

# The Moderating Effect of Autonomy on Promotional Health Messages Encouraging Healthcare Professionals' to Get the Influenza Vaccine

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Rates of flu vaccination among healthcare professionals often remain lower than recommended guidelines. We tested whether autonomy-supportive communication styles could improve the effectiveness of statements seeking to promote professionals' flu vaccination uptake. A pilot study established that statements presented in an autonomy-supportive communication style (i.e., upholding freedom of choice) posed a significantly lower threat to freedom compared to equivalent statements presented in a controlling communication style (i.e., thwarting choice by implying obligation). The main experiment examined the impact of these two communication styles on healthcare professionals' behavioral intentions to vaccinate against the flu. Results replicated the dampening effect of autonomy-supportive communication style on perceived threat to freedom. Crucially, only autonomy-supportive communication styles led to a significant increase of behavioral intentions to vaccinate. Furthermore, this effect was moderated by motivational regulations (measured by the Treatment Self-Regulation Questionnaire for Flu; TSRQ-flu scale): it was strongest for those who tended to see flu vaccination as unimportant and unconnected with their internal values (low autonomous regulation), those who tended not to see vaccination as an act that would give them pride or reduce guilt (low introjection) or who tended to be unwilling to act to get vaccinated (high amotivation). Implications for future policy or institution-led communication campaigns are discussed.

### Public Significance Statement

The present study found that autonomy-supportive communication styles (e.g., “Consider having the flu jab”) can be more effective than controlling communication (e.g., “Make sure you have the flu jab”) to boost hesitant healthcare professionals' intentions to vaccinate against seasonal flu, particularly among those who reported not vaccinating during the previous flu season. These findings are important for communication campaign managers and policy-makers seeking to increase vaccination uptake among healthcare professionals, as they indicate that framing messages around choice rather than obligation may be a more effective way to increase uptake.

**Keywords:** health communication, influenza vaccine, healthcare professionals, autonomy

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Influenza (flu) is a highly infectious virus that poses a serious threat to life, causes excess mortality, and can lead to other long-term health complications. The World Health Organisation listed a flu pandemic as one of the top 10 global health threats (World Health Organization, 2019). Although global populations are currently gripped by the Coronavirus Disease 2019 (COVID-19) pandemic, the risk of a flu pandemic or localized epidemics remain. During the 2018/2019 flu

season, the United Kingdom (U.K.) reported 5,000 flu-related hospital admissions and approximately 1,031 acute respiratory illness outbreaks in closed settings such as care homes, hospitals, and schools (Public Health England [PHE], 2019). Additionally, excess all-cause deaths were seen for the UK's 2019/2020 flu season, prior to the circulation of COVID-19 (Public Health England, 2020).

To reduce the risk of catching or spreading the highly infectious flu virus, in healthcare settings, at-risk groups such as healthcare professionals are advised to get the annual flu vaccine (National Health Service Choices, 2019; World Health Organization, 2015). Common strategies used to encourage vaccine uptake include informational and educational campaigns. However, despite annual immunization campaigns, coverage rates for healthcare professionals remain lower than recommended guidelines. For example, in the U.K. only 52% of National Health Service (NHS) Trusts<sup>1</sup>

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<sup>1</sup> An NHS Trust is an organisational unit of healthcare providers such as hospitals, and patient services within the community (National Health Service Digital, 2020).

achieved the 75% flu vaccine coverage target during the 2018/2019 flu season (range: 37%–95%; PHE, 2019). Moreover, campaigns aimed at healthcare professionals reveal small effects, with educational campaigns revealing no effect on average (Lytras et al., 2016).

### Known Predictors of Flu Vaccination Uptake

Vaccination-related behaviors are complex and may result from differing motivations, beliefs, and attitudes (Betsch et al., 2018; Corace et al., 2013; Peretti-Watel et al., 2015). A common approach to address low vaccination uptake has been to identify psychological, social, and environmental determinants of behavior (see Betsch et al., 2018; Thomson et al., 2016). Traditionally, the health belief model and the theory of planned behavior have been used to assess flu vaccination behavior. For example, the health belief model's constructs of *perceived benefits*, *perceived susceptibility*, and *cues to action* have been shown to be significant predictors of healthcare professionals' vaccination uptake, with vaccinated and unvaccinated healthcare professionals' differing significantly on these measures (Corace et al., 2016; Prematunge et al., 2012; To et al., 2016). Similarly, studies informed by the theory of planned behavior revealed that negative attitudes, professional obligations, and vaccine or disease misconceptions are among the primary barriers to receiving the flu vaccination (for a detailed review, see Schmid et al., 2017).

These studies, however, remain descriptive and correlational in nature. They highlight some potential predictors of decisions to vaccinate oneself against the flu, but they do not inform experimental tests of behavior change interventions (for a review, see Corace et al., 2016). Another limitation of these approaches is that they conceive decisions as informed by socio-cognitive considerations (Redding et al., 2000; Vallée-Tourangeau et al., 2018), but omit the possible role played by motivational and emotional considerations, which may very well weigh in on decisions such as the decision to get vaccinated against the flu.

### The Important Role of Autonomy in Decisions

Rather than viewing healthcare professionals' decisions to get the flu vaccination as resulting from a careful weighing of risks and benefits, we propose to adopt the lens of self-determination theory (Ryan & Deci, 2000), and view these decisions as behavioral activations resulting from a motivated state. When the motivation state is highly internalized, the decision to engage in the target behavior is self-determined. Increased levels of engagement result in behavior becoming more persistent over time. Supporting the need for autonomy through communication has been shown to be an important predictor for achieving positive behavioral outcomes (for a meta-analysis, see Gillison et al., 2019). For example, communication supporting autonomy significantly increased perceptions of autonomy compared to neutral or forced choice formats (Chatzisarantis et al., 2012; Moustaka et al., 2012), resulting in increased engagement with physical activity and persistence. Messages supporting autonomy have also been shown to improve and sustain levels of exercise (Kinnafick et al., 2016), and reduce the likelihood of programme dropout (Coa & Patrick, 2016), while providing choice in digital health campaigns increased the overall effectiveness of the message (Smit et al., 2019).

Choice has also been shown to be important for healthcare professionals' vaccination decisions. For example, higher levels of perceived choice have been linked with increased flu vaccine acceptance (Kassianos et al., 2018; Vallée-Tourangeau et al., 2018). Israeli nurses' demand for a choice has shown a significant association with whooping cough vaccine acceptance (Baron-Epel et al., 2013). On the other hand, the violation of choice in healthcare professionals' flu vaccination decisions has been reported as a potential barrier to uptake (Hakim et al., 2011). Furthermore, higher feelings of choice, coupled with a positive instrumental attitude, significantly increased medical students' intentions to get vaccinated against the flu (Lehmann et al., 2015). More recently, we used self-determination theory (Ryan & Deci, 2000) to develop a measure of the need for autonomy in healthcare professionals' flu vaccine decisions (Moon et al., under review). Across a sample of 718 healthcare professionals, autonomous motivation was the strongest predictor of past vaccination behavior as well as future behavioral intention, beyond other more typical determinants, such as perceived benefits and risks associated with vaccination.

Taken together, these findings point to the existence of a positive association between autonomy and healthcare professionals' past and future decisions to get vaccinated against the flu. There is also evidence to show that manipulating autonomy through priming can be an effective intervention to allow better processing of otherwise threatening risk information regarding alcohol consumption (Pavey et al., 2012). Past research examined the impact of interventions seeking to increase psychological empowerment in relation to parents' measles, mumps and rubella (MMR) vaccination decisions (Fadda et al., 2017, 2018), but to the best of our knowledge, research has yet to provide evidence that appealing to autonomy can have a positive (causal) effect on healthcare professionals' decisions to vaccinate against the flu.

In the next sections, we examine how an autonomy-supportive communication style may be used to test this causal link and we review the possible moderating effect of motivational regulations on its impact.

### Autonomy-Supportive Communication Style and Vaccination Acceptance

While autonomy-supportive communication may encourage positive behaviors or intentions, its counterpart, namely, controlling communication, may or may not decrease these intentions. Health-related messages advocating behavior are usually directive, emphasizing obligation with key messages such as "don't take flu with you" or "don't delay, book your flu jab early." However, explicit and directive language can be construed as controlling (McLaughlin et al., 1980) and a perceived threat to personal freedom (Miller et al., 2007). Moreover, forceful or persuasive language may increase negative attitudes, reduce positive behavioral intentions, and elicit unintentional emotional responses such as fear, guilt, or anger (for a review, see Steindl et al., 2015). For example, controlling language in promotional health messages increased the perceptions of anger (Miller et al., 2007), and messages overtly discouraging smoking among young adults can backfire and increase the likelihood of engaging with smoking behaviors (Grandpre et al., 2003). Additionally, health-related communications appealing to guilt have been shown to increase feelings of anger (Coulter & Pinto, 1995), reduce HPV vaccination intentions

(Carciooppo et al., 2017), and increase the likelihood of message rejection (Graton & Mailliez, 2019). Such negative behavioral outcomes or rejection of messages may be attributed to psychological reactance, which is a motivated state serving to restore perceived threats to personal freedom (Brehm, 1966).

By contrast, the use of non-controlling language has been shown to be of importance when supporting the need for autonomy: combining strategies such as non-controlling language, meaningful rationale, or the provision of choice was more beneficial to supporting the basic psychological need of autonomy (Gillison et al., 2019). Health-related messages making use of more autonomy-supportive language (e.g., emphasizing what one could do vs. what one must or should do) have been shown to reduce the perceived threat to personal freedom as they emphasize choice and improve initiation of behavioral engagement (Vansteenkiste et al., 2006). Similarly, participants who read an autonomy-supportive promotional message related to exercise and physical activity demonstrated a reduced perceived threat to freedom compared to those who read a controlling promotional message (Miller et al., 2007).

Whether such autonomy-supportive communication styles used to promote flu vaccination among healthcare professionals could also reduce perceived threat remains to be established. The initial aim of the present study was, therefore, to examine whether autonomy-supportive messages promoting the flu vaccination could reduce healthcare professionals' perceived threat to freedom, compared to controlling messages.

### The Possible Moderating Effect of Motivational Regulation

According to self-determination theory, the likelihood that one will engage positively with a behavior in a sustained manner over time is increased when they perceive the situation as supporting autonomy (Deci & Ryan, 2000; Kirkland et al., 2011). The theory further conceptualizes the need for autonomy (feeling that one has free-choice) on a motivation continuum comprised of six types of motivation ranging from least to most autonomous: amotivation (e.g., the lack of willingness to act), external (e.g., behaviors initiated to satisfy an external demand or imposed reward), introjection (e.g., behaviors initiated to avoid guilt or to attain pride), integrated (e.g., acknowledgement of importance), identified (e.g., acting in alignment with internal values), and intrinsic regulation (e.g., behaviors initiated out of enjoyment—although, admittedly, this type of regulation is unlikely to apply to vaccination behaviors and falls beyond the scope of the present study). Amotivation, external regulation, and introjection are considered externalized and controlled forms of motivation; that is, they characterize behaviors that are not self-determined and are initiated to satisfy external demands such as completing a work task set by one's line manager to avoid sanctions. By contrast, integrated and identified regulations are considered to be internalized and autonomous forms of motivation, meaning that behaviors are self-determined, driven by internal value and behaviors are activated for their own sake, interest and or enjoyment (Deci & Ryan, 1985).

Individual differences in autonomous regulation of motivation may influence how messages are perceived. For example, using elements consistent with self-determination theory, two types of newsletters encouraging colon cancer screening (minimally tailored or enhanced-tailored) were given to participants who had either an

autonomous communication preference or directive communication preference. While, at the 12-month follow-up, neither newsletter significantly improved screening rates, communication preference moderated the impact of the intervention on screening rates. Having an autonomous preference improved screening rates particularly within the enhanced-tailored newsletter condition, whereas no significant difference was found among those who preferred directive communications (Resnicow et al., 2014). Research on the promotion of healthy eating has found similar results: for example, health-related messages designed to increase fruit and vegetable intake led to a significantly increased intake in all conditions (experimental and control) at the 3-month follow up, although no overall between-group differences were found. However, levels of autonomy moderated the impact of condition on intake: higher autonomy in the experimental condition increased intake compared to the control condition, whereas lower autonomy showed little change to intake in the control condition (Resnicow et al., 2008). Similarly, Churchill and Pavey (2013) found evidence that the impact of message framing around fruits and vegetables consumption (emphasizing gains associated with increased consumption vs. losses associated with lower consumption rates) depended on individuals' initial levels of need for autonomy; specifically, the effectiveness of gain-framed messages was most effective for individuals with higher levels of need for autonomy. Although plausible, there is no evidence for whether and how healthcare professionals' individual differences in autonomous regulation of motivation may impact flu vaccination decisions. Therefore, a secondary (exploratory) aim of this study was to test if such individual differences could moderate the impact of autonomy-supportive communication style on healthcare professionals' intentions to vaccinate against the flu vaccine.

### The Current Research

In a pilot study and an experiment, we examined whether adopting an autonomy-supportive communication style would increase healthcare professionals' intentions to receive the seasonal flu vaccination. We first present a pilot study where we report the development and testing of experimental materials since the use of autonomy-supportive language to promote flu vaccine uptake among healthcare professionals had not been investigated before. We then present the main experiment, which was pre-registered on AsPredicted.org prior to data collection.<sup>2</sup> The pre-registered aim of this experiment was to establish the impact of autonomy-supportive language on healthcare professionals' behavioral intentions to vaccinate against the flu. A secondary aim was to test whether motivational regulations would predict behavioral intentions to vaccinate against the flu.<sup>3</sup> In addition, we planned several secondary analyses including a comparison of the respective impact of autonomy-supportive and controlling messages on healthcare professionals' behavioral intentions to vaccinate against the flu, as well as an exploration of whether the impact of the communication style on intentions to vaccinate was moderated by individual differences

<sup>2</sup> See <https://aspredicted.org/blind.php?x=u2zx39> for the complete pre-registration document.

<sup>3</sup> In the original pre-registration document, we used the label "low-controlling" to qualify what we now call "autonomy-supportive" language or messages. The labels are interchangeable, but we chose to adapt the wording throughout the present report to improve readability.

in motivational regulations and by whether healthcare professionals had already taken the flu vaccine in the past. We also intended to explore the impact of the communication style (autonomy-supportive vs. controlling) on perceived feelings toward the messages, as well as several robustness checks which we detail below.

### Pilot

The pilot study aimed to establish whether promotional health messages adopting a controlling or autonomy-supportive style would be perceived differently and, more specifically, whether autonomy-supportive messages promoting flu vaccination would result in a lower threat to the freedom of choice. Approval from the Faculty of Business and Social Science Research Ethics Committee of Kingston University London was granted prior to data collection (application #181954).

### Method

#### Participants

Fifty-four healthcare professionals (35 females) with a mean age of 42.23 years ( $SD = 10.62$ ) took part in this pilot study. Data collection occurred between May and June 2019. Most participants worked within an NHS Hospital setting (68.5%), were Doctors (40.7%), and 87% had direct patient contact (see Table 1 for participant demographics).

#### Materials

Short message statements aiming to reflect an autonomy-supportive or controlling communication style were developed by the first author, using 21 unique messages from the NHS Flu Fighter Campaign (available online during May 2018). The NHS statements were adapted to include a discourse which could be considered either autonomy-supportive or controlling (see Miller et al., 2007). Controlling language was operationalized as using imperatives such as “should,” “ought,” “must,” and “need.” Autonomy-supportive language was operationalized as using terms such as “could,” “can,” “may,” “might,” and “consider.” For example: “You could [must] protect yourself and those around you.” Additional statements were also developed by the

**Table 1**  
*Demographic Information for the Pilot and Experiment 1 Studies*

Characteristics	Pilot ( $N = 54$ )	Experiment 1 ( $N = 90$ )
Gender, $N$ female (%)	35 (65)	86 (96)
Age in years, $M$ ( $SD$ )	42.23 (10.62)	42.82 (10.67)
Range	23–73	22–64
Occupation, $N$ (%)		
Doctor/clinical specialist	22 (41)	5 (6)
Nurse	18 (33)	28 (31)
Admin and clerical staff	3 (6)	11 (12)
Other	11 (20)	46 (51)
Place of work, $N$ (%)		
NHS hospital	37 (69)	45 (51)
Community/GP practice/care home	2 (4)	34 (38)
Private hospital	9 (17)	1 (2)
Other	6 (11)	16 (18)
With direct patient contact, $N$ (%)	47 (87)	68 (76)

research team and all statements were subsequently discussed and reviewed by all authors. Messages were controlled for length (Blandford et al., 2008) and complexity (Flesch, 1948). Overall, readability scores for autonomy-supportive statements were 71.6% (total word count = 348), and controlling statements were 78.3% (total word count = 347). For the full list of statements with readability estimates, see Supplementary Table 1.

### Design and Procedure

Participants were randomly assigned to one of two communication style conditions. In the autonomy-supportive communication condition, participants read a random set of 10 out of 19 possible statements presented in an autonomy-supportive communication style. Conversely, participants in the controlling communication condition were presented with a set of 10 out of 19 possible statements presented in a controlling communication style. Each statement was immediately followed by the four-item perceived threat to freedom scale (Dillard & Shen, 2005): “The message threatened my freedom to choose”; “The message tried to make a decision for me”; “The message tried to manipulate me”; and “The message tried to pressure me.” Answers were rated on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*) ( $\alpha = .929$ ). Finally, participants were asked to estimate the likelihood that they would get the flu vaccination in the next flu season (autumn/winter 2019).

### Results and Discussion

Data analyses were conducted using JASP (JASP Team, 2019) version 0.11.1. The majority of controlling statements (58%) were perceived to pose a significantly greater threat to freedom than their counterpart of autonomy-supportive statements ( $p < .05$ ), indicating a difference between the two conditions (for data distributions, assumptions and  $t$ -tests see Supplementary Tables 2–5). For 15 of the 19 statements, the difference in threat to freedom was in the predicted direction (lowest in the autonomy-supportive communication style). Each statement pair was then ranked according to (a) Bayes Factor (BF), (b) the highest and lowest mean perceived threat to freedom, and (c) the variation within the standard errors (McDonald, 2014). BF provide a clearer estimate for the strength of evidence compared to the classical  $p$  value (Jarosz & Wiley, 2014), guarding against overinterpretation of findings (Verhagen & Wagenmakers, 2014). The experimental material presented in the main experiment was then created using seven of the most highly ranked statements (see Supplementary Tables 5 and 6). We also conducted an exploratory Bayesian correlation analysis to examine correlations between perceived threat to freedom and healthcare professionals’ reported likelihood of future vaccination. Using the default prior options for Bayesian correlations (i.e., a stretched beta prior width of 1), we found a non-null, negative correlation,  $r(52) = -.43$ ,  $p < .001$ , 95% CI:  $[-0.176, -0.615]$ ,  $BF_{10} = 28.57$ , suggesting that perceived threat to freedom was inversely related to healthcare professionals’ predicted likelihood of vaccination: those who reported lower levels of perceived threat to freedom overall also reported being more likely to get vaccinated in the upcoming flu season.

### Main Experiment

Using the statements from the pilot, we constructed two persuasive paragraphs aiming to promote flu vaccination among healthcare



professionals, using either an autonomy-supportive communication style or a controlling style. As a mean to check that our experimental materials were successful in affecting perceived threat to freedom, our first pre-registered hypothesis stated that autonomy-supportive messages would be perceived as less threatening to one's freedom compared to controlling messages (H1). Previous research (Miller et al., 2007, p. 231) assessing the perceived threat to freedom of controlling and autonomy-supportive messages in exercise-related health behaviors found a medium effect size ( $\eta_p^2 = .05$ ). An a priori power analysis using G\*Power (version 3.1.9.4) (Faul et al., 2007) and based on a medium effect size and an  $\alpha$  criterion of .05 revealed that we required a minimum sample size of 116 ( $n = 58$  per condition) to achieve a power of 80% to test H1.

The main experiment had two pre-registered aims (see footnote 2). First, it aimed to establish what impact different communication styles (autonomy-supportive vs. controlling) had on healthcare professionals' behavioral intentions to vaccinate against the flu. To address this aim, we hypothesized that healthcare professionals' intentions to vaccinate against the flu would *increase* after they read a persuasive message written in an autonomy-supportive style (H2a). Conversely, we hypothesized that healthcare professionals' intentions to vaccinate against the flu would *decrease* after they read a persuasive message written in a controlling style (H2b). We also intended to conduct a robustness check test to assess whether the effect of communication style on intention to vaccinate would remain after excluding extreme answers, as well as whether extreme views were immune to any persuasive communication. Finally, we intended to explore whether the autonomy-supportive communication style would result in a greater impact on intentions to vaccinate compared to the controlling communication style.

A secondary aim of this experiment was to test whether different types of motivational regulation are associated with different baseline behavioral intentions to vaccinate against the flu. More specifically, we hypothesized that higher levels of autonomous regulation would be positively associated with baseline (i.e., pre-intervention) behavioral intentions to vaccinate against the flu (H3a) while higher levels of external regulation would be negatively associated with baseline behavioral intentions to vaccinate against the flu (H3b).

We also planned to explore the impact of communication styles on feelings toward the message (Coulter & Pinto, 1995), as well the existence of possible moderators of the effect of communication style on intentions to vaccinate: individual levels of externalized and controlled forms of motivation (external regulation, introjection, and amotivation) as well as internalized and autonomous regulation (integrated and identified regulations) and past vaccination behavior.

Approval from the Faculty of Business and Social Science Research Ethics Committee at Kingston University London was granted prior to data collection (application #181954).

## Method

### Participants

One-hundred and thirty U.K. healthcare professionals were recruited via Prolific Academic and were financially compensated £1.50 for their participation prior to data screening. Data collection occurred between June and July 2019. Forty participants were excluded from analysis, based on pre-registered criteria (i.e., completing the experiment in under 180 s,  $n = 36$ ; or indicating that

they were not active healthcare professionals in the U.K.,  $n = 4$ ), leaving 90 participants for analysis. See Table 1 for demographics. For the flow of participant exclusion and assignment to condition, see Supplementary Figure 1.

### Materials

We created two short persuasive messages using the 11 statements from the pilot study (see Supplementary Table 6 to identify the pilot statements selected). The first message was written in an autonomy-supportive style (Condition 1):

"It's flu season, have you considered getting the flu jab? The flu virus can cause mild to severe illnesses, even death. By choosing to protect ourselves against the virus, we'll reduce our risk of developing flu-related health complications. The flu is highly infectious and is easily transmitted to others. Healthy people can catch the flu too, passing on the virus without even knowing they were infected. We can stop the spread of flu to our patients. We have a duty to protect ourselves, our families, colleagues, and patients. Flu kills, but you could help to fight it. Consider having the flu jab this season. Vaccines are readily available. You could book your appointment today!"

The second message was written in a controlling style (Condition 2):

"It's flu season. You should get the flu jab! The flu virus can cause mild to severe illnesses, even death. You must protect yourself against the virus to reduce your risk of developing flu-related health complications. The flu is highly infectious and is easily transmitted to others. Healthy people can catch the flu too; you may pass on the virus without even knowing you were infected. Don't spread flu to your patients. It is your duty to protect yourself, your family, colleagues, and patients. Flu kills, and you should be helping to fight it. Make sure you have the flu jab this season. Vaccines are readily available. Don't delay, book your appointment today!"

The two messages were closely matched in terms of overall length, sentence length, and ease of readability, autonomy-supportive style condition: word count = 114, readability ease = 65%; controlling style condition: word count = 113, readability ease 71%.

### Design and Procedure

After reviewing the information sheet and providing informed consent, participants were first asked whether they had been vaccinated against the flu during the 2018/2019 flu season. Their answer was recorded using a categorical scale ("Yes" or "No"). They were then asked to state how certain they were that they would vaccinate against the flu during the next flu season. Their answer was recorded on a sliding scale ranging from -100 (*I am absolutely certain that I WILL NOT vaccinate against the flu*), to 100 (*I am absolutely certain that I WILL vaccinate against the flu*), with 0 represented by "I have absolutely no idea whether I will or will not vaccinate against the flu" (see, Schwarz, 1999). This provided a baseline measure of behavioral intention to vaccinate. Next, participants were given the 11-item TRSQ-Flu Scale (Moon et al., under review), which assessed healthcare professionals' motivation toward getting the flu vaccination. The scale captures four regulations of autonomy: autonomous ( $\alpha = .936$ , e.g., "I personally believe that having the flu vaccine will protect my health"); introjection ( $\alpha = .854$ , e.g., "I would feel bad about myself if I didn't get the flu jab"); external

( $\alpha = .666$ , e.g., “I want my line-manager to think I’m a good employee.”); and amotivation ( $\alpha = .727$ , “It is easier to do what I’m told than to think about it.”). Responses were measured on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Next, participants were randomly assigned to one of two persuasive message interventions: the autonomy-supportive communication style condition ( $n = 43$ ), or the controlling communication style condition ( $n = 47$ ). After reading the persuasive message, participants were asked to rate the same four statements from the perceived threat to freedom scale (Dillard & Shen, 2005) we had used in the pilot ( $\alpha = .927$ ), as well as the four feelings from the perceived appeal to feelings scale (adapted from Coulter & Pinto, 1995). The perceived appeals to feelings scale asked: “In your opinion, how was the message attempting to make the reader feel?”<sup>4</sup> The four feelings to rate were “Happy,” “Guilty,” “Accountable,” and “Angry” and were measured on a 5-point Likert scale ranging from 1 (*Not at all*) to 5 (*Very*). The experimental message remained visible for participants while filling out both scales. Participants were then once again asked to state how certain they were that they would vaccinate against the flu during the next flu season, using the same sliding scale as for their original rating, ranging from  $-100$  to  $0$  to  $100$ . This second measure provided a post-intervention estimate of behavioral intentions to vaccinate to allow evaluating the impact of the persuasive message, if any, on behavioral intentions. Finally, participants were asked to fill in demographic information before viewing the debrief form. They were automatically redirected to Prolific Academic upon submitting their answers.

## Main Results

The results are presented as follow: following data distribution and assumption checks, we report the manipulation check testing the effect of communication style (autonomy-supportive vs. controlling) on perceived threat to freedom (H1). Next, we report analyses aiming to address the first aim of this experiment—namely, to establish the impact of different communication styles (autonomy-supportive vs. controlling) on healthcare professionals’ behavioral intentions to vaccinate against the flu. We begin by comparing baseline and post-intervention measures of intentions to vaccinate to test for the within-subject effect of autonomy-supportive communication styles (H2a) and for the within-subject effect of controlling communication styles (H2b) on healthcare professionals’ intentions to vaccinate. Next, we report exploratory analyses comparing the between-subject relative impact of each communication style on the post-intervention measures of intention to vaccinate. We conclude this section with robustness checks.

In the following section, we report analyses aiming to address the second aim of this experiment—namely, to test whether different types of motivational regulation were associated with different baseline behavioral intentions to vaccinate against the flu. We begin by reporting a multiple regression analysis of motivational regulations and baseline (pre-intervention) behavioral intentions to vaccinate to test whether autonomous regulation was positively associated with baseline behavioral intentions to vaccinate against the flu (H3a) and whether external regulation was negatively associated with baseline behavioral intentions to vaccinate against the flu (H3b).

We conclude by reporting exploratory analyses examining the impact of communication styles on perceived appeal to feelings, as

well as moderation analyses examining (a) the interaction of healthcare professionals’ individual differences with motivational regulation and (b) past vaccination behavior, on the efficacy of the autonomy-supportive communication style.

## Preliminary Checks

### Data Distributions and Assumption Checks

Prior to the assessment of evidence, relevant data distributions, and assumptions checks for corresponding statistical tests were assessed. For an overview of data distributions of each hypothesis and assumption checks, see from [Supplementary Table 7](#). Data analyses were conducted using JASP (JASP Team, 2020) version 0.14 and R (2020) version 4.0.3.

### Manipulation Check

As expected, and replicating the finding observed in the pilot study, ratings of threat to freedom were significantly lower when the persuasive message was framed in an autonomy-supportive communication style ( $M = 2.73$ ,  $SD = 1.12$ ) compared to a controlling communication style ( $M = 3.48$ ,  $SD = 1.07$ ), one-tailed  $t(88) = 3.29$ ,  $p < .001$ ,  $d = 0.69$ . BF were computed using the default prior width for Bayesian independent samples  $t$ -tests (i.e., 0.707). The strength of evidence can be assessed as either having evidence in favor of the null hypothesis ( $BF_{01}$ ), or evidence in favor of the alternative hypothesis ( $BF_{10}$ ). When assessing the alternative hypothesis, the higher the  $BF_{10}$  value, the stronger the evidence for a true effect (Jarosz & Wiley, 2014). We found very strong evidence in support of Hypothesis 1,  $BF_{+0} = 43.41$  (where  $BF_{+0}$  indicates a one-tailed test). Although we did not reach our initial target of 58 participants per condition after completing our pre-registered screening procedure, we stopped data collection and conducted our analysis on this initial screened sample since the BF analysis suggested there was very strong evidence to support the hypothesis that our manipulation had been successful in affecting healthcare professionals’ perceived threat to freedom.

## Communication Styles and Behavioral Intentions to Vaccinate Against the Flu

Next, we assessed whether behavioral intentions changed after reading persuasive messages. As the distribution of the difference between baseline and post-intervention measures revealed non-normality in both the autonomy-supportive and the controlling communication style conditions (maximum kurtosis = 20.40; see [Supplementary Table 7](#)), one-tailed Wilcoxon signed-rank tests and one-tailed Bayesian Wilcoxon Signed-Rank tests based on JASP data augmentation algorithm with five chains of 2,000 iterations are reported.

Healthcare professionals’ behavioral intentions to vaccinate against the flu were significantly higher after reading a persuasive message framed in an autonomy-supportive style (median = 85)

<sup>4</sup> This scale was included for exploratory purposes and was deliberately framed to obtain ratings from a generic reader’s perspective rather than the participants’ personal feelings as the perceived appeal to feelings scale was designed to measure the extent to which readers may perceive appeals to feelings in persuasive messages rather than measure their immediate emotional reaction to the messages.

compared to their baseline intentions (median = 82),  $W = 249$ ,  $p = .010$ ,  $r_{tb} = .53$ ,  $BF_{+0} = 5.81$ , thus providing evidence in support of Hypothesis 2a. By contrast, contrary to what we had hypothesized (H2b), there was no evidence that intentions to vaccinate decreased after reading a persuasive message framed in a controlling communication style: median<sub>post</sub> = 76, median<sub>pre</sub> = 65 versus,  $W = 351.50$ ,  $p = .979$ ,  $r_{tb} = .42$ ,  $BF_{0-} = 16.01$ , providing strong evidence for the null hypothesis postulating no difference between the pre- and post-measures, and relative to the alternative hypothesis suggesting that controlling communication styles decrease intentions to vaccinate.

Robustness checks analyses revealed that findings remained consistent even after excluding participants with extreme views (i.e., reporting absolute certainty they would or would not get vaccinated for the baseline measurement, corresponding to a baseline answer of 100 or -100 respectively): median<sub>pre</sub> = 45, median<sub>post</sub> = 68,  $W = 218.5$ ,  $p = .007$ ,  $r_{tb} = .58$ ,  $BF_{+0} = 12.93$ ,  $n = 27$  in the autonomy-supportive communication style condition; median<sub>pre</sub> = 32, median<sub>post</sub> = 25,  $W = 297.5$ ,  $p = .985$ ,  $r_{tb} = .47$ ,  $BF_{-0} = 0.07$ ,  $n = 29$  in the controlling communication style condition. There was no statistically significant change in behavioral intentions among healthcare professionals who reported absolute certainty regarding their future vaccination in the autonomy-supportive communication style condition, median<sub>pre</sub> = median<sub>post</sub> = 100,  $W = 2$ ,  $p = .50$ ,  $r_{tb} = .33$ ,  $BF_{+0} = 0.35$ ,  $n = 16$  or the controlling communication style condition, median<sub>pre</sub> = median<sub>post</sub> = 100,  $W = 3$ ,  $p = .61$ ,  $r_{tb} = .00$ ,  $BF_{-0} = 0.36$ ,  $n = 18$ .

Finally, to explore whether the controlling communication style would result in a lesser impact on intentions to vaccinate compared to the autonomy-supportive communication style, we computed an impact score based on the difference between the post-interventions measure of participants' intentions to vaccinate and their baseline intentions. We then compared the resulting impact in the two communication style conditions. The assumption for homogeneity of variance was met ( $p = .837$ ). However, data distributions revealed non-normality in both conditions (max kurtosis = 20.43). Therefore, we analyzed the impact scores using a one-tailed Mann-Whitney  $U$  test, as well as a one-tailed Bayesian Mann-Whitney  $U$  test based on JASP data augmentation algorithm with five chains of 2,000 iterations. Overall, we found moderate support for the null hypothesis stipulating no difference between the two communication styles. The median change was 0 in both conditions,  $W = 1007.5$ ,  $p = .492$ ,  $r_{tb} = -0.003$ ,  $BF_{0-} = 3.63$ . Assuming a Cauchy prior distribution for  $\delta$ , the median of the resulting posterior distribution was -0.15 with a 95% credible interval ranging from -0.49 to -0.01. In other words, it may or may not be that the

controlling communication style is less efficient than the autonomy-supportive style to change behavioral intentions. Based on our current data, there remains substantial uncertainty about the true size of this effect, which could be anywhere between null and medium.

### Motivational Regulation and Behavioral Intentions to Vaccinate Against the Flu

The secondary aim of this experiment was to test whether different types of motivational regulation are associated with different baseline behavioral intentions to vaccinate against the flu. We subjected the data to a multiple regression analysis using participants' scores from the treatment self-regulation questionnaire for flu (TSRQ-Flu) subscales as predictors and the baseline intentions to vaccinate as the outcome. The model was significant,  $F(4, 85) = 24.08$ ,  $p < .001$ , Adjusted  $R^2 = .509$  (see Table 2). As expected, there was a positive correlation between baseline intentions and an autonomous regulation of motivation,  $r(88) = .71$ ,  $p < .001$ ,  $BF_{10} > 150$ , indicative of decisive evidence in favor of H3a. Autonomous regulation had the greatest effect on baseline intentions to get vaccinated against the flu,  $\beta = .621$ ,  $t(85) = 6.64$ ,  $p < .001$ . On average, a one-unit increase in autonomous regulation was associated with a 29% incremental increase in intention to vaccinate when all other motivation regulations were held constant.

Contrary to what we had hypothesized in H3b, however, baseline intentions were not negatively correlated with an external regulation of motivation,  $r(88) = .30$ ,  $p = .004$ ,  $BF_{-0} = 0.035$ , providing strong evidence in favor of the null hypothesis postulating no association. Furthermore, there was no evidence that external regulation was a predictor of baseline intentions to vaccinate against the flu, above and beyond autonomous regulation,  $\beta = .07$ ,  $t(85) = 0.64$ ,  $p = .527$ . See Supplemental Table 7b for means, standard deviations, and intercorrelations between baseline intentions and all motivational regulation predictors. Finally, we found no evidence that introjection and amotivation predicted baseline intentions.

### Additional Analyses

#### Appeal to Feelings

On average, autonomy-supportive communication style appealed to significantly lower levels of perceived feeling of accountability and anger. The two communication styles did not appear to make different appeals to happiness or guilt (see Table 3).

**Table 2**

*Summary of a Multiple Regression Using Baseline Intentions as the Criterion*

Predictor	<i>b</i>	<i>b</i> 95% CI	Bootstrapped <i>b</i> 95% CI	$\beta$	$\beta$ 95% CI	$sr^2$	$sr^2$ 95% CI	<i>r</i>
(Intercept)	-147.06**	[-191.97, -102.15]	[-184.90, -106.20]					
Autonomous	29.48**	[20.64, 38.31]	[19.57, 37.40]	.62	[0.43, 0.81]	.24	[.11, .38]	.71**
Introjection	5.07	[-3.40, 13.54]	[-4.25, 13.75]	0.13	[-0.09, 0.35]	.01	[-.02, .03]	.53**
External	2.93	[-6.24, 12.09]	[-4.23, 14.55]	0.07	[-0.14, 0.28]	.00	[-.01, .02]	.30**
Amotivation	0.34	[-9.55, 10.22]	[-9.15, 8.75]	.01	[-0.17, 0.18]	.00	[-.00, .00]	.03

*Note.* A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights.  $\beta$  indicates the standardized regression weights.  $sr^2$  represents the semi-partial correlation squared. *r* represents the zero-order correlation.

\*  $p < .05$ . \*\*  $p < .01$ .  $R^2 = .531$ , Bootstrapped 95% CI [.36, .62].

**Table 3**  
*Perceived Appeal to Feelings Within Each Communication Style*

Variable	Autonomy-supportive	Controlling	<i>t</i> (88)	<i>p</i> value	Cohen's <i>d</i>	Bayes factor
Happiness, <i>M</i> ( <i>SD</i> )	2.00 (1.09)	1.66 (0.76)	-1.73	.087	-0.36	$BF_{10} = 0.82$
Guilt, <i>M</i> ( <i>SD</i> )	3.30 (1.35)	3.81 (1.19)	1.89	.063	0.4	$BF_{10} = 1.04$
Accountability, <i>M</i> ( <i>SD</i> )	4.07 (1.03)	4.53 (0.62)	2.60	.011	0.55	$BF_{10} = 4.06$
Anger, <i>M</i> ( <i>SD</i> )	1.49 (0.77)	1.98 (1.05)	2.50	.014	0.53	$BF_{10} = 3.32$

Note. Two-tailed *t*-test. BF = Bayes factors.

### Moderating Effect of Motivation Regulations on Intentions to Vaccinate

A series of hierarchical multiple regressions analyses examined whether the impact of different communication styles was moderated by motivational regulations measured with the TSRQ-Flu Scale. For each participant, we computed the difference between the post-test (after receiving the persuasive message) and baseline (before receiving the persuasive message) measures of the likelihood they would get vaccinated against the flu. A positive change in certainty is indicative of a positive effect of the persuasive message and an increase in the reported likelihood of getting vaccinated.

We explored whether changes in certainty depended on individual differences on each of the four types of motivational regulation measured by the TSRQ-flu through testing for significant interactions between condition (autonomy-supportive vs. controlling communication styles) and motivational regulation. We also report simple slopes analyses to better understand the origin of the significant interactions. Data analyses were conducted using R Studio (2020) version 1.2.5019, and the *interactions* (Long, 2019a), *jtools* (Long, 2019b), *QuantPsyc* (Fletcher, 2012), *lmtest* (Zeileis & Hothorn, 2002), *ggplot2* (Wickham, 2016), and *boot* (Canty & Ripley, 2019; Davison & Hinkley, 1997) packages. Table 4 provides an overview of the analysis and Figure 1 illustrates the simple slope analyses.

#### Moderating Effect of Autonomous Regulation

The impact of the communication style on healthcare professionals' future intentions to vaccinate depended on their individual level of autonomous regulation; that is, on the extent to which flu vaccination was a behavior that they positively endorsed and that was connected to other personal values,  $\beta = -.155$ ,  $t(85) = -2.08$ ,  $p = .041$ . Simple slope analyses indicated that this interaction was due to a difference in impact for those who had lower scores of autonomous regulation and were thus less likely to endorse and value flu vaccination,  $t(85) = 2.01$ ,  $p = .048$ . As Figure 1 (Panel a) illustrates, the autonomy-supportive communication style was much more persuasive than the controlling communication style in this instance.

#### Moderating Effect of Introjection Regulation

A similar pattern was observed for introjection regulation; that is, the extent to which flu vaccination was motivated by guilt avoidance or ego protection,  $\beta = -.123$ ,  $t(85) = -2.13$ ,  $p = .036$ . Simple slope analyses indicated that this interaction was due to a difference in impact for those who had lower scores of introjection regulation,

$t(85) = 2.05$ ,  $p = .043$ . As Figure 1 (Panel b) illustrates, here again, the autonomy-supportive communication style was much more persuasive than the controlling communication style.

#### Moderating Effect of External Regulation

There was no evidence that the impact of communication style depended on individual differences in external regulation, that is the extent to which healthcare professionals were motivated by external contingencies to get the flu vaccine,  $\beta = .026$ ,  $t(85) = 0.40$ ,  $p = .691$  (see also Figure 1, panel c).

#### Moderating Effect of Amotivation

Contrary to external regulation, we did find that amotivation scores, that is, the extent to which individuals had no motivation to get the flu vaccine, moderated the effect of the communication style on future likelihoods to get the flu vaccine,  $\beta = .189$ ,  $t(85) = 2.32$ ,  $p = .023$ . Only, in this instance, simple slope analyses indicated that this interaction was due to a difference in impact for those who had higher scores of amotivation regulation,  $t(85) = 2.10$ ,  $p = .038$ . As Figure 1 (Panel d) illustrates, the autonomy-supportive communication style was much more persuasive than the controlling communication style in this instance.

#### Moderating Effect of Past Behavior on Intentions to Vaccinate

Arguably, the main target of persuasive communication campaigns advocating flu vaccination is the healthcare professionals who did not get vaccinated in the past. However, it is also important to continue to remind those who have vaccinated in the past. For this reason, we examined whether the effect of communication style would depend on whether participants had taken the flu vaccine in the past. A multiple regression revealed that past vaccination behavior was a significant moderator of the impact of communication styles on the reported change in likelihood to get vaccinated against the flu. Specifically, behavioral intentions to vaccinate against the flu were significantly improved by the autonomy-supportive communication style (compared to the controlling style), but only for those who did not get vaccinated during the previous flu season (see Table 5 and Figure 2).

### Discussion

The primary objective of the present research was to establish the impact of autonomy-supportive communication style on the



**Table 4***Moderation and Simple Slopes Analyses of the Four TSRQ-Flu Motivation Regulations Using Change of Certainty as the Criterion*

Model	<i>b</i>	<i>SE</i>	<i>b</i> 95% CI		$\beta$	<i>t</i>	<i>p</i> value
			Lower	Upper			
<i>Moderation 1 autonomous</i>							
(Constant)	-11.96	16.22	-44.19	20.28		-0.74	.463
Condition	63.34	28.98	5.73	120.94	.922	2.19	<b>.032</b>
Autonomous	3.22	3.05	-2.85	9.28	.141	1.06	.294
Condition $\times$ Autonomous	-10.63	5.11	-20.80	-0.47	-.925	-2.08	<b>.041</b>
BCa (Condition $\times$ Autonomous)			-24.90	-3.73			
One <i>SD</i> above mean (6.87)	-9.88	10.30	-30.36	10.61		-0.96	.340
Mean (5.37)	6.23	7.40	-8.49	20.94		0.84	.403
One <i>SD</i> below mean (3.86)	22.33	11.11	0.25	44.41		2.01	<b>.048</b>
<i>Moderation 2 introjection</i>							
(Constant)	-4.13	10.61	-25.22	16.96		-0.39	.698
Condition	36.43	16.23	4.16	68.71	.531	2.24	<b>.027</b>
Introjection	2.48	2.76	-2.99	7.96	.132	0.90	.370
Condition $\times$ Introjection	-8.42	3.96	-16.29	-0.55	-.572	-2.13	<b>.036</b>
BCa (Condition $\times$ Introjection)			-19.21	-3.49			
One <i>SD</i> above mean (5.49)	-9.81	10.22	-30.12	10.51		-0.96	.340
Mean (3.65)	5.69	7.25	-8.72	20.10		.785	.434
One <i>SD</i> below mean (1.81)	21.19	10.33	0.65	41.72		2.05	<b>.043</b>
<i>Moderation 3 external</i>							
(Constant)	15.46	11.14	-6.69	37.62		1.39	.169
Condition	-0.88	15.26	-31.22	29.45	-.013	-0.06	.954
External	-3.66	3.26	-10.15	2.82	-.175	-1.12	.265
Condition $\times$ External	1.78	4.46	-7.09	10.65	.010	0.40	.691
BCa (Condition $\times$ External)			-4.02	15.07			
<i>Moderation 4 amotivation</i>							
(Constant)	21.05	10.83	-0.47	42.58		1.94	.055
Condition	-24.58	14.50	-53.41	4.25	-.358	-1.70	.094
Amotivation	-7.09	4.08	-15.19	1.02	-.267	-1.74	.086
Condition $\times$ Amotivation	12.95	5.58	1.87	24.04	.538	2.32	<b>.023</b>
BCa (Condition $\times$ Amotivation)			0.13	35.50			
One <i>SD</i> above mean (3.55)	21.46	10.20	1.19	41.73		2.10	<b>.038</b>
Mean (2.26)	4.63	7.19	-9.67	18.93		0.64	.521
One <i>SD</i> below mean (0.96)	-12.19	10.22	-32.50	8.12		-1.19	.236

*Note.* *b* represents unstandardized regression weights. CI = confidence interval; BCa = bias-corrected and accelerated confidence interval for  $N = 2,000$  iterations. Condition coded as: 0 = controlling; 1 = autonomy-supportive. Moderation 1,  $\Delta R^2 = .048$ ,  $F(1, 86) = 4.32$ ,  $p = .041$ ; Moderation 2,  $\Delta R^2 = .049$ ,  $F(1, 86) = 4.53$ ,  $p = .036$ ; Moderation 3,  $\Delta R^2 = .002$ ,  $F(1, 86) = 0.16$ ,  $p = .691$ ; Moderation 4,  $\Delta R^2 = .059$ ,  $F(1, 86) = 5.39$ ,  $p = .023$ . Bold denotes  $p < .05$ . *SE* = standard error.

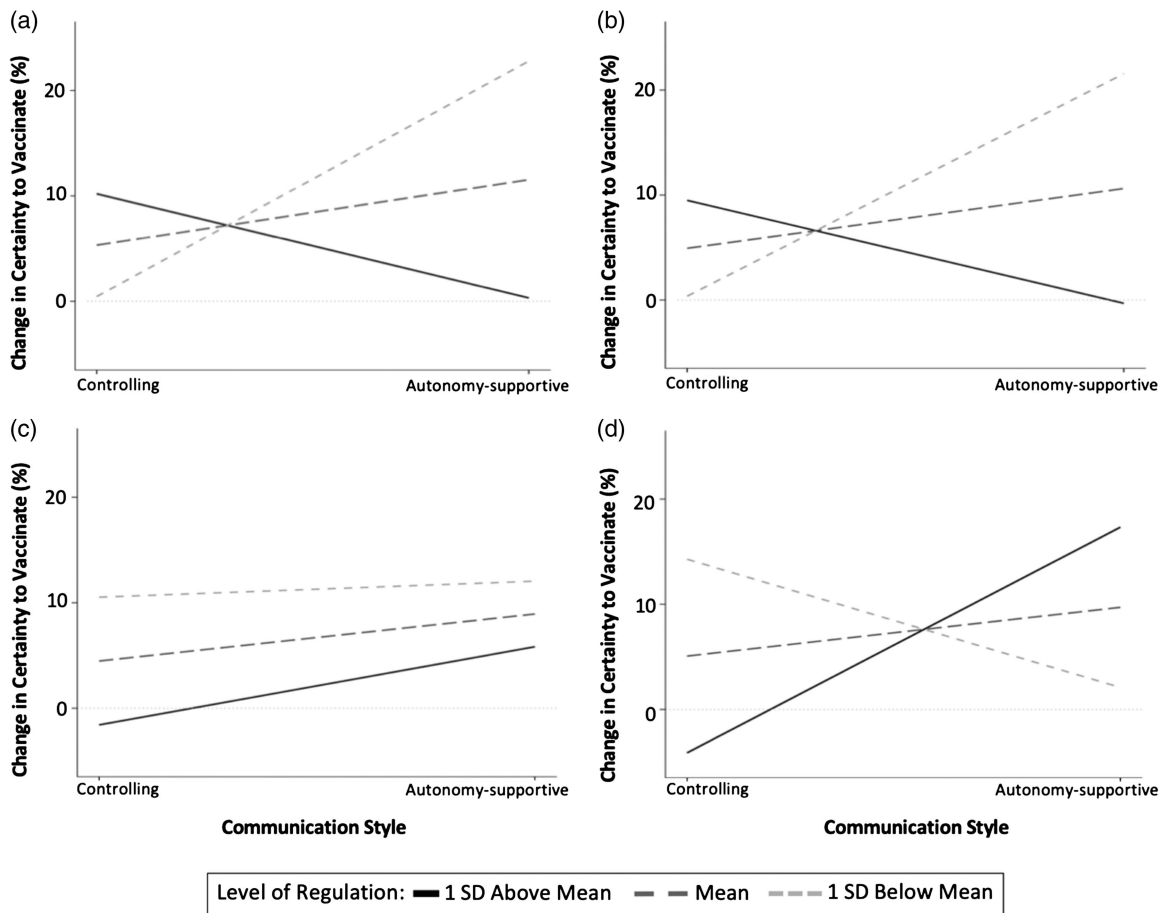
healthcare professionals' behavioral intentions to vaccinate against the flu. The results supported hypothesis H1, which stipulated that autonomy-supportive communication styles would be perceived as posing a lower threat to freedom compared to more controlling communication styles. Importantly, we found evidence to support hypothesis H2a, which stipulated that healthcare professionals' intentions to get the vaccine would increase upon reading an autonomy-supportive message. We did not find evidence, however, to support the hypothesis that controlling communication would have an adverse effect on intentions to vaccinate (H2b). The secondary objective of this study was to test whether different types of motivational regulation are associated with different baseline behavioral intentions to vaccinate against the flu. We found decisive evidence in support of the hypothesis that intentions to take the flu vaccine were positively related to healthcare professionals' levels of autonomous regulation (H3a). This was the only type of motivational regulation which was a significant predictor of baseline intentions to get vaccinated against the flu. In particular, the evidence did not support the hypothesis stipulating that external regulation would be negatively associated with baseline behavioral intentions to vaccinate against the flu (H3b). While controlling communication styles may

not have an adverse impact on healthcare professionals' intentions to vaccinate, as we had anticipated, our data nevertheless provided strong support for the null hypothesis, suggesting that this type of communication style will likely be ineffective to increase healthcare professionals' vaccination uptake.

Our exploratory analyses were inconclusive with regard to an overall advantage of an autonomy-supportive communication style over a controlling style in changing healthcare professionals' behavioral intentions to get vaccinated against the flu. The overall absence of an effect of different communication styles is also consistent with findings in other areas of applications such as exercise-related promotional health messages (Miller et al., 2007) and more recently, safety information concerning a COVID-19 contact tracing application (Bradshaw et al., 2021). However, the present work extends previous research by investigating the role of prior motivation and we found that the impact of these two communication styles was moderated by individual differences in motivational regulations.

Indeed, perhaps our most significant finding in terms of its potential impact, was the observed clear advantage for using

**Figure 1**  
Simple Slopes for the Moderation Effect of the TSRQ-Flu Regulations



*Note.* Simple slopes analyses of the four motivation regulations moderating the effect of communication style (controlling or autonomy-supportive) on the change in certainty to vaccinate against the flu for 1SD above the mean of regulation, the mean of regulation, and 1SD below the mean of regulation. Dotted line at 0 represents no change in the certainty to vaccinate. Panel a: autonomous regulation; Panel b: introjection regulation; Panel c: external regulation; Panel d: amotivation regulation.

autonomy-supportive communication style when communicating to professionals who had not fully internalized their motivation to receive the flu vaccination. The autonomy-supportive communication style was indeed more effective for those who tended to see flu

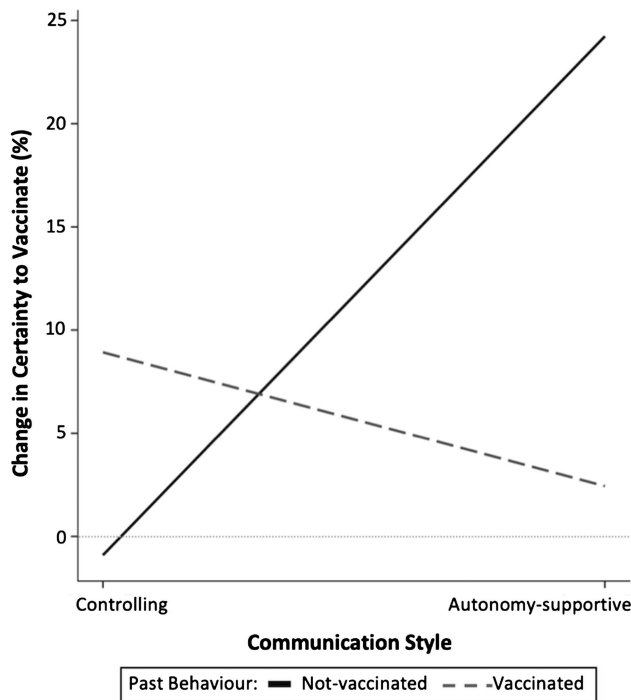
vaccination as unimportant and unconnected with their internal values (low autonomous regulation), those who tended not to see vaccination as an act that would give them pride or reduce guilt (low introjection), or who tended to be unwilling to act to get vaccinated

**Table 5**  
Moderation and Simple Slopes Analysis of Past Vaccination Status Using Change of Certainty as the Criterion

Predictor	b	SE	95% CI for b		β	t	p value
			LL	UL			
(Constant)	8.92	6.82	-4.63	22.47		1.31	.194
Condition (autonomy-supportive)	-6.49	9.23	-24.84	11.87	-.095	-0.70	.484
Past behavior (not vax)	-9.83	9.97	-29.64	9.98	-.140	-0.99	.327
Condition × Past behavior	31.63	15.08	1.65	61.61	.324	2.09	<b>.039</b>
BCa (Condition × Past behavior)			4.96	82.77			
Slope of vaccinated	-6.49	9.23	-24.84	11.87		0.70	.484
Slope of not-vaccinated	25.14	11.93	1.43	48.85		2.11	<b>.038</b>

*Note.* b represents unstandardized regression weights. SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit. BCa = bias-corrected and accelerated confidence interval for N = 2,000 iterations. Reference level of condition = autonomy-supportive; past behavior = not-vaccinated. ΔR<sup>2</sup> = .048, F(1, 86) = 4.40, p = .039. Bold denotes p < .05.

**Figure 2**  
Simple Slopes for the Moderation Effect of Past Behavior



*Note.* Simple slopes analysis for each level of past vaccination behavior status (not-vaccinated or vaccinated) moderating the effect of communication style (controlling or autonomy-supportive) on the change in certainty to vaccinate against the Flu. Dotted line at 0 represents no change in the certainty to vaccinate.

(high amotivation). Additionally, the impact of the type of communication style was also moderated by healthcare professionals' past behaviors: those who had not received the flu vaccination in the preceding season (a strong indicator of intention formation, [Ernsting et al., 2011](#)) were positively influenced by the autonomy-supportive communication style.

Altogether, these results establish the subtle yet important role prior motivation may play in the effectiveness of persuasive campaigns. They provide insight into how words or phrases appealing to choice (autonomy) can positively affect how healthcare professionals perceive the request to get vaccinated, and align with previous research threatening freedom or evoking psychological reactance in health-related communication campaigns ([Dillard & Shen, 2005](#); [Miller et al., 2007](#); [Sprengholz & Betsch, 2020](#)). While autonomy-supportive communication styles seem to bear no consequences for those who are already inclined to engage in the target behavior, it also encourages positive behavioral outcomes for those who were historically less inclined to engage with flu vaccination. From a theoretical perspective, this finding is consistent with self-determination theory's premise that supporting autonomy is associated with positive behavioral outcomes ([Deci & Ryan, 2000](#)). Supporting the need for autonomy using autonomy-supportive language may be key to improving behavioral outcomes by appealing to internalized beliefs.

Communicating in a way that increases the chance of engagement with positive health-related behaviors may be even more important

during outbreaks of infectious diseases, such as the ongoing COVID-19 pandemic. Although a vaccine has just become available, there is concern that people might be hesitant to take it (e.g., [Fadda et al., 2020](#)). While the present research does not make any claims as to whether an autonomy-supportive communication style will increase the intention to receive the newly available COVID-19 vaccine, it offers an avenue for investigating the possibility. Perhaps the moderating effect of autonomy may explain why safety information concerning a COVID-19 contact-tracing application found no significant differences between the impact of different communication styles ([Bradshaw et al., 2021](#)).

Further, it is important to note that vaccination is a behavior that occurs rarely, and thus might differ from other important health behaviors that need constant compliance, such as social distancing and hand washing. Research on the use of autonomy-supportive communication for more sustainable behaviors might offer some insight. For example, [Kinnafick et al. \(2016\)](#) explored the effect of text messages on physical activity. The short text messages were either neutral or facilitated autonomy support and were sent to participants twice weekly over a 10-week period. The results suggested that although both groups showed an initial increase in physical activity, only the intervention group (autonomy-support) had significantly increased moderate intensity of physical activity at the 4-month follow up, whereas the control group (neutral information) had reverted to the baseline. Further research could thus explore the use of autonomy-supportive text messages in an infection control setting to ascertain whether such messages could be effective, as they would be of low cost and easy for health authorities to implement.

### Limitations and Future Research

To the best of our knowledge, this is the first study testing short promotional messages appealing to healthcare professionals need for autonomy in flu vaccination decisions. Although the results are promising, they are not without their limitations. First, data was based on convenience sampling and although experimental manipulations were conducted online (which may increase the ecological validity as NHS communications include digital formats), generalizability of results could be improved through replication and using organizational-specific samples, allowing results to be corroborated with objective vaccine uptake. A second potential limitation of this study was the scale used to assess certainty. At preregistration, it was considered that a percentile scale would enable granular exploration of certainty levels, however, it is arguable that the scaling (ranging from  $-100$  to  $100$ ) was too large and could have potentially introduced added variance comparative to the sample size, thus resulting in the deviations from normality we observed. Nevertheless, we were able to address this shortcoming using robust non-parametric tests and robustness checks. Future studies could assess the level of certainty using Likert scales or alternative presentation formats, with qualitative follow-up questions related to ease of use. Third, as we only had one measure of motivation at baseline (and did not measure it again after the presentation of the persuasive message), we cannot be certain of the extent to which autonomy-supportive communication directly or indirectly affected motivation. Since autonomous motivation was a strong predictor of future intentions to vaccinate, a valuable addition in future research could be to test whether the impact of

autonomy-supportive communication styles on these intentions is moderated by a change in autonomous regulation. Fourth, although participants were randomly allocated to the two conditions, most healthcare professionals allocated to the autonomy-supportive communication were inclined to have positive baseline behavioral intentions or having received the flu vaccination in the past. This may have caused an underestimation of changes in the certainty to vaccinate against the flu due to the autonomy-supportive communication, through ceiling effects. Despite this, however, we found clear evidence that autonomy-supportive communication had a positive impact on behavioral intentions.

This study was informed by self-determination theory (Deci & Ryan, 2000) which conceives autonomous regulation as an internalized and individual form of motivation. There exist other conceptions, however, such as “relational autonomy” whereby autonomy is not defined as a state of individual independence but is instead viewed as situated in “complex webs of personal and institutional relationships that make possible, or sometimes hinder, the making of real choices” (MacDonald, 2002, p. 195; see also Gómez-Virseda et al., 2019). While this was out of scope for the current study, future research could benefit from exploring how perceptions of relational autonomy may also impact healthcare professionals’ decisions to get vaccinated against the flu, especially since the need for them to get vaccinated against the flu is primarily occupational (e.g., it is recommended to limit the risk of transmission to vulnerable patients, Horcajada et al., 2003).

### Implications for Policy and Practice

A key finding from this study is that autonomy-supportive communication styles implying freedom of choice (e.g., “Consider having the flu jab”) can be more effective than controlling communicative styles implying obligation (e.g., “Make sure you have the flu jab”) to boost hesitant healthcare professionals’ intentions to vaccinate against seasonal flu, particularly among those who did not consider flu vaccination as important or aligned with their values (low autonomous regulation). This may prove of vital importance for communication campaign managers and policy-makers seeking to increase vaccination uptake among healthcare professionals as they indicate that framing messages around choice, rather than obligation, may be a more effective way to increase uptake.

The 2019/2020 Commissioning for Quality and Innovation (CQUIN) scheme aims to draw attention to evidence-based interventions which are simple, and do not pose a significant cost to implementation (National Health Service England, 2020). The evidence presented here potentially answers the need for such an intervention, as adopting an autonomy-supportive style within future communication campaigns could help to enhance healthcare professionals’ vaccination decisions, without contributing to significant financial implications of implementation. After reading autonomy-supportive communication, behavioral intentions to get vaccinated against the flu were significantly higher than baseline intentions. Moreover, our findings suggest that this communication style could be particularly beneficial for targeting those who have not previously vaccinated against the flu, or who are less likely to vaccinate. Interpretation of the estimated Cohen’s *d* effect size (see Magnusson, 2020) indicated that for one more healthcare professional to have an improved intention to get vaccinated, 10 healthcare professionals would have to read autonomy-supportive

communication. By contrast, our evidence suggest that a controlling communication style would be inefficient. Based on the estimate (albeit not statistically significant) effect size of this communication style, one should expect one improved behavioral intention for every 31 healthcare professionals reached.

### Conclusions

The current work highlights that the presence of an autonomy-supportive language is an important component of communication campaigns appealing to healthcare professionals to get the flu vaccination. It affords promising outcomes for encouraging positive vaccination decisions and behavioral outcomes, highlighting that prior motivation is an important factor to consider when determining the impact of different communication styles. It provides a useful foundation for future research to build upon, which may also provide foundations to examine how messaging campaigns may be designed for the forthcoming COVID-19 vaccination campaigns. The current work also draws attention to a simple, low-cost intervention for institutions such as the NHS, and even small effects could improve vaccination uptake when considering the global number of healthcare professionals.

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