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Increasing the intent to receive a pandemic influenza vaccination: Testing the impact of theory-based messages

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Abstract

Objective. Vaccination is an effective preventive measure to reduce influenza transmission, especially important in a pandemic. Despite messages encouraging vaccination during the last pandemic, uptake remained low (37.6% in clinical risk groups). This study investigated the effect of different types of messages regarding length, content type, and framing on vaccination intention.

Method. An online experiment was conducted in February 2015. A representative sample of 1424 people living in England read a mock newspaper article about a novel influenza pandemic before being randomised to one of four conditions: standard Department of Health (DoH) (long message) and three brief theory-based messages - an abridged version of the standard DoH and two messages additionally targeting pandemic influenza severity and vaccination benefits (framed as risk-reducing or health-enhancing, respectively). Intention to be vaccinated and potential mediators were measured.

Results. The shortened DoH message increased vaccination intention more than the longer one, by increasing perceived susceptibility, anticipated regret and perceived message personal relevance while lowering perceived costs, despite the longer one being rated as slightly more credible. Intention to be vaccinated was not improved by adding information on severity and benefits, and the health-enhancing message was not more effective than the risk-reducing.

Conclusion. A briefer message resulted in greater intention to be vaccinated, whereas emphasising the severity of pandemic influenza and the benefits of vaccination did not. Future campaigns should consider using brief theoretically-based messages, targeting knowledge about influenza and precautionary measures, perceived susceptibility to pandemic influenza, and the perceived efficacy and reduced costs of vaccination.

Keywords: Vaccination uptake; theory-based health messages; psychological predictors; online experiment.

Introduction

Influenza pandemics are unpredictable phenomena, and their consequences can be severe, with a potential to cause millions of deaths worldwide and compromise social and economic wellbeing (WHO, 2013). In contrast to seasonal influenza epidemics, influenza pandemics emerge from a variant of a virus entirely novel to humans or not having circulated for several decades. As a result, the world population has little or no immunity to the virus, which can cause severe, sometimes life-threatening, illness. Vaccination is the most effective precautionary measure against influenza pandemics (WHO, 2012), but its success relies on the public´s decision to be vaccinated. Despite extensive media campaigns, data from different countries show that during the 2009 influenza A (H1N1) pandemic most people did not get vaccinated, even those with chronic diseases (CDC, 2011; Mereckiene et al., 2012).

In a future outbreak, communication with the public will be key for encouraging vaccination uptake. Communication will need to be informed by evidence and theory from behavioural science (Michie & Abraham, 2004), and be systematically evaluated (Yardley, Morrison, Bradbury, & Muller, 2015). Therefore, we tested theory-guided and evidenced-based health messages promoting vaccination uptake to determine their persuasiveness in advance of a future pandemic. More specifically, we compared, in relation to a health message used in 2009-10 campaign against A(H1N1) influenza, the effectiveness of shorter messages and explored whether further addressing other theoretical constructs relevant for vaccination may contribute to increased vaccination uptake and how vaccination benefits should be framed.

Health message length

The degree to which arguments in a message are scrutinised depends on both motivation (e.g., relevance of the issue) and ability (e.g., cognitive resources, time) of the message recipient (Petty & Cacioppo, 1986). Thus, even if individuals are motivated, they may not have the cognitive resources or the time to process the message in great depth. Thus, the longer a message is, the more likely it is to be processed superficially (Petty & Cacioppo, 1984), with the number of arguments working as a peripheral cue to persuasion (Calder, Insko, & Yandell, 1974) and message content having a lesser impact on attitude change. Accordingly, shorter messages are more likely to be recalled (Gerver, 1969) and have a greater impact on behaviour change (Noar, Benac, & Harris, 2007).

Health message content

A number of social-cognitive antecedents of vaccination uptake that can be targeted by health messages have been identified (see Bish et al., 2011; Brien et al., 2012 for reviews). Believing the pandemic influenza is serious and that one is personally at risk (Brewer et al., 2007; Marcu, Rubinstein, Michie, & Yardley, 2015) and perceiving vaccination as beneficial and protective against pandemic influenza as well as a means of avoiding spreading the infection to others (Han, Michie, Potts, & Rubin, 2016; Rubinstein, Marcu, Yardley, & Michie, 2015) have been identified as

vaccination uptake facilitators. Factors associated with reduced intention to be vaccinated are: being sceptical about the threat posed by pandemic influenza (Rubin, Finn, Potts, & Michie, 2015; Rubin, Potts, & Michie, 2010), thinking that pandemic influenza is similar to seasonal influenza, which is not considered to be a serious illness (Rubinstein et al., 2015), perceptions of being healthy and having a strong immune system (Han et al., 2016; Rubinstein et al., 2015), and having concerns around the safety of the vaccine, such as fearing eventual side effects (Sypsa et al., 2009).

Based on people's prior experience with the A(H1N1) virus, which was less severe than others from previous pandemics (WHO, 2013) and perceived as a mild threat (Bish, Michie, & Yardley, 2010), it is likely that the risk of a future pandemic will be initially perceived as relatively low. Thus, it has been suggested that, in order to increase the public willingness to vaccinate, health messages need to focus on the severity of pandemic influenza (Bish et al., 2010). However, this information should be followed by the benefits of vaccination, as high levels of fear and arousal produced by risk messages can undermine their motivational effect as a result of leading to avoidance and/or denial responses (Peters, Ruiter, & Kok, 2013).

Framing of benefits

Although the benefits of vaccination are often presented in relation to disease prevention (*risk-reducing* benefits), benefits can also be framed in relation to health promotion (*health-enhancing* benefits). Recent studies have suggested that highlighting the health-enhancing benefits of vaccination, such as strengthening the immune system, may be more effective than emphasising the reduced risk of infection (Rubinstein, et al., 2015; Teasdale, Santer, Geraghty, Little, & Yardley, 2014).

The present study

This study aimed to evaluate evidence- and theory-based messages promoting uptake of vaccination for pandemic influenza in the context of an uncertain pandemic influenza scenario, and investigate psychological explanations of message effectiveness. Despite the existence of a wealth of observational and correlational studies on pandemic influenza vaccination, considerably fewer studies have experimentally evaluated the effectiveness and change process of theory-based health messages for the promotion of vaccination uptake (see McGlone, Bell, Zaitchik, & McGlynn, 2013 and Payaprom, Bennett, Alabaster, & Tantipong, 2011, for exceptions). Moreover, to our knowledge, no other study has done so using a representative sample of the population, which is relevant considering the demographic variations in vaccination intentions and uptake.

Intention to be vaccinated was used as a proxy measure for behaviour on the basis of evidence of its predictive power in the context of single action behaviours (Sheeran, 2002), such as vaccination (Lehmann, Ruiter, Chapman, & Kok, 2014; Renner & Reuter, 2012). Psychological predictors of vaccination uptake were measured to test the mechanisms responsible for differential effects across different health messages on vaccination intentions.

We predicted that:

1) A briefer message (one page long) would lead to higher intentions to be vaccinated than a longer one (12 pages long).
2) Emphasizing the severity of pandemic influenza and benefits of vaccination would contribute to an increase in the intention to be vaccinated.
3) A message focusing on the health-enhancing (rather than risk-reducing) benefits of vaccination would be more effective.

Method

Study design

After reading the study objectives and providing their informed consent, participants were requested to read a mock newspaper article describing an uncertain influenza pandemic. They were informed that it was fictitious, but were asked to imagine themselves in that situation. They then answered one question measuring their baseline intention to be vaccinated and were randomized to one of four conditions: 1) DoH message, 2) Shortened DoH message, 3) Shortened risk-reducing message, or 4) Shortened health-enhancing message.

Participants

A representative sample in relation to age, gender and geographic location of adults living in England was recruited through a market research company online panel (see Supplementary File 1 for details on recruitment procedures). Participants were required to be fluent in English and to be aged between 16 and 75[1]. The sample size was calculated using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) to give 80% power to detect a statistically significant difference at $\alpha = 0.05$, if an effect size of 0.1 or higher was observed, adjusting for one covariate, and inflated by 30%, given the possibility of drop-out.

Materials

Pandemic influenza scenario. This was a mock news item, based on one used by Rubinstein et al. 2015 (see Appendix A). The use of an uncertain, moderate scenario relied on previous research showing this methodology to be valid (Wright, French, Weinman, & Marteau, 2006) and that under a severe pandemic scenario the majority of people would accept vaccination (Rubinstein et al, 2015; Teasdale, Yardley, Schlotz, & Michie, 2012).

Health messages. The *DoH Message* (condition 1), was an amended version of the 12-page leaflet used by the DoH in the 2009-10 pandemic, where "swine flu" was substituted with "a new flu strain" and medication names with dummy labels. The other three messages were created to look similar to the posters used in 2009-2010, including similar visual lay out and images, and the same tag

[1] The upper age limit was set up at 75 years as only 37% of people aged 75 or more use the internet whereas in other age groups this percentage is above 70% (Office for National Statistics, 2014).

line and logos (see Supplementary File 2). We were explicit about the source of information, a factor known to be important for message credibility (Quinn et al, 2013).

The *Shortened DoH message* (condition 2) contained only the key information selected from the 12-page leaflet. It targeted known vaccination predictors: knowledge about flu and precautionary measures, perceived susceptibility, perceived costs (emphasising low risk of side-effects and vaccine safety) and vaccine efficacy. *Shortened risk-reducing message* (condition 3) presented the vaccine as a way of reducing the risk of contracting pandemic flu, while *Shortened health-enhancing message* (condition 4) presented the vaccine as a way of boosting the immune system and maintaining good health, with both conditions further emphasising the severity of pandemic influenza.

All messages were piloted to ensure they were appropriately theoretically based: three experts in behaviour change theory independently coded the theoretical constructs targeted by the messages. Any disagreements were resolved through discussion and a consensus was reached (see Table 1).

Measures

The questionnaire included measures of vaccination intentions as well as of psychological, demographic and clinical factors associated with vaccination intentions (see Supplementary file 3). The psychological factors were hypothesised to be differently affected by each of the four messages tested (see Table 2). Demographic and clinical factors previously associated with vaccination uptake were also assessed in order to assess the similarity between our sample and the population in relation to relevant variables. The questionnaire was piloted with a convenience sample (n= 19), to ensure that: a) the task was not too burdensome, b) the questions were clear, concise and not misleading, and c) the response scales were adequate. Appropriate modifications were made in response to the feedback received.

Statistical Analyses

All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 22, after ensuring the statistical assumptions for the performed tests were met. Analyses of co-variance (ANCOVA) adjusting for intentions at baseline were performed, in order to test whether the message length (comparing *DoH message* with *Shortened DoH message*) or message content (comparing the three shorter messages), had an impact on intention to be vaccinated. Two MANOVAs with fixed main effects for group were performed to determine whether the length or content of the messages influenced intention predictors. A Chi-square test tested the association between length and whether people reported reading the message in full. For significant effects, mediational analysis, a statistical analysis for testing causal inferences regarding the effect of one independent variable (IV) on a dependent variable (DV) through more than one putative process variables (i.e., mediators), were performed through a computational tool for path analysis-based mediation (Hayes, 2013). A detailed description of analyses performed is provided on Supplementary File 4.

Results

Participants

Of 1424 participants, 716 (50.3%) were women and 708 (49.7%) men, aged 16-75 (*M*= 45.42; *SD*= 18.18). The majority (91.7%) were white and had finished at least higher secondary education (75%). About a quarter had ongoing health problems (25.6%), about a third were vaccinated every year for seasonal flu (35%) and 14.5% reported having been vaccinated against H1N1 in 2009-10. These were similar to the general population (28.0%, 27.9% and 10.4%, respectively). Detailed sample characteristics, in relation to the population, are presented in Table 3.

Baseline intentions to be vaccinated

Intentions to be vaccinated were high prior to message exposure: $M = 5.51$, $SD = 1.69$ in the DoH; $M = 5.47$, $SD = 1.73$, in the shortened DoH; $M = 5.83$, $SD = 1.53$ in the shortened risk-reducing; and $M = 5.56$, $SD = 1.73$ in the shortened health-enhancing message conditions, respectively.

Message Impact

Effect of message length

(i) Intention to be vaccinated. Participants in the Standard DoH message condition showed lower intention to be vaccinated compared with those in the Shortened DoH message condition. See Table 4 for details.

(ii) Predictors of intention**.** The Shortened DoH message led individuals to perceive pandemic influenza to be more severe, themselves to be more susceptible and feeling more anticipated regret if they decided not to vaccinate and then got pandemic influenza. The shorter message was also better recalled, and rated as being more personally relevant, despite being considered as slightly less credible than the longer one (see Table 4). Moreover, a chi-square test revealed that those in the DoH (longer) message condition reported more often not having read in full the information that was presented, when compared to those in the Shortened DoH message condition, χ^2 (2, 712) = 10.91, $p < .01$.

(iii) Mechanisms. The effect of message length on intention was explained, i.e., mediated by multiple predictors, namely the increase in perceived susceptibility (Indirect effect; β= 0.006, 95% CI [0.001; 2.418]) and anticipated regret (Indirect effect: β= 0.016, 95% CI [0.006; 1.756]), and the lowering of perceived costs of vaccination, (Indirect effect: β= 0.004, 95% CI [0.001; 0.373]), as well as by increased perceived relevance of the information presented, (Indirect effect: β= 0.029, 95% CI [0.016; 2.863]) and message credibility, (Indirect effect: β = 0.004 , 95% CI [0.000; 0.675]) (Figure 1).

Effect of message content

(i) Intention to be vaccinated. No differences were found across the three shorter messages for intention (see Table 5).

(ii) Predictors of intention. Those receiving the 'shortened risk-reducing' message perceived the pandemic to be more severe, felt more susceptible to it, and perceived the message to be more credible than those receiving the shortened DoH message. Those receiving the 'shortened risk-reducing' message also perceived vaccination to be more beneficial and rated the message as being clearer when compared to either those receiving the 'shortened health-enhancing' or the shortened DoH message, and showed lower levels of scepticism than those in the 'shortened health-enhancing' condition. However, the information presented in the shortened DoH message was better recalled when compared to the other two conditions (see Table 5 for statistical details).

Discussion

Systematically testing vaccination promotion messages in advance of a future influenza pandemic is vital to successfully encouraging the public to be vaccinated. This online experiment compared the effectiveness of different health messages in motivating people to be vaccinated and explained some underlying psychological mechanisms. The briefer message with DoH content contributed to higher intention to be vaccinated than the longer one. This effect was explained by perceiving increased susceptibility to pandemic influenza, anticipated regret if deciding not to vaccinate, and personal relevance, and perceiving the costs of vaccination to be less; this is despite the longer message being rated as slightly more credible. Further emphasising the negative consequences of pandemic influenza and benefits of vaccination did not lead to higher intention to be vaccinated and the health-promoting message was not more effective than the risk-reducing one.

A shorter message was found to be more effective in promoting vaccination uptake than a longer one, in line with our first hypothesis. Previous studies also showed that shorter messages tend to be more effective in promoting behaviour change (Noar et al., 2007). It is also consistent with research showing that cognitive resources are limited and that people do not always process the messages they are exposed to in a systematic way (Petty & Cacciopo, 1986). Thus, shorter messages are more likely to be read in full, as our results have shown, be processed more systematically, have a more positive effect on psychological predictors and, as a consequence, increase vaccination uptake. Such findings have potential implications for delivering health messages over social media, including Twitter. The shorter message was rated as slightly less credible than the longer one. This may be because, regardless of their quality, a greater number of arguments in a message can positively influence message credibility (Petty & Caccioppo, 1984). The shorter message was also regarded as more personally relevant than the longer one, which may reflect the fact that the longer one contained information relevant only to certain population groups (e.g., pregnant women). As a consequence, those who received this leaflet may have not identified with all the information that was provided. This suggests that a series of tailored brief messages are likely to be more effective than a longer comprehensive one.

Although adding a severity element to the message as well as stressing the benefits of vaccination led people to perceive pandemic flu as being more serious and to anticipate greater gains from vaccination, this did not contribute to higher intentions to be vaccinated, contrary to our second hypothesis. Despite the finding from other studies showing that changes in these beliefs contributed to increased intentions to be vaccinated (e.g., McGlone et al., 2013; Payaprom et al., 2011), the fact that, even before the exposure to the health messages, intentions were generally high in our study, may have contributed to a ceiling effect.

Contrary to our third hypothesis, the two ways of framing vaccination benefits (i.e., health-enhancing and risk-reducing) were equally effective in promoting vaccination intentions, similar to results of previous meta-analyses on the effects of framed arguments on vaccination (O´Keefe & Nan, 2012). However, the shortened risk-reducing message was perceived to be clearer and led to lower levels of scepticism and to vaccination being perceived as more beneficial. One explanation for this finding is that there was a better fit between the vaccination arguments and a prevention (i.e., risk-reducing) frame. Results of a qualitative study have shown that people tended to think about vaccination as something they do to avoid a disease (prevention) rather than something they do to improve their health and wellbeing (promotion) (Mowbray, Marcu, Godinho, Michie, & Yardley, in press). Another explanation is that risk-reducing arguments may have been regarded as more balanced, as they acknowledged risk and uncertainty around a pandemic situation, contributing to them being seen as more clear and trustworthy (Mowbray et al., in press).

In the 2009/10 pandemic, most of the population received information through traditional media (i.e., television, radio, newspapers and magazines) (Walter, Böhmer, Reiter, Krause, & Wichmann, 2012). However, since people are increasingly searching for health information through the internet (Fox & Duggan, 2013), it will be important to investigate how best to convey health information and motivate vaccination impact through social media and internet banners (Chew & Eysenbach, 2010; McNeill et al., in preparation). It should be noted that increasing motivation is only one of the keys to behaviour change: increasing opportunity and capability are also needed (Michie, Stralen & West, 2011). For example, the vaccines need to be widely accessible and people need to be encouraged to make plans regarding when, where and how to get vaccinated (Hagger & Luszczynska, 2014; Payaprom et al., 2011).

Study limitations and strengths

There were some limitations to this study. Although using scenarios is unavoidable in the absence of a real pandemic, responses at the peak of a pandemic may vary considerably from those when there is no real pandemic threat, in line with evidence showing that people mentally represent close and distant future events in different ways, with implications for decision-making (Trope & Liberman, 2003), and that behaviour does not always reflect intentions (Webb & Sheeran, 2006). Second, there was little variability in intentions, which were generally high even prior to message

exposure, possibly due to social desirability bias in responses, or to the uncertainty around the consequences of the virus highlighted by the scenario, contrary to what happened in 2009-10, when A/H1N1 was already known to be a mild virus by the time vaccines were made available. The fact that a 7-point scale was used may have contributed to a ceiling effect; a 10-point scale or higher (see Payaprom et al., 2011) could have been more sensitive to capture small changes in intentions. Third, although there is no gold standard for Cronbach alpha level (Schmitt, 1996), the measure of perceived costs showed a reliability level that was below the conventional cut-off level of .70, revealing some heterogeneity in the way participants rated the different perceived vaccination costs. Also, the visual presentation was not pretested and there was a confound between health messages´ length and content, as both shortened risk-reducing and shortened health-enhancing messages had slightly more information than the Shortened DoH poster. Future research could disentangle these two factors through a design where only content (but not length) varies across conditions and pre-test the visual layout of the different messages. Finally, even though the sample was selected to be equivalent to the population in terms of age, gender and geographic location, data collected through online surveys are not exempt from bias (Blasius & Brandt, 2010). Despite these limitations, the use of theory to inform the development of precautionary messages, their rigorous testing through the use of an experimental design and a representative sample of the population, and the investigation of what psychological processes were responsible for message effectiveness are strengths of the present study that merit to be acknowledged.

Conclusions

This study has demonstrated that shorter messages are more effective in promoting peoples' intentions to be vaccinated. Its results suggest that messages should communicate information on the new strain of virus and that virtually anyone is at-risk, and on vaccine effectiveness and safety tests.

Conflict of interest statement: The authors declare that there are no conflicts of interest.

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Appendix A. Presented uncertain scenario – mock news not addressing vaccination concerns

Pandemic flu 'has reached our shores' says expert

May Beal, Health Correspondent Tuesday 6th January

The pandemic flu virus that started in Peru has been detected in the UK. 'This is a new strain of flu virus, so most people have no immunity to it. It's a different and more dangerous strain of flu' said Dr James McGuire of the National Institute of Medical Research today. Most people who catch this strain of flu will feel ill for about 7 days with high fever, severe chills, muscle pain and headache. Scientists estimate that 1 in every 100 people who get pandemic flu will become so ill they need hospital care and about 1 in every 1000 will die. Some people can have the flu and don't know it because they have no symptoms and that means that they can still transmit it to others.

Dr McGuire said that 'at this stage we don't know how badly people in the UK will be affected. We are trying to learn about it as fast as we can but right now we can't be sure how serious it will be. It is spreading so it is important to follow advice'.

The UK Health Secretary said today that 'if the virus spreads across the UK, we don't know whether life can carry on as usual or whether there will be problems with the NHS, schools or with getting vital supplies. We could see disruption to important services such as the postal service, police and refuse collection if a lot of people are absent with the virus.'

A vaccine has been developed to stop it spreading and vaccination is advised for everyone over 6 months old.

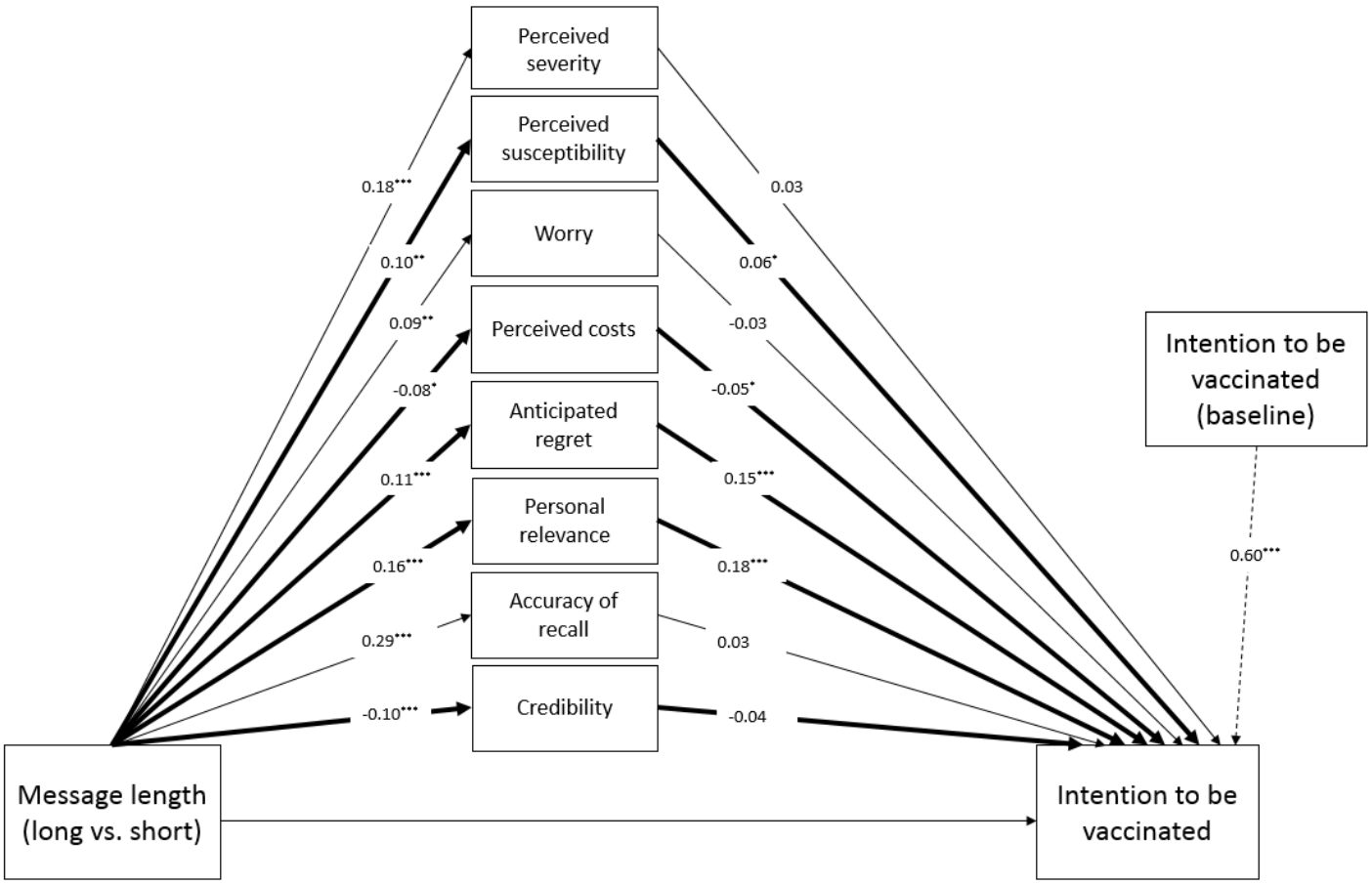

Figure 1. Multiple mediation model of the effect of the message length (short vs. long) on intention to be vaccinated. A multiple mediation model is one that seeks to identify and explicate the mechanisms or processes that underlie an observed relationship between an independent variable (in this case, message length) and a dependent variable (in this case, intention to be vaccinated) via the inclusion of several hypothetical mediator variables (in this case, perceived severity, perceived susceptibility, worry, perceived costs, anticipated regret, personal relevance, accuracy of recall and credibility).

Note. The presented coefficients represent the direct effects (i.e., effect of the independent variable on each mediator (i.e., *a* paths) and effect of each mediator on the dependent variable (*b* paths) and are standardised. The values reported in the results section correspond to the indirect effect (i.e., a path * b path). Significant indirect effects are represented in bold. Baseline level of intention was included in the model as covariate and message length was coded as a dummy variable (Long = 0; Short = 1). $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 1. *Study design and targeted constructs in each message condition*

	Message length			
Content	Longer	Shorter	**Targeted constructs**	**Content description**
Department of Health content	*DoH message* (1646 words)	***Shortened DoH message*** (130 words)	- Knowledge about flu and precautionary measures	- Pandemic flu is a new strain of virus (…) - The Department of Health has launched the pandemic flu vaccination programme and is advising that people are vaccinated as soon as possible.
			- Perceived susceptibility	- Even if you have been vaccinated for seasonal flu you are not protected against pandemic flu.
			- Perceived Costs (lack of side-effects & vaccine safety)	- The vaccine has been clinically tested in trials involving 5000 people and it would not be licensed if it was not safe. - The vaccine is NOT live so you cannot get pandemic flu from it.
			- Perceived Efficacy	- The vaccine will protect you against the virus that causes pandemic flu.
Theory-enhanced content		**Risk-reducing message** (191 words)	*Shortned DoH message, plus:*	
			- Perceived severity	- It can take weeks to fully recover from pandemic flu - Some people will develop complications (such as pneumonia) - Pandemic flu can also result in death
			- Perceived benefits (risk-reduction)	- Being vaccinated reduces your risk of infection, and prevents the infection from spreading to family, friends and people at work - Being vaccinated reduces your chances of becoming infected and seriously ill with flu
		Health-enhancing (195 words)	*Shortened DoH message content and perceived severity, plus:*	
			- Perceived benefits (health-enhancing)	- Being vaccinated helps you stay healthy, active and able to look after your family in a pandemic - Being vaccinated boosts your natural immune system, strengthens your body's natural defences and maintains healthy levels of antibodies

Note. Conditions compared to test hypothesis 1 (long vs. shorter length) are signalled in italics; conditions compared to test hypothesis 2 (standard DoH vs. Theory-enhanced content) are signalled in bold.

Table 2. *Measures used in the study*

Measures	Example of items	Number of items	Scale	Reliability (Cronbach α)	Reference
Baseline measure					
Baseline intention[2]	*'Assuming a new pandemic flu outbreak occurs (…), how much do you agree with the following statements? …I want to be vaccinated for pandemic flu'*	2	1-7	α= .95	Payaprom et al., 2011; Smit et al., 2011
Main outcome measure					
Intention to be vaccinated[3]	*'If this situation was happening right now… … I intend to be vaccinated for pandemic flu'*	2	1-7	α= .97	Payaprom et al. 2011; Smit et al., 2011
Predictors of intention					
Perceived severity	*'Please indicate how severe you think pandemic flu is from not at all severe (1) to very severe (7)'*	1	1-7	-	Weinstein, 2000
Worry	*'I would feel (anxious / worried) about catching pandemic flu'*	2	1-7	α= .94	Teasdale et al., 2012
Perceived Susceptibility	*'How likely is it that (you personally/ people who are the same age and sex as you) could be infected with pandemic flu'*	2	1-10	α= .90	Brewer et al., 2007
Perceived benefits[4]	*'Being vaccinated would be effective in protecting me form catching pandemic flu'; 'being vaccinated will allow me to maintain my wellbeing'*	4	1-7	α= .76	Janz & Becker, 1974
Perceived costs[5]	*'Being vaccinated for pandemic flu would not be safe'*	3	1-7	α= .66	Janz & Becker, 1974
Anticipated regret	*'I would feel regret if I had not been vaccinated and ended up getting pandemic flu'*	2	1-7	α= .85	Sheeran & Orbell, 1999
Scepticism	*'Too much fuss is being made about the risk of pandemic flu'*	1	1-7	-	Rubin et al., 2010

[2] Assessed before scenario presentation.
[3] Assessed after the scenario and health message presentation.
[4] Two of the items referred to risk-reduction and the other two to health-enhancing benefits.
[5] Costs related to vaccine potential lack of safety and effectiveness.

Table 2. *(continued)*

Measures	Example of items	Number of items	Scale	Reliability (Cronbach α)	Reference
Accuracy of recalling[6]	*'The vaccine is live'*	3	T/F[7]	-	-
Message's personal relevance	*'Do you think that the advice is relevant to you personally?'*	1	1-7	-	Petty et al., 2012
Perceived credibility	*'Valid claims'*	3	1-7	α= .79	Lane et al., 2006
Perceived clarity	*'Not at all understandable'*	5	1-7	α= .88	Lane et al., 2006
Perceived cognitive challenge	*'Intellectually engaging'*	5	1-7	α= .78	Lane et al., 2006

[6] This measure was used to verify the degree to which individuals processed and remembered the information presented, by assessing the correctness of their replies to three items related to the message content

[7] T/F = true or false; Cronbach alpha is not provided as the composite variable is not a scale.

Table 3. *Demographic characteristics of the sample of England residents (n=1424) collected in February 2015*

Demographic characteristics	Number / Proportion of the sample *n* (%)	Proportion of the population *N* (%)[8]
Gender		
Female	716 (50.3%)	46.1%
Male	708 (49.7%)	53.9%
Age		
16-24 years	226 (15.9%)	14.6%
25-34 years	261 (18.3%)	16.7%
35-44 years	265 (18.6%)	21.4%
45-54 years	268 (18.8%)	21.4%
55-75 years	404 (28.4%)	25.8%
Ethnicity		
White	1306 (91.7%)	85.5%
Other	108 (7.6%)	14.3%
Prefer not to answer	10 (0.7%)	-
Highest qualification		
No qualifications	4 (0.3%)	22.5%
Primary school	10 (0.7%)	13.3%
Secondary education	342 (24.0%)	18.8%
Higher secondary education	432 (30.3%)	12.4%
University and tertiary education	484 (34%)	27.4%
Post graduate qualification	152 (10.7%)	
Occupation		
Self-employed	99 (7.0%)	9.8%
Employed full time	498 (35.0%)	38.6%
Employed part time	148 (10.4%)	13.7%
Looking after home/family	76 (5.3%)	4.4%
Unemployed	55 (3.9%)	4.4%
Unable to work due to illness or disability	51 (3.6%)	4.0%
Retired	377 (26.5%)	13.7%
Student	120 (8.4%)	9.2%
Healthcare workers	61 (4.3%)	2.3%
Non-healthcare workers	684 (91.8%)	
Children in the household		
Yes	382 (26.8%)	37%[9]
No	1033 (72.5%)	61%
Prefer not to answer	9 (0.6%)	-
Pregnancy (*n* = 387[10])		
Yes	14 (3.6%)	7.8%[11]
No	699 (95.9%)	
Prefer not to answer	2 (0.5%)	

[8] According to data from 2011 census for individuals aged 16-75 (http://www.ons.gov.uk/ons/datasets-and-tables/index.html).
[9] Beaumont, J. (2011). Households and families (data from 2010). London, UK: Office for National Statistics.
[10] Women aged 16-44
[11] Estimate based on the conception rate for 2012. Office for National Statistics (http://www.ons.gov.uk/ons/rel/vsob1/conception-statistics--england-and-wales/2012/2012-conceptions-statistical-bulletin.html)

Demographic characteristics	Number / Proportion of the sample *n* (%)	Proportion of the population *N* (%)[12]
Ongoing health problems		
Yes	365 (25.6%)	28%
No	1059 (74.4%)	72%
Vaccination for seasonal flu		
Every year	499 (35.0%)	27.9%[13]
Occasionally	85 (6.0%)	
Rarely	95 (6.7%)	
Never	738 (51.8%)	
Prefer not to answer	7 (0.5%)	
Vaccination for pandemic flu (H1N1)		
Yes	206 (14.5%)	10.4%
No	1078 (75.7%)	
Can't remember	140 (9.8%)	
Diagnosed with pandemic flu (H1N1)		**NA**
Yes	48 (3.4%)	
No	1373 (96.4%)	

[12] According to data from 2011 census (http://www.ons.gov.uk/ons/datasets-and-tables/index.html).

[13] Estimate on influenza season vaccination coverage for people aged 16-75, based on Public Health England report for 2014-2015 (retrived from: https://www.gov.uk/government/publications/public-health-england-annual-report-and-accounts-2014-to-2015)

Table 4. *Descriptive statistics for baseline intention and post-message presentation estimated marginal means and standard errors for intention (and mean and standard deviations for predictors of intention) according to message length.*

Outcome	**Scale**	**DoH message Mean (*SD*)**	**Shortened DoH message Mean (*SD*)**	***F***	***Df***	**Sig.**	**η^2**
Baseline intention	1-7	5.51 (1.69)	5.47 (1.73)	0.085	(1,679)	*n.s.*	
Intention	1-7	5.33 (0.05)	5.68 (0.05)	27.93	(1,699)	<.001***	.04
Perceived severity	1-7	5.34 (1.28)	5.76 (1.14)	16.57	(1, 571)	<.001***	.03
Perceived susceptibility	1-10	6.75 (2.05)	7.11 (2.01)	4.34	(1, 571)	.04*	.01
Worry	1-7	5.01 (1.65)	5.29 (1.50)	3.55	(1, 571)	.06	.01
Benefits	1-7	5.27 (0.99)	5.25 (1.15)	0.01	(1, 571)	*n.s.*	.00
Costs	1-7	3.33 (1.16)	3.04 (1.30)	3.67	(1, 571)	.06	.01
Anticipated regret	1-7	5.61 (1.45)	5.88 (1.39)	6.37	(1, 571)	.01**	.01
Scepticism	1-7	3.37 (1.68)	3.15 (1.61)	2.80	(1, 571)	.09	.01
Accurately recalling information	0-3	1.32 (0.63)	1.64 (0.60)	38.79	(1, 571)	<.001***	.06
Personal relevance of information	1-7	5.35 (1.50)	5.88 (1.50)	20.35	(1, 571)	<.001***	.03
Message credibility	1-7	5.22 (1.43)	4.98 (1.42)	4.06	(1, 571)	.04*	.01
Message clarity	1-7	5.68 (1.20)	5.63 (1.23)	0.20	(1, 571)	*n.s.*	.00
Message cognitive challenge	1-7	5.03 (1.15)	5.05 (1.09)	0.04	(1, 571)	*n.s.*	.00

Note. Baseline intention was used as a covariate for post-message presentation effects on intention. For intention, the reported values correspond to the estimated marginal means (i.e., estimated means after controlling for baseline intention) and standard errors (*SE's*). The means and standard deviations (*SD*'s) reported are for the non-transformed variables. All variables were measured on a scale of 1-7 except accurately remembering information that could vary from 0-3 correct answers. All the inferential statistics provided (F-test value (*F*), degrees of freedom (Df), p-value and eta partial squared (η^2), a measure of effect size) were calculated with the transformed variables. *n.s.* = $p > .10$

Table 5. *Descriptive statistics for baseline intention and post-message presentation estimated marginal means and standard errors for intention (and mean and standard deviations for predictors of intention) according to message content.*

Outcome	**Scale**	**Shortened DoH message Mean (*SD*)**	**Risk-reducing message Mean (*SD*)**	**Health-enhancing message Mean (*SD*)**	***F***	***Df***	**Sig.**	**η^2**
Baseline intention	1-7	5.47 (1.73)^{a}	5.83 (1.53)^{b}	5.56 (1.73)^{ab}	4.15	(2,1010)	.02	
Intention	1-7	5.79 (0.05)^{a}	5.77 (0.05)^{a}	5.79 (0.05)^{a}	0.15	(2, 999)	*n.s.*	.00
Perceived severity	1-7	5.76 (1.14)^{a*}	5.96 (1.07)^{b}	5.78 (1.21)^{ab}	2.62	(2, 865)	.07	.01
Perceived susceptibility	1-10	7.11 (2.01)^{a*}	7.57 (1.76)^{b}	7.27 (1.98)^{ab}	3.12	(2, 865)	.05*	.01
Worry	1-7	5.29 (1.50)^{a}	5.48 (1.42)^{a}	5.28 (1.50)^{a}	0.20	(2, 865)	*n.s.*	.00
Benefits	1-7	5.25 (1.15)^{a**}	5.57 (1.01)^{b}	5.34 (1.20)^{a*}	5.64	(2, 865)	<.01**	.01
Costs	1-7	3.04 (1.30)^{a}	2.81 (1.29)^{a}	2.94 (1.32)^{a}	1.51	(2, 865)	*n.s.*	.00
Anticipated regret	1-7	5.88 (1.39)^{a}	5.94 (1.29)^{a}	5.71 (1.48)^{a}	1.95	(2, 865)	*n.s.*	.00
Scepticism	1-7	3.15 (1.61)^{ab}	3.02 (1.58)^{a*}	3.26 (1.69)^{b}	1.94	(2, 865)	*n.s.*	.00
Accurately recalling information	0-3	1.64 (0.60)^{a}	1.49 (0.62)^{b**}	1.53 (0.62)^{b*}	6.23	(2, 865)	<.01**	.01
Personal relevance of information	1-7	5.88 (1.28)^{a}	6.02 (1.11)^{a}	5.80 (1.35)^{a}	1.56	(2, 865)	*n.s.*	.00
Message credibility	1-7	4.98 (1.42)^{a}	5.30 (1.40)^{b**}	5.16 (1.41)^{ab}	3.68	(2, 865)	.03*	.01
Message clarity	1-7	5.64 (1.23)^{a}	5.85 (1.17)^{b*}	5.64 (1.32)^{a}	2.87	(2, 865)	.06	.01
Message cognitive challenge	1-7	5.05 (1.09)^{a}	5.16 (1.18)^{a}	5.09 (1.17)^{a}	1.04	(2, 865)	*n.s.*	.00

Note. Baseline intention was used as a covariate for post-message presentation effects on intention. The means and standard deviations (*SD*'s) reported are for the non-transformed variables. All the inferential statistics provided (F-test value (*F*), degrees of freedom (*Df*), p-value and eta partial squared (η^2), a measure of effect size) were calculated with the transformed variables. Least Significant Difference multiple comparisons are show; means in the same row that do not share subscripts differ at $^{*}p < .05$, $^{**}p < .01$ or $^{***}p < .001$.

Highlights:

- A briefer message resulted in greater intention to be vaccinated
- Information on severity and benefits did not further increase vaccination intention
- Framing benefits as health-promoting was as effective as framing as risk-reducing
- Psychological mechanisms explaining effectiveness of shorter message are presented
- Mechanisms: perceived susceptibility, costs, message relevance, anticipated regret