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Reducing SARS-CoV-2 transmission in the UK: A behavioural science approach to identifying options for increasing adherence to social distancing and shielding vulnerable people

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Purpose. To describe and discuss a systematic method for producing a very rapid response (3 days) to a UK government policy question in the context of reducing SARS-CoV-2 transmission.

Methods. A group of behavioural and social scientists advising the UK government on COVID-19 contributed to the analysis and writing of advice through the Government Office for Science. The question was as follows: What are the options for increasing adherence to social distancing (staying at home except for essential journeys and work) and shielding vulnerable people (keeping them at home and away from others)? This was prior to social distancing legislation being implemented. The first two authors produced a draft, based on analysis of the current government guidance and the application of the Behaviour Change Wheel (BCW) framework to identify and evaluate the options.

Results. For promoting social distancing, 10 options were identified for improving adherence. They covered improvements in ways of achieving the BCW intervention types of education, persuasion, incentivization, and coercion. For promoting shielding of vulnerable people, four options were identified covering the BCW intervention types of incentivization, coercion, and enablement.

Conclusions. Responding to policymakers very rapidly as has been necessary during the COVID-19 pandemic can be facilitated by using a framework to structure the thinking and reporting of multidisciplinary academics and policymakers.

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COVID-19 poses the most serious global threat to mortality, physical and mental health, way of life, and economies since World War II. Reducing transmission of the SARS-CoV-2 virus that causes it is paramount to reducing its devastating toll. In the absence of an effective vaccine, the UK government has recommended that the population adopt a series of behaviours intended to reduce transmission. There are two key sets of COVID-19-related behaviours that apply to the population as a whole. The first is 'personal protective behaviours': Individual behaviours aimed to protect oneself or others. This includes handwashing with soap or a suitable sanitizer, not touching the T-zone (eyes, nose, and mouth), and coughing and sneezing into tissues (Michie, West, Amlot, & Rubin, 2020; West, Michie, Amlot, & Rubin, 2020). The second involves more upstream behaviours aimed at ensuring physical distance between people. This includes 'social distancing' (staying at home except for essential journeys and work) and 'shielding' of vulnerable people (keeping them at home and making sure that they do not come into contact with someone who might be infected).

There is a science of behaviour and behaviour change informed by a range of disciplines including psychology, social epidemiology, anthropology, and sociology that we can draw on when developing and evaluating interventions and policy measures to prevent and mitigate a wide range of health problems (Van Bavel *et al.*, 2020). SARS-CoV-2 is a novel virus that has swept across the world with great speed, limiting the possibility, at least in the short term, of generating direct evidence as to how best to implement such measures.

For measures to have their intended effects, they require the population to accept and adhere to them. In the absence of direct evidence, knowledge gleaned from studies investigating public responses to a range of risks and threats, and measures to reduce transmission of other infections occurring in different countries and times can be drawn on. General principles can be extracted which can inform interventions and policies in the current situation to maximize the likelihood that they will achieve their intended outcomes and avoid unintended harmful consequences. As well as this body of evidence, behavioural science has produced a number of theories and frameworks that can be useful in structuring thinking, considering options in a systematic, comprehensive manner and linking principles to specific intervention strategies. One such framework used to inform policy work of governments at national and local level is the Behaviour Change Wheel, which links a model of behaviour change to a set of nine intervention types and seven policy options, representing a synthesis of a wide range of 19 frameworks (Michie, Atkins, & West, 2014; Michie, Van Stralen, & West, 2011). This has proved useful in structuring thinking and recommendations in a range of different public policy areas, especially when the domain is complex and/or deadlines are tight.

Behavioural and social scientists advising the UK government on COVID-19 were asked to consider interventions to increase population adherence to two sets of guidance from the UK government to reduce COVID-19 transmission. Their work addressed the question: 'What are the options for increasing adherence to the social distancing measures (1) general social distancing by everyone and (2) shielding for vulnerable people for at least 12 weeks?'. The timescale was 3 days, allowing for only limited scrutiny and review. The method we used, and the results, may be of interest to others tasked with rapidly considering policy options. This policy document was submitted to the UK government and has been made available online Scientific Pandemic Influenza Group on Behaviours (2020).

Method

We started with the official government guidance on social distancing and shielding. The government guidance on social distancing was (Public Health England, 2020a):

'Everyone should try to follow the following measures as much as is practicable.

1. Avoid contact with someone who is displaying symptoms of coronavirus (COVID-19). These symptoms include high temperature and/or new and continuous cough.
2. Avoid non-essential use of public transport when possible.
3. Work from home, where possible. Your employer should support you to do this. Please refer to employer guidance for more information.
4. Avoid large and small gatherings in public spaces, noting that pubs, restaurants, leisure centres and similar venues are currently shut as infections spread easily in closed spaces where people gather together.
5. Avoid gatherings with friends and family. Keep in touch using remote technology such as phone, internet, and social media.
6. Use telephone or online services to contact your GP or other essential services.

We strongly advise you to follow the above measures as much as you can and to significantly limit your face-to-face interaction with friends and family if possible, particularly if you: are over 70, have an underlying health condition, are pregnant.'

The government guidance on shielding was (Public Health England, 2020b):

'If you have a vulnerable person living with you:

1. Minimise as much as possible the time any vulnerable family members spend in shared spaces such as kitchens, bathrooms and sitting areas, and keep shared spaces well ventilated.
2. Aim to keep 2 m (3 steps) away from vulnerable people you live with and encourage them to sleep in a different bed where possible. If they can, they should use a separate bathroom from the rest of the household. Make sure they use separate towels from the other people in your house, both for drying themselves after bathing or showering and for hand-hygiene purposes.
3. If you do share a toilet and bathroom with a vulnerable person, it is important that you clean them every time you use them (for example, wiping surfaces you have come into contact with). Another tip is to consider drawing up a rota for bathing, with the vulnerable person using the facilities first.
4. If you share a kitchen with a vulnerable person, avoid using it while they are present. If they can, they should take their meals back to their room to eat. If you have one, use a dishwasher to clean and dry the family's used crockery and cutlery. If this is not possible, wash them using your usual washing up liquid and warm water and dry them thoroughly. If the vulnerable person is using their own utensils, remember to use a separate tea towel for drying these.

We understand that it will be difficult for some people to separate themselves from others at home. You should do your very best to follow this guidance and everyone in your household should regularly wash their hands, avoid touching their face, and clean frequently touched surfaces.'

The first two authors identified specific behaviours in each set of guidance and relevant principles of behaviour change, drawing on expertise and knowledge of existing theory and evidence, as the timescale of three days precluded a formal review of the literature. The Behaviour Change Wheel was used to guide thinking and structure the options

presented. Much of the evidence that was drawn on was very recent and therefore had not been subject to peer review.

Options for increasing adherence to social distancing measures were generated by considering what other countries had done, the challenges faced by UK public health authorities and suggestions for addressing them. These were evaluated using a set of criteria specifically developed to evaluate behaviour change interventions by two authors. The criteria have the acronym, APEASE (Acceptability, Practicability, Effectiveness, Affordability, Spill-over effects, Michie *et al.*, 2014, 2011). An initial judgement of each option was made for each criterion using a combination of evidence, first principles and reasoning. Feedback on the options was sought from the group and the options revised, with the final version entered into an APEASE grid. This was based on a rapid assessment, guided as far as possible by evidence. The report was drafted and reviewed by nine further participants in the advisory group, following which the report was revised.

Results

There were minimal changes suggested by the reviewers of the draft analysis: They were mainly elaborations and explanations. The options arrived at were not intended to be mutually exclusive. In fact, there is evidence that greatest behaviour change impact is achieved by interventions that operate at many levels simultaneously and consistently (National Institute for Health & Care Excellence, 2007). There are nine broad ways of achieving behaviour change drawn from the Behaviour Change Wheel: Education, Persuasion, Incentivization, Coercion, Training, Restriction, Environmental restructuring, Modelling and Enablement (Michie *et al.*, 2014, 2011). We focused on those that were most relevant for this task and where there was evidence to draw on. In each case, we used our understanding of behaviour change theory and practice to arrive at a set of options and then evaluated these using the APEASE criteria (Table 1).

Tables 2 and 3 show the APEASE evaluations of options identified for general social distancing and shielding, respectively. While most were judged to be acceptable, practicable, and affordable, the judgement of effectiveness was mostly higher if accompanied by other options. Most spill-over effects were judged to be positive but there was considerable uncertainty about equity of impact; reflecting the challenge of anticipating the potential impact of interventions on advantaged and disadvantaged sectors of society. Following this analysis, the recommendations below were formulated for delivering each of the intervention types.

Table 1. APEASE criteria for evaluating interventions (Michie *et al.*, 2014)

Acceptability	How far is it acceptable to all key stakeholders?
Practicability	Can it be implemented as designed within the intended context, material and human resources?
Effectiveness	How effective and cost-effective is it in achieving desired objectives in the target population?
Affordability	How far can it be afforded when delivered at the scale intended?
Side-effects	How far does it lead to unintended adverse or beneficial outcomes?
Equity	How far does it increase or decrease differences between advantaged and disadvantaged sectors of society?

Table 2. APEASE grid of evaluation criteria for options to increase general social distancing

	Evaluation criteria (APEASE)					
Option	Acceptability	Practicability	Effectiveness	Affordability	Spill-over effects	Equity
1. Provide clear, precise, credible guidance about specific behaviours	High	High	High if accompanied by other options	High	Positive	Uncertain
2. Use media to increase sense of personal threat	High	High	High if accompanied by other options	High	Could be negative	Uncertain
3. Use media to increase sense of responsibility to others	High	High	High if accompanied by other options	High	Positive	Uncertain
4. Use media to promote positive messaging around actions	High	High	High if accompanied by other options	High	Positive	Uncertain
5. Tailor messaging	High	High	High if accompanied by other options	High	Uncertain	Uncertain
6. Use and promote social approval for desired behaviours	High	High	Could be high	High	Positive	Uncertain
7. Consider enacting legislation to compel required behaviours	Could be high if equity issues addressed	Depends on timescale	Could be high if acceptable and enforced	Uncertain depending on level of enforcment	Could be negative	Could be negative
8. Consider use of social disapproval for failure to comply	Uncertain	High	Could be high if accompanied by other measures	High	Could be negative	Could be negative
9. Develop and mobilize adequately resourced community infrastructure	High	Variable	High	Moderate	Positive	Positive
10. Provide financial and material resources to mitigate effects of measures on equity	High	Variable	High	Uncertain	Positive	Positive

Table 3. APEASE grid of evaluation criteria for options to increase shielding of vulnerable people

Option	Evaluation criteria (APEASE)					
	Accept ability	Practic- ability	Effectiveness	Affordability	Spill-over effects	Equity
1. Provide clear structured, specific guidance	High	High	High if accompanied by other options	High	Positive	Uncertain
2. Clearly tailor guidance to make clear who needs to do what	High	High	High if accompanied by other options	High	Positive	Uncertain
3. Expand the guidance to include vulnerable adults and employers	High	High	High if accompanied by other options	High	Positive	Uncertain
4. Provide community support, targeted media campaigns, apps, and websites to help people follow the guidance	High	High	High	High	Positive	Positive

General social distancing by everyone

Options

Education.

1. *Specificity:* The guidance currently lacks clarity and specificity with regard to recommended behaviours. For example, instead of the phrase 'try to', it should just say 'do'. Phrases such as 'as much as is practicable', 'non-essential', 'significantly limit', and 'gathering' are open to wide differences in interpretation. This can lead to confusion about exactly what people are being required to do (e.g., gathering outside or going for walks). Guidance now needs to be reformulated to be behaviourally specific: *Who* needs to do *what* (precisely) and *why* (explain the rationale) and communicated through channels that provide personalized advice and account for individual circumstances including SMS messaging and an interactive website (Carter, Drury, Rubin, Williams, & Amlot, 2015; Michie & Johnston, 2005; Scientific Pandemic Influenza behaviour Advisory Committee (SPI-B), 2020b).

Persuasion.

2. *Perceived threat:* A substantial number of people still do not feel sufficiently personally threatened; it could be that they are reassured by the low death rate in their demographic group (IPSOS MORI, Personal communication), although levels of concern may be rising (Atchison *et al.*, 2020). Having a good understanding of the risk has been found to be positively associated with adoption of COVID-19 social distancing measures in Hong Kong (Dowd *et al.*, 2020). The perceived level of

personal threat needs to be increased among those who are complacent, using hard-hitting emotional messaging based on accurate information about risk. To be effective, this must also empower people by making clear the actions they can take to reduce the threat (Pearce, Lindekilde, Parker, & Rogers, 2019; Pearce, Rubin, Amlôt, Wessely, & Rogers, 2013; Peters, Ruiter, & Kok, 2013).

3. *Responsibility to others:* This is important where there is insufficient understanding of, or feelings of responsibility about, people's role in transmitting the infection to others. This may result in part from messaging around the low level of risk to most people and talk of the desirability of building 'herd immunity'. Messaging needs to emphasize and explain the duty to protect others (Everett, Colombatto, Chituc, Brady, & Crockett, 2020; Haidt, 2012).
4. *Positive messaging around actions:* People need to see self-protective actions in positive terms and feel confident that they will be effective. Individuals also need to understand that the survival of the severely ill will be increased by the capacity of the health care system, which in turn will be increased by reducing the rise in infections now. Messaging about actions needs to be framed positively in terms of protecting oneself and the community and increases confidence that they will be effective (Gallagher & Updegraff, 2012).
5. *Tailoring:* Some people will be more persuaded by appeals to adhere to government instructions, some by duty to the community, and some to personal risk (Haidt, 2012). Different approaches are needed to take account of this and of the realities of the different lives of people, including their material and social circumstances and their individual needs. Messaging needs to take account of the different motivational levers and circumstances of different people, informed by the findings from surveys and focus groups (Lunn *et al.*, 2020; McClelland *et al.*, 2017).

Incentivization.

6. *Social approval:* Social approval can be a powerful source of reward. Not only can this be provided directly by highlighting examples of good practice and providing strong social encouragement and approval in communications; members of the community can be encouraged to provide it to each other. This can have a beneficial spill-over effect of promoting social cohesion, although negative unintended consequences such as social shaming and stigma should be avoided (Lunn *et al.*, 2020). Communication strategies should provide social approval for desired behaviours and promote social approval within the community.

Coercion.

7. *Compulsion:* Experience with UK enforcement legislation such as compulsory seat belt use suggests that, with adequate preparation, rapid change can be achieved where some parts of the population do not initially accept this (Bauld, 2011; Vasudevan, Nambisan, Singh, & Pearl, 2009). Some other countries have introduced mandatory self-isolation on a wide scale without evidence of major public unrest and the large majority of the UK's population appear to be supportive of more coercive measures. For example, 64% adults in Great Britain said they would support putting London under a 'lock down' (YouGov, 2020). However, data from Italy and South Korea suggest that for aggressive protective measures to be effective, special attention should be devoted to those population groups that are more at risk (Kwok,

2020; McClelland *et al.*, 2017). In addition, communities need to be engaged to minimize risk of negative effects. Consideration should be given to enacting legislation, with community involvement, to compel key social distancing measures.

8. *Social disapproval:* Social disapproval from one's community can play an important role in preventing anti-social behaviour or discouraging failure to enact pro-social behaviour (Lunn *et al.*, 2020). However, this needs to be carefully managed to avoid victimization, scapegoating, and misdirected criticism, and also to minimize erosion of social cohesion and collective efficacy, and minimize the visibility of non-adherence which may then undermine adherence. It needs to be accompanied by clear messaging and promotion of strong collective identity. Consideration should be given to use of social disapproval but with a strong caveat around unwanted negative consequences.

Environmental restructuring.

9. *Community resourcing:* People are being asked to give up valued activities and access to resources for an extended period. To make these privations acceptable, people need to be compensated by ensuring that people have access to opportunities for social contact and rewarding activities that can be undertaken in the home. To make them feasible, people need to be enabled through resources such as sufficient income, employment rights, and food. Adequately resourced community infrastructure and mobilization need to be developed rapidly and with coverage across all communities (Lunn *et al.*, 2020; Scientific Pandemic Influenza Behaviour Advisory Committee (SPI-B), 2020b).
10. *Reducing inequity:* Adherence to these measures is likely to be undermined by perceived inequity in their impact on different sections of the population, especially those who are already disadvantaged, for example, those in rented accommodation, self-employed, and those working in precarious employment. Reducing costs of phone calls, data downloads, etc., by 'responsibility deals' or government subsidies should be considered. Sections of the population who are particularly adversely affected need to be identified and steps taken to mitigate the adverse impact on their lives (Scientific Pandemic Influenza Behaviour Advisory Committee (SPI-B), 2020a, 2020c).

Shielding vulnerable people for at least 12 weeks

Options

Education.

1. *Specificity and structuring:* The guidance is vague and is not behaviourally specific. For example, it uses the phrase 'as much as possible' which is ambiguous and undermines the message. The phrase 'aim to' is too weak – the guidance should promote action not aims. Use of the term 'avoid' is weaker than 'do not'. Key parts of messaging are missing. For example, it says 'clean' and 'wipe' but does not state that this needs to be with disinfectant. It uses the term 'regularly' but does not specify the situations when this should occur. It talks about 'touching the face' when what is crucial is to avoid touching the 'T-Zone' – mouth, nose, and eyes. The structure can be improved to help people to understand what actions need to be undertaken where and when. Guidance needs to be behaviourally specific and structured: *Who* needs to

do *what* (precisely), *where* (e.g., in what rooms), and *why* (explain the rationale; Michie & Johnston, 2005).

2. *Tailoring:* Much of the guidance is contingent on the person's living circumstances but the tailoring could be clearer so that people can easily see what applies to them and are not distracted by content that is not relevant. Guidance should be structured to make clear which parts are relevant to whom. This could be done through an interactive website where people can put in personal details (e.g., key worker, live with someone vulnerable, husband just developed a cough) and receive tailored guidance (Lunn *et al.*, 2020; Scientific Pandemic Influenza Behaviour Advisory Committee (SPI-B), 2020b).
3. *Audience:* The guidance is directed exclusively to those living with vulnerable people. It needs to be extended to the vulnerable people themselves so that they understand what measures need to be taken, and why, and so that they are motivated to accept the necessary changes, inconvenience, and restrictions. They also need to be active partners in decisions made in the household so that following the guidance is a collaborative process. A third key audience is employers of vulnerable people. Vulnerable people need to be justifiably confident that they can self-isolate without financial or career penalty. Guidance should be directed to all members of the household, including the vulnerable people themselves and any employers recognizing the need for partnership (Scientific Pandemic Influenza Behaviour Advisory Committee (SPI-B), 2020c).

Enablement.

4. *Support:* This is complex guidance that is difficult for many people to understand, remember, and follow. There needs to be more specific information, education, and practical support. This could potentially be done by trained community support volunteers, by targeted media campaigns, social media, and user-friendly interactive apps and websites. Community support, targeted media campaigns, apps, and websites are needed to assist households with vulnerable people to establish new living arrangements and routines and to adhere to the guidance; adequately resourced local authorities and public health teams can play an important role here (Lunn *et al.*, 2020; Scientific Pandemic Influenza Behaviour Advisory Committee (SPI-B), 2020c).

Discussion

This paper presents a behavioural science approach to identifying options for increasing adherence to social distancing measures using a framework, the Behaviour Change Wheel, to structure thinking and reporting. The format enabled efficient collaborative working which was especially valuable in the face of a tight deadline.

The interventions identified have the potential to enhance the effectiveness of adherence to guidance. The proposed adaptations to messaging were welcomed by policymakers as especially useful in guidance being developed at speed, or guidance aimed at a wide audience and thus running the risk of being too general or lacking behaviourally specificity. While the method has identified likely candidates for effective interventions, they should be pre-tested with representatives of the intended audience using mixed methods, including 'read aloud' methods (Morgan, Fischhoff, Bostrom, & Atman, 2002) and online experiments (so-called 'AB testing).

In terms of considering issues relevant to implementation of the options, the APEASE criteria proved a useful structure. However, the three-day timescale precluded a more systematic and rigorous method being used: The current assessment must therefore be considered as tentative. Of note is the uncertainty around equity issues and the potential for differential effects of interventions on advantaged and disadvantaged sections of society, which suggests that this is an area requiring more research.

A more general challenge is one of implementation. While we were able to produce options that we consider valid and useful, whether they can be used in practice is a separate matter. Importantly, choice of which of the identified recommendations to adopt is also not context free. As with all science advice during a crisis, the decision as to which course of action is right for a country must, rightly, rest with elected political representatives. It is national governments who face the daunting task of weighing the possible effectiveness of different interventions against their potential economic and social costs, their population dynamics (e.g., age, health), capacity to deliver or support each option, as well as against the more general values of the nation. Science can take us only so far.

The translation of scientific advice into policy and practice can lead to unintended consequences with the potential to undermine the rationale informing the advice (e.g., policing sun-bathers who are following the 2 metres apart rules of social distancing in parks). Thought must therefore be given to ensuring that the principles underpinning behavioural science-based advice are not lost in translation between the point of advice and the point of delivery. The use of the APEASE grid of evaluation criterion to enable the application of the Behaviour Change Wheel framework at each stage of the process may better enable the translation of evidence-based advice into health protection practice.

We hope that this approach will be useful for policymakers to adopt routinely in considering and evaluating their options to address a particular policy question. In response to a call for policymakers for guidance for applying the Behaviour Change Wheel framework to policy work, two 'user-friendly' guides have been produced, one for local government (West, Michie, Atkins, Chadwick, & Lorencatto, 2020) and one for national government, to be launched in late 2020 (details from https://www.ucl.ac.uk/behaviour-change/).

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Conflicts of interest

All authors declare no conflict of interest.

Author contributions

All authors contributed to the conceptualization. Robert West and Susan Michie wrote the original draft. All authors contributed to reviewing and editing the manuscript.

Data availability statement

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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