An experimental COVID-19 messaging study in a representative sample of the Scottish population

Received: 18 March 2022 | Accepted: 1 June 2022

DOI: 10.1111/bjhp.12632

ARTICLE

An experimental COVID-19 messaging study in a representative sample of the Scottish population: Increasing physical distancing intentions through self-efficacy

Chantal den Daas[1] | Marie Johnston[1] | Gill Hubbard[2] | Diane Dixon[1] | Mioara Cristea | Alive Davis | Fiona Dobbie | Niamh Fitzgerald | Leanne Fleming | Barbara Fraquharson | Trish Gorely | Cindy Gray | Mark Grindle | Eileen HarkessMurphy | Kate Hunt | Robin Ion | Lisa Kidd | Terry Lansdown | Leah Macaden | Wendy Maltinsky | Stewart Mercer | Peter Murchie | Ronan O'Carroll | Kate O'Donnell | Gozde Ozakinci | Amanda Pitkethly | Kate Reid | Dina Sidhva | Martine Stead | Mary E Stewart | Debbie Tolson | Catharine Ward Thompson | Sally Wyke

[1]Health Psychology Group, University of Aberdeen Institute of Applied Health Sciences, Aberdeen, UK

[2]Department of Nursing and Midwifery, University of the Highlands and Islands Institute of Health Research and Innovation, Inverness, UK

Correspondence

Chantal den Daas, Health Sciences Building, Foresterhill, Aberdeen AB25 2ZD, UK.
Email: chantal.dendaas@abdn.ac.uk

Funding information

Chief Scientist Office, Edinburgh, Grant/Award Number: COV/ABN/20/07

Abstract

Objectives: Self-efficacy is important for adherence to transmission-reducing behaviours (e.g., physical distancing) as also shown in the CHARIS project. We aimed to show that a theory-based short message can increase physical distancing self-efficacy and intentions to keep physical distance.

Design: Structured telephone surveys with a randomly selected nationally representative sample of adults in Scotland (N = 497).

Methods: Participants were randomly assigned to one of two experimental conditions: message condition (short message to increase self-efficacy via vicarious experiences, verbal persuasion and emotional arousal) or control condition (no message). Followed by measures for self-efficacy and intention for physical distancing on 4-point scales. Adherence

to physical distancing was assessed on a 5-point frequency scale (never – always).

Results: Using mediation analyses with bootstrapping procedures, we first confirmed that self-efficacy was associated indirectly with adherence, via higher intentions in a partial mediation (unstandardized indirect effect .21, 95% CI .18–.25). The message increased self-efficacy; participants receiving the message reported higher self-efficacy (M = 4.23, SD = .80) compared to participants in the control condition (M = 4.08, SD = .77; standardized regression coefficient = .19, $p < .05$) and self-efficacy affected intention (.48, $p < .001$). There was a small significant indirect effect of the message on intention via self-efficacy (unstandardized indirect effect .07, CI .01–.14).

Conclusions: Increasing self-efficacy for physical distancing with a short message can successfully increase intention to physical distance via increased self-efficacy. As both self-efficacy and intentions are important predictors of adherence to transmission-reducing behaviours short messages have potential to limit the spread of COVID-19.

KEYWORDS
adherence, COVID-19, intentions, messaging, physical distancing, self-efficacy

Statement of contribution

What is already known?

- Physical distancing reduces the transmission of COVID-19.
- But, adherence to is declining and becoming more difficult.
- Self-efficacy and intention predicted adherence to physical distancing in each sociodemographic group.

What does this study add?

- We confirmed the theoretically hypothesized association between self-efficacy, intentions, and adherence in cross-sectional data.
- We show that a theory-based short message can increase physical distancing self-efficacy.

INTRODUCTION

The COVID-19 pandemic has highlighted the importance of behavioural science to increase adherence to transmission-reducing behaviours to eliminate or control transmission. One of the effective transmission-reducing behaviours during the COVID-19 pandemic has been physical distancing, as shown by reduced COVID-19 rates after the introduction of physical distancing measures (Islam et al., 2020). These authors assessed physical distancing in the broadest sense, including closures of schools, work-

places and public transport, restrictions on mass gatherings and public events, and restrictions on movement (lockdowns). In its individualized form, physical distancing, in the UK context, referred to staying 2 m away from other people, except those who live in your household (The Scottish Government, 2020; other distances were recommended in other countries and contexts).

Adhering to physical distancing is seen as one of the more difficult behaviours, as it needs to be repeated and maintained, it is difficult to plan for, involves navigating different environments and often is related to interactions with other people. Nevertheless, several studies show that adherence to physical distancing, especially just after easing of the lockdown towards the end of the first wave of the pandemic, was high in North America and Europe including the UK (Coroiu et al., 2020; Dixon et al., 2021; Park et al., 2020). Specifically, the CHARIS project (COVID-19 Health and Adherence Research In Scotland; Den Daas et al., 2021) showed that adherence to physical distancing was high, with a mean self-reported adherence score well above 4 on a 5-point scale (Dixon et al., 2021). This is in line with other studies finding ~95% of people indicated they often or always keep a safe distance of two metres (Coroiu et al., 2020), or ~87% of people adhering to putting six feet [2 m] of physical distance between themselves and other people (Park et al., 2020).

However, it is possible that over the course of the pandemic physical distancing became more difficult as feelings of loneliness and social isolation increase (Williams et al., 2021), and as the proportion of the people who are vaccinated increases, the perceived necessity of physical distancing may decline. That said, modelling studies (Iacobucci, 2021; O'Brien & Clements, 2021) accurately predicted multiple waves of the pandemic and the consequent increases in hospitalizations and deaths, which, in late 2020, required the UK governments to reimpose physical distancing restrictions that had previously been relaxed. Subsequently, restrictions on physical distancing were again relaxed and the requirement to wear face coverings were removed in England during the summer of 2021. These relaxations in transmission-reducing behaviours probably contributed to the large rise in cases of COVID-19 in the UK despite high rates of vaccine uptake. The population of the UK has, therefore, experienced multiple cycles of being required to adhere to transmission-reducing behaviours, followed by periods of relaxation of requirements followed by the reimposition of restrictions. Thus, interventions aimed at supporting behaviour change are likely to remain of importance for transmission control both now and into the future of the current and subsequent pandemics. It is currently unknown whether messaging interventions aimed at increasing physical distancing could work.

One candidate for interventions aimed at promoting adherence to physical distancing is self-efficacy, the belief that one can carry out the transmission-reducing behaviour. The construct of self-efficacy is part of two main theories, namely Social Cognitive Theory (SCT; Bandura, 1986) and the Reasoned Action Approach (RAA; Ajzen & Schmidt, 2020; Fishbein & Ajzen, 2011). SCT posits that people's motivation and action are extensively regulated by forethought about the behaviour (Luszczynska & Schwarzer, 2005). Key constructs of SCT are self-efficacy and outcome expectancies. Self-efficacy refers to the belief that one is capable of performing a recommended behaviour to attain a desired outcome (e.g., not getting COVID-19). In RAA, self-efficacy (or sometimes called perceived behavioural control) is determined by control beliefs, how much a person thinks they have control over the behaviour and their confidence about being able to perform the behaviour. Self-efficacy affects behaviour through intentions. That self-efficacy might play a role in performing health protective behaviours such as the transmission-reducing behaviours for COVID-19 was again evidenced in a recent systematic review showing that an individual's perception of his/her competency to successfully perform behaviours aimed at managing one's health affects their actual behaviour (Breland et al., 2020). Moreover, a meta-analyses has shown that that interventions that experimentally modify self-efficacy are effective in promoting health behaviour change (Sheeran et al., 2016). There are as of yet no studies showing the effect of self-efficacy interventions on COVID-19 transmission-reducing behaviours, although it has been found that measured self-efficacy is related to adherence rates.

The CHARIS project (Den Daas et al., 2021) found that for COVID-19 transmission-reducing behaviours both self-efficacy and intentions were important predictive constructs. Behaviour specific self-efficacy was the strongest predictor for physical distancing, as well as for hand washing and wearing

a face covering ([blinded for review]). In addition, the relationship between self-efficacy and adherence to transmission-reducing behaviours was not influenced by group membership, such as gender, age, socioeconomic deprivation and perceived COVID-19 status, making self-efficacy a good candidate for promoting physical distancing across many sociodemographic groups. These findings were confirmed by Berg and Lin (2020), who found that self-efficacy was distinctly able to predict compliance with prevention guidelines, and Hsing et al. (2021), who also found that self-efficacy was the strongest predictor for physical distancing (referred to as social distancing). Furthermore, self-efficacy seems to be a stronger predictor of adherence to transmission-reducing behaviours than either illness perceptions or perceptions of risk or threat (Chong et al., 2020).

Self-efficacy can be enhanced through a number of routes (Bandura, 1977): (i) previous experiences of personal accomplishment, or mastery; (ii) positive vicarious experiences, someone perceived as similar to the individual successfully mastering the behaviour; (iii) verbal persuasion, someone reassuring the individual they can perform the behaviour and (iv) emotional arousal, that a person does not experience apprehension towards the performance of the behaviour in a particular context, and therefore, feels able to perform the behaviour (Conner & Norman, 2005).

Although these enhancements have not been applied to change transmission-reducing behaviours, they have been applied to change other behaviours, for example physical activity. A meta-analysis of intervention studies that aimed to increase physical activity behaviours via enhanced self-efficacy showed that vicarious experiences and feedback on other people's behaviour were able to increase self-efficacy for physical activity, whereas verbal persuasion alone was not effective at increasing self-efficacy (Ashford et al., 2010). Unfortunately, this study did not address whether changes in self-efficacy were associated with subsequent changes in behaviour. However, another review found that studies that were successful in changing self-efficacy towards physical activity behaviours, were also effective in changing physical activity behaviour (Williams & French, 2011). The behaviour change techniques (BCTs) that effectively increased self-efficacy were action planning, providing instruction and reinforcing effort towards behaviour; these three BCTs were also associated with increased levels of physical activity. Williams and French account for the effectiveness of the BCTs via their ability to increase the likelihood of successful performance of physical activity behaviours and hence promote mastery experiences. However, these results may not be universally applicable; self-efficacy and physical activity in obese individuals were increased by two BCTs, namely self-monitoring of behavioural outcomes and social support (Olander et al., 2013), both of which were associated with reduced self-efficacy in the William and French review. Similarly, a review of infection control behaviours in HIV (Mize et al., 2002), which are perhaps more closely aligned to COVID-19 transmission-reducing behaviours, also showed inconsistent effects of interventions on self-efficacy, with effects depending on follow-up time and migration backgrounds of the participants. Thus, techniques effective at increasing self-efficacy and hence behaviour might vary by population and also by behaviour and context, which is not surprising given that self-efficacy itself is theorized within the intersection between the actor, the particular behaviour and the context in which the behaviour is enacted (Bandura, 1997).

In addition, research has already shown which groups may benefit from interventions as adherence to transmission-reducing behaviour was low and there was room for improvement; these groups could be based on sociodemographic variables (such as age and gender), but also on constructs (e.g., groups low in self-efficacy, Dixon et al., 2021). For example, younger people are often less adherent than older populations, and men seem to adhere less than women (Dixon et al., 2021; Coroiu et al., 2020; Masters et al., 2020; Pedersen & Favero, 2020). However, the existing literature provides rather less evidence of causal relationships between employed intervention and changes in either the target determinants or behaviours. As a result, we cannot be wholly confident that interventions to change self-efficacy will increase either self-efficacy, intentions, or adherence to behaviours such as physical distancing. Before we can conclude that evidence pertaining to differences between people is relevant for interventions to change determinants and outcomes (Johnston, 2015), specific studies to address this knowledge gap are required. Therefore, these studies will also need to show that the effect is specific, targeting self-efficacy changes relevant outcomes, such as intentions and adherence. In addition, these studies will need to show that the message affects the targeted determinant and no other theoretical constructs from for example

the Reasoned Action Approach (Ajzen & Schmidt, 2020; Fishbein & Ajzen, 2011), the Common-sense Self-Regulation Model (Diefenbach & Leventhal, 1996) and Protection Motivation Theory (Rogers, 1975).

In the present study, recognizing the limitations of cross-sectional studies, we aimed first to confirm that in the context of the pandemic and COVID-19 transmission-reducing behaviours, that self-efficacy for physical distancing affects adherence to physical distancing through intentions (Figure 1). In this confirmation, self-efficacy, intention and adherence have been measured at the same time, concurrently, we only aim to provide support for the existing theoretical relations in our population and for transmission-reducing behaviours in principle, without showing causality, as these relations have been established in previous research numerous times (Conner & Norman, 2005). Second, we aimed to explore whether self-efficacy for physical distancing can be increased via messaging, and through self-efficacy, increase intentions for physical distancing. Therefore, we manipulated self-efficacy, through a short verbal message that used positive vicarious experiences, verbal persuasion and emotional arousal to increase self-efficacy and intentions for physical distancing, which were measured after the presentation of the message.

We also explored whether the message affected constructs from other theories relevant to the behavioural responses to the pandemic based on the theories assessed in the CHARIS project, namely another construct from RAA (Ajzen & Schmidt, 2020; Fishbein & Ajzen, 2011), behavioural norms, the belief about how others would like to behave. We address whether systematically varying positive vicarious experiences, could have changed behavioural norms (thinking about someone else performing the behaviour and there inferring the norm) instead of self-efficacy. In addition, we explore constructs from the Common-Sense Self-Regulation Model (CS-SRM: Diefenbach & Leventhal, 1996). The CS-SRM identifies cognitive and emotional representations of illness and proposes that these representations affect the behavioural response to it. Cognitive representations that CS-SRM identifies are beliefs about illness identity, consequences, timeline, control and what causes the illness (Leventhal et al., 1992). Emotional representations indicate the emotions that are engendered by the illness threat (such as anxiety or worries). The systematic variation of mastery, might influence the emotional representations. Finally, Protection Motivation Theory (PMT: Rogers, 1975) was developed to understand the impact of fear appeals. PMT posits that people make a threat appraisal based on evaluating how severe the threat is and how vulnerable they perceive themselves to be to the threat. In addition, an individual makes a coping appraisal based on for example self-efficacy (as in SCT). The systematic variation of mastery, might influence the perceived vulnerability people experience.

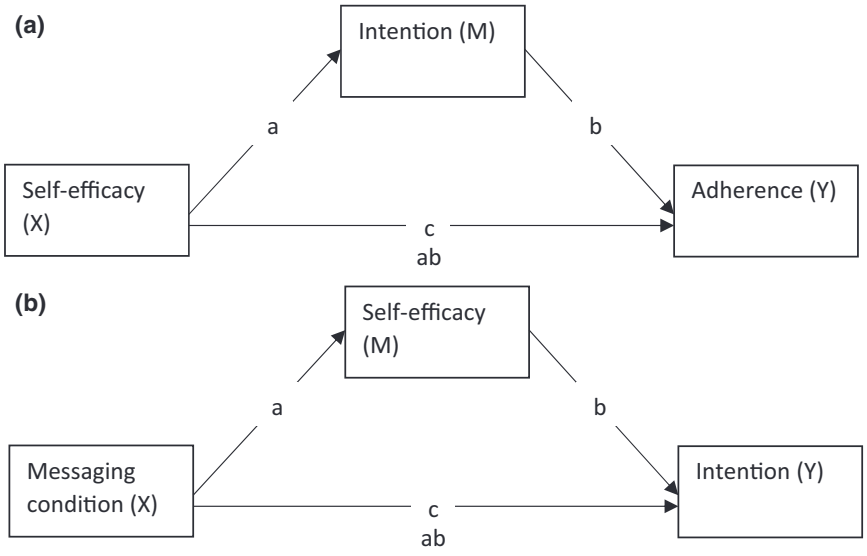

FIGURE 1 Associations between (a) physical distancing adherence (y) and self-efficacy (X) mediated by intention (M) and (b) intention for physical distancing (Y) and the messaging condition (X) mediated by self-efficacy (M)

METHODS

Design

A detailed description of the design of the CHARIS project can be found elsewhere (Den Daas et al., 2021). Briefly, approximately 500 adults from Scotland were recruited each fortnight, for a nationally representative survey. Some core measures including transmission-reducing behaviours were assessed for each wave, there was a flexible component to the data collection waves, that differed for each wave; we manipulated self-efficacy in only one of the waves. This study used data from two different non-overlapping samples. For the first sample, we used data collected in six of the fortnightly waves between 16th July and 7th October (N = 3002) to perform confirmatory analyses on the effect of self-efficacy on physical distancing through intentions. The second sample for the experimental messaging study with a randomized between-subject design, we used data from one of the waves, between 8th and 21st October 2020 (N = 497), to assess whether a message could affect intention through self-efficacy. Self-efficacy and intentions were measured concurrently within the same data collection wave, after participants were presented with the message (or not). The survey was administered by telephone through random digit dialling by Ipsos Mori.

Participants

Adult men and women aged 16 or older, able to speak English and currently living in Scotland were eligible to participate. No other exclusion criteria were applied. Participants did not receive compensation for their participation.

Measures

Experimental messaging manipulation

Participants were randomly assigned to the two self-efficacy conditions (manipulation vs. control) of our between-subject design. The randomization process was embedded into the telephone survey script as a routeing variable. The script contained a variable to randomly allocate a number between 0 and 1 to each phone call. Calls assigned a 0 to .5 received one route/message, and those assigned a .51 to 1 received the other route/message. Self-efficacy was manipulated through a verbal message, addressing vicarious experiences, verbal persuasion and emotional arousal indicated in brackets. Half of the participants were told [*italics* indicate the type of manipulation]: 'About 8 out of 10 of people in Scotland who have taken part in the study before, say they are managing to keep 2 m distance from other people most or all of the time [*vicarious experience*], which shows that people like you can do this [*verbal persuasion*]. By keeping to the 2 m distancing, you can help reduce the spread of the virus and keep people safe [*emotional arousal*].'. The participants in the control condition did not receive this message. Data in this message were based on findings from previous CHARIS waves (Dixon et al., 2021).

Self-efficacy: was assessed by one item: 'How confident or not are you that you can follow the government instructions, all or most of the time, on staying 2 m (6 feet) away from other people, except those who live in your household?' on a 4-point scale (not at all confident – very confident).

Intention: was assessed by one item: 'Do you intend to follow all the government instructions on staying 2 m (6 feet) away from other people, except those who live in your household?' on a 5-point scale (never – always).

Adherence: was assessed by one item: 'In the past week, you stayed 2 m (6 feet) away from other people, except those who live in your household.' on a 5-point scale (never – always).

Other theoretical constructs: Behavioural Norms (Reasoned Action Approach) were assessed by one item (Den Daas et al., 2021): 'How many people in your area do you think are following the government instructions of limiting contact with people, washing their hands thoroughly and frequently and wearing a face covering when out shopping or on public transport most or all of the time?', on a 5-point scale (1 = hardly anyone, 5 = everyone). Illness Representations (Common-Sense Self-Regulation Model): As in previous research (Hubbard et al., 2021), illness (COVID-19) representations were measured using an adapted brief illness perception questionnaire (Broadbent et al., 2006). The brief illness perception questionnaire uses a single item to assess each of the constructs from the Common-Sense Self-Regulation Model (Diefenbach & Leventhal, 1996; Leventhal et al., 1992), and we calculated the average of five items (representations: consequences, duration, recurrence, worries, anxiety) as a total score for illness representation (scale: 1 = strongly disagree – 4 = strongly agree), with a higher score reflecting more negative illness representations (Cronbach alpha = .71). Perceived Threat (Protection Motivation Theory): was measured in accordance with Protection Motivation Theory (Orbell et al., 2020; Rogers, 1975) using two items to assess the constructs perceived severity and perceived vulnerability: 'If you were ill with COVID-19 it would be serious for you;' and 'It is likely that you will get COVID-19'. The measures of perceived severity and vulnerability (scales: 1 = strongly disagree – 4 = strongly agree) were multiplied to produce a perceived threat score (range 1–16; Den Daas et al., 2021; Hubbard et al., 2021).

Data analysis

We first sought to confirm whether self-efficacy affected adherence through intentions as proposed in RAA (Fishbein & Ajzen, 2011). In Figure 1a intention is a mediator (M) of the relationship between self-efficacy (X) and physical distancing adherence (Y). We used bootstrapping (10,000 samples) to analyse the extent to which the effect of self-efficacy increased intentions and through intentions increased adherence. In this procedure, total effects, direct effects and indirect effects are estimated by means of ordinary least squares (OLS) regression analyses. The effect of the independent variable (self-efficacy) is displayed in the total effect, when controlling for the mediator variable (intention) it is indicated in the direct effect. The indirect effect comprises the path over intention.

To assess the effect of the message, we first compared our messaging and control condition on the sociodemographic variables (age and gender), and theoretical variables using Chi-squared analyses for gender, and t-test for the other continuous variables to assess whether the random allocated groups were similar in sociodemographic variables and the theoretical variables.

We then sought to assess whether the message affected intentions through self-efficacy. In Figure 1b self-efficacy is a mediator (M) of the relationship between the messaging condition (X) and intentions for physical distancing (Y). We used bootstrapping (10,000 samples) to analyse the extent to which the effect of the messaging condition increased self-efficacy and through self-efficacy increased intentions. In this procedure, total effects, direct effects and indirect effects are estimated by means of ordinary least squares (OLS) regression analyses. The effect of the independent variable (messaging condition) is displayed in the total effect; when controlling for the mediator variable (self-efficacy) it is indicated in the direct effect. The indirect effect comprises the path over self-efficacy. By providing accelerated confidence intervals bootstrapping mitigates power problems and constitutes more accurate type I error rates. All statistics were performed using IBM SPSS Statistics and the mediation analyses with the PROCESS macro (Model 4; Hayes, 2017).

Ethics

Ethical approval for this study was granted by the Life Sciences and Medicine College Ethics Review Board (CERB) at the University of Aberdeen (CERB/2020/5/1942).

RESULTS

Mediation of self-efficacy by intentions on adherence to physical distancing

In total 3002 people participated (*M* age = 51.61, *SD* = 18.50, range 16–99), of whom 1824 (60.76%) were female. Self-efficacy did affect intentions (a unstandardized *B* = .56, *SE* = .02, 95% Confidence Interval (CI) = [.52, .59]). The path between intention and adherence was significant (b unstandardized *B* = .38, *SE* = .02, 95% CI = [.34, .42]). Importantly, the indirect effect (denoted as *ab in* Figure 1) of self-efficacy on adherence to physical distancing via intentions was significant, *ab* unstandardized *B* = .21, *SE* = .02, 95% CI = [.18, .25]. The direct effect was also significant, c unstandardized *B* = .29, *SE* = .02, 95% CI = [.25, .33]. Taken together, self-efficacy was associated indirectly with adherence to physical distancing, via higher intentions in a partial mediation.

Messaging – Comparing theoretical variables between conditions

In total 497 people participated (*M* age = 52.47, *SD* = 18.49, range 16–92), of whom 295 (59.36%) were female. Participants who received the message did not differ from those in the control condition in age (*M* = 51.68, *SD* = 19.03, *M* = 53.31, *SD* = 17.89, *t*[495] = .98, ns), or gender (38.91% and 42.25% males in the respective conditions, χ[1] = .57, ns). Participants in the two conditions did not differ in their experienced social norms (*M* = 3.65, *SD* = .66, *M* = 3.57, *SD* = .75, *t*[488] = −1.14, ns), perceived threat (*M* = 7.18, *SD* = 3.52, *M* = 6.79, *SD* = 3.14, *t*[354] = −1.09, ns) and illness representations (*M* = 3.07, *SD* = .69, *M* = 2.99, *SD* = .63, *t*[492] = −1.35, ns).

Mediation of messaging by self-efficacy on intentions for physical distancing

The message increased self-efficacy (a unstandardized *B* = .19, *SE* = .07, 95% CI = [.01, .29]), participants in the messaging condition (*M* = 4.23, *SD* = .80) reported higher self-efficacy for physical distancing compared to the control condition (*M* = 4.08, *SD* = .77). The effect of self-efficacy on intentions was significant (b unstandardized *B* = .48, *SE* = .04, 95% CI = [.40, .55]). Importantly, the indirect effect of the messaging conditions on intentions towards physical distancing via self-efficacy was significant, *ab* unstandardized *B* = −.03, *SE* = .01, 95% CI = [−.06, −.01]. The direct effect was null, c unstandardized *B* = .04, *SE* = .03, 95% CI = [−.02, .09]. Taken together, the message condition was associated indirectly with intention to physical distancing, via higher self-efficacy. Although we found significant indirect effects of the messaging manipulation on intentions towards physical distancing via self-efficacy, we acknowledge that there was no significant total effect of our manipulation on intentions (c unstandardized *B* = .09, *SE* = .07, 95% CI = [−.06, .21]). However, researchers have suggested that mediation can exist and be tested even in the absence of such overall significant associations, and therefore, we assessed the message intention link (Kenny & Judd, 2014; MacKinnon & Fairchild, 2009).

DISCUSSION

Previous research widely supports that self-efficacy for physical distancing has a strong influence on physical distancing intentions (Berg & Lin, 2020; Dixon et al., 2021; Hsing et al., 2021); there is also some support for self-efficacy playing a role in HIV preventive behaviour (Mize et al., 2002). The main goal of the current study was to extend this research by investigating whether the link between self-efficacy and intentions was simply correlational or if self-efficacy had a causal link to intentions. By manipulating self-efficacy via the message content, we found support for a causal relationship suggesting that this type

of message might be effective in interventions to increase adherence to physical distancing. In addition, we identified some potential determinants of self-efficacy and intentions.

While there are well-recognized limitations to cross-sectional studies, this study contributes to a body of evidence that can guide the development of public health messaging interventions. In particular, the experimental study suggests the benefits that might be gained from a messaging intervention targeting self-efficacy as a means of enhancing intentions and thereby adherence to physical distancing. We are now working directly with public health departments to explore the use of similar preliminary experimental methods as 'proof of principle' before testing the effects of messages on the adherence behaviours of the general population.

We first confirmed that self-efficacy affected adherence to physical distancing through intentions in a representative sample of the Scottish population. More importantly, we found that a brief message designed to increase vicarious experience, verbal persuasion and reduce emotional arousal successfully increased self-efficacy. In addition, we found that higher levels of perceived self-efficacy in those who received the message positively affected intention to keep physical distance. Finally, our results suggest that the message did not directly impact intentions but did impact intentions indirectly via the mediating effect of self-efficacy. A potential explanation for this could be that the intention to keep physical distance were high amongst all participants, including those in the control condition, and this ceiling effect could have affected the power to detect and direct effect of the message on intentions (Kenny & Judd, 2014; MacKinnon & Fairchild, 2009).

The strengths of the CHARIS project are its inclusivity and representativeness of a national population. Moreover, the current study was done in a representative sample of the Scottish population. By conducting this study by telephone, it did not exclude persons and groups such as older or deprived people (Kearns & Whitley, 2019), who might be particularly at risk of COVID-19 and benefit from increased intentions for physical distancing (Hawkins et al., 2020; Selvan, 2020). A previous cross-sectional study has shown that self-efficacy and intentions were associated with transmission-reducing behaviours in all subpopulations; therefore, the proposed message could potentially be effective in increasing physical distancing intentions through self-efficacy in all subpopulations. Another strength of this study is that both self-efficacy and intentions were measured specifically for physical distancing and matched in specificity. We were also able to show that the messaging manipulation uniquely affected self-efficacy as planned, and not any other theoretical variables we assessed. We not only show that self-efficacy is a suitable candidate for interventions, we also provide support for the causal influence of the message on self-efficacy and intentions to physical distancing.

Limitations of this study are also important to note, these results are based on self-reports, and because we employed a telephone survey, time was limited and for self-efficacy and intentions for physical distancing we had single items. Therefore, any limitations of self-report surveys need to be recognized, notably social desirability bias. However, social desirability likely played the same role in both messaging conditions, therefore, would not affect difference between the conditions, but inflate intentions for physical distancing in both conditions.

In addition, to confirm the association between self-efficacy, intentions and adherence we used cross-sectional data. Stronger evidence would be provided by longitudinal studies, assessing the effects of self-efficacy and intentions on behaviour at a later point in time. However, the time effect has already been shown for the theorized associations, and we just wanted to confirm this effect our main interest was in the effect of messaging on self-efficacy, which we addressed experimentally. A further limitation is that we assessed self-efficacy and intentions to physical distancing and did not observe this behaviour. Although intentions are reflected as the most proximal predictors of behaviour in, for example, the Reasoned Action Approach (Ajzen & Schmidt, 2020; Fishbein & Ajzen, 2011), there is a well-known intention-behaviour gap (Webb & Sheeran, 2006). While there were important practical and policy reasons for designing the studies to assess self-reported intentions, it is important also to establish the potential causal relation between the messages and intention, before spending the substantial resources required to assess the impact of a message on observable behaviour. Future studies should include follow-up later in time assessing adherence behaviour.

Since the control of COVID-19 is primarily determined by population behaviour change, ensuring that there is evidence of successful intervention, specifically a message that mediates the effect on intentions through self-efficacy, and through intentions can influence behaviour. Even though effective vaccines are available, it remains important to investigate potential interventions that can affect adherence to transmission-reducing behaviours, since (some subgroups) of people are experiencing vaccine hesitancy (Murphy et al., 2021). Moreover, physical distancing will remain an important behaviour since there seems to be a modest waning of protection of the vaccine over time (Tregoning et al., 2021). The rapid development and testing of theory and evidence-based interventions, like the simple message tested here, enables them to be made available to governments and policy makers in a timely manner. This will support governments to implement evidence-based interventions, instead of relying on intuitive, common-sense models of behaviour change, which are often less effective in changing behaviour (Michie & Prestwich, 2010).

CONCLUSION

The current study has shown the potential for a short message to increase adherence to physical distancing, through which COVID-19 transmission can be controlled. As one of the more difficult, but effective transmission-reducing behaviours, physical distancing can still impact transmission especially in groups where uptake of vaccination is low. Moreover, physical distancing is likely to remain crucial to prevent COVID-19 cases now, but also to prevent transmission of new infectious diseases in the future, and prevent transmission of existing common infectious diseases such as seasonal flu and the common cold.

AUTHOR CONTRIBUTIONS

Chantal den Daas: Conceptualization; formal analysis; funding acquisition; investigation; methodology; writing – original draft. **Marie Johnston:** Conceptualization; funding acquisition; methodology; writing – review and editing. **Gill Hubbard:** Conceptualization; funding acquisition; methodology; writing – review and editing. **Diane Dixon:** Conceptualization; funding acquisition; methodology; writing – review and editing.

ACKNOWLEDGEMENTS

We are grateful to all the participants of the Scottish Health Council (SHC) Public Engagement Group and the NHS Research Scotland Primary Care Patient and Public Involvement. CHARIS was funded via a grant from the Chief Scientist Office, Edinburgh (COV/ABN/20/07).

COLLABORATORS THE CHARIS CONSORTIUM

Mioara Cristea, Heriot-Watt University; Alive Davis, The Institute of Occupational Medicine; Fiona Dobbie, University of Edinburgh; Niamh Fitzgerald, University of Stirling; Leanne Fleming, University of Strathclyde; Barbara Fraquharson, University of Stirling; Trish Gorely, University of the Highlands and Islands; Cindy Gray, University of Glasgow; Mark Grindle, University of the Highlands and Islands; Eileen HarkessMurphy, University of the West of Scotland; Kate Hunt, University of Stirling; Robin Ion, University of the West of Scotland; Lisa Kidd, University of Glasgow; Terry Lansdown, Heriot-Watt University; Leah Macaden, University of Stirling; Wendy Maltinsky, University of Stirling; Stewart Mercer, University of Edinburgh; Peter Murchie, University of Aberdeen; Ronan O'Carroll, University of Stirling; Kate O'Donnell, University of Glasgow; Gozde Ozakinci, University of St Andrews; Amanda Pitkethly, Edinburgh Napier University; Kate Reid, University of Glasgow; Dina Sidhva, University of the West of Scotland; Martine Stead University of Stirling; Mary E Stewart, Heriot-Watt University; Debbie Tolson, University of the West of Scotland; Catharine Ward Thompson, University of Edinburgh; Sally Wyke, University of Glasgow.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Chantal den Daas https://orcid.org/0000-0003-0955-3691

REFERENCES

Ajzen, I., & Schmidt, P. (2020). Changing behavior using the theory of planned behavior. In *The handbook of behavior change* (pp. 17–31). Cambridge University Press.

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, *15*(Pt 2), 265–288. https://doi.org/10.1348/135910709X461752

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191–215.

Bandura, A. (1986). *Social foundations of thought and action* (pp. 23–28). Englewood Cliffs.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W H Freeman/Times Books/Henry Holt & Co.

Berg, M. B., & Lin, L. (2020). Prevalence and predictors of early COVID-19 behavioral intentions in the United States. *Translational Behavioral Medicine*, *10*(4), 843–849.

Breland, J. Y., Wong, J. J., & McAndrew, L. M. (2020). Are common sense model constructs and self-efficacy simultaneously correlated with self-management behaviors and health outcomes: A systematic review. *Health Psychology Open*, *7*(1), 2055102919898846.

Broadbent, E., Petrie, K. J., Main, J., & Weinman, J. (2006). The brief illness perception questionnaire. *Journal of Psychosomatic Research*, *60*(6), 631–637. https://doi.org/10.1016/j.jpsychores.2005.10.020

Chong, Y. Y., Chien, W. T., Cheng, H. Y., Chow, K. M., Kassianos, A. P., Karekla, M., & Gloster, A. (2020). The role of illness perceptions, coping, and self-efficacy on adherence to precautionary measures for COVID-19. *International Journal of Environmental Research and Public Health*, *17*(18), 6540.

Conner, M., & Norman, P. (2005). *Predicting and changing health behaviour: Research and practice with social cognition models* (Vol. 3). Open University Press.

Coroiu, A., Moran, C., Campbell, T., & Geller, A. C. (2020). Barriers and facilitators of adherence to social distancing recommendations during COVID-19 among a large international sample of adults. *PLoS One*, *15*(10), e0239795.

Den Daas, C., Hubbard, G., Johnston, M., & Dixon, D. (2021). Protocol: Protocol of the COVID-19 Health and Adherence Research in Scotland (CHARIS) study: understanding changes in adherence to transmission-reducing behaviours, mental and general health, in repeated cross-sectional representative survey of the Scottish population. *BMJ Open*, *11*(2), e044135.

Diefenbach, M. A., & Leventhal, H. (1996). The common-sense model of illness representation: Theoretical and practical considerations. *Journal of Social Distress and Homeless*, *5*(1), 11–38.

Dixon, D., Den Daas, C., Hubbard, G., & Johnston, M. (2021). Using behavioural theory to understand adherence to behaviours that reduce transmission of COVID-19; evidence from the CHARIS representative national study. *British Journal of Health Psychology*, *27*(1), 116-135.

Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach*. Psychology Press.

Scottish Government. (2020). Coronavirus (COVID-19): Scotland's route map.

Hawkins, R. B., Charles, E., & Mehaffey, J. (2020). Socio-economic status and COVID-19–related cases and fatalities. *Public Health*, *189*, 129–134.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Hsing, J. C., Ma, J., Barrero-Castillero, A., Jani, S. G., Pulendran, U. P., Lin, B.-J., Thomas-Uribe, M., & Wang, C. J. (2021). Influence of health beliefs on adherence to COVID-19 preventative practices: International, social media–based survey study. *Journal of Medical Internet Research*, *23*(2), e23720.

Hubbard, G., den Daas, C., Johnston, M., & Dixon, D. (2021). Sociodemographic and Psychological Risk Factors for Anxiety and Depression: Findings from the Covid-19 Health and Adherence Research in Scotland on Mental Health (CHARIS-MH) Cross-sectional Survey. *International Journal of Behavioral Medicine*, *28*, 788–800.

Iacobucci, G. (2021). *Covid-19:"Freedom day" in England could lead to "significant third wave of hospitalisations and deaths," modelling predicts*. British Medical Journal Publishing Group.

Islam, N., Sharp, S. J., Chowell, G., Shabnam, S., Kawachi, I., Lacey, B., Massaro, J. M., D'Agostino, R. B., Sr., & White, M. (2020). Physical distancing interventions and incidence of coronavirus disease 2019: Natural experiment in 149 countries. *BMJ*, *370*, m2743.

Johnston, M. (2015). Use and usability: Are theoretical models of behaviour change practical? In S. M. A. R. W. Simon Christmas (Ed.), *Thinking about behaviour change: An interdisciplinary dialogue* (pp. 69–83). Silverback Publishing.

Kearns, A., & Whitley, E. (2019). Associations of internet access with social integration, wellbeing and physical activity among adults in deprived communities: Evidence from a household survey. *BMC Public Health*, *19*(1), 1–15.

Kenny, D. A., & Judd, C. M. (2014). Power anomalies in testing mediation. *Psychological Science*, *25*(2), 334–339. https://doi.org/10.1177/0956797613502676

Leventhal, H., Diefenbach, M., & Leventhal, E. A. (1992). Illness cognition: Using common sense to understand treatment adherence and affect cognition interactions. *Cognitive Therapy and Research*, *16*(2), 143–163.

Luszczynska, A., & Schwarzer, R. (2005). Social cognitive theory. In *Predicting health behaviour: research and practice with social cognitive models* (pp. 127–169). Open University Press.

MacKinnon, D. P., & Fairchild, A. J. (2009). Current directions in mediation analysis. *Current Directions in Psychological Science*, *18*(1), 16–20.

Masters, N. B., Shih, S.-F., Bukoff, A., Akel, K. B., Kobayashi, L. C., Miller, A. L., Harapan, H., Lu, Y., & Wagner, A. L. (2020). Social distancing in response to the novel coronavirus (COVID-19) in the United States. *PLoS One*, *15*, e0239025.

Michie, S., & Prestwich, A. (2010). Are interventions theory-based? Development of a theory coding scheme. *Health Psychology*, *29*(1), 1–8.

Mize, S. J., Robinson, B., Bockting, W., & Scheltema, K. (2002). Meta-analysis of the effectiveness of HIV prevention interventions for women. *AIDS Care*, *14*(2), 163–180.

Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., McKay, R., Bennett, K., Mason, L., & Gibson-Miller, J. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature Communications*, *12*(1), 1–15.

O'Brien, D. A., & Clements, C. F. (2021). Early warning signals predict emergence of COVID-19 waves. *medRxiv*.

Olander, E. K., Fletcher, H., Williams, S., Atkinson, L., Turner, A., & French, D. P. (2013). What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behaviour: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *10*(1), 1–15.

Orbell, S., Zahid, H., & Henderson, C. (2020). Changing behavior using the health belief model and protection motivation theory. In *The handbook of behavior change* (pp. 46–59). Cambridge University Press.

Park, C. L., Russell, B. S., Fendrich, M., Finkelstein-Fox, L., Hutchison, M., & Becker, J. (2020). Americans' COVID-19 stress, coping, and adherence to CDC guidelines. *Journal of General Internal Medicine*, *35*(8), 2296–2303.

Pedersen, M. J., & Favero, N. (2020). Social distancing during the Covid-19 pandemic: Who are the present and future noncompliers? *Public Administration Review*, *80*, 805–814.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, *91*(1), 93–114.

Selvan, M. E. (2020). Risk factors for death from COVID-19. *Nature Reviews Immunology*, *20*(7), 407.

Sheeran, P., Maki, A., Montanaro, E., Avishai-Yitshak, A., Bryan, A., Klein, W. M., Miles, E., & Rothman, A. J. (2016). The impact of changing attitudes, norms, and self-efficacy on health-related intentions and behavior: A meta-analysis. *Health Psychology*, *35*(11), 1178–1188.

Tregoning, J. S., Flight, K. E., Higham, S. L., Wang, Z., & Pierce, B. F. (2021). Progress of the COVID-19 vaccine effort: Viruses, vaccines and variants versus efficacy, effectiveness and escape. *Nature Reviews Immunology*, *21*, 1–11.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychological Bulletin*, *132*(2), 249–268.

Williams, C. Y., Townson, A. T., Kapur, M., Ferreira, A. F., Nunn, R., Galante, J., Phillips, V., Gentry, S., & Usher-Smith, J. A. (2021). Interventions to reduce social isolation and loneliness during COVID-19 physical distancing measures: A rapid systematic review. *PLoS One*, *16*(2), e0247139.

Williams, S. L., & French, D. P. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—And are they the same? *Health Education Research*, *26*(2), 308–322.

How to cite this article: den Daas, C., Johnston, M., Hubbard, G., & Dixon, D. (2022). An experimental COVID-19 messaging study in a representative sample of the Scottish population: Increasing physical distancing intentions through self-efficacy. *British Journal of Health Psychology*, *00*, 1–13. https://doi.org/10.1111/bjhp.12632