



Special section paper

Reasoned action approach and compliance with recommended behaviours to prevent the transmission of the SARS-CoV-2 virus in the UK

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Objectives. To examine associations between demographics, people's beliefs, and compliance with behaviours recommended by the UK government to prevent the transmission of the SARS-CoV-2 virus that causes COVID-19.

Design. A two-wave online survey conducted one week apart during the national lockdown (April, 2020).

Measures. A sample of 477 UK residents completed baseline measures from the reasoned action approach (experiential attitudes, instrumental attitudes, injunctive norms, descriptive norms, capacity, autonomy, and intention) and perceived susceptibility for each of the following recommended behaviours: limiting leaving home, keeping at least 2 m away from other people when outside and when inside shops, not visiting or meeting friends or other family members, and washing hands when returning home. Self-reported compliance with each of the recommended behaviours was assessed one week later.

Results. Rates of full compliance with the recommended behaviours ranged from 31% (keeping at least 2 m away from other people when inside shops) to 68% (not visiting or meeting friends or other family members). Capacity was a significant predictor of compliance with each of the five recommended behaviours. Increasing age and intentions were also predictive of compliance with three of the behaviours.

Conclusions. Interventions to increase compliance with the recommended behaviours to prevent the transmission of the SARS-CoV-2 virus, especially those relating to social distancing, need to bolster people's intentions and perceptions of capacity. This may be achieved through media-based information campaigns as well as environmental changes to make compliance with such measures easier. Such interventions should particularly target younger adults.

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Statement of contribution

What is already known on this subject?

- Little is known about the psychosocial determinants of compliance with recommended behaviours to prevent the transmission of the SARS-CoV-2 virus and thereby reduce the spread of COVID-19.
- People's beliefs about the recommended behaviours, as outlined in social cognition models of health behaviour such as the reasoned action approach, represent key modifiable determinants that can be targeted in interventions.

What does this study add?

- Self-reported full compliance with some of the recommended preventive behaviours, especially social distancing, was low.
- Increased compliance was associated with stronger intentions and perceptions of capacity as well as with increasing age.
- Interventions should seek to bolster people's intentions and perceptions of capacity, and target younger adults.

Background

The coronavirus (COVID-19) outbreak was identified as a public health emergency by the World Health Organization on 30 January 2020 and subsequently declared a global pandemic on 11 March 2020. By the end of April 2020, there had been over 3 million confirmed cases and over 200,000 deaths from COVID-19 worldwide (WHO, 2020). In response to the pandemic, governments around the world introduced various measures in an attempt to prevent the transmission of the SARS-CoV-2 virus that causes the disease COVID-19. In the UK, the government announced a nationwide lockdown on 23 March 2020, which was extended by a further 3 weeks on 16 April 2020. As part of the lockdown, the government advised people to 'stay at home' and provided four specific behavioural recommendations to: (1) only leave home for food, health reasons or work (if you are unable to work from home), (2) stay at least 2 m away from other people at all times when away from home, (3) not to meet other family members and friends that you do not live with, and (4) wash your hands as soon as returning home (GOV.UK, 2020a). For this advice to be effective in reducing the transmission of the SARS-CoV-2 virus, and in turn help to reduce the number of COVID-19 cases and deaths, it is important that there are high levels of compliance with these recommended behaviours. Early government modelling of the potential impact of behavioural and social interventions to reduce the spread of the virus in the UK assumed compliance rates of at least 50% (GOV.UK, 2020b).

In order to increase compliance with advice to engage in behaviours to prevent the transmission of the SARS-CoV-2 virus, information is needed on who does or does not comply with the recommended behaviours as well as the modifiable psychosocial factors that are associated with compliance and non-compliance. Research has identified a range of demographic variables (e.g. age, gender, ethnicity, and deprivation) that are consistently associated with health behaviours including cancer screening (Sarma, Silver, Kobrin, Marcus, & Ferrer, 2019), physical activity (Rhodes, Janssen, Bredin, Warburton, & Bauman, 2019), and smoking (West, 2019). In previous pandemics, young people and

males have been found to be less likely to comply with recommended preventive behaviours (Leung *et al.*, 2003; Tang & Wong, 2003). However, while this knowledge helps to identify who should be targeted in interventions, it does not explain why certain people do or not comply with behavioural advice or help to guide what to target in interventions. Moreover, research indicates that the effects of demographics on health behaviour may be mediated by people's beliefs about the behaviour (e.g. Orbell, Szczepura, Weller, Gumber, & Hagger, 2017).

The present study used the reasoned action approach (RAA; Fishbein & Ajzen, 2010), an extension of the widely applied theory of planned behaviour (TPB; Ajzen, 1991), as the theoretical framework for examining the extent to which people's beliefs about the recommended preventive behaviours are associated with compliance. The RAA proposes that the most proximal determinant of behaviour is a person's intention which, in turn, is determined by the extent to which they believe that engaging in the behaviour would be pleasant (i.e. experiential attitude), that it would be beneficial (i.e. instrumental attitude), that others would approve of them engaging in the behaviour (i.e. injunctive norm), that others engage in the behaviour (i.e. descriptive norm), that they are confident that they could engage in the behaviour (i.e. capacity), and that they have control over whether or not to engage in the behaviour (i.e. autonomy). The RAA has a strong evidence base with a meta-analysis estimating that it explains 59% and 31% of the variance in health-related intentions and behaviour, respectively (McEachan *et al.*, 2016). To date, the RAA has not been applied to explain compliance with recommended behaviours in response to the COVID-19 pandemic, although the TPB has been applied in relation to previous pandemics to explain intentions to self-isolate (Zhang, Wang, Zhu, & Wang, 2020), intentions (Agarwal, 2014; Yang, 2015) and uptake (Liao, Cowling, Lam, & Fielding, 2011) of the H1N1 (swine flu) vaccine and SARS-preventive behaviours (Cheng & Ng, 2006). In addition to the variables outlined in the RAA, many models of health behaviour include perceived susceptibility as an important determinant of behaviour (Conner & Norman, 2015). For example, in the health action process approach (Schwarzer & Luszczynska, 2015), risk perception (i.e. perceived susceptibility) is considered to be an essential prerequisite for motivation to take action in response to a health threat, although it is viewed as a distal determinant of intention and behaviour. While research has indicated that perceived susceptibility typically has a weak correlation with health behaviour (Milne, Sheeran, & Orbell, 2000), it has been found to be associated with increased compliance with recommended preventive behaviours in previous pandemics (Leung *et al.*, 2003; Tang & Wong, 2003). Research in South Korea during the early stages of the current pandemic found perceived susceptibility to being infected with COVID-19 to be significantly associated with the wearing of facial masks, but not other preventive behaviours (Lee & You, 2020).

The present study

The present study examined compliance with behaviours recommended by the UK government to prevent transmission of the SARS-CoV-2 virus in a sample of UK residents reported over a one-week period during the national lockdown. In particular, the study assessed rates of compliance with each of the recommended behaviours and whether compliance was associated with demographic variables (i.e. age, sex, ethnicity, and

deprivation), perceived susceptibility, and people's beliefs as outlined in the RAA. The study used hierarchical logistic regression analyses to identify the key predictors of each of the recommended behaviours and to identify whether the RAA explained additional variance in compliance over and above the influence of the demographic variables and perceived susceptibility.¹ The baseline survey was conducted on 23 April 2020 with a follow-up assessment of behaviour one week later. This therefore represented the second week of the second period of the lockdown measures in the UK. On the date of the baseline survey, there had been a total of 133,499 laboratory-confirmed COVID-19 cases in the UK. In addition, 9,003 deaths involving COVID-19 were registered in the UK in the week ending 24 April 2020, making a total of 29,907 deaths since the start of the pandemic (Office for National Statistics, 2020).

Methods

Participants and procedure

A sample of UK adult residents was recruited via Prolific, a participant recruitment company, to complete an online survey hosted on Qualtrics. Prolific uses quota sampling to recruit samples from their pool of research participants that are broadly representative of the UK adult population in terms of age, sex, and ethnicity.² Before accessing the baseline survey, participants were presented with an online information sheet and consent form. Participants were required to click on a series of statements to indicate that they had read the information sheet and understood what the study would involve. They then had to click on a final statement to indicate that they consented to take part in the study. Participants were unable to access the baseline survey without indicating informed consent. Ethical approval for the study was obtained from a University Research Ethics Committee (ref. 034149).

In total, 500 participants completed the baseline survey on 23 April 2020, of whom 480 (96%) completed a follow-up survey one week later. Three participants failed to provide postcode information to calculate deprivation scores, which resulted in a final sample of 477 participants for analysis. See Table 1 for a summary of the sample characteristics of the final sample. Attrition analyses revealed that those who did not complete all of the measures ($N = 23$) were younger ($M = 34.52$, $SD = 15.54$ vs. $M = 24.22$, $SD = 15.20$, $t(498) = 3.60$, $p < .001$) and had lower capacity scores for not visiting family and friends ($M = 6.13$, $SD = 1.55$ vs $M = 6.56$, $SD = 0.97$, $t(498) = 2.01$, $p = .045$) than those who completed all of the measures ($N = 477$). All other comparisons on the baseline measures were non-significant.

¹ The study also assessed associations between the demographic variables, perceived susceptibility, RAA variables, and intentions to engage in each of the recommended preventive behaviours. These analyses are presented in File S1. The RAA explained an additional 29–38% of the variance in intentions to engage in the recommended behaviours. Capacity was a significant predictor of intentions to engage in all five of the recommended behaviours. Significant effects were also found for cognitive attitudes (four behaviours), injunctive norms (three behaviours), autonomy (two behaviours), and descriptive norms (one behaviour). Perceived susceptibility was a significant predictor of intention in only one, and demographic variables in none, of the final regression models.

² The baseline sample ($N = 500$) was compared against 2011 UK census data in terms of age, sex, and ethnicity profiles (see File S2). The recruited sample was very similar to the age and sex profile of the adult UK population, and was broadly representative in terms of ethnicity, although slightly fewer 'White' participants were recruited than in the 2011 UK census data.

Table 1. Sample characteristics (N = 477)

	M	SD	N	%
Age	46.22	15.20		
Sex				
Male			234	49.1
Female			243	50.9
Ethnicity				
White			393	82.4
Asian/Asian British			38	8.0
Black/African/Caribbean/Black British			22	4.6
Mixed/Multiple Ethnic Groups			13	2.7
Other			11	2.3
IMD Decile	5.70	2.71		

Measures

In addition to the demographic information provided by Prolific (i.e. age, sex, and ethnicity), participants were asked to provide their postcode which was then linked to Index of Multiple Deprivation (IMD) scores using lookup tables.³ IMD scores represent area-level measures of relative deprivation based on income, employment, health and disability, education, skills and training, crime, access to services, housing, and the living environment. Decile scores are coded such that lower scores represent higher levels of relative deprivation.

The baseline survey also contained measures of beliefs about the following recommended behaviours: only leave home for food shopping, exercise, medical needs, or travelling to work (if you cannot work from home); keep at least 2 m (6 feet) away from other people when outside away from home; keep at least 2 m (6 feet) away from other people when inside shops; not visit or meet friends or other family members that you don't live with; and wash your hands as soon as you return home.⁴ For each of the recommended behaviours, participants completed items with 7-point response scales to assess *experiential attitudes* ('To what extent would you doing each of the behaviours listed below over the next week be unpleasant or pleasant? Unpleasant–Pleasant'), *instrumental attitudes* ('To what extent would you doing each of the behaviours listed below over the next week be harmful or beneficial? Harmful–Beneficial'), *injunctive norms* ('To what extent would other people disapprove or approve of you doing each of the behaviours listed below over the next week? Would disapprove–Would approve'), *descriptive norms* ('To what extent do you think other people will do each of the behaviours listed below over the next week? None–All'), *capacity* ('How confident are you that you could do each of the behaviours listed below over the next week? Not at all confident–Very confident'), *autonomy* ('How much control do you have over whether or

³ Lookup tables linking postcode data with Index of Multiple Deprivation scores were used for England (<http://imd-by-postcode.opendatacommunities.org/imd/2019>), Scotland (<https://www.gov.scot/publications/scottish-index-of-multiple-deprivation-2020v2-postcode-look-up/>), Wales (<https://statswales.gov.wales/Catalogue/Community-Safety-and-Social-Inclusion/Welsh-Index-of-Multiple-Deprivation>), and Northern Ireland (<https://deprivation.nisra.gov.uk/>).

⁴ Three additional preventive behaviours were included in the study, but not reported here: limit yourself to one session of exercise (e.g. walk, run, and cycle) close to home each day; limit the number of times you leave home each week to shop for food; and wear a mask when away from home. The results for these behaviours are presented in File S3.

not you do each of the behaviours listed below over the next week? No control–Complete control’), and *intention* (‘Do you intend to do each of the behaviours listed below over the next week? Definitely don’t–Definitely do’). Participants also rated their *perceived susceptibility* of getting coronavirus if they did not do each of the recommended behaviours (‘If you don’t do each of these behaviours, how likely is it that you would get coronavirus? Not at all likely–Very likely’).

One week later, participants were asked to report on how often they had engaged in each of the recommended behaviours over the previous week (‘To what extent have you done each of the behaviours listed below over the past week? Not at all–All the time’). A second question asked participants to also report how often they had failed to comply with each of the recommended behaviours over the previous week: left home for reasons other than food shopping, exercise, medical needs, or travelling to work (if you cannot work from home); been within 2 m (6 feet) of other people when outside away from home; been within 2 m (6 feet) of other people when inside shops; visited or met friends or other family members that you don’t live with; and not washed your hands as soon as you returned home. Copies of the measures included in the surveys at baseline and one-week follow-up are presented in File S4.

Data analysis

First, descriptive statistics were conducted for the measures of demographics, RAA variables, perceived susceptibility, and rates of compliance with each of the recommended behaviours. Participants were coded as fully compliant (1) with each of the recommended behaviours if they reported engaging in the behaviour ‘all the time’ (score = 7) and reported breaking the recommended behaviour ‘not at all’ (score = 1) over the past week. Participants who did not meet both of these criteria were coded as not fully compliant (0). Second, associations with compliance for each of the recommended behaviours were assessed using point-biserial correlations. Third, a series of hierarchical logistic regression analyses was conducted to examine the unique contributions of the demographic and belief measures to the prediction of compliance with each of the recommended behaviours. For each analysis, the independent variables were entered in three blocks: (1) demographic variables, (2) perceived susceptibility, and (3) the RAA measures. In this way, it was possible to assess whether the RAA explained additional variance in compliance with each of the recommended behaviours after controlling for the effects of the demographic variables and perceived susceptibility.⁵

Results

Compliance with, and beliefs about, the recommended behaviours

Rates of compliance varied across the recommended behaviours with 30.4% and 40.9% of participants reporting full compliance with keeping more than 2 m away from other

⁵ Additional analyses were conducted to examine whether significant effects remained when controlling for measures of preventive behaviour over the previous month. These analyses are presented in File S5. Past behaviour explained an additional 1–6% of the variance in compliance and was a significant predictor of each of the five recommended behaviours. The effect of perceived susceptibility on keeping more than two metres away from other people when outside as well as the effects of experiential attitudes, capacity, and intention on washing hands became non-significant when controlling for past behaviour. All other significant effects remained significant. Past behaviour explained an additional 0–2% of the variance in compliance and was only a significant predictor of intentions to wash hands. The effect of perceived susceptibility on limiting visiting friends became non-significant when controlling for past behaviour. All other significant effects remained significant.

Table 2. Rates of compliance with the recommended preventive behaviours at one-week follow-up ($N = 477$)

	<i>N</i>	%
Limit leaving home	210	44.0
Keep > 2 metres outside	195	40.9
Keep > 2 metres inside	145	30.4
Not visit friends/family	323	67.7
Wash hands	308	64.6

Table 3. Means (and standard deviations) of the reasoned action approach variables and perceived susceptibility for the recommended preventive behaviours ($N = 477$)

	Limit leaving home	Keep > 2 m outside	Keep > 2 m inside	Not visit friends/family	Wash hands
Experiential Attitudes	4.08 (1.71)	4.38 (1.78)	4.19 (1.87)	2.24 (1.73)	5.53 (1.44)
Instrumental Attitudes	5.92 (1.41)	6.26 (1.08)	6.34 (1.07)	5.40 (1.87)	6.61 (0.79)
Injunctive Norms	6.28 (1.19)	6.40 (1.09)	6.40 (1.15)	6.05 (1.46)	6.58 (0.92)
Descriptive Norms	4.67 (1.26)	4.90 (1.36)	4.59 (1.49)	4.33 (1.38)	6.58 (0.92)
Capacity	6.65 (0.88)	6.44 (0.93)	5.84 (1.48)	6.56 (0.97)	6.68 (0.81)
Autonomy	6.44 (1.11)	5.45 (1.60)	4.67 (1.86)	6.58 (0.96)	6.87 (0.47)
Intention	6.66 (0.97)	6.60 (0.91)	6.32 (1.19)	6.60 (1.03)	6.74 (0.75)
Perceived Susceptibility	4.25 (1.56)	4.57 (1.68)	4.89 (1.69)	4.78 (1.63)	5.07 (1.72)

people when outside and inside shops, respectively, and 44.0% managing to only leave home for food shopping, exercise, medical needs, or travelling to work. In contrast, full compliance with not visiting friends/family members and washing hands when returning home was reported by 67.7% and 64.4% of participants, respectively (Table 2). Participants' beliefs about each of the recommended behaviours were very positive with mean scores near the top end of the response scales (Table 3). The exceptions were experiential attitudes, perceived susceptibility, and (apart from washing hands) descriptive norms, which had mean scores closer to the mid-point of the response scales indicating relatively neutral affective attitudes towards the behaviours, moderate levels of perceived susceptibility, and moderate perceived performance of the recommended behaviours by others.

Bivariate associations with compliance with the recommended behaviours

Considering the demographic variables (Table 4), increasing age was significantly associated with higher rates of compliance for all of the recommended behaviours with the exception of keeping at least 2 m away from others when inside shops. In addition, females reported greater compliance for washing hands than males, White participants reported greater compliance for keeping at least 2 m away from others when outside than non-White participants, and participants living in less deprived areas reported greater compliance for keeping at least 2 m away from others when outside. The significant correlations were small according to Cohen's (1992) criteria.

Table 4. Associations with compliance with the recommended preventive behaviours at one-week follow-up ($N = 477$)

	Limit leave home	Keep > 2 m outside	Keep > 2 m Inside	Not visit friends/family	Wash hands
Age	.12*	.15**	.09	.09*	.21*
Sex ^a	.07	.07	.04	.03	.13**
Ethnicity ^b	.07	.09*	.07	.08	-.02
IMD Decile	.06	.12**	.08	.01	.03
Experiential Attitudes	.04	.10*	.20***	.02	.44***
Instrumental Attitudes	.17***	.16***	.15***	.13**	.30***
Injunctive Norms	.12**	.16***	.16***	.10*	.23***
Descriptive Norms	.08	.19***	.08	.10*	.13**
Capacity	.18***	.30***	.27***	.34***	.33***
Autonomy	.14**	.21***	.19***	.18***	.17***
Intention	.11*	.25***	.20***	.32***	.32***
Perceived Susceptibility	-.01	.11*	.02	.13**	.18***

Note. Values are point-biserial correlation coefficients.

^a0 = Male, 1 = Female; ^b0 = Non-White, 1 = White; * $p < .05$; ** $p < .01$; *** $p < .001$.

With few exceptions, measures of RAA variables were positively, and significantly, correlated with the recommended behaviours at one-week follow-up (Table 4). Thus, more positive experiential and instrumental attitudes, greater perceptions of approval from others, greater perceptions of others' compliance, stronger perceptions of capacity, stronger perceptions of autonomy, and more positive intentions at baseline were each associated with greater compliance at one-week follow-up. Many of the significant correlations were small, although medium-sized correlations were found between measures of experiential and instrumental attitudes and compliance for hand washing. In addition, several medium-sized correlations with compliance were found for the measures of capacity and intention. Perceived susceptibility was also significantly correlated with compliance for three of the five recommended behaviours, such that higher perceptions of susceptibility were associated with greater compliance, although these correlations were small.

Logistic regressions predicting compliance with recommended behaviours

The results of the logistic regressions for each of the recommended behaviours are presented in Table 5. The demographic variables, entered in block 1, significantly predicted compliance with limiting leaving home, keeping more than 2 m away from others when outside and hand washing, but not compliance with keeping more than 2 m away from others when inside shops or not visiting friends and family members. Age was significantly associated with increased compliance with three of the five recommended behaviours (limiting leaving home, keeping more than 2 m away from other people when outside, and washing hands). In addition, being female (washing hands) and decreasing deprivation (keeping more than 2 m away from other people when outside) were significant predictors of compliance with individual behaviours. Overall, the demographic variables explained between 2% and 6% of the variance in compliance with the recommended behaviours.

Table 5. Hierarchical logistic regressions predicting recommended preventive behaviours (N = 477)

	Limit leave home	Keep > 2 m outside	Keep > 2 m inside	Not visit friends/family	Wash hands
Block 1					
Age	1.01* (1.00-1.03)	1.02** (1.01-1.03)	1.01 (1.00-1.03)	1.01 (1.00-1.03)	1.02* (1.00-1.03)
Sex ^a	1.32 (0.92-1.90)	1.32 (0.91-1.92)	1.18 (0.80-1.76)	1.14 (0.78-1.68)	1.75** (1.19-2.56)
Ethnicity ^b	1.25 (0.75-2.06)	1.35 (0.80-2.29)	1.29 (0.74-2.27)	1.44 (0.87-2.37)	0.78 (0.46-1.31)
IMD Decile	1.04 (0.97-1.12)	1.09* (1.02-1.17)	1.06 (0.99-1.15)	1.00 (0.93-1.08)	1.03 (0.96-1.11)
Δ Chi-square	11.01*	21.49***	8.36	6.51	15.62**
Δ Nagelkerke R ²	.03	.06	.03	.02	.04
Block 2					
Age	1.01* (1.00-1.03)	1.02** (1.01-1.03)	1.01 (1.00-1.03)	1.01 (1.00-1.03)	1.02* (1.00-1.03)
Sex ^a	1.33 (0.92-1.93)	1.30 (0.89-1.89)	1.18 (0.80-1.75)	1.07 (0.72-1.58)	1.52* (1.03-2.26)
Ethnicity ^b	1.25 (0.76-2.07)	1.33 (0.79-2.26)	1.29 (0.73-2.26)	1.49 (0.89-2.48)	0.80 (0.47-1.35)
IMD Decile	1.04 (0.97-1.12)	1.09* (1.01-1.17)	1.06 (0.99-1.15)	1.01 (0.93-1.08)	1.04 (0.96-1.12)
Perceived Susceptibility	0.97 (0.87-1.10)	1.13* (1.01-1.27)	1.01 (0.90-1.14)	1.19** (1.06-1.34)	1.20** (1.07-1.35)
Δ Chi-square	0.18	4.55*	0.03	8.10**	10.28**
Δ Nagelkerke R ²	.00	.01	.00	.02	.03
Block 3					
Age	1.01* (1.00-1.03)	1.02* (1.00-1.03)	1.01 (1.00-1.02)	1.01 (1.00-1.02)	1.02** (1.01-1.03)
Sex ^a	1.11 (0.76-1.64)	1.17 (0.78-1.77)	1.00 (0.65-1.54)	0.98 (0.63-1.50)	1.01 (0.71-1.70)
Ethnicity ^b	1.32 (0.79-2.23)	1.73 (0.99-3.02)	1.75 (0.96-3.20)	1.46 (0.84-2.52)	0.84 (0.48-1.48)
IMD Decile	1.04 (0.97-1.11)	1.08 (1.00-1.16)	1.08 (1.00-1.17)	0.98 (0.91-1.06)	1.03 (0.95-1.11)
Perceived Susceptibility	0.94 (0.83-1.07)	1.14* (1.01-1.29)	1.00 (0.88-1.14)	1.11 (0.97-1.27)	1.08 (0.95-1.23)
Experiential Attitudes	0.98 (0.88-1.10)	1.01 (0.89-1.14)	1.18* (1.05-1.34)	0.98 (0.86-1.11)	1.18* (1.01-1.38)
Instrumental Attitudes	1.24* (1.05-1.46)	1.02 (0.81-1.29)	1.06 (0.81-1.38)	1.02 (0.90-1.16)	1.25 (0.91-1.73)
Injunctive Norms	1.02 (0.85-1.24)	1.05 (0.84-1.31)	1.28 (0.99-1.65)	0.97 (0.83-1.14)	1.21 (0.94-1.54)
Descriptive Norms	1.04 (0.88-1.22)	1.17 (0.99-1.38)	0.93 (0.79-1.09)	1.05 (0.89-1.23)	1.03 (0.86-1.23)
Capacity	1.52* (1.09-2.12)	1.99*** (1.39-2.84)	1.49*** (1.19-1.88)	1.86*** (1.35-2.55)	1.44* (1.01-2.07)
Autonomy	1.10 (0.89-1.35)	1.11 (0.96-1.29)	1.05 (0.92-1.21)	0.98 (0.76-1.26)	1.01 (0.62-1.66)
Intention	0.96 (0.74-1.23)	1.64* (1.11-2.42)	1.24 (0.95-1.63)	1.46** (1.11-1.92)	1.91** (1.17-3.13)
Δ Chi-square	26.82***	68.32***	63.75***	59.05***	66.90***
Δ Nagelkerke R ²	.07	.17	.17	.16	.17
% correctly classified	61.6	64.8	71.7	74.4	71.9

Note. Values are ORs with 95% CIs.

^a0 = Male, 1 = Female; ^b0 = Non-White, 1 = White; *p < .05; **p < .01; ***p < .001.

The addition of perceived susceptibility in block 2 significantly improved the prediction of compliance for three of the five recommended behaviours (keeping more than 2 m away from other people when outside, not visiting friends and family members, and washing hands). Overall, perceived susceptibility explained an additional 0–3% of the variance in compliance with the recommended behaviours, although the demographic variables from block 1 remained significant.

The addition of the RAA measures further, and significantly, improved the prediction of compliance with all five recommended behaviours. Perceived capacity was a significant predictor of each of the five recommended behaviours, and intention was a significant predictor of three of the recommended behaviours (keeping more than 2 m away from other people when outside, not visiting friends and family members, and washing hands). In addition, measures of instrumental (limiting leaving home) and experiential attitudes (keeping more than 2 m away from others when inside shops, and washing hands) were significant predictors for three of the recommended behaviours. Overall, the RAA variables explained an additional 7–17% of the variance in compliance with the recommended behaviours. However, age remained as a significant predictor for three of the recommended behaviours as did perceived susceptibility for keeping more than 2 m away from other people when outside. The final models correctly classified between 62 and 74% of participants.

Discussion

Rates of compliance with recommended behaviours to prevent transmission of the SARS-CoV-2 virus during the lockdown were varied. Approximately two-thirds of the sample reported that they had fully complied with not visiting friends and other family members (68%) and always washing hands when returning home (64%) in the past week. In contrast, attempts to limit leaving home and maintain social distancing when outside the home were less successful, with less than half the sample reporting that they had fully complied with limiting leaving home (44%) or maintaining a distance of at least 2 m from other people when outside (41%) or inside shops (31%). The rates of full compliance for some of the recommended social distancing behaviours are therefore lower than the 50% level assumed in early modelling of the impact of behavioural and social interventions on the COVID-19 pandemic in the UK (GOV.UK, 2020b).

Considering the potential determinants of compliance, the demographic variables explained between 2% and 6% of the variance in compliance with the recommended behaviours. Only age was consistently associated with compliance, such that younger adults reported lower rates of full compliance with the recommended behaviours, in line with findings from previous pandemics (Leung *et al.*, 2003; Tang & Wong, 2003). Perceived susceptibility explained an additional 0 to 3% of the variance in compliance, with significant effects for three of the recommended behaviours; however, two of these effects became non-significant when controlling for variables from the RAA, consistent with the idea that perceived susceptibility is a more distal determinant of action taken in response to a health threat (Schwarzer & Luszczynska, 2015). Variables from the RAA explained an additional 7 to 17% of the variance in compliance with the recommended behaviours. In particular, perceived capacity was a significant independent predictor of compliance for all five of the recommended behaviours. Significant effects were also found for intention (three behaviours), affective attitudes (two behaviours), and cognitive attitudes (one behaviour). Age remained as a significant predictor of three of the

recommended behaviours, independent of the effects of the RAA variables and perceived susceptibility.

This is the first study to use the RAA to explain compliance with recommended behaviours to prevent transmission of the SARS-CoV-2 virus in the UK. The findings are in line with the theoretical structure of the RAA and other models of health behaviour which outline intention and capacity (i.e. self-efficacy) as key proximal determinants of behaviour (Conner & Norman, 2015) as well as with meta-analytic evidence that has found these two variables to be the strongest correlates of health behaviour (McEachan *et al.*, 2016). The findings therefore confirm the predictive utility of the RAA in line with earlier research which has used the TPB to explain behavioural responses to previous pandemics (Agarwal, 2014; Cheng & Ng, 2006; Liao *et al.*, 2011; Yang, 2015; Zhang *et al.*, 2020). In addition, the weaker and more distal influence of perceived susceptibility noted in the present study is in line with a cross-sectional survey conducted in South Korea during the early stages of the COVID-19 outbreak (Lee & You, 2020). A further cross-sectional survey conducted by Gibson-Miller *et al.* (2020) before the lockdown was introduced in the UK, examined correlates of hygienic practices (e.g. hand washing, cleansing surfaces, and avoiding touching eyes and mouth) using the COM-B model which proposes that behaviour is a function of people's capabilities, opportunities, and motivation (Michie, van Stralen, & West, 2011). In line with the current findings, reflective motivation (which encompasses intention and self-efficacy in the COM-B) was found to be the strongest correlate of engaging in the hygienic practices. The study also reported that females, non-Whites, and those with higher incomes were more likely to engage in the hygienic practices, although the effects were smaller.

Strengths and limitations

The study has a number of strengths including the use of a prospective design to increase confidence in the likely direction of effects, the recruitment of a large sample that was broadly representative sample of UK adults (in terms of age, sex, and ethnicity) that increases confidence in the generalizability of the findings, and a focus on specific preventive behaviours that were recommended by the UK government as part of the lockdown advice. The study also has a number of limitations including the use of self-report measures of compliance with the recommended behaviours which may have engendered socially desirable responding. To mitigate this possibility, the study employed a strict measure of compliance based on a combination of two measures that assessed whether participants engaged in the recommended behaviour all of the time and never broke the recommended behaviour. Indeed, inspection of the distribution of the frequency measures of compliance and non-compliance revealed that they were highly skewed. Moreover, other ways of measuring compliance, for example through the use of tracking apps, may have their own limitations in terms of distinguishing between essential and non-essential trips and a dependence on others downloading and using such apps which could lead to over- or under-estimates of compliance with social distancing. Another study limitation concerned the analysis of ethnicity as it was only possible to compare compliance levels of White versus non-White participants. Larger representative samples, or more focused/quota sampling, would be required to compare the beliefs and behaviours of different ethnic groups in the UK. Although the study included a measure of deprivation, it did not consider other social, economic, and environmental factors that may impact of individuals' ability to comply with the recommended protective

behaviours such as number of dependents, type of work, housing conditions, and access to a garden or nearby green space. It is likely that these factors may impact of people's confidence in their capacity (i.e. self-efficacy) to comply with the recommended preventive behaviours.

Conclusions and policy implications

This study indicates that full compliance with the recommended protective behaviours during the lockdown in the UK was varied. Limiting leaving home and maintaining social distancing while away from home were particularly challenging behaviours to fully comply with. These behaviours are likely to continue to be central to attempts to reduce the spread of COVID-19 in the UK and worldwide as lockdown measures are eased. These behaviours should therefore be the focus of future intervention efforts. The present findings indicate that interventions are needed to bolster people's intentions and perceptions of their capacity to perform these social distancing behaviours consistently. In order to bolster intentions to comply with recommended preventive behaviours,¹ public health messages should continue to emphasize the importance of these behaviours for helping to reduce the spread of the SARS-CoV-2 virus even though many people do not feel personally at risk of catching the virus. Such messages should also emphasize social approval from other for engaging in these behaviours. In order to bolster perceptions of their capacity, public health messages should provide clear advice and instructions of how to engage in recommended preventive behaviours. In addition, it may also be necessary to put environmental and structural measures in place that may make it easier for people to comply with recommendations. This may require changes to the design and use of public transport as well as workplaces, shops, and leisure, hospitality, and entertainment venues. Finally, interventions need to be particularly targeted towards younger adults who report lower levels of compliance with the recommended preventive behaviours.

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Conflicts of interest

All authors declare no conflict of interest.

Author contributions

PN and MC developed the original idea and all authors contributed to the study design, data collection, and interpretation of the data. PN conducted the statistical analysis and produced the first draft of the manuscript. MC and SW provided critical comment on the manuscript. All authors read and approved the final version of the manuscript.

Data availability statement

The data that support the findings of this study are openly available via the Open Science Framework at <https://osf.io/udkxh>.

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Supporting Information

The following supporting information may be found in the online edition of the article:

File S1. Summary of analyses predicting intentions to engage in the recommended preventive behaviours.

File S2. Representativeness of the sample in terms of age, sex and ethnicity.

File S3. Summary of analyses of additional preventive behaviours.

File S4. Survey items.

File S5. Summary of analyses controlling for past behaviour.