concerning the modification of such strategies, thus eliminating expectation effects. This study further matched the proportion of the observed subgroups to reflect the exact population distributions to control for the robustness and stability of the original findings. Of note, the sensitivity analyses replicated nearly all (i.e. 52 out of 55 investigated relationships) the main findings, a substantial strength of this study.

This study also has several noteworthy limitations, including its cross-sectional design that precludes any causal conclusions about the directions of the established associations. Future studies are advised to attempt to examine the highlighted associations using multiple time points, which may be of increased benefit in the clarification of directions given temporal precedence in such data. Another limitation of this investigation involves the use of self-report questionnaires in measuring adherence, which are more prone to social desirability and less accurate than objective measures of adherence. Additionally, this study did not investigate the extent to which the participants felt they understood the mitigation protocols implemented, which is of relevance regarding adherence. Indeed, studies have found that participants may find the rules confusing and hard to follow (e.g. Williams et al., 2020a, 2020b). Consequently, lack of measuring comprehension of mitigation protocols presents another limitation of this study. Additionally, other covariates that may be of importance regarding adherence to behaviour, including attitudinal and political factors, were not measured in this study. Future studies should further investigate the relationship between other motivational factors than those related to illness protection (i.e. minimisation of transmission risks). Moreover, the dichotomisation of employment status provides little detailed information concerning divergent workgroups and their association with adherence to behaviour, serving both as a limitation for the present study and revealing gaps in the literature for forthcoming studies.

Future directions

The pandemic literature would highly benefit from forthcoming studies investigating adherence in other populations, such as adolescents and children. Investigations of time trends and changes in adherence over time are further of importance, revealing important information of how adherence may change during the course of a pandemic while attempting to identify what underlies such changes. Finally, studies using a complex systems approach may be of high utility, with the ability to discover specific mechanisms associated with specific adherence to behaviours.

Concluding remarks

In this multifactorial study, several important factors associated with favourable and suboptimal adherence levels were identified. Greater adherence to both SDPs and

WHO-recommended HB was associated with greater altruistic attitudes, highlighting that formation of altruistic norms and its reinforcement, in addition to appealing to existent altruistic attitudes, may prove utile in increasing adherence to SDPs and HB. Furthermore, increased risk perception was associated with greater adherence to SDPs and HB, implying the possible that a possible route for fostering adherence levels may involve presentation of the risks connected to contracting the coronavirus for the individual, peers and society along with messages that foster a sense of self-efficacy to adhere to such protocols. Voluntary (i.e. self-chosen) social distancing as opposed to mandatory (i.e. instructed or rule-enforced) social distancing was associated with greater adherence to both SDPs and HB. Moreover, the positive association between fear of contracting the virus and greater adherence to SDPs and HB suggests that appropriate fear appeal concerning the health-related dangers of contracting the virus as an individual may be a utile strategy in health messaging. The findings of this study further reveal that dissemination of such information may be most impactful primarily through the use of national newspapers, and thereafter televisions, with the obtainment of information through the former platform being associated with the highest adherence to SDPs and HB. Among in-risk demographic subgroups, the findings highlight that it may be beneficial to direct additional dissemination efforts towards informing males, single and younger individuals about the importance of adherence, as these demographic groups were generally at greater risk of reporting adherence difficulties to both SDPs and HB. Employed individuals were further at risk of having greater difficulties with SDPs. With regard to personality variables, extroverted individuals were more inclined towards lower adherence to SDPs. Finally, increases in alcohol consumption were associated with decreases in adherence to both SDPs and HB. These findings reveal several substantial factors associated with adherence to concurrently implemented mitigation protocols, which forthcoming studies may be based upon in the pursuit of identifying causal mechanisms related to adherence.

Disclosure statement

ORCID

Asle Hoffart http://orcid.org/0000-0002-8042-8570

Data availability statement

Our received ethical approval granted by the Regional Committees for Medical and Health Research Ethics in Norway does not allow us to submit the data to a Public repository. In line with the ethics approval, the data are to be kept at a secure server only accessible by the authors at the University of Oslo. Access to the data can be granted from the first author following ethical approval of suggested project plan for the use of data from NSD and REK. Such requests are to be sent to Omid V. Ebrahimi, e-mail: omideb@uio.no.

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