Autonomy Matters: The Role of Autonomous Motivation in Healthcare Professionals' Decisions to Vaccinate Against Seasonal Influenza.

A thesis presented in partial fulfilment of the requirements of Kingston University for the degree of Doctorate of Philosophy (PhD)

Karis Moon
Faculty of Business and Social Sciences
Kingston Business School
Kingston University London
February 2020

Declaration of originality

I declare that the work presented in this thesis is my own and where this has been contributed to by others, it is appropriately acknowledged.

Acknowledgements

I gratefully acknowledge Kingston University London for awarding and funding my full-time studentship, and the Healthcare Professionals' who took the time out of their busy lives to participate in my research. Thank you to the NHS Trust who supported the early development of this research.

This thesis would not have been possible without the support of many. Family and friends, thank you for your continued enthusiasm, encouragement and support. You gave me the courage to persist on a journey which challenged every corner of my mind. Thanks to my colleagues at Kingston Business School for the inspiration and support. DART members past and present, thanks for being the best team.

A special thanks goes to my first supervisor Gaëlle, years ago you spotted a glimmer of potential and from there you guided the beginnings of my research career. You taught me how to write, discover and question. Through you (and because of you) I found a passion, there aren't words to describe my gratitude. Thank you for giving me the keys to a world which was once unattainable. To my other supervisors Amélie and Anine, you've been a source of strength when the going got tough. You've helped me grow as a researcher and I'll always be thankful for the opportunities, support and guidance that you sent my way.

To my husband David, you've seen the worst of me and not once did you allow me to falter. With your support, you helped to make this journey and all of its outcomes possible. Thank you for being my rock in the wildest of storms.

Finally to Olivia and Emily**,** you have both been my source of inspiration and you're the reason I always persisted. This thesis is dedicated to you…don't worry you don't have to read it but…

...May you always find the strength and belief to follow your dreams. May you always want to challenge yourself, discover and question why.

Remember, while you're out there smashing glass ceilings and achieving things you never thought possible, be kind to yourself always. And, for the days when those clouds roll in, may you always be surrounded by strong, inspirational and dedicated people who see your potential, raise you up, guide and support you.

Abstract

Influenza (flu) is a highly infectious respiratory virus, posing a serious and increased risk for health complications and premature death. To protect against the spread of the virus, 'at-risk' groups such as Healthcare Professionals should be vaccinated. Ensuring improved immunity within this target group may help to reduce the risk of nosocomial transmission to patients (Goins et al., 2011). Yet, despite annual flu campaigns, the recommended 75% vaccine coverage rate remains a challenge. Typically, psychological frameworks such as the health belief model and the theory of planned behaviour are used to understand, predict and explain psychological, social and environmental factors of vaccination decisions. However, research often only goes as far as to predict vaccination uptake, and there is a need for an increase in scientifically-led theory-based interventions (Corace et al., 2016).

This thesis applies the theoretical lens of self-determination theory (SDT), a general theory of human motivation (Ryan & Deci, 2000), to investigate the role of autonomy in Healthcare Professionals' decisions to get vaccinated against the flu. In addition, it seeks to understand how encouraging an autonomous decision may impact behavioural intentions to receive the flu vaccination. Its contribution begins with a systematic review identifying and assessing the effectiveness of existing health-related behavioural interventions rooted in SDT, highlighting that autonomy is an important factor for positive behavioural outcomes and sustained behaviour change. It provides insight into strategies and measures for the development of behavioural interventions, contrasting environments which support choice or force change. Based on these findings, four cross-sectional survey studies are reported, which all contributed to the development of a psychometric scale measuring Healthcare Professionals' flu vaccine motivations. The scale was distinct from, and contributed over and beyond, other psychosocial measures of flu

vaccination behaviour and can be used to understand the motivation of both vaccine acceptors and vaccine deniers. Findings support the recommendation that assessing autonomous regulation is essential for understanding the psychological drivers of vaccine uptake (Denman et al., 2016), adding that additional regulations of autonomy, such as introjection (guilt avoidance) and external control are also important for assessing healthcare professionals' flu vaccine decisions. The final contribution of the thesis, in response to the increased need for scientifically led theory-based interventions, includes a pilot and an experimental study which developed and tested different communication styles aimed at promoting healthcare professionals' vaccine uptake. Reported findings reveal that communication messages supporting the need for autonomy, compared to messages using high controlling language, reduce the threat to freedom of choice. Autonomy-supportive messages have a positive impact on the change in behavioural intentions to vaccinate against the flu when autonomous and introjection regulations are low. Thus, the present thesis provides a new and important avenue to understand the motivation driving healthcare professionals' flu vaccine decisions, and it provides theoretically driven foundations for a future behaviour change intervention, incorporating autonomy-supportive communication styles.

Table of Contents

List of Tables

List of Figures

Abbreviations

HCP	Healthcare Professionals (used for plural and possessive)
IM	Impression Management
MetaQAT	Meta Quality Appraisal Tool
NHS	National Health Service (UK)
NICE	National Institute for Health and Care Excellence
SDE	Self-Deceptive Enhancement
SDT	Self-determination theory
UK	United Kingdom
WHO	World Health Organization

Chapter 1: General Introduction

The request for healthcare professionals' (HCP) to get vaccinated stems from the increased risk of exposure to, and spread of, the flu virus within healthcare settings. Ensuring improved immunity among this group may help to reduce the risk of nosocomial transmission, and potential pandemics (Goins et al., 2011). Yet, despite continuing efforts of immunisation programmes specifically targeting HCP, nationwide vaccination uptake rates remain suboptimal. For example in England, 70.3% of frontline HCP with direct patient care working within the National Health Service (NHS) were reported to have received the flu vaccination during the 2018/19 winter season, compared to 51.2% in Scotland, 55.5% in Wales, and 39.5% in Northern Ireland (Public Health England, 2019a). Moreover, there is significant variability in flu vaccine coverage rates across NHS Trusts ranging from 36.8% to 95.4%, with only 52.2% of Trusts across the UK achieving the recommended 75% target (Public Health England, 2019b). This chapter introduces the background to the problem of flu vaccination uptake, the traditional psychological frameworks used to predict vaccination-related behaviour, and concludes with an overview of the thesis and its contribution to knowledge.

Background

Vaccination is a medical intervention which aims to improve immunity and reduce the spread of infectious diseases and illnesses. It is responsible for the eradication of smallpox and has vastly reduced the mortality rates associated with major diseases such as diphtheria, measles, and polio (Andre et al., 2008). Vaccines work to stimulate the body's immune system enabling it to recognise and respond to the specific infection more easily. A vaccine will contain a weakened live or inactive form of a disease-causing microorganism, which allows the immune system to remember and destroy it, should true

exposure to the disease occur (World Health Organization, 2017). Beyond protecting the individual directly, vaccination also provides indirect protection by reducing the spread of disease and infection, otherwise referred to as herd immunity (Logan et al., 2018).

Vaccines are recognised as one of the most effective public health interventions. No other modality, except for clean water, has had such a positive impact on population growth and mortality reduction (Plotkin & Plotkin, 2012). However, despite progressive advancements and improvements to control and eliminate such infections, vaccine-preventable diseases and vaccine hesitancy remain among the top ten global health threats (World Health Organization, 2019b). Specifically, the risk of a global influenza pandemic is listed as one of the top three threats to global health. The World Health Organization (2019c) has recently initiated a Global Influenza Strategy for 2019-2030, aiming to prevent seasonal influenza, control the spread of the virus from animals to humans, and to prepare for the next pandemic through improved methods of detection, treatment and preventative methods.

Influenza (flu) is a highly infectious respiratory illness caused by either a type A, B or C virus. Each year the flu virus evolves by altering its key characteristics, otherwise known as an antigenic drift (Department of Health & Public Health England, 2019; Ziegler et al., 2018). Antigenic drifts make it notoriously difficult to specify a universal vaccination to improve immunity, and this can lead to epidemics and pandemics. The most recent pandemic in 2009 resulted in an estimated 400,000 global deaths. Preceding pandemics in 1957 and 1968 caused up to 4 million deaths each (World Health Organization, 2019a). In response to the frequency of antigenic drifts, a new flu vaccine is offered each year in preparation for the new flu season.

Typically in the UK, the flu season peaks during the months spanning December to March (NHS, 2019). Each year, laboratories informing the World Health Organization predict the most probable flu virus to circulate that season and the vaccine is matched to the predicted strains. However, predictions can sometimes result in suboptimal matches reducing the effectiveness of the flu vaccine (Agor & Özaltın, 2018). For example, while effectiveness rates differ considerably across age groups, the flu vaccine in the UK had an overall effectiveness of 15% for the 2017/18 flu season, compared to an overall effectiveness of 39.8% for the 2016/17 flu season (Public Health England, 2017, 2018). The provisional flu vaccine effectiveness for 2018/19 is 44.3% (Public Health England, 2019b). Unlike infectious diseases such as measles, mumps and rubella whereby vaccination may provide long term protection and is 90-95% effective (Public Health England, 2019c), the flu vaccine can only offer a short-term solution and may not always provide maximum effectiveness.

In the 2018/19 flu season, the UK reported 1340 acute respiratory illness outbreaks within closed settings such as care homes, hospitals and schools. Of those cases virologically tested, 72.4% were associated with the flu virus. Additionally, there were over 5000 hospital admissions associated with the flu. For the 2017/18 flu season, 26,408 deaths were associated with the flu in England alone, and the majority of these deaths were seen in those people over the age of 65 years (Public Health England, 2019b).

As previously mentioned, vaccination works directly to protect the individual but also indirectly via herd immunity. Vaccinating a large proportion of a community can help to reduce the likelihood of an outbreak (Logan et al., 2018). The World Health Organization (2015) recommends that to protect against the spread of the flu virus, all ‘at-risk’ groups such as children, pregnant women, those with chronic health conditions, the

elderly, and HCP should be vaccinated. Within the UK the flu vaccination is made freely available to such target groups (NHS, 2019). Thresholds to establish herd immunity for the flu remain high: within Europe, the target vaccination coverage rate is 75%, whereas in the United States, target vaccination coverage rates are 90% for at-risk groups (Plans-Rubió, 2012). Yet, the flu vaccination coverage rates within the UK remain a challenge with marked differences in the rate of vaccine uptake across provinces and 'at-risk' groups. For example, flu vaccine coverage rates for the population aged 6 months to 65 years old considered at risk because of an underlying health condition were 42.4% in Scotland, compared with 52.4% in Northern Ireland. For those 65 years old and over, flu vaccination coverage rates in Wales were 68.3% compared to 73.7% in Scotland. The 75% flu vaccine coverage rate is yet to be achieved in individual provinces and 'at-risk' groups (for a detailed report see Public Health England, 2019b). Given the nature of the flu virus, its associated mortality rates and the variance in vaccination coverage, the flu places an unpredictable pressure on healthcare services. A challenge is not only to raise the flu vaccine coverage rate but to also understand how high coverage rates may be maintained. The next section introduces current policy-led incentivised schemes within the UK and discusses the effectiveness of interventions aiming to increase flu vaccination uptake among HCP.

UK Government Position on HCP Flu Vaccination and Policy-Led Initiatives Encouraging Flu Vaccination Uptake

The House of Commons, Science and Technology committee (2018) requested that the UK Government consider a mandatory flu vaccination policy for certain groups of HCP. Government response to the parliamentary report acknowledged the need for a multicomponent approach to increase vaccination coverage (2019), and an opt-out approach has been implemented for the 2019/20 flu season whereby HCP are required to

provide a reason for not receiving the flu vaccination. However, while HCP decision to receive the flu vaccination remains autonomous, this type of approach encourages individuals to re-examine their decision for declining the flu vaccine, and can be considered a form of mandating (Stead et al., 2019). Research examining unvaccinated nurses' perceptions of mandatory flu vaccination policies found that declination forms still respected their crucial need for choice. However, there was also potential for negative psychological consequences, such as fear of work-related consequences should a patient in their care become infected after signing a declination form (Pless et al., 2017).

For the 2019/20 flu season, the Commission for Quality and Innovation (CQUIN) target for HCP flu vaccination coverage has increased from a 75% vaccine coverage rate to 80% for frontline clinical staff. The CQUIN framework is a policy-led initiative which financially rewards healthcare providers on conditional demonstration of a variety of care related quality improvements, such as prevention of ill health, mental health, and patient safety (NHS England, 2019, 2020). The basis for financial reward is calculated on achieving flu vaccine coverage rates between 60-80% (NHS England, 2020). Historically, the CQUIN scheme has been criticised for setting complex targets which impose an unfair burden on single organisations. Therefore, in response to this criticism, the new 2019/20 CQUIN scheme aims to draw attention to good evidence-based practice, calling for the use of simple interventions that do not significantly increase implementation costs (NHS England, 2020).

More broadly, an evaluation of incentives and interventions used to increase HCP flu vaccination uptake, across various countries, revealed that coverage rates improved when a multitude of components were implemented. For example, ease of access, declination forms, information targeting knowledge or behavioural modification, and

dedicated employees instigating vaccine uptake strategies (for a review, see Hollmeyer et al., 2013). In addition, a meta-analysis for intervention effectiveness revealed that components such as increased incentives, access and awareness were least effective, but when used together matched the effectiveness rate of declination forms (Lytras et al., 2016). The UK's National Institute for Health and Care Excellence (NICE) recommends that during the flu season campaigns healthcare providers' should plan to: assign employees the task of increasing flu vaccination awareness and uptake among their colleagues; use peer vaccinators who challenge myths related to the flu vaccine; publicise support from senior leaders and staff representatives; provide information campaigns on the safety and effectiveness of the flu vaccine; adopt organisational led incentives such as a free coffee if the vaccine is received; use digital and individually targeted prompts and reminders; implement out-of-hours or mobile flu vaccination clinics; publicise organisational vaccine uptake rates or comparative coverage of individual departments (NICE & Public Health England, 2018).

Understanding Vaccination Decisions and Behaviour

This section outlines the key determinants related to vaccination decisions and behaviour that have previously been investigated. Throughout this thesis when the term 'decision' is used it refers to measures such as beliefs and attitudes relating to the intention to get vaccinated, and the term 'behaviour' refers to measures of actual behavioural action, such as the use of objective measures of vaccination uptake. A common approach to address the challenge of low vaccination uptake has been to identify psychological, social and environmental barriers and drivers of vaccination uptake to predict behaviour. Behaviours associated with vaccination uptake are complex, and it is possible that with each vaccine comes distinctive motivations, beliefs and attitudes (Betsch et al., 2018;

Corace et al., 2013; Peretti-Watel et al., 2015). Psychological frameworks for vaccination behaviour such as the 5As taxonomy (Thomson et al., 2016) and 5C psychological antecedents of vaccination (Betsch et al., 2018) facilitate a broad and mutual understanding of primary barriers and drivers to vaccination uptake. Next, both frameworks will be discussed with evidence provided for each domain in relation to factors associated with HCP flu vaccination uptake.

Broadly, the 5As taxonomy classifies typical determinants of vaccine uptake for diseases such as measles, mumps and rubella, tuberculosis, diphtheria, pertussis (whooping cough), and tetanus, influenza (flu) and hepatitis (Thomson et al., 2016). From a systematic review of the literature, 23 factors associated with suboptimal uptake rate were identified, and these formed five key domains, namely: access, affordability, awareness, acceptance and activation. *Access* refers to the ability of individuals to receive the vaccine, encompassing contributing factors such as place of birth, contact with healthcare systems, and convenience. *Affordability* refers to factors associated with cost both in terms of financial and other aspects such as time. *Awareness* refers to the degree of acquired knowledge of vaccines such as associated benefit and risks, knowledge of the recommended vaccination schedule, and the availability of information. *Acceptance* refers to the degree in which individuals' question, refuse or accept vaccination, encompassing determinants such as attitudes towards vaccination, perceived safety, efficacy or severity. In addition, acceptance encompasses concerns regarding vaccines, diseases, personal beliefs and the social context such as peer influence. *Activation* refers to the nudging techniques that influence individuals to take action, such as prompts, reminders and workplace policies. The 5Cs adds to these key domains by including *calculation*. Calculation refers to a need for (and engagement with) extensive information, relating to risk perceptions of vaccination and disease. Those with high calculation are considered

risk-averse, and potentially use the experiences of others to inform their decisions. Next, evidence concerning these domains and flu vaccination decisions among HCP are discussed.

Nurses in the United Kingdom were significantly more likely to receive the flu vaccine if they believed that there was a benefit for those HCP who were otherwise considered healthy; if they felt more at risk of contracting the flu virus (awareness and acceptance); or if they had received a recommendation by occupational health (activation) (O'Reilly et al., 2005). In addition, increased vaccination coverage was significantly correlated with work location and an out-of-hours provision (access). The decision to refuse the flu vacation has been associated with common beliefs that the flu vaccine is ineffective, that it makes staff unwell, or is not required for a healthy person (acceptance, awareness and calculation) (Heinrich-Morrison et al., 2015). In relation to research addressing activation, a large randomised controlled trial (N = 7540) using a nudging technique to encourage frontline HCP to vaccinate, found no statistical evidence to suggest that vaccination coverage rates were affected by a letter reminder (activation). The letter incorporated descriptive social norms such as comparing behaviour to peers, or injunctive social norms such as providing a personalised appeal from authoritative personnel such as the Medical Director (Schmidtke et al., 2019). Whereas knowing if a line manager (or other authoritative personnel) had been vaccinated significantly increased the likelihood of HCP vaccinating (Kassianos et al., 2018; Vallée-Tourangeau et al., 2018), above and beyond factors concerning perceived risk variables such as the likelihood of contracting the flu virus without the flu vaccine. Knowledge of line manager vaccination was not explicitly included within the 5As taxonomy but could form part of the acceptance domain relating to the social context.

Psychological Behaviour Models of Flu Vaccination Decisions and Behaviour

To understand the decision to engage with vaccinations there is a need to extend research beyond the identification of drivers, barriers, and attitudinal measures (Corace & Garber, 2014). Fostering psychological models of behaviour change such as the health belief model and the theory of planned behaviour may facilitate improved outcomes of behavioural change interventions (Corace & Garber, 2014), and these models are widely used in assessing flu vaccination behaviour. However, beyond predicting behaviour, limited evidence exists for their use in behaviour change interventions (for a recent review of the literature, see Corace et al., 2016) and they are often used to develop measures of behaviour rather than being used explicitly designing an intervention (Abraham & Michie, 2008). This may be due to the issue that behaviour change theories offer little guidance on how to actually change behaviour (Michie & Abraham, 2004). Perhaps this provides an explanation as to why there is a lack of these theory-based interventions addressing HCP flu vaccination behaviours has been identified. Nevertheless, both of these traditional models are discussed next, together with the evidence of their use concerning flu vaccine uptake among HCP. Further, the cognitive model of empowerment is also discussed, as more recently this model has been applied to understand HCP decisions to engage with the flu vaccination in an attempt to explore *why* a HCP would be motivated to receive, or advocate receiving, the flu vaccination.

The Health Belief Model. Initially developed by (Hochbaum, 1958) to understand why disease prevention interventions or early detection screening tests were not widely accepted, the health belief model is now the most commonly used behavioural model (Corace et al., 2016; Janz & Becker, 1984). It places an importance on understanding attitudes and beliefs toward a variety of health behaviours such as diet, exercise, visiting a physician, and flu vaccination uptake. The model conceptualises behavioural outcomes as

a product of the individual's desire to be healthy by avoiding illness or improving health, and the belief that a requested action will prevent ill-health (Janz & Becker, 1984). For example, receiving the flu vaccine will depend upon the individual's perceived threat of contracting the flu virus, coupled with the perceived likelihood that the flu vaccine will prevent it.

Four original key concepts are included within the health belief model: *perceived susceptibility* which refers to the subjective risk of contracting the illness; *perceived severity* which refers to the subjective seriousness of contracting the illness; *perceived benefits* which refer to the subjective beliefs for the effectiveness of the behavioural action; and *perceived barriers* which refers to the subjective cost incurred for initiating the behavioural action. Over time, modifiable concepts have been added (Redding et al., 2000), such as *cues to action*, which refers to a necessary stimulus used to trigger the behavioural action, and *self-efficacy*, which refers to the subjective belief that the behaviour can be successfully executed. It has been argued that self-efficacy is most relevant to the concept of perceived barriers (Janz & Becker, 1984). Yet there is limited evidence that the inclusion of this separate construct improves the predictive power of the health belief model (Champion & Skinner, 2015). The conceptualisation of the model provides no directive approach for the strategies required to change behaviour. While there is an acceptance that attitudes and beliefs predict behaviour, a concrete understanding of how these concepts influence health behaviours are lacking (Champion & Skinner, 2015). Moreover, there is a lack of adequate standardised measures to reliably assess the concepts of health belief model (Janz & Becker, 1984), thus implicating content validity (Champion & Skinner, 2015). Often, conclusions drawn about vaccination behaviour are based on the predictive power of single items within the construct (Corace et al., 2013; Myers &

Goodwin, 2011), meaning that latent reliability measures such as Cronbach's alpha reliability estimates are lacking.

When applied to the assessment of HCP flu vaccination behaviour, the health belief model constructs of *perceived benefits, perceived susceptibility*, and *cues to action* are significant predictors of vaccination uptake, and significant differences between vaccinated and unvaccinated HCP are evident (Corace et al., 2016; Prematunge et al., 2012a; To et al., 2016). For example, vaccinated HCP in Canada were more likely to perceive higher susceptibility for contracting the flu virus, higher perceived severity concerning the danger of the flu virus, and more positive perceptions regarding the effectiveness of the flu vaccine. For unvaccinated HCP, perceived barriers such as the cost of time were higher, and perceived benefits were lower, with a greater belief of low risk for susceptibility (i.e., contracting the virus) (Corace et al., 2013). More recently, perceived susceptibility and perceived benefits were associated with positive intentions to receive the flu vaccine among nurses in Hong Kong (Mo et al., 2019), and positive perceptions for receiving the flu vaccine in vaccinated HCP working within an Irish hospital (Hogan et al., 2019).

Theory of Planned Behaviour. Extending the Theory of Reasoned Action (Fishbein, 1967), the theory of planned behaviour (Ajzen, 1991) has been used to provide insights into psychological factors associated with the initiation of health behaviours such as vaccination, smoking cessation, alcohol consumption, physical activity and condom use (Armitage & Talibudeen, 2010; Montaño & Kasprzyk, 2015). The underlying assumption of both models is that intention is the best predictor for behavioural outcomes, and these intentions are directly determined by an individual's attitude toward the behaviour, and the subjective norms associated with the behaviour (Montaño & Kasprzyk, 2015). *Perceived behavioural control* refers to the belief in the ability to overcome barriers to achieve the

behavioural outcome, and it is concerned with the perception of volitional control over the performance of the behaviour. *Attitudes* refer to beliefs that the outcome of the behaviour is worthwhile such that positive attitudes are a result of holding a strong belief that the outcome of the behaviour has value. *Subjective norms* refer to the belief that other people in a position of importance will approve or disapprove of the behaviour (normative belief); therefore, the perception of the behaviour is influenced by the judgement of others (Montaño & Kasprzyk, 2015). Behavioural interventions adopting this framework have demonstrated that a change in the concepts related to the theory of planned behaviour can induce overall changes in behaviour (for an overview, see Montaño & Kasprzyk, 2015). Similarly to the health belief model, the theory of planned behaviour discerns that attitudes, subjective norms, or control beliefs are likely to be different depending on the population, or the behavioural action under consideration, and as a consequence, adequate standardised measures are lacking. However, unlike the health belief model, the theory of planned behaviour assumes a causal relationship among the constructs of the models, with clearly specified approaches to measurement and computations (Montaño & Kasprzyk, 2015).

When using the theory of planned behaviour to understand and predict HCP flu vaccination uptake, research finds that negative attitudes, professional obligation, and vaccine or disease misconception were primary barriers for HCP not to receive the flu vaccination (for a detailed review, see Schmid et al., 2017). Attitudes, subjective norms and perceived behavioural control have demonstrated significant correlations with student nurses' intention to get vaccinated against the flu, explaining 41.9% of the variance in the intention score, increasing to 47.3% once controlling for past vaccination history (Cornally et al., 2013). For Canadian HCP working in public hospitals, the intention to get vaccinated against the flu was significantly predicted by subjective norms and perceived

behavioural control. However, when measured against objective measures of vaccination uptake rates, only moral norms (the feeling of obligation) was a significant mediator between the relationship of intention and behaviour (Godin et al., 2010).

New Research Directions. Research has begun to step away from these traditional models by moving towards an understanding of *why* HCP may *want* to get vaccinated against the flu. For example, the cognitive model of empowerment has been adopted to understand HCP flu vaccination behavioural decisions, measuring their intrinsic motivations to engage with purposeful behaviour (Vallée-Tourangeau et al., 2018). Rooted in organizational psychology (Thomas & Velthouse, 1990), the psychological component of empowerment refers to employees' intrinsic task motivation, which is measurable through four cognitive task assessments of impact, competence, meaningfulness and choice. *Impact* refers to the degree in which the individual believes that accomplishing an assigned task will make a difference. *Competence* refers to the degree in which an individual believes that they skilfully perform the required task. *Meaningfulness* refers to the degree in which an individual perceives value for the task's purpose, and it is relative to the individual's ideals: for example, low perceptions of meaningfulness may be associated with feelings of apathy. *Choice* refers to the degree of causal responsibility for a person's action (Thomas & Velthouse, 1990), and perhaps this aligns with deCharms' (1968) locus of causality, in which behavioural outcomes are a result of events internal and external to the individual. Taken together, these four cognitive assessments are considered a reflection of "proactive, rather than passive, orientation of an individual in relation to his or her work role." (Cabigao & Hahklotubbe, 2014, p. 175).

Applying the cognitive model of empowerment framework, healthcare professionals' sentiments and motivation of flu vaccination behaviour have been explored

through the development of the Motors of Vaccination Uptake (MoVac-flu) scale (Vallée-Tourangeau et al., 2018). The scale applies the four task assessment cognitions of value (the degree of caring), impact (the belief the behaviour makes a difference), knowledge (the belief that one has the skills and knowledge to perform the behaviour) and autonomy (the belief that the initiation of the purposeful behaviour is self-determined). While this recently developed scale leans towards extending beyond the traditional measures of risk perception and benefits, it is not without limitations. The authors note that the underlying factor structure for the four cognitions used a limited set of items. For example, choice is measured using a single item "I can choose whether to get a flu jab or not". While the use of one item indicator may be considered permissible (Wilkerson et al., 2016; Youngblut & Casper, 1993), a more extensive set of items may better encapsulate the cognitive assessment of choice (Vallée-Tourangeau et al., 2018). Subsequently, research has attempted to extend the dimension of choice and explored the use of additional items relating to autonomy. Kassianos et al. (2018, p. 3), characterised choice using three items relating to: autonomy "Whether or not I will get a flu jab is entirely up to me." (note that the wording of this item is slightly different to the original scale "I can choose whether to get a flu jab or not"), extrinsic pressure "I feel under pressure to get a flu jab.", and to intrinsic motivation "I get the flu jab because I want to, not because I feel obligated to." While consistent within the cognitive model of empowerment's broad definition of choice, only the latter item emerged as having acceptable predictor importance of HCP engagement with flu vaccination uptake.

Overall, the unstable nature for the measure of choice calls for further investigation toward fully understanding of the role of autonomy in reference to HCP motivation to receive the flu vaccination. Having the freedom to choose whether or not to get the flu vaccine may play an essential role in HCP decisions. For example, research seeking to

understand HCP general flu vaccination perceptions found that HCP in the United States who were asked to provide statements related to mandatory flu vaccination policies frequently reported (54.4%) the violation of choice as a barrier to get vaccinated (Hakim et al., 2011). Israeli nurses' demand for a choice in the decision to be vaccinated had a significant association with acceptance of the whooping cough vaccine (Baron-Epel et al., 2013). Furthermore, higher feelings of choice coupled with a positive instrumental attitude, have been found to significantly increase the likelihood of medical students' intention to get vaccinated (Lehmann et al., 2015).

In other words, the feeling of autonomy (or free choice) may be an important factor associated with vaccine decisions, yet beyond the research using the cognitive model of empowerment the exploration of autonomy as a factor appears limited with the literature. Moreover, the cognitive model of empowerment is often applied within the context of employees' task motivation (Thomas & Velthouse, 1990), perhaps to further understand autonomy, exploration of this concept from the context of the health behaviour perspective may be complementary. The next section briefly introduces the theoretical framework of SDT, explaining why this theoretical lens has been adopted to further understand the role of autonomy, and concludes with an overview of the thesis.

Understanding the Need for Autonomy

While the health belief model and the theory of planned behaviour are successful psychological behavioural models for the prediction of HCP flu vaccination behaviour (Corace et al., 2016), both models frame decision making as a rational systematic act and focus on the individuals inherent value of health (Redding et al., 2000). Rather than considering that decisions may be motivated by a non-rational reaction, the two models also do not address important facets such as self-control, and emotional processing (West

& Brown, 2013). Unlike the health belief model and the theory of planned behaviour, self-determination theory (SDT) places an importance on the energised quality of behaviour, rather than the quantifiable determinants of behaviour (Deci & Ryan, 2012), and is the only theory to identify autonomy as a basic human psychological need (Deci & Ryan, 2000). The theory also offers that need for autonomy can be satisfied through interpersonal relationships and external factors (Deci & Ryan, 2000), which subsequently lead to improved behavioural outcomes. For example, within an education setting, students perceiving a greater autonomy-supportive learning environment demonstrated better engagement with learning (Reeve et al., 2004). Within health contexts, a longitudinal study determined improved outcomes for smoking cessation after increasing perceived autonomy support (Williams et al., 2006). Given that the scope of this research is to primarily extend our understanding of how the need for autonomy may influence HCP vaccination decisions and behavioural intentions, the theoretical lens of SDT was adopted and is fully discussed in Chapter 3.

It is important to note that the present research does not intend to position SDT as superior to the other models or theoretical frameworks associated with flu vaccination decision-making or behaviour, but rather considers it as complementary to exploring the challenge of flu vaccination and how behavioural outcomes may be improved. Within health-related research the complementary nature of SDT has been used in conjunction with other models of behaviour. For example, using both the health belief model and SDT to predict flu vaccination intention and behaviour of university students, it was found that while certain constructs of the Health Belief model predicted intention well, only the construct of self-efficacy predicted actual behaviour. Whereas SDT's controlled and autonomous motivation predicted intention, with autonomous motivation also predicting behaviour (Fall et al., 2018). These findings suggest that SDT could broaden our

understanding of the psychosocial facilitators and barriers of vaccination decisions and subsequent behaviour. In other research both SDT and the theory of planed behaviour have been integrated acting as complementary to understanding health-related intentions and behaviour (for a meta-analysis, see Hagger & Chatzisarantis, 2009). For example, a study examining the conceptual overlap of SDT and theory of planned behaviour for physical activity and exercise behaviour (Brooks et al., 2017), concluded that while statistical similarities and differences remain between the concepts of each framework, SDT explained more of the variance for theory of planned behaviour than theory of planned behaviour did for SDT, and is complementary to understanding behavioural intention.

It is known that the use of one (or more) models guiding interventions may exclude specific or possible influences that other theories or frameworks may address (Michie et al., 2011). Therefore, rather than use a dual (or multiple) theory-based approaches, the present research only adopted SDT. The decision for this was two-fold: Firstly, SDT is the only theory of human motivation advocating autonomy as a basic psychological need. Secondly, the health belief model and the theory of planned behaviour are already widely used to understand HCP flu vaccine decisions. Therefore, by only using SDT not only widens the scope of our current understanding, but also allows for a deeper exploration of how autonomy may influence HCP flu vaccine decisions. In addition, the sole application of SDT may help to shine a light on specific or potential influences not captured within these other theories, allowing for findings to be positioned as a clear yet complementary indicator to future research.

Changing Behaviour

Before presenting an overview of the thesis, the next section briefly discusses the challenge of changing behaviour and highlights why popular frameworks for behaviour

change intervention design, such as the COM-B model (Michie et al., 2011, 2014) were not adopted as an overarching method for design for the foundations of a behaviour change intervention is presented within Chapter 6.

Sustaining changes in behaviour is a challenge. Even if behaviour change interventions or techniques are successful, individuals are likely to revert back to their old behaviours over time. For example, even after successfully reducing problematic alcohol consumption or quitting smoking, participants return to the unwanted behaviour (for a review see Bouton, 2014). The COM-B model is a useful, practical tool to identify how effective a behaviour change intervention may be. As a theoretical framework of behaviour change it ascertains that the outcome of behaviour is due to the interaction between three core elements, the physical or psychological 'capability' to perform the behaviour; the physical or social 'opportunity' to engage with the behaviour, and the automatic or reflective 'motivation' to carry out the behaviour. Moreover, for a new behaviour to occur, one or more of these elements requires change (Michie et al., 2011). As such, these changes can positively impact behavioural outcomes and reduce the risk of individuals reverting back to the unwanted behaviour (Rubinstein et al., 2015).

Given what is already known about the facilitators and barriers to HCP flu vaccination decisions and behaviour, it could be argued that many of the measures previously used may fall into the category of 'capability' such as perceived risks and benefits seen in the health belief model and Theory of planned behaviour, or the category of 'opportunity' such as calculation or access previously identified in the 5A taxonomy and 5C antecedents of vaccine decisions. However, the motivation aspect of COM-B appears somewhat underdeveloped within the literature concerning HCP flu vaccination. Research adopting the COM-B model as a framework for thematic analysis to understand

vaccination facilitators and barriers for 71 members of the general public (Rubinstein et al., 2015), report that automatic motivation was mostly centred around emotions such as fear (or the lack of concern) and reflective motivations were centred on aspects such as risk perceptions, beliefs, health identity and social role. Interestingly, choice did not appear as a prominent factor, perhaps due to the situational differences between those of the general public and HCP providing care within healthcare settings. Perhaps using an SDT perspective to explore why HCP may want to get vaccinated (or not), and in particular how autonomy may play a role in that decision, could expand our understanding of the motivational element driving vaccination decisions. This exploration, in turn, could be of complementary use to future research using the COM-B model for intervention design. It is important to note that it was not within the scope of the present research to fully design a behaviour intervention but rather provide an empirical foundation for the understanding of how autonomy may be supported to encourage decisions to vaccinate.

Overview of Thesis

The present research project had two aims. First, to explore the role of autonomous motivation in healthcare professionals' decisions to get vaccinated against the flu. Second, to test whether encouraging autonomous motivation can have an impact on healthcare professionals' intentions to vaccinate.

Chapter 2 outlines the approach of the present work, highlighting specific research questions, methods used and their implications to the pathway of this project, and the approach taken to handle and interpret data. The third chapter presents a systematic review of the role of autonomy as a basic psychological need within the health-decision domain. It identifies existing behavioural interventions that have sought to improve health outcomes through the lens of self-determination theory. It provides an insight into strategies that

could be applied to future behavioural interventions aiming to improve flu vaccination uptake, and support HCP need for autonomy. Chapter 4 presents a psychometric analysis of healthcare professionals' autonomous motivation to get vaccinated against the flu. It provides a new validated measure which may be used in conjunction with other psychosocial measures of vaccination decisions. It adds to a more in-depth insight as to why healthcare professionals may or may not be motivated to get the flu vaccination. Chapter 5 outlines an analysis of communication materials used by NHS Trusts each flu season to encourage healthcare professionals to get the flu vaccine. It offers an understanding of the current discourse adopted to encourage healthcare professionals to get the flu vaccination. Chapter 6 presents initial evidence for the impact that different communication styles have on the certainty to receive that flu vaccination, and offers a promising foundation for future behaviour change interventions. Results from a pilot study and one experiment highlight that by adopting a discourse which seeks to support the need for autonomy, the motivation towards receiving the flu vaccine next flu season is improved.

The present research programme thus contributes to knowledge by (1) empirically validating a measure of extrinsic motivation for HCP flu vaccination decisions, (2) providing preliminary evidence for the causal role of autonomous regulation in healthcare professionals' intentions to get vaccinated against the flu, and (3) provides the foundations of a behavioural change intervention, explicitly targeting support of autonomous regulation in healthcare professionals' decisions to vaccinate against the flu.

Chapter 2: Research Questions and Methodological Considerations

This chapter introduces the approach adopted to design the research, providing methodological considerations for addressing the problem of low vaccination uptake rates among HCP. First, an outline of the underlying philosophical perspective directing the pathway of this thesis is presented. Second, a general overview for individual study aims and research questions is provided. Specific information relating to the methods of each empirical study is discussed within their corresponding chapter.

Philosophical Underpinnings

It is within the approach taken to understand or observe 'truth' that the researcher's philosophical assumptions and principles are reflected (Creswell, 2009). This thesis embraces the pragmatic paradigm, adopting an overarching realist epistemology and constructivist ontology. Epistemology is concerned with what is acceptable knowledge, and ontology is concerned with the construction of reality (Bryman & Bell, 2015). Pragmatism does not commit to one philosophy, the research question is placed with primary importance above and beyond underlying philosophical perspectives or methods (Creswell, 2014). To understand the subscription to the pragmatic worldview, limitations of other philosophical paradigms such as positivism and constructivism are briefly discussed.

Positivism shapes knowledge objectively. It assumes that an outcome is causal, and that the cause is measurable, observable and testable through rigorous means which are reliable and valid (Creswell, 2014). However, the complexity involved in addressing low flu vaccine uptake among HCP is a problem rooted in human behaviour and motivation. A multitude of vaccination drivers and barriers have been identified (Thomson et al., 2016), and it has been acknowledged that attitudes and beliefs may be vaccine-specific (Yaqub et

al., 2014). These findings suggest that there is not a 'one-size fits all' approach. Vaccination related experiences and behaviours are subjective, thus detaching from the objectivity rooted in positivism. Post-positivism recognises the complexities involved with the study of human behaviour (Creswell, 2014). Critical realism extends post-positivism (Groff, 2004) as it accepts subjective experiences while preserving the importance of identifying underlying structures related to the social world (Bryman & Bell, 2015). However, within the post-positivism paradigm, there is little room for understanding the research problem from the individual perspective.

On the other hand, the constructivist paradigm offers an alternative perspective as its principles align with the attempt to understand the views and values held by the individual, rather than generalise and narrow meaning into categories (Creswell, 2014). Instead of establishing cause and effect, constructivism focuses on the relationship between events (O'Reilly, 2012). A social constructivist's perspective allows knowledge to emerge from understanding the individuals who construct meaning and experience. Perhaps it is within this approach to understanding knowledge that the importance of an autonomous decision to get vaccinated among nurses in Baron-Epel et al. (2013) emerged.

Arguably, there is value to be found in more than one philosophical worldview, method, or research approach. It is within the recognition of value for alternative approaches to seek 'truth' and understanding of the social world that the present research aligns with the pragmatic philosophical perspective. Pragmatism is an inclusive perspective, advocating freedom of choice for methodology and research methods. With the focus placed on the research problem, pragmatism enables a depth of understanding for situations and consequences that one single method may not achieve (Creswell, 2014).

Overview of the Research Design, Aims and Questions

The landscape of human behaviour and decision making is complex. The idea that such complexity may be measured, observed or understood through one single method or philosophical perspective places a limitation on the scope of the research and may inadequately address the complexities involved (Creswell, 2014).

The present research began by adopting a fixed multiphase mixed method design. This enabled the research objective to be advanced through incremental research questions which were shaped and directed by the theoretical lens, rather than predetermined research methods (Creswell & Plano Clark, 2010). Two predominant strategies, concurrent or sequential, are used in designing of mixed methods research. The concurrent approach uses data from two sources at parallel, then converges results. Whereas the sequential strategy is most appropriate when research outcomes are unexpected (Morse, 1991) and dictates that data is collected in light of the study that precedes it (Creswell, 2014). Similarly, rather than assigning to a deductive or inductive approach to data interpretation, this thesis considers an abductive approach. Abduction attempts to overcome the limitations of deductive and inductive reasoning by drawing the most likely inference from the data, assessing probabilities and strength of evidence, acknowledging the potential for many explanations of a given phenomenon (Creswell, 2014). In summary, the studies described within this thesis were driven by the research problem. Research questions were developed in response to data interpretation of the preceding study, and the theoretical lens of self-determination theory shaped the direction of the research programme. The research aims, questions and hypotheses used to investigate how HCP motivation to get the flu vaccine could be understood and improved through the theoretical lens of SDT, are presented in Table 1.

Table 1

Summary of Individual Research Approaches Aims and Questions

Study	Approach	Method	Aims	Questions
1	Exploratory	Systematic literature review	To explore health-related behaviour change interventions among healthy adults that are rooted within the theoretical framework of self-determination theory.	What is the role of autonomy in health behaviour change interventions? How is autonomy measured and appealed to?
2	Exploratory	Cross-sectional questionnaire	To understand if the central tenets of autonomy apply to the domain of flu vaccination. To construct and conduct an initial validation of a flu-vaccination decisions self-regulation scale (TRSQ-Flu). To assess initial evidence of the adapted scale items and their application to HCP flu vaccination decisions.	*Phase1:* 1) What previous SDT validated scales can be adapted to reflect HCP motivation to get vaccinated against the flu? *Phase 2:* 1) Which items should be included in the TSRQ-FLU scale? *Phase 3:* 1) Can the hypothesised model derived from the exploratory factor analysis be confirmed across two samples? 2) Is the dimensionality of the hypothesised model appropriate across groups: vaccinators and non-vaccinators? *Phase 4:* 1) Does the scale meet the standards of reliability and validity? 2) Are responses contaminated by social desirability biases? *Phase 5:* 1) Does the scale demonstrate criterion-related validity? 2) Do the scale outcomes predict behavioural intention? 3) Does the TSRQ-Flu demonstrate incremental validity?
3	Exploratory	Content analysis	To determine the common phrasing used by NHS Flu Fighters campaign to encourage HCP to get vaccinated against the flu. To apply the central tenets of extrinsic motivation in identifying and presenting information relating to the discourse of communication.	How is the request to get vaccinated against the flu communicated through the 2018/19 NHS Flu Fighters Campaign? Can the adapted NHS Flu Fighters communication be considered to use an autonomous or controlling discourse?

Study	Method	Design	Aims	Questions
4	Explanatory and Exploratory	Experiment	To develop and test an intervention strategy based of central tenets of autonomy as indicated by SDT. To establish the impact of controlling communication styles on HCP behavioural intentions to vaccinate against the flu. To determine if the effect of controlling communication style moderated by motivation as measured by the four dimensions of the TSRQ-flu (Autonomous regulation, Introjection, External regulation, and Amotivation).	What is the role of autonomous motivation when asking HCP to vaccinate against the seasonal flu? Will low-controlling message have a positive impact on behavioural intentions to vaccinate against the flu, compared to high-controlling messages? Is motivation (as measured by the TSRQ-Flu) is a predictor of behavioural intentions to vaccinate against the flu. *Main Hypotheses:* H1) Low-controlling messages will be perceived as a lower threat to freedom than high-controlling messages. H2a) Low-controlling messages will increase behavioural intentions to vaccinate against the flu, compared to baseline intentions. H2b) High-controlling message will decrease behavioural intentions to vaccinate against the flu, compared to baseline intentions. H3a) Higher autonomous regulation will be positively associated with baseline behavioural intentions to vaccinate against the flu. H3b) Higher external regulation will be negatively associated with baseline behavioural intentions to vaccinate against the flu. *Pre-registered exploratory analyses:* Will low-controlling messages have a positive impact on behavioural intentions to vaccinate against the flu, compared to high-controlling messages? Will the effect of controlling communication style be moderated by motivation as measured by the four dimensions of the TSRQ-Flu? Will past vaccination behaviours moderate the effect of the communication style on intentions to vaccinate in the future? What are the perceived feelings associated with the communication styles? Are extreme baseline intentions immune to the level of control in communication styles?

Methods of Data Collection and Data Analysis

Three types of research design were used throughout this thesis, a systematic review, a cross-sectional and an experimental design. These are discussed in relation to the research needs and the implications to data inferences.

Systematic Literature Review

To advance knowledge, it is logical to begin with an understanding of what previous research has identified. Systematic reviews synthesize data into categories, developing "knowledge that is not apparent from reading the individual studies in isolation" (Denyer & Tranfield, 2009, p. 685). Systematic reviews offer a replicable and transparent approach to understanding what is known and not known (Tranfield et al., 2003). They enhance methodological rigour, reliability and validity and overcome limitations of general literature reviews, such as selection bias (that is selecting only those studies that support the rationale, Briner & Denyer, 2012). There are four main approaches to data analysis: aggregative, integrative, interpretative, and explanatory. The systematic review presented in Chapter 3 takes an explanatory approach, as the selected studies are compared in order to understand the underlying causal mechanisms involved in behavioural outcomes (Briner & Denyer, 2012). To limit researcher-led and data extraction biases (see Petticrew & Roberts, 2006), the Cochrane and PRISMA principles for systematic reviews were used (Moher et al., 2009). In addition, the MetaQAT critical appraisal tool (Rosella et al., 2016) was applied as a way of objectively assessing individual studies.

Cross-Sectional Design

A cross-sectional survey enables a large amount of data collection, and intends to establish the relationship between variables at a single point in time (Howitt & Cramer,

2007). However, the use of this design may pose a threat to validity, which is the extent to which the intended measures are being measured (Huang et al., 1998). For example, confounds such as social desirability response bias can obscure, suppress or falsify variable relationships (King & Bruner, 2000). Approaches to overcoming this type of bias within the sample can be achieved by omitting irrelevant demographical questions, providing a well formulated information sheet and placing emphasis on anonymity (Mitchell & Jolley, 2013). In addition, drawing on the insight of experts can strengthen content validity (Howitt & Cramer, 2007). To strengthen content and face validity, healthcare managers and NHS practitioners provided feedback on the adapted scale items described in Chapter 5. The survey studies within this thesis were conducted online using Qualtrics and were released in line with the flu season. The analytical methods chosen to validate the scale and the implications for inferences are discussed in detail within Chapter 5.

Another research strategy within cross-sectional design is content analysis. Through structured coding and classification of text and images, conclusions may be drawn from their substantive features, form features, manifest content or latent content (Rose et al., 2014). Latent content refers to the meaning behind visible and countable manifest content. Substantive features refer directly to the lexical message while form features refer to how the message is conveyed (Schreier, 2012). Similar biases to those previously mentioned can arise during content analysis such as sampling bias and data interpretation (Krippendorff, 2004). The study described in Chapter 5 is a quantitative content analysis applied to the written materials from the NHS Flu Fighters Campaign (2019). The rationale for the using the content analysis research strategy was in response to the need for developing experimental materials for the study describe in Chapter 6.

Experimental Design

Experiments offer a way to infer causality between variables, influencing outcomes through manipulation of particular variables (Creswell, 2014). To increase the external validity of inferences drawn, replication across different samples, environments and times is preferred (C. J. Goodwin, 2010). The study described in Chapter 6 implemented an experimental design to test an intervention strategy based of SDT's central tenets of autonomy. Replication studies were not within the parameters of this research project, rather the intention of the study was to provide preliminary evidence for the foundations of a future behaviour change intervention wishing to incorporate communication.

Study Population

The target population for this research are HCP primarily working within the NHS. As previously mentioned, the NHS target for flu vaccine uptake is 75% uptake yet this remains a challenge nationwide for some Trusts. Vaccinating all HCP, particularly those who have direct patient contact is an important step in preventing the spread of the virus among patients who may have or are at risk of developing chronic health conditions (Public Health England, 2016).

Sampling

Sampling refers to the ability to select participants that will be representative of the study population and this may be achieved through a number of different strategies such as systematic or random (Bryman & Bell, 2015). The studies conducted in this thesis make use of self-selected sampling and purposive sampling. Self-selected samples can raise issues of generalisability to the larger population (Bryman & Bell, 2015). Through this method of sampling, bias may have been introduced as participant responses driven by

extreme positive or negative views toward flu vaccination were unable to be controlled for. Therefore, it would be prudent to say that while the research intended to be representative of HCP in general, future research should further add to the validity and generalisability of the findings before specific inferences of different healthcare sectors or demographics are drawn. The consideration of this limitation aligns with the argument that "findings can only be generalised to the population from which the sample was taken" (Bryman & Bell, 2015, p. 205). That said, this thesis explores the role of autonomy from the SDT perspective which postulates that basic psychological needs are universal, with the potential to overcome differences within a population (Deci & Ryan, 2000; Ryan & Deci, 2000). This premise is discussed further in Chapter 3.

Ethical Considerations

Ethical considerations need to be addressed within each stage of a study, as there are important implications for the participants involved, the storing of data, and the creditability of results (Creswell, 2014). The general ethical considerations for this research programme are summarised next.

All studies requiring participation were submitted and approved by the Kingston University Faculty Ethical Committee (see Appendix A). At all stages of the data collection process, participation was voluntary with no risk to participants involved other than what participants would encounter in their daily life. As part of this research was in collaboration with an organization (the name of which is omitted for ethical obligations), we ensured that participants were aware that there was no employment-related, or other obligation to participate. At the participant's first point of contact with the research team, all necessary information was communicated using a study information sheet and informed consent was obtained. All data was anonymised prior to reporting the results. In addition,

data categories such as individualized demographic information were collapsed to safeguard anonymity (de Vaus, 2001).

The raw data sets for all studies are password protected and kept securely on Kingston University servers for a minimum period of 10 years following project completion, after which data will be securely destroyed in compliance with Kingston University's Records Retention and Disposal Schedule. For the purpose of Open Science, the studies are registered on the Open Science Framework and AsPredicted.org (see Rouder (2016), for a brief review of the current replicability issues and the movement towards open science and open data). Ethical approval for the studies discussed in this thesis was granted with the assumption that pre-prepared and anonymised data sets were not publicly available and may only be released to individual researchers via successful submission of a Data Transfer Agreement which adheres to further ethical review from Kingston University's Ethical Committee. However, upon peer-reviewed publication of material resulting from this thesis, a new ethical request will be submitted to request that anonymised datasets be made publicly available indefinitely. Results reported do not explicitly refer to specific organizations or locations so that Trusts and their employees remain protected.

Role of the Researcher

In addition to the ethical consideration of participant and data protection, there is the consideration for the role of the researcher (Creswell, 2014). I take a positive view on vaccination and therefore recognise a risk of introducing researcher led bias into the designing, interpretation and reporting of the research. In attempt to overcome such biases, each study is led by the data preceding it and there is no omission of data that disproves hypotheses (Creswell, 2014). Each study remains consistent in the process of screening

data prior to analysis. Processes aiming to assess or reduce the risk of bias are adopted, such as using robust analysis, providing scripts and syntax of all data analyses, and ensuring reporting to industry standard guidelines.

The Approach to Data Screening

A large body of literature is dedicated to understanding outliers and unusual influence within data (Field, 2013; Flora et al., 2012; Tabachnick & Fidell, 2007), as are there different perspectives on what constitutes an outlier and they should be handled. The outline to the screening of data which remains consistent throughout this research programme are summarised next.

First, univariate outliers and unusual scores will be assessed. Participants not within the scope of the research such as those who are not currently a healthcare professional were excluded from analysis. In addition, simple non-differentiation straightliners (i.e., those who gave the same value response for each question e.g., 1,1,1) were removed from analysis as they may implicate the validity and reliability of results (Kim et al., 2019). In addition, those who completed unreasonably quickly were removed from analysis. The minimum expected competition time was relative to the estimation of time need for each study. Of most importance was the experiment described in Chapter 6. It was recorded in the pre-registration that those completing before 3 minutes would be excluded from analyses. Next, the proportion of missing data and missing data patterns will be assessed on those who did not drop out of the study before providing answer to the first dependent measure. Missing data may represent bias within the measures, highlighting the potential increase of systematic error (Fox-Wasylyshyn & El-Masri, 2005). Influential and multivariate outliers will be assessed using conventional cut-offs for Malahanobis distance ($p < .001$), Cook's Distance (< 1) and leverage (max critical ratio equal to $\frac{3(k+1)}{n}$, where k is

the number of independent variables) (Fidell & Tabachnick, 2003; Field, 2013). Should influential outliers be detected on all 3 measures aforementioned, analyses will be run with and without the identify outliers to ascertain their influence.

Chapter 3: Identifying the Role of Adults' Autonomous Motivation When Engaging With Health-Related Behavioural Change Interventions: A Systematic Literature Review

Despite the evidence that HCP can reduce their risk of contracting the flu virus and infecting their patients by getting the flu vaccine, uptake remains below official targets which poses a challenge for public health. As previously mentioned, a common approach to address this challenge has been to identify barriers and drivers of uptake to predict behaviour. The use of evidence-based models of behaviour such as the health belief model and theory of planned behaviour often only go as far as to predict behaviours, and a lack of evidence-based interventions has been identified (Corace et al., 2016). What is missing, is a better understanding of what can be done to promote flu vaccination behaviour among HCP. Without sufficient evidence within the vaccine behaviour domain coupled with the need to extend beyond predictors of psychological frameworks, it is necessary to assess the evidence from alternative applied settings within the health behaviour domain. Moreover, addressing the disparity of flu vaccine uptake calls for an alternative approach, stressing the need to explore conceptualisations of human motivation within the health behaviour domain. Considering that autonomy has been highlighted as an important driver of HCP vaccination decisions, and that Chapter 1 introduced SDT as the only general theory of human motivation which postulates autonomy is a basic human psychological need (Deci & Ryan, 2000), the present chapter first presents an outline of SDT, followed by an investigation of the literature concerning health-related behavioural change interventions rooted within the theoretical framework of SDT.

Motivation is acknowledged as one of many causes for behavioural outcomes (Higgins, 2012). Historically, conceptualisations of motivation draw on two central issues,

basic needs and action control (Gollwitzer & Oettingen, 2001). Theoretical frameworks interpret motivation as purposeful, offering that humans choose their behaviours and have control over their actions (e.g., expectancy-value theory (Atkinson, 1957), and self-efficacy theory (Bandura, 1982)). However, these theories remain mute with regards to the antecedents of motivated states as well as those antecedents' relationships with behavioural outcomes (Gollwitzer & Oettingen, 2001). Moreover, these theories do not address the need for autonomy or the violation of choice, which has been a reported barrier for getting vaccinated (Hakim et al., 2011). For example, nurses' attitudes towards the right for autonomy revealed a significant association for receiving the Whooping Cough vaccine (Baron-Epel et al., 2013). Yet this concept of autonomy, or free choice, is a motivational construct that is absent from the traditional psychological frameworks used to explore HCP decisions to vaccinate against seasonal flu (Vallée-Tourangeau et al., 2018).

Understanding what drives HCP to engage in health-related decisions, coupled with the need for evidence-based behaviour change interventions, warrants an exploration of the health behaviour domain and behavioural change interventions rooted in conceptualisations of human motivation. Moreover, this may allow for a richer understanding for the manifestations of actual behavioural outcomes, complementing the commonly addressed predictors of behaviour.

Self-Determination Theory

The difference between a free-choice and forced-action can be addressed within the framework of self-determination theory (SDT) which is described as the only human motivation theory to identify autonomy as a basic psychological need (Ryan & Deci, 2000). A general and multidimensional theory of human motivation, SDT distinguishes between different types of motivation, each of which are centred on different behavioural

goals or actions (Ryan & Deci, 2000). This distinction begins with the most basic divide of intrinsically motivated or extrinsically motivated behaviours. Intrinsic motivation is associated with behaviours that are initiated for one's own sake, interest and/or enjoyment. Extrinsic motivation, on the other hand, represents engaging with a behaviour for external reasons, such as working because you get paid (Ryan & Deci, 2000). Extending the classical approach to understanding extrinsic motivation, SDT proposes that there are different forms of extrinsic motivation (Ryan & Connell, 1989). For example, completing a work task to avoid sanctions or to improve one's career are both behaviours that are extrinsically motivated however, the latter adopts a sense of choice and is (often) self-endorsed (Ryan & Deci, 2000). Early research sought to understand the effects of extrinsic reward (e.g., money) on intrinsically rewarding tasks, concluding that such rewards undermined intrinsic motivation due to a sense of control or pressure (Deci, 1971; Deci & Ryan, 2000). This built upon deCharm's (1968), extension of perceived locus of causality (PLOC) whereby it was argued that an individual could perceive themselves as the 'origin' of their behaviour (internal PLOC) or acting in accordance with external pressures (external PLOC) (Ryan & Connell, 1989). Consequently, SDT evolved with the central distinction between motivation as either autonomous or controlled (Higgins, 2012).

To realise intrinsic motivation and self-determined behavioural outcomes, three basic psychological needs should be satisfied: the needs for autonomy, competence and relatedness (Moller et al., 2006; Ryan & Deci, 2000). Autonomy is the need for free choice, and is sometimes operationally defined as intrinsic motivation(Ryan & Deci, 2000). Competence is the need to feel effective within one's environment, and relatedness refers to the need to have a sense of belonging to the social context (Baumeister & Leary, 1995) Often research is more concerned with internalisation of autonomy versus control (Ryan & Deci, 2000). The satisfaction of these three needs has been associated with higher

levels of persistence for a behaviour and an increased likelihood that sustained behaviour change will occur (for a review, see Kirkland et al., 2011). Arguing that humans are innately driven to satisfy these three psychological needs (Ryan & Deci, 2000), SDT explores the degree of satisfaction within different social contexts and the consequences of experiences (Ryan & Deci, 2000). It has been applied to disciplines such as education (Grolnick et al., 1991), sport and exercise (Teixeira et al., 2012), work (Gagné & Deci, 2005) and health care (Bernard et al., 2014), and is associated with initiation and sustainment of healthy behaviours, and improved physical and mental health outcomes.

As a theory, SDT emphasises the importance for the quality of behaviour in addition to measuring the direction of behaviour (Patrick & Williams, 2012). It conceptualises behavioural regulations on a motivation continuum extending from amotivation (the lack of willingness to act) to integrated regulation (the most autonomous form of extrinsic motivation). A shift along the motivation continuum reflects a more persistent behaviour with an increased level of engagement (Ryan & Deci, 2000). This is a different theoretical approach compared to other influential psychological theories used to predict behaviour such as the theory of planned behaviour (Ajzen, 1991) and the health belief model (Hochbaum, 1958). Rather than viewing behaviour as determined by cognitive constructs such as judgments of outcome likelihood, perceived severity or perceived difficulty in engaging in the related health behaviour (Gerend & Shepherd, 2013), SDT views behavioural outcomes as the result of a motivated state (Ryan & Deci, 2000). Within the spectrum of motivation SDT has two sub theories, organismic integration theory (OIT) and cognitive evaluation theory (CET). The OIT is concerned with the internalisation and integration of behavioural regulations that may explain different forms of extrinsic motivation, such as the engagement of a behaviour to avoid sanction or to improve a career path. Internalisation conceptualises how motivation can

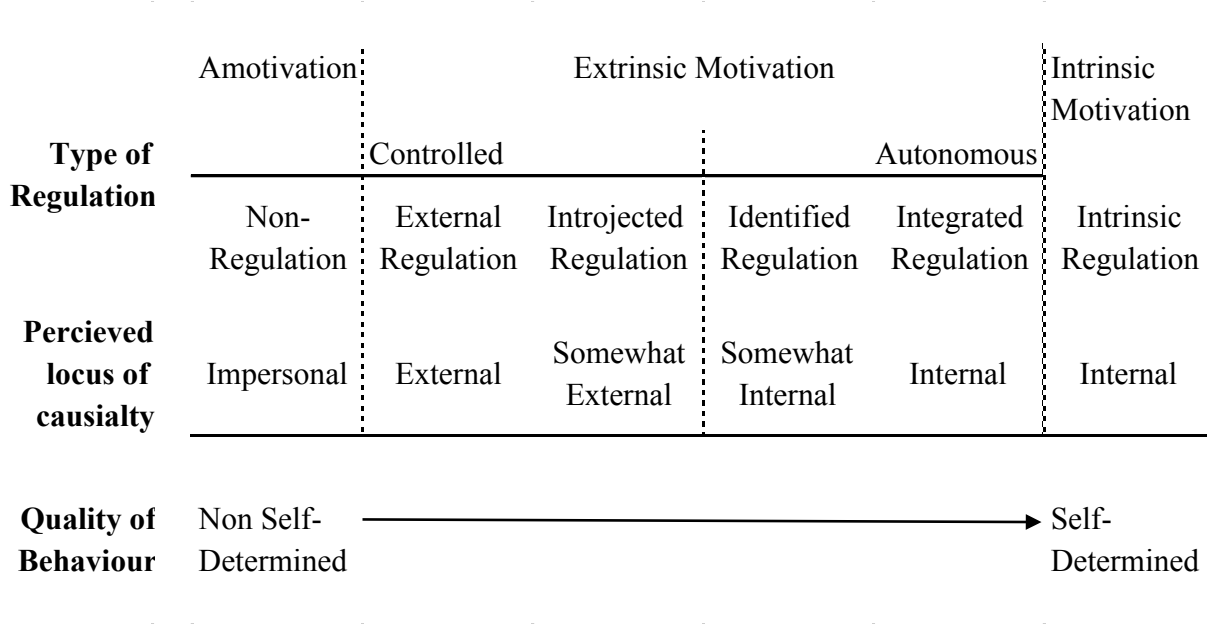
transition from an unwillingness to act, to a committed participation in a task, activity or behaviour and is explained as the "process of taking in a value or regulation" (Ryan & Deci, 2000, p. 71). Integration is the "process by which individuals more fully transform the regulation into their own so that it will emanate from their sense of self." (Ryan & Deci, 2000, p. 71). Cognitive evaluation theory (CET) is responsible for explaining the variability in intrinsic motivation, specifying that to experience a high level of intrinsic motivation there must be satisfaction of the need for competence and autonomy (Ryan & Deci, 2000). It is argued that the CET aspect of SDT could facilitate the level of intrinsic motivation through environmental events such as the influence of significant others or stimuli by supporting or thwarting the needs of autonomy and competence. However, this principle of CET only applies to behaviours which are inherently interesting, suggesting that when the behaviour is not deemed interesting to the individual, the aspects of extrinsic motivation should be explored (Ryan & Deci, 2000).

The motivation continuum

Incorporating the notion of internalisation and integration (OIT), the motivation continuum consists of six different constructs (see Figure 1). Each construct reflects an increasing degree of autonomy or self-determined behaviour, and the shift from one to another reflects a better quality of behaviour with an increased persistence for engagement (Ryan & Deci, 2000). However, the continuum is not developmental, meaning that the individual does not have to progress through each construct; a behaviour can adopt any point of regulation (Ryan & Deci, 2000).

Figure 1

Motivation Continuum (adapted from Malhotra & Galleta, 2003; Ryan & Deci, 2000)



Beginning with *amotivation*, which is the lack of willingness to act, this construct is associated with the absence of self-determined behaviour. Moreover, it is assumed that amotivation is the result of low sense of competence to complete the activity, a lack of value for the activity and not believing that participation will achieve a desired outcome (Ryan & Deci, 2000). Next is *extrinsic motivation* and this is formed of four regulations: external, introjection, integrated and identified. *External regulation* is the least autonomous form of extrinsic motivation, whereby external demands are often experienced as controlling and associated behaviours are conducted simply to satisfy the external demand or imposed reward. *Introjected regulation* is reflective of behaviours associated with the avoidance of guilt or attainment of pride, and the primary objective of these behaviours is to maintain or enhance self-esteem. These two regulations are considered controlled motivation and result in short-lived behaviour change (Ryan & Deci, 2000). Next, identification and integration form what is refer to as *autonomous motivation*. *Identification* refers free choice, whereby the individual recognises the importance of the

behaviour and begins to act in accordance with the self. *Integrated regulation* is the most autonomous form of extrinsic motivation and behaviours are considered self-determined, aligning with internal values and needs. Ryan and Deci (Ryan & Deci, 2000) explain that while integration is similar to intrinsic motivation such that associated behaviours are autonomous and self-determined, they continue to be motivated by an external outcome.

Extrinsically motivated behaviours are generally considered not inherently interesting to the individual and therefore are externally prompted. The primary reason for engaging in externally prompted behaviours is due to the sense of being valued by significant others, society or social groups. This is where the basic need of relatedness becomes important to the internalisation of a behavioural regulation (Ryan & Deci, 2000). In addition, perceived competence facilitates the internalisation of behaviours occurring when individuals feel that they understand the task and can be effective in achieving the goal (Ryan & Deci, 2000). The final category along the motivation continuum is intrinsic motivation, which is the most autonomous form of motivation, and behaviours occur in "the absence of operationally separable consequences" (Deci & Ryan, 2000, p. 233). Intrinsic behaviours do not depend on reward or reinforcement as the action or participation in the behaviour in itself is intrinsically rewarding.

Autonomy supportive contexts can enable the transition between extrinsically motivated behaviours towards those which are more self-determined (autonomous), therefore increasing the likelihood of achieving positive behavioural outcomes (Gagné & Deci, 2005; Ryan & Deci, 2000). For example, medical students had increased internalisation of psychosocial values when their instructors were supportive of autonomy, resulting in increased autonomous motivation and stronger psychosocial beliefs (Williams & Deci, 1996). Additionally, the level of autonomy support received by healthcare

providers predicted patients' autonomous motivation for health behaviour change (Williams et al., 1998). According to SDT, the root of behaviour ownership manifests in the fundamental need of autonomy, whereby an individual who perceives choice within a situation will experience higher levels of autonomy, which in turn has a positive effect on the desired behavioural outcome and sustainment of behaviour change (Ryan & Deci, 2000).

The Present Study

The purpose of the systematic review was to examine theory-based interventions focussing on the role of autonomous motivation in health-related behaviours among healthy adults. So to gauge an understanding of the role of autonomy, how it is measured and whether autonomy can be appealed to or intervened upon when addressing the HCP flu vaccination challenge. Six eligible studies targeting exercise, physical activity, diet, and health screening were included in the review. All studies focused on the constructs of autonomous and controlled regulation, with five studies examining the role of autonomy support.

Addressing the psychological need for autonomy in health behaviour change could be key to understanding HCP motivations to vaccinate against flu, in order to drive sustained behaviour change. As it stands, there is no clear consensus as to whether HCP have any autonomy in their decision to get vaccinated against the flu. While some argue that mandatory vaccine policies (i.e., the absence of autonomy) is the route to effectively increase flu vaccine uptake (Babcock et al., 2010), others argue that more evidence is needed to fully understand the protective benefits for patients before HCP' personal autonomy is overridden (Behrman & Offley, 2013). Recall that SDT suggests that an individual who perceives choice with a situation will experience higher levels of autonomy

(the fundamental need whereby behaviour ownership manifests) (Ryan & Deci, 2000). Adopting the SDT theoretical framework may enable a deeper understanding of what drives HCP motivation to engage in (or disengage from) health-related decisions such as flu vaccination. Furthermore, SDT may provide an appropriate response to nurses' expression for autonomy in vaccination uptake decisions (Baron-Epel et al., 2013) and for the uptake outcomes of thwarting choice (Hakim et al., 2011).

The primary objective of this systematic review was therefore to explore the effectiveness of health behaviour change interventions which are rooted in the theoretical framework of SDT. To the best our knowledge, SDT is yet to be applied in the context of HCP and flu vaccine behavioural interventions. Exploring other health behaviours may offer insight into understanding the motivational needs or caveats to HCP vaccination decisions and behaviour. Furthermore, highlighting sustainable interventions within the health behaviour domain could facilitate the development and application of theory-based interventions, aiming to improve flu vaccine uptake among HCP.

Method

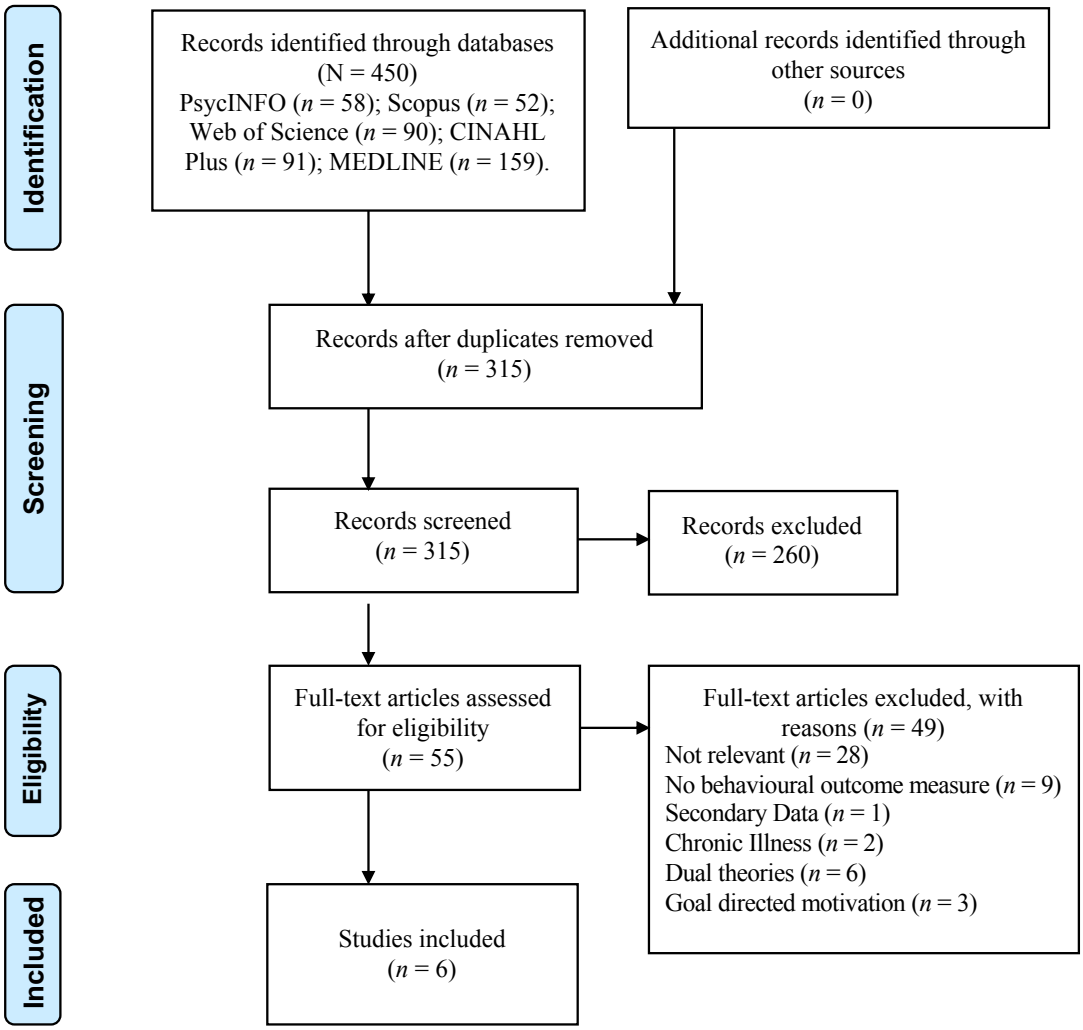
An electronic keyword search was conducted across 5 databases' (PsycINFO, Scopus, Web of Science, CINAHL Plus, MEDLINE), using the terms 'health behaviour' AND 'self-determination' from inception to 2nd March 2017. Search terms were defined in response to the research objective and team discussions. The decision to keep the search terms simple and broad was due to an attempt to include all relevant information and minimise selection bias. By using the databases specific options available, keyword searches did also include related words and terms. The searches were limited to peer reviewed articles in English language. For example, the full search string used for Scopus

was KEY (“health behaviour” OR “health behaviour”) AND (“Self-Determination”) AND (LIMIT-TO (LANGUAGE, “English”)) AND (LIMIT-TO (DOCTYPE, “ar”)).

A total of 450 publications were identified from all data sources using the search strategy (see Figure 2 for full details). Any duplicates were removed using the reference management software Mendeley, and 315 abstracts were screened. If the abstract was insufficient in determining eligibility, the full text was retrieved and reviewed (see Figure 2). Included studies were those: (1) rooted within the measurement and application of self-determination theory; (2) interventions; (3) featuring explicit measures of autonomous motivation; (4) producing original data; (5) recruiting populations of healthy adults (>18 years), and those who were (6) not purposefully selected for having chronic illnesses such as cancer, diabetes, heart conditions and affective disorders. Studies were excluded if (1) more than one theory was used to predict behavioural outcomes; (2) they did not include a behavioural outcome; (3) they adopted a qualitative approach (e.g., motivational interviewing); (4) they were longitudinal studies exceeding 1 year. During the selection process, an additional exclusion criterion was identified as the design of some interventions allowed participants to choose a health goal. This presented a potential confound as instead of being directed, participants were requested to select from a choice of health behaviour goals. Arguably, this may increase the likelihood that an individual is already intrinsically motivated to participate in that behaviour. Intrinsically motivated behaviours “do not require operationally separable consequences - because the doing of an interesting activity is itself intrinsically rewarding” (Deci & Ryan, 2000, p. 233). A risk of bias assessment was conducted using the Public Health Ontario Meta Quality Appraisal Tool (MetaQAT) (Rosella et al., 2016) to guide the critical appraisal process.

Figure 2

Study Inclusion and Exclusion Decision Using the PRISMA Flow Diagram (Liberati et al., 2009)



Results

Study Selection

The literature search yielded a total of 315 studies after duplicates were removed. Abstracts and titles were then individually screened. The selection process identified 55 articles to which full text papers were obtained as eligibility was not clear from the information provided in the abstract and title, or the abstracts were unavailable (*n* = 8). A

follow up assessment identified 49 articles that did not meet the previously stated inclusion criteria. The six studies meeting the inclusion criteria were interventions primarily focused on acknowledging the role of autonomous motivation in health behaviours or health-related decisions.

Study Characteristics

Six intervention-based studies which investigated constructs of SDT in relation to engagement with healthy behaviours were identified. Information regarding the aims, hypothesis, design, intervention, sample size, measures and findings were extracted and summarised (see Table 2). Interventions either explored various communication styles seeking to support the need for autonomy (Chatzisarantis et al., 2012; Coa & Patrick, 2016; Kinnafick et al., 2016; Moustaka et al., 2012; Resnicow et al., 2014) or the use of financial incentives (Moller et al., 2012).

Table 2

Summary of Articles

Authors	Intervention	Participants	*N*	Sampling Method	Health Behaviours	SDT Constructs	Main outcome(s)
Chatzisarantis et al., (2012).	Autonomy-supportive 3 experimental conditions thwarted need for autonomy; controlled; enhanced autonomy support or rationale only. 2-week fitness centre access.	Undergraduate students (Australia).	152	Opportunity sample. Participants recruited through an advertisement in exchange for course credits.	Physical Activity	Autonomy-support Competence	Significant positive correlations between physical activity participation and perceived autonomy or perceive competence. Stronger perceptions of competence in the autonomy support.
Coa and Patrick (2016).	Communication 6-week text message intervention.	General population (USA).	193	Opportunity sample. Participants already part of a Smokefree.gov Initiative (SFGI).	Diet Physical activity	Autonomous Identified Integrated Controlled Introjected External	Within the first 2 weeks of a 6-week program, higher levels of baseline autonomous motivation were associated with significantly lower odds of drop-out. There was no association of controlled motivation with early drop out.
Kinnafick et al., (2016).	Communication 2x need supportive text messages sent weekly over a 10-week intervention phase. Follow up at 4 months.	University staff and students (UK).	65	Purposeful sampling. Participants had to be physical inactive, own a mobile phone and intend to attend first week of exercise classes after a period of 2-week inactivity.	Physical activity	Autonomy-support Autonomy Competence Relatedness Amotivation External Introjected Identified Intrinsic	Text messages using SDT framework facilitate greater levels of autonomy support compared to neutral messages for physical activity uptake. Intervention SMS enhances likelihood of sustained behaviour.

Author	Type of intervention	Participants	*N*	Sampling Method	Health Behaviours	SDT Constructs	Main outcome(s)
Moller et al., (2012).	Financial incentive 3-week intervention phase. 17 week financially incentivised follow up.	General population (USA).	204	Purposive sample. Recruited via community advertisements. Eligibility criteria applied to participants e.g. consumed less <5 fruits and vegetables a day; <60 min moderate/vigorous physical activity per day.	Diet Physical activity	Intrinsic Controlled	Financial incentives could potentially undermine the successful maintenance in an intensive lifestyle intervention. Financial motivation was significantly more prevalent among men.
Moustaka et al., (2012).	Autonomy supportive Evening exercises classes 3 times per week of 8 weeks. Instructor styles, supportive (experimental); neutral (control).	Greek females aged 30-58 (Greece).	35	Convenience sample. In addition, participants were not randomly allocated to the conditions as they were already taking part in the classes prior to the initiation of the intervention.	Exercise	Autonomy-support Autonomy Competence Relatedness Amotivation	An autonomy supportive instructor style is beneficial for behavioural persistence and the fulfilment of psychological needs.
Resnicow et al., (2014).	Communication 2 x groups Each received either 2 minimally tailored or 2 enhanced tailored printed newsletters promoting CRC screening.	African American members aged 50-74 (USA).	881	Purposive sample. Participants were selected from an integrated health care delivery system and not up to date with screening.	Health screen	Autonomy Controlled (directive)	Those with an autonomous preference for communication were 1.70 times more likely to obtain CRC screening in the enhanced group than minimally tailored group, $p = 0.056$ Preference for the directive versus autonomous communication rated importance of CRC screening significantly higher at the baseline, $p < .01$.

Note. UK = United Kingdom; USA = United States of America.

Text Message-Based Interventions. Kinnafick et al. (2016) explored the effect of need supportive text messages on physical activity. The messages acted as a facilitator of autonomy support and were sent to participants twice weekly over a 10-week period. Strategies addressed the basic need for autonomy by 'providing information as a meaningful rationale' or allowing a 'provision of choice and variety'. The basic need of competence was addressed by offering 'advice on resisting and overcoming barriers', and the need of relatedness was addressed by portraying 'respect, understanding and care'. The experimental condition received messages that included many strategies, for example: "Hi…! We understand that you may not always feel like going to your exercise class; if you are busy or the weather is bad. Perhaps try and think about the elements you enjoy, whether it's your favourite exercise or instructor?". The control group received only neutral messages such as: "The Government has set a target in England and Wales for 70 % of the population (in Wales, people up to the age of 65) to be 'reasonably active' by 2020". Findings suggested that participants in the intervention group perceived significantly greater levels of autonomy support. In addition, the text messages provided significantly higher satisfaction of the three basic needs (autonomy, competence and relatedness). Both the intervention and control group showed an initial increase in activity. However, at the 4 months follow up only the intervention group had significantly increased moderate intensity of physical activity, whereas the control group had reverted to the baseline level.

Coa and Patrick (2016) used a text message resource to explore the active dropout rate of users two weeks into a 6-week intervention phase for diet and exercise. The primary objective was to assess participants' baseline perceptions of controlled vs. autonomous motivation at the start of the 6-week intervention program to distinguish if the quality of

motivation was indicative of dropout. Controlled motivation was assessed with items such as “Others want me to eat more fruits, vegetables and whole grains.”, and presented no association with early dropout. Whereas autonomous motivation was assessed using items such as “Eating more fruits, vegetables, and whole grains is an important thing for me to do.”, and participants with higher levels of perceived autonomous motivation were significantly less likely to drop out of the intervention. While this study did not attempt to measure the manipulation of the text messages, arguably findings suggest that those who are more autonomously motivated (identified or integrated regulation) are more likely to persist in text message based behavioural change interventions.

Autonomy Support Interventions. Chatzisarantis et al. (2012), developed three interventions offering various levels of autonomy support to examine the impact of attendance levels and persistence for a physical activity programme. Participants were randomly assigned to one of the three interventions which either fully supported the need for autonomy, provided a rationale only, or presented participants with a forced choice. Participants saw information encouraging them to exercise over a 2-week period for more than four times a week, and given free, unlimited access to a fitness centre. All three conditions were presented with information explaining the benefits of participating in physical activity such as “Scientific evidence suggests that exercising for more than 4 days per week is beneficial to health in terms of reducing the risk of cardiovascular disease and in terms of improving positive mood and emotion. People who exercise for more than 4 days per week are likely to live longer and feel better.”. No further information was offered to the Rationale-only condition. However, participants in the forced-choice condition were told that exercising was compulsory and that it should be done more than 4 times a week. Only participants in the autonomy supportive condition went on to read information which reinforced personal choice such as “Please note that we do not want to obligate you to

exercise and that we would like you to make a conscious and free decision about whether or not you want to exercise for more than 4 days per week the next two weeks at the fitness centre…". They also read information that acknowledged any potential difficulties associated with the task "We can understand that sometimes you may find going to the fitness centre with the purpose to exercise quite difficult or frustrating…". Past physical activity behaviour, perceived competence and perceptions of autonomy support were measured directly after the presentation of the experimental information. The findings suggest that there were significant positive correlations for perceived autonomy support and physical activity participation. Participants in the autonomy-supportive condition reported higher perceptions of competence compared to the forced-choice condition. There were also significant effects of condition, with the control group and forced-choice condition reporting lower perceptions of autonomy support. Moreover, overall higher proportions of participants exercised more in the autonomy supportive condition.

Moustaka et al. (2012) manipulated the level of autonomy support provided by an instructor during exercise classes, in order to explore the effect on participant's perceptions of basic needs, persistence to engage, and quality of their self-determined behaviour. Participants enrolled in an eight-week course consisting of three exercise classes a week, each of which lasted one hour. The experimental condition (autonomy-supportive) and the control condition ran consecutively and had the same instructor. For the autonomy-supportive condition, the instructor used supportive language such as 'could' instead of 'should'. They also provided a meaningful rationale for the benefits of exercise and offered participants the freedom of choice relating to exercise type and music. Whereas participants in the control condition experienced pressurising language and an absence of a meaningful rationale and choice. The effectiveness of the intervention was evaluated at the end of each session through a measure of perceived autonomy support using six items such

as “In today’s class I felt that the exercise instructor was providing me choices and options”. In addition, information regarding perceived autonomy, competence and relatedness was collected. Results indicated that there were significant increases of perceived autonomy support from the baseline for both conditions. However, there was also a significant main effect of condition, with those in the autonomy-supportive condition having higher levels of perceived autonomy support. The autonomy-supportive condition had significantly higher levels of perceived autonomy and competence compared to the control condition. Most importantly, the persistence to exercise, measured by class attendance, was significantly higher in the autonomy-supportive condition. The authors conclude that supporting basic needs of competence and autonomy is beneficial for the effectiveness of an autonomy-supportive exercise intervention.

Resnicow et al. (2014) developed two types of newsletter communicating the promotion of colorectal cancer (CRC) screening in either a style that was autonomy supportive or directive. The study sought to understand the impact of tailored messages on the uptake of CRC screening. At the baseline participants’ communication preferences were assessed using two items: “In general, when it comes to my health, I would rather be told what to do”, and “When it comes to my health, I want my doctor to tell me what to do”. Participants were randomly assigned to one of the two intervention groups and received either an enhanced tailored newsletter (autonomy supportive condition) or minimally tailored newsletter (directive condition). Those classified with an autonomous communication preference had newsletters written in alignment with SDT constructs, using encouraging language: “[NAME], what are some good things you feel will come from getting checked for colon cancer? Thinking about reasons to get tested may help you take that next step…” Additionally, the enhanced invention group was presented with information which included tailored information relating to demographics, personality

traits and family history. The directive communication did not include enhanced information and differed in terms of the language style used, adopting a dictating narrative: "[NAME], experts agree – regular screening is one of the best ways to help prevent colon cancer. If a screening test finds a problem, doctors can usually diagnose and treat you right away". The results concluded that although there was no main effect of the intervention, CRC screening uptake rates were moderated by participants' communication preferences: participants with an autonomous preference were almost twice as likely to get the CRC screening when in the enhanced intervention group, compared to those in the directive condition.

Financial Incentives. Moller et al. (2012) sought to understand the consequences of using financial incentives on the motivation of participants' engagement and persistence with a health behaviour goal. Participants were required to record and input diet and activity related information into a handheld device during an intervention initiation phase over a three-week period. Once participants had shared this baseline data, they were provided with tailored behavioural targets. These were incentivised over a three-week period and participants could earn up to $175 for completing their health behaviour goals. The final stage of the intervention was a 17-week follow up phase in which participants were told that meeting their goals was no longer a requirement, however, payment was subject to recording data at predetermined intervals. This phase of the intervention was considered a period of free-choice and participants' activity levels were an indicator of their intrinsic motivation. The results indicated that financial incentives have the potential to undermine the sustained success of health behaviour change outcomes and levels of intrinsic motivation. Financial motivation was negatively associated with weight maintenance, with participants with a higher motivation for the financial incentive, on average weighing more at the end of the intervention phases. This suggests that the higher

the level of motivation for financial incentives, the greater the detriment of a successful outcome. The authors interpret that overemphasised financial incentives could be perceived as controlling which may weaken the level of autonomous motivation and thus affect the successful maintenance of healthy behaviours.

Risk of Bias Within Studies

A risk of bias assessment evaluating the relevancy, reliability, validity and applicability was conducted (see Table 3) using the MetaQAT tool which is a framework specifically developed for the appraisal of public health evidence (Rosella et al., 2016). The overall risk of bias was considered moderate.

Table 3

Risk of Bias Assessment (MetaQAT) (adapted from (Corace et al., 2016)

Study	Relevancy	Reliability			Validity				Applicability
	Does the study address a topic(s) relevant to the issue under investigation?	Is the study presented clearly?	Are the research methodology and results clearly described?	Are ethics procedures described?	Is the study methodology appropriate for the scope of research?	Is the research methodology free from bias?	Are the authors' conclusions explicit and transparent?	Can I be confident about the findings?	Can the results be applied within the scope of public health?
Chatzisar-antis et al. (2012)									
Coa and Patrick (2016)									
Kinnafick et al. (2016)									
Moller et al. (2012)									
Moustaka et al. (2012)									
Resnicow et al. (2014)									

Note: grey = yes, white = unclear, black = no.

Risk of Bias Across studies

Sampling, lack of control groups and baseline measures were noted as a potential bias. For example, an assumption of gender was made with participants presumed female as a result of an advertisement placed on a website targeted at women (Coa & Patrick, 2016). There were potentials for bias within research methodology which reduced confidence for the interpretation of the findings. For example, the three basic needs were not clearly individualised (Kinnafick et al., 2016), increasing methodology bias and reducing clarity for replication.

Discussion

Summary of Evidence

The primary objective of this systematic review was to examine the effectiveness of health behaviour change interventions rooted in the theoretical framework of SDT that would be relative to healthy adults. Although various settings, length of interventions, sample sizes, and demographics were used, the central three needs proposed remained applicable in different contexts, behaviours and populations. This aligns with the premise of SDT that the three basic psychological needs of autonomy, competence and relatedness are universal, an innate requirement and therefore do not assume differences such as culture (Ryan & Deci, 2000).

The studies included in the review identified that supporting the need for autonomy through external means was not only important for positive behavioural outcomes but also for sustained behaviour change. It was revealed that participants who experienced situations or communication which enhance autonomy support had significantly increased perceptions of autonomy and competence compared to the presentation of neutral information or forced choices (Chatzisarantis et al., 2012; Moustaka et al., 2012); resulting

in increased activity, engagement and persistence. The communicative use of text messages attempting to satisfy the three basic needs appeared to improve and sustain levels of exercise (Kinnafick et al., 2016), and reduce the likelihood of programme dropout (Coa & Patrick, 2016). This links to previous research that has suggested that messaging interventions are more likely to be successful if grounded in behavioural theories (van't Riet et al., 2010). However, future research could focus on the separation of constructs. For example, multiple strategies addressing autonomy, competence and relatedness were incorporated into each text message (Coa & Patrick, 2016), thus possibly masking the actual mechanisms underlying the behavioural change.

Autonomous and controlled motivation can be measured through five types of regulations (amotivation, external, introjected, identified and integrated regulation) conceptualised along the motivation continuum, and the type of motivation regulation drives the quality of the self-determined behaviour (Ryan & Deci, 2000). However, the assessment of these individual regulations was not always present across the studies. For example, Moller et al. (2012) measured autonomous motivation using activity level as a proxy, whereas Reniscow et al. (2014) used only two items to measure autonomous or controlled regulation. This highlights some inconsistences for the interpretation of autonomous vs. controlled motivation and subsequently its role in behavioural change. Moreover, integrated regulation, which forms part of extrinsic motivation can overlap with intrinsic motivation (Ryan & Deci, 2000). Yet the studies did not appear to explicitly address the possibility that individuals may have already been intrinsically motivated to engage with the behaviour. Perhaps this was a potential weakness of the intervention design whereby if the motivation was already intrinsic, attempting to improve motivation further would likely result in non-significant effects of the interventions.

Another interesting finding of this review is the suggestion that financial incentives undermine the successful sustainment of healthy behaviour change outcomes by reducing participants' autonomous motivation (Moller et al., 2012). However, the use of financial incentives within vaccination behaviour have shown some positive results. For example, offering movie tickets or frozen yoghurt coupons to HCP directly after getting vaccinated against the flu saw an increase in coverage rates (for a review, see Anikeeva et al., 2009). Addressing the impact of financial incentives on HCP decisions to vaccinate through the lens of self-determination theory could offer a richer understanding of how this type of incentive may impact on sustained behaviour change and the successful implementation of the NHS annual flu campaigns.

Much of the research assessed in this review has been undertaken with participants willing to engage in health behaviours which could suggest an element of pre-existing intrinsic motivation. For example, participation itself might be driven by the participant's own interest or enjoyment. Moreover, these studies included behaviours which required persistence such as exercise or diet. Only one study focussed on a behaviour that did not require continuous maintenance such as health screening (Resnicow et al., 2014). Although screening uptake was related to participants' communication preferences (autonomous or directive), there was no effect of the tailored newsletter intervention. This could have been due to the potential confounds relating to the design of the intervention and dissemination of the newsletter. For example, participants may not have fully engaged with the eight-page newsletter for various reasons such as length of information or external distractions. However, what this study does highlight, is the need to extend the understanding for behavioural interventions which do not require prolonged participation such as annual vaccinations.

Limitations

Although this systematic review attempted a wide scope of the literature, it is possible that all potential studies were not identified given the broad keyword search terms. Much of the SDT literature has focused on school aged children and their engagement with physical activity, diet and exercise, aligning itself with rising obesity of younger generations. Therefore, the inclusion criteria for this systematic review were narrowing in seeking healthy adult populations with the view to transpose findings to the domain of vaccination behaviour. The review sought to identify interventions that may be applicable to the annual expectation of flu vaccination and excluded longitudinal studies exceeding one year, thus potentially increasing the risk of selection bias. However, while it is reasonable to conceive that studies with intervention schedules exceeding one year may not be applicable in the context of the annual vaccine, further exploration of this timeline may highlight additional studies associated with a one-shot behaviour such as health screening (Resnicow et al., 2014).

Conclusions

There is a disparity of flu vaccination uptake throughout NHS Trusts and while there is a plethora of research addressing predictors of uptake among HCP, it has been highlighted that this abundance of evidence does not extend to evidence-based interventions (Corace et al., 2016). By highlighting the outcomes of behavioural change interventions within the health domain, this review offers potential avenues in which the framework of SDT could be applied to understand vaccination behaviour. For example, SDT may provide a framework to explore nurses' demand for an autonomous decision when getting vaccinated, thus facilitating an explanation for the significant association to receiving the pertussis vaccine when the demand for an autonomous decision was addressed (Baron-Epel et al., 2012, 2013). Assuming that the basic psychological needs of

autonomy, competence and relatedness are satisfied, SDT predicts a higher likelihood of behavioural change taking place and being sustained over time. Therefore, future research using SDT could focus on health behaviours whereby the reluctance to participate could be problematic to the wider society such as increasing vaccination coverage. This may enable a deeper exploration of the mechanisms associated with internalisation and the quality of self-determined behaviour.

In conclusion, this review acknowledges potential opportunities to bridge the gap between understanding predictors of behaviour and how that behaviour may materialise. Since addressing the demand for free choice has been significantly associated with the increased likelihood of uptake (Baron-Epel et al., 2012), this review brings to light the opportunity to use SDT to explore the role of autonomy in HCP decisions to vaccinate against flu, and provides a potential avenue for evidence-based interventions addressing flu vaccination decisions and behaviour.

Chapter 4: Initial Validity Evidence for the Treatment Self-Regulation Questionnaire Assessing HCP Flu Vaccination Behaviour Questionnaire (TSRQ-Flu)

Chapter 3 concluded that SDT offers a promising framework to design interventions aiming to promote vaccine uptake among HCP, and identified how existing interventions may inform future inventions aiming to improve flu vaccination. To empirically understand if the role of autonomy is important to why HCP may be motivated (that is may *want*) to get vaccinated against the flu a measure of extrinsic motivation is needed. Such a measure may enable a better generalisable understanding for the role of autonomy within this unique setting. Therefore, the present chapter outlines the development and validation of a psychometric scale which captured the constructs of extrinsic motivation in relation to HCP decision to get the flu vaccine. Across five phases, item generation, factor structure, scale dimensionality, reliability and validity of the Flu Treatment Self-Regulation Questionnaire (TSRQ-Flu) is investigated. A total of 718 participants responded to the studies. Exploratory analyses revealed a four-factor structure. Confirmatory factor analyses provided evidence for the stability of the hypothesised four-factor structure across two samples, and across two groups. Further, adequate support was obtained for the subscale's reliabilities (Autonomous, $\alpha = .947$; Introjection, $\alpha = .794$; External, $\alpha = .808$; Amotivation, $\alpha = .745$). Criterion-related and incremental validities were also acceptable. Overall, the results provided initial support of TSRQ-Flu scale, rendering it an appropriate assessment of HCP extrinsic motivation when considering the flu vaccination.

The Present Study

Recall that, the initiation and maintenance of healthy behaviours have been associated with autonomous motivation (as discussed in Chapter 3). Originating from self-

determination theory, autonomous motivation is a form of a behavioural regulation which aligns with internal values and needs (Deci & Ryan, 2000). Yet, the application of this key determinant is somewhat limited within the vaccine domain. Addressing HCP psychological need for autonomy could be key to understanding their motivations to receive the flu vaccine. The violation of personal autonomy has been cited as a barrier to vaccine uptake (Baron-Epel et al., 2012; Hakim et al., 2011). Though there is evidence suggesting that autonomy may be important in vaccination decisions (Vallée-Tourangeau et al., 2018), to the best of our knowledge, no empirical measures of HCP autonomous motivation for the flu vaccination exists.

Autonomous motivation has been associated with parental vaccination intentions in HPV vaccination (Denman et al., 2016) and the flu vaccination intention of university students (Chan et al., 2015; Fall et al., 2018). However, as previously mentioned, behaviours associated with vaccination uptake are complex with a potential for vaccine-specific motivations, beliefs and attitudes (Corace et al., 2016), particularly when the request to engage with a healthy behaviour is informed by external demands such as satisfying the request of policies and workplace guidelines.

Self-determination theory (SDT) is the only theory of human motivation which places emphasis on the conceptualisation of autonomous motivation, advocating that human motivation is formed from varying degrees of behavioural regulations conceptualised on a motivation continuum. The most basic divide of such regulations is intrinsic motivation, referring to behaviours initiated for one's own sake, interest or enjoyment, and extrinsic motivation which represents engaging with a behaviour for external reasons such as completing a work task to avoid sanctions, or to improve one's

career (Deci & Ryan, 1985). However, the continuum is not developmental, and a behaviour can adopt any point of regulation (Deci & Ryan, 2000).

The Treatment Self-Regulation Questionnaire (TSRQ) scale originally developed a way of assessing autonomous self-regulation in health related behaviours (Williams et al., 1996). It has been validated across various health behaviours such as diet, smoking, exercise (Levesque et al., 2006), diabetes (Williams et al., 2004), and parental HPV vaccination decisions (Denman et al., 2016). Recall that, the measurable behavioural regulations of extrinsic motivation include amotivation, external, introjected and autonomous motivation (see Chapter 1, Figure 1, p. 51). A brief summary of each regulation is provided, moving from the most externalised regulation to the most internalised regulation. As extrinsic motivation becomes more internalised the more autonomously motivated the behavioural outcome is (Ünlü & Dettweiler, 2015). *Amotivation* is the lack of willingness to act and is associated with the absence of self-determined behaviour. It is assumed that amotivation is the result of low sense of competence to complete an activity, a lack of value for the activity and a belief that participation will not achieve a desired outcome. Next is *Controlled Regulation* comprising of external and introjected regulation. These constructs represent the least autonomous forms of extrinsic motivation and result in short-lived behaviour change (Deci & Ryan, 2000). *External regulation* arises when external demands are perceived as controlling, resulting in behavioural action which seeks to simply satisfy the external demand or imposed reward. *Introjected regulation* reflects behaviours associated with the avoidance of guilt or attainment of pride, and the objective of behavioural action is to maintain or enhance self-esteem. Previous TSRQ measures have found external and introjected regulation to form two separate latent variables (Denman et al., 2016; Levesque et al., 2006), however controlled regulation may also be represented as one latent variable

(Williams et al., 1998, 2004). Finally, *Autonomous regulation* is formed of identification and integrated regulation. These are the most autonomous and internalised forms of extrinsic motivation. Identification occurs when the individual recognises the importance of the behaviour resulting in action which is in accordance with the self, or free choice. Integrated regulation is similar to intrinsic motivation, as the associated behaviours are autonomous and self-determined although they continue to be motivated by an external outcome (Deci & Ryan, 2000).

Occasionally, introjection may be more associated with autonomous regulation. Introjection is considered 'somewhat internal' and the extent to which this regulation is more internalised than externalised remains undetermined within SDT. However, methodological approaches have attempted to provide a quantifiable understanding of the shared internalisation and externalisation of introjection (Ünlü & Dettweiler, 2015). Understanding the extent to which these behavioural regulations may drive HCP decision to vaccinate, or not vaccinate against the flu vaccination may be useful to developing targeted flu-campaigns aimed at facilitating improved vaccination uptake.

The aim of the present work is to provide initial evidence for the validation of the TSRQ-FLU scale. Previously, measures of autonomous motivation for flu uptake have used ad hoc adaptions (Chan et al., 2015; Fall et al., 2018). The reliability of these measures has not yet been formally validated. Secondly, items have not been developed to assess the motivations of HCP. Though it has been suggested that HCP feelings towards the flu vaccination are not that dissimilar to the general population (Brewer et al., 2017; Capolongo et al., 2006). However, the general population in the UK are not urgently advised to get the flu vaccination unless categorised as at-risk such as, having a chronic health condition, being over 64 years old or pregnant (NHS, 2019). As such, caution is

needed when drawing conclusions or comparisons for the relevance of autonomy to HCP compared to the general population or university students. In addition, HCP have external demands and expectations for vaccination adherences placed by organisations such as the NHS, Public Health England and the World Health Organization.

Method

Procedural Overview

Following the approach to scale validation adopted by Van den Broeck, Vansteenkiste, De Witte, Soenens, and Lens (2010), the construct validity, discriminant validity, criterion-related validity and reliability were assessed across five phases. Phase 1 included item generation. In Phase 2 the final set of items were selected based on exploratory factor analysis and item-total correlations. In Phase 3 the factor structure was established using confirmatory factor analysis and examined the dimensionality of the model across groups. In Phase 4 the internal consistency, reliability and validity of the scale were assessed. In addition, responses were examined for the potential of social desirability contamination, assessing whether HCP may have been overly inclined to report their willingness to get vaccinated against the flu as a result of social desirability influences (Riccò et al., 2017). Finally, in Phase 5 the criterion-related, predictive and incremental validity of the TSRQ-Flu were examined. Specifically, based on conceptual grounds it was hypothesised that (a) autonomous motivation would predict vaccination intention, (b) past behaviour would be positively associated with autonomous regulation for vaccinators while (c) controlled regulation would be negatively associated.

Measures

Measures to Establish Common Method Bias. The short form version of the Balanced Inventory of Desirable Responding Scale (BIDR-16) (Hart et al., 2015) was used to check that responses were not confounded by social desirability bias. This 16-item scale captures self-deceptive enhancement (SDE) relating to honest but overly positive responding (α = .697), as well as impression management (IM) reflecting the conscious presentation of a favourable public image (α = .657).

Measures to establish discriminant and criterion-related validity. Cognitive empowerment was assessed using the Motors of Influenza Vaccination (MoVac-flu) scale (Vallée-Tourangeau et al., 2018). Responses were measured on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). The 9-item scale captures the cognitive empowerment of HCP which includes sentiments of *Impact* (e.g., "Vaccination is a very effective way to protect me against the flu."); *Value* (e.g., "The flu jab plays an important role in protecting my life and that of others."); *Autonomy* ("I can choose whether to get a flu jab or not."), and *Knowledge* (e.g., "I know very well how vaccination protects me from the flu."); α = .929. Vaccine attitudes were assessed using a shortened version of the pH1N1 Vaccine Attitude Scale (Corace et al., 2013). The 11-item scale captures sentiments related to *perceived susceptibility* (e.g., "It is very likely that I can infect patients with pH1N1 if I don't get the pH1N1 vaccine."); *perceived severity* (e.g., "The thought of getting pH1N1 scares me."); *perceived benefits* (e.g., "I believe the pH1N1 vaccine is safe."); *perceived barriers* (e.g., "The pH1N1 vaccine will NOT make me sick."), and *cues to action* which are internal and external stimuli that motivate vaccine uptake (e.g., "My supervisor thought it was a good idea for me to get the pH1N1 vaccine."). The word 'pH1N1' was substituted for the word 'flu' Responses were

measured on a 5-point Likert scale ranging from 1 (*Strongly Agree*) to 5 (*Strongly Disagree*); α = .832.

Behavioural Measures. Participants were asked if they had been vaccinated against the flu during the current flu season (e.g. 2016/2017, or 2017/2018), measured using *Yes* = 1, *No* = 0. If they intended to vaccinate during the next flu season (e.g. 2017/2018 or 2018/2019), measured using 3 categories (*Yes* = 1, *Don't Know* = 0.5, *No* = 0), and whether they knew if their line manager was vaccinated against the flu (*Yes* = 1, *No* = 0.5, *Don't know* = 0).

Results

Participants Overview

Four samples (*N* = 718) were used throughout the five phases (see Table 4 for demographic data). The organizational pilot sample consisted of 66 HCP specialising in Mental Health care. An invitation to participate was sent to 4,600 medical professionals (1.43% response rate). *Sample 2* were an opportunistic sample recruited from Kingston University London School of Nursing and Facebook. An invitation to participate was posted on Kingston University's internal communications and nursing-related Facebook groups. A combined total of 534 HCP and Nursing students responded to the online questionnaire. Data were screened (see Phase 2 for further detail) and a total of 122 questionnaires were discarded resulting in 412 individual responses. *Sample 3* (*n* = 152) were recruited using Prolific Academic, an invitation to participate was posted to HCP working within the United Kingdom. A total of 154 HCP responded. However, two questionnaires were discarded as they indicated they were not in the UK. *Sample 4* were student nurses recruited from Kingston University. A total of 117 student nurses

responded, the data were screened (see Phase 4 for further detail), 29 questionnaires were discarded (n = 88).

Table 4

Participant Demographic Information Across the Four Samples

	Pilot sample (N = 66)		Sample 2 (N = 412)		Sample 3 (N = 152)		Sample 4 (N = 88)	
	n	%	*n*	%	*n*	%	*n*	%
Age								
Range	24 - 63		19 - 67		20 - 63		19 - 50	
M (years)	46.45		29.95		38.41		27.95	
SD	10.03		10.14		10.24		8.23	
Gender								
Female	49	74.2	340	82.5	142	93.4	68	77.3
Male	16	24.2	33	8.0	9	5.9	11	12.5
Self-describe			1	0.2			2	2.3
Prefer not to say	1	1.5	3	0.7	1	0.7	7	8
Occupation								
Doctor	5	7.6	8	1.9	4	2.6		
Nurse	14	21.2	165	40.0	46	30.3		
Clinical specialist	4	6.1	15	3.6	6	3.9		
Allied health professional	10	15.2	20	4.9	39	25.7		
Admin and clerical staff	19	28.8	3	0.7	30	19.7		
Volunteer	1	1.5	1	0.2	1	0.7		
Student	1	1.5	100	24.3	7	4.6		
Other	11	16.7	65	15.8	18	11.8		
Year of study								
Under graduate (year 1)								
Under graduate (year 2)							27	30.7
Under graduate (year 3)							49	55.7
Post graduate (year 1)								
Post graduate (year 2)							3	3.4
Other							2	2.3
Place of Work								
NHS Hospital	47	71.2	255	61.9	85	55.9	75	85.2
Community/GP Practice	9	12.1	120	29.1	37	24.3	10	11.4
Private Hospital			8	1.9	5	3.3	5	5.7
Care Home			6	1.5	12	7.9	8	9.1
Other	5	7.5	19	4.6	19	12.5	4	4.5
Direct Patient Contact								
Yes	49	74.2	358	86.9	124	81.6	70	79.5
No	16	24.2	18	4.4	27	17.8	18	20.5

Phase 1: Item Development

The SDT literature and existing measures assessing autonomous motivation for health-related behaviours were examined to develop items. To form the basis of the

adaptation, the TSRQ concerning diabetes (part of the SRQ-Health Care Questionnaire Packet, Centre of Self-Determination Theory, 2019) was selected. The chosen twenty-item scale reflects behaviour involving the use of medicines, therefore it was considered the closet representation for vaccination behaviour, compared to diet or physical activity. As flu vaccination is a controversial topic and uptake likelihood is associated with opposing sentiments of motivated behaviour (Kassianos et al., 2018); therefore two sets of the twenty-item scale were initially developed so to reflect both vaccinators and non-vaccinators. Past behaviour determined which set of items participants would receive. An example of a vaccinator statement was "I would feel bad about myself if I didn't get the flu jab.", whereas a non-vaccinator statement read "I would feel bad about myself if I got the flu jab.". The first nine items were formulated under the stem "I [do not] have the flu vaccine because:" and the remaining 11 items were under the stem "The reason I [do not] get vaccinated against the flu:". An additional item related to protective behaviours "It's [not] important to get the jab to protect my colleagues and patients from the flu." was added. Responses were rated on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). All items were discussed with healthcare managers and experts from the field of behavioural decision-making psychology to ensure that stability of underlying concepts while using language familiar to HCP. In total, nine items related to autonomous regulation, and 11 items related to controlled regulation, these were randomised under the appropriate stem prior to dissemination.

Pilot Sampling. A pilot sample was used to assess the homogeneity of the two twenty-item scales (n = 42 for vaccinators; n = 24 for non-vaccinators). The distribution of data and the correlations between items were examined. It was observed that nine items reflecting controlled regulation had high values of skewness and kurtosis on the non-vaccinator scale (maximum observed skewness = 4.90, kurtosis = 24.00). Additionally,

seven controlled regulation items had very small correlations ($r \leq 0.1$) within the non-vaccinators scale compared to two items on the vaccinator scale (see Appendix B, Table S1).

We considered that items reflecting controlled regulation were inconsistent across the two scales which may have implications for additional analyses. For example, exploratory factor analysis attempts to explain the common variance within the correlation matrix (Field, 2013), and it is suggested that a substantial number of correlations should exceed .30 (Hair Jr. et al., 2013). Therefore, a universal scale which could jointly assess the motivation regulations for both vaccinators and non-vaccinators was developed. Thus, items were reformulated under the stem indicative for an intended behaviour *"If I were to have the flu jab next season it would be because:"*, and the literature was reviewed to ensure that item formulation remained consistent to previous versions of the TSRQ. In particular, the use of linguistics within the 15-item TSRQ scale validated across three different health behaviours (Levesque et al., 2006) was assessed. The items were adapted to reflect flu vaccination behaviour e.g., from *"Because I feel pressure from others to stop smoking permanently."* to *"Because I feel pressure from others to get the flu jab."*. Accounting for the distribution of data observed in the pilot sample, it was decided that 18 items would be retained. The final item pool included eight items for autonomous regulation, three items for introjected regulation, five items for external regulation, and two items for amotivation (see Appendix B, Table S2 for reformulated items)

Phase 2: Item Selection

Data Screening. A total of 534 HCP and Nursing students responded to the online questionnaire. Participants who had left the questionnaire early before attempting the TSRQ-Flu items (n = 82) were removed. In addition, those who did not work within the

UK were excluded (n = 36) due the potential confounds of variance in governmental regulations such as condition-of-service policies (for a review, see Gruben et al., 2014). Further, the TSRQ-Flu items were individually examined and cases (n = 5) with incomplete data were identified. The proportion of missing values were low, < 1% (see Appendix B, Table S3). After examination of missing data patterns (see Appendix B, Table S4), the missingness could be considered random (Fox-Wasylyshyn & El-Masri, 2005). Subsequently, the cases were removed listwise as implications of removal is considered inconsequential when random missing values are below 5% (Schafer, 1999). In addition, data were screened for straightlining (i.e. identical responses for a set of items) as these may implicate reliability and validity (Kim et al., 2019). Two simple nondifferentiation cases were identified and removed from the data set. Multivariate outliers were identified using Malahanobis distances (n = 39, p < .001). Following the guidance of Fidell and Tabachnick (2003) to detect unusual score combinations, only 1 case with a leverage value exceeding the expected threshold of .14 was identified (calculated as $\frac{3(k+1)}{n}$, where k is the number of items; Field, 2013). However, the participant had consistently chosen extreme values across measures and therefore was retained in analysis. Moreover, the critical Cook's distance ratio of .50 was not violated (see Appendix B, Table S5 for multivariate outlier analyses). The final sample was (N = 412).

Exploratory Factor Analysis. The distribution of the item scores was examined. The 2 items representing amotivation suggested a tendency for low scores (M = 1.83, 1.70; SD = 1.48, 1.43) with item 18 having higher values for skewness and kurtosis (skewness = 2.29; kurtosis = 4.64). Previous validations of TSRQ scales have chosen to omit amotivation measures due to poor factor loading (Denman et al., 2016), and low scores for

amotivation are prevalent (Levesque et al., 2006). At this exploratory stage both items were retained (see Appendix B, Table S6 for full data distributions).

An initial parallel analysis using a Monte Carlo approach (O'Connor, 2000) suggested the presence of two significant components, corresponding with the theoretical underlying factors, autonomous and controlled regulation. However, some TSRQ scales suggest a four-factor structure in which introjected regulation, external regulation and amotivation can form together to represent controlled regulation (Levesque et al., 2006). Next, an EFA using principal component analysis and an oblique rotation (direct oblimin), was conducted, and factors were extracted based on eigen values. For a full commentary on the EFA analysis refer to Appendix B.

The following provides a summary commentary on the EFA analysis. An initial examination of the correlation matrix suggested the presence of multicollinearity across items representing autonomous regulation (determinant < .00001). The presence of multicollinearity may suppress the assessment of predictor importance, leading to inflated standard errors which are consequential to the stability of items across samples (Field, 2013). Collinearity diagnostics identified item 6 as having the highest variance inflation factor (VIF) of 9.19, with a tolerance of 0.11 (see Appendix B, Table S6). Tolerance and VIF values provide an indication for the strength of the linear relationship between items. Items with tolerance values below .20 are potentially problematic, with values below .01 indicating more serious problems (Field, 2013). Item 6 was subsequently removed, and analysis were re-run with no issues of multicollinearity present (determinant > .00001). The Kaiser-Meyer-Olkin sampling of adequacy (KMO) was .905, with all KMO values for individual items above .50. Bartlett's test of sphericity was significant, $\chi^2(136) = 4427.55$, $p < .001$.

Next, a check of the communalities revealed that items seven and eight did not meet the expected threshold of .40 (Field, 2013) and these were removed respectively. Two factors were extracted accounting for 63.96% of the explained variance. However, the pattern matrix revealed cross loadings on the items relating to introjection. As introjection and autonomous regulation are closest on the motivation continuum, it is plausible that there may be some overlap. A decision was made to force the extraction of four factors based on recent models of the TSRQ (Denman et al., 2016; Levesque et al., 2006) and the levelling off of eigen values on the scree plot (Cattell, 1966) (see Appendix B, Figure S2). Item 16 did not load on the expected factor and was removed. Three items (15, 10 and 12) were removed respectively as they did not contribute to a simple factor structure.

The final four factor solution (see Table 5) explained 83.16% of the variance with 12% nonredundant residuals with absolute values > .05, suggesting a good factor model (Field, 2013). KMO remained meritorious at .862, Bartlett's test of sphericity ($\chi^2(55) = 3097.17$, $p < .001$). All items had a minimum loading of .760 with no cross loading above .249.

Table 5

Summary of Exploratory Factor Analysis (N = 412)

Item	*M*	*SD*	Skewness (*SE* = 0.12)	Kurtosis (*SE* = 0.24)	Communalities	Factor Loadings 1	2	3	4
Autonomous regulation									
It's important to get vaccinated to protect myself from the flu virus.	4.65	2.07	-0.44	-1.05	.873	**.972**	.023	.013	.064
I personally believe that having the flu vaccine will protect my health.	4.60	2.17	-0.39	-1.24	.889	**.968**	-.023	.019	.091
I personally believe it's important to do so in order to stay healthy.	5.08	2.01	-0.79	-0.62	.794	**.933**	-.026	.049	.016
I've carefully thought about flu vaccination and believe it's the right thing to do.	4.18	2.22	-0.15	-1.40	.847	**.783**	-.032	-.157	-.140
It’s important to get the jab to protect my colleagues and patients from the flu.	4.71	2.24	-0.49	-1.23	.795	**.781**	.037	.007	-.219
Introjection									
I'd feel guilty if I didn't get the flu jab.	3.22	2.09	0.44	-1.09	.809	-.085	.008	.033	**-.961**
I would feel bad about myself if I didn't get the flu jab.	2.79	2.04	0.74	-0.79	.885	.249	.039	.002	**-.760**
External									
I want my line-manager to think I'm a good employee.	3.17	2.09	0.43	-1.12	.859	.040	**.970**	-.044	.086
I don't want other people to be disappointed in me.	2.42	1.80	1.05	0.03	.766	-.085	**.763**	.101	-.150
Amotivation									
I just do it because my line-manager recommends to.	1.83	1.48	1.89	2.91	.805	-.023	-.045	**.923**	-.004
It is easier to do what I'm told than to think about it.	1.70	1.43	2.29	4.64	.827	.037	.065	**.871**	-.009
Eigenvalue						4.73	2.77	.87	.79
% of variance						42.97	25.16	7.87	7.16
α						.946	.742	.774	.803

Note. Extraction Method: Principal Component Analysis; Rotation Method: Oblimin with Kaiser Normalization;
Loadings larger than .40 are is bold; *SE* = standard error.

Phase 3: Factor Structure

To examine the hypothesised four-factor structure (derived from the EFA), and test for measurement invariance across groups, confirmatory factor analyses (CFA) using *Sample 2* and *Sample 3* were conducted. Analysis of the sample from which the EFA was derived allows a more accurate assessment of potential methodological explanations, should the CFA fail within the new data set (Van den Broeck et al., 2010; van Prooijen & van der Kloot, 2001). Analysis was conducted using RStudio (2019) version 1.2.5019, and the *lavaan* (Rosseel, 2012), *semTools* (Jorgensen et al., 2019) and *MVN* (Korkmaz et al., 2014) packages.

Data Screening. A total of 154 HCP responded to the online questionnaire. The method used in Phase 2 was applied to assess the new dataset (*Sample 3*) for missing values and outliers. Two participants indicated that they were not living in the UK and were subsequently excluded. All participants (n = 152) completed TSRQ-Flu items. There was an absence of simple nondifferentiation cases. Further, there were an absence of influential outliers as indicated by Cook's distance, leverage, and Malahanobis distances. Next the data distributions, univariate normality, multicollinearity, linearity, homogeneity and normality of the standardized residuals were examined (see Appendix B).

Next, multivariate normality (MVN) was assessed using Mardia (1970) MVN test for kurtosis and skewness, which indicated that data was non-normal ($p < .001$). Multivariate normality is an assumption of the maximum likelihood (ML) estimation method applied in CFA and structural equation modelling (SEM) analyses. Violation may lead to bias within the fit indices, and an alternative estimation method may be applicable (Hu & Bentler, 1999; Jackson et al., 2009). Therefore, four goodness of fit indices (RMSEA, CFI, TFI and SRMR) using the diagonally weighted least squares (WLSMV)

estimation were examined. This robust distribution-free estimator demonstrates less bias and increased accuracy within the factor loading estimates, particularly in the presence of non-normal distributions (Li, 2016). Further, the Satorra-Bentler scaled test statistic was applied, as robust estimates are provided when data is considered non-normal, particularly with small and medium sample sizes (Lai & Zhang, 2017; Satorra & Bentler, 2001). Scaling was fixed to one on the latent factors, enabling all parameters to be freely estimated, which is useful for analyses of covariance structures and the variance contribution of each observed item (T. D. Little et al., 2006).

Model Evaluation. Within the literature distinguishing what constitutes an absolute acceptable model fit varies, and the practicality of applying a single cut-off rule is not always appropriate (Hair Jr. et al., 2013). The following explanations are of widely reported model fit indices used to assess the appropriateness CFA, inclusive of respective guideline cut-off values. Comparative fit index (CFI), measures the incremental fit of the hypothesised model relative to a base model, CFI values ≥ .95 indicate excellent fit attaining that the model adequately describes the sample data, whereas values above .90 may be associated with models of adequate fit (Hair Jr. et al., 2013). Root mean squared error of approximation (RMSEA) measures the discrepancies between the hypothesised model and the observed model, values below .08 are indicative of reasonable fit, while values above .10 are an indication of poor fit (Bryne, 2010; Hair Jr. et al., 2013). Standardized root mean square residual (SRMR) provides an absolute fit measure of the overall difference between predicted and observed correlations or the residuals, SRMR values ≤ .08 indicate an acceptable model fit (Hu & Bentler, 1999).

The hypothesized four-factor model (Model A) was compared to a two-factor model (Model B) whereby introjection, external regulation and amotivation were

combined to reflect controlled regulation. Both models were compared to a unidimensional model (Model C). The fit indices of the four-factor model indicated a favourable fit: *Sample 2*, CFI = .985, RMSEA = .065 [90% CI: .057, .073], SRMR = .050; *Sample 3*, CFI = .986, RMSEA = .064 [90% CI: .050, .078], SRMR = .054. Further, to test the superiority of model fit when compared to alternative models (Model B and C), the Satorra-Bentler (2001) test of chi-square difference was used as this is appropriate when computing the difference of the scaled chi-square statistics goodness of fit measures. In both samples, the hypothesised four-factor solution (Model A) achieved superior fit *Sample 2*: SB Δ-$\chi^2(5)$ = 304.99, $p < .001$; SB Δ-$\chi^2(6)$ = 601.55, $p < .001$; *Sample 3:* SB Δ-$\chi^2(5)$ = 235.22, $p < .001$; SB Δ-$\chi^2(6)$ = 280.69, $p < .001$, suggesting a meaningful distinction in favour of the hypothesized latent factors and the four theoretical regulations of autonomous, introjection, external and amotivation (see Table 6 for fit measures of the models). All items loaded significantly onto their respective factors (*Sample 2*: ranging from .677 to .991, $p < .001$; *Sample 3*: ranging from .691 to .950, $p < .001$), exceeding the minimum threshold of .50 for standardized parameter estimates (Hair Jr. et al., 2013). The average loadings in *Sample 2* and *Sample 3* were superior or equal to .777, and .748, respectively, thus exceeding the ideal threshold of .70 (Hair Jr. et al., 2013). See Appendix B, Table S8 for the parameter estimates.

Table 6

Fit Indices for the Measurement Models of Extrinsic Motivation Regulations in Samples 2 and 3

Model	SB-χ^2	df	*p*	S*c*	RMSEA	90% CI	CFI	SRMR	Comparison	SB Δ-χ^2	df	*p*
Sample 2												
Model A	235.22	38	.000	.332	.065	[.057, .073]	.985	.050				
Model B	1230.03	43	.000	.497	.183	[.174, .192]	.868	.168	A	304.99	5	.000
Model C	1542.97	44	.000	.414	.185	[.177, .193]	.861	.170	A	601.55	6	.000
Sample 3												
Model A	108.42	38	.000	.331	.064	[.050, .078]	.986	.054				
Model B	641.77	43	.000	.402	.193	[.180, .206]	.857	.153	A	235.22	5	.000
Model C	660.81	44	.000	.395	.192	[.179, .205]	.855	.154	A	280.69	6	.000

Note. Computation of Satorra-Bentler (SB Δ-χ^2) test in R uses the estimated scaled SB-χ^2 value; therefore, SB-χ^2 is reported as such with Sc representing the scaled-correction factor. Robust estimands for all other fit indices are reported.

Measurement Invariance. The aim of the TSRQ scale is to understand the underlying motivation driving vaccination decisions among vaccinators and among non-vaccinators. It is therefore important to ensure that the latent constructs have similar meanings and structures across these two groups. A prerequisite for meaningful group comparisons (Chen, 2008) is measurement invariance. It is tested through four incrementally restrictive levels (configural, metric, scalar and strict), and generalisability (Putnick & Bornstein, 2016). The absence of measurement invariance (non-invariance) suggests that the latent constructs may have different meanings and structures across groups, which has implications for inferences for group analyses (Putnick & Bornstein, 2016). The configural level of measurement invariance assesses if the hypothesised model has equivalent factor structure across groups and is of "key significance to the test of dimensionality" (Boateng et al., 2018, p. 11). The metric level of measurement invariance,

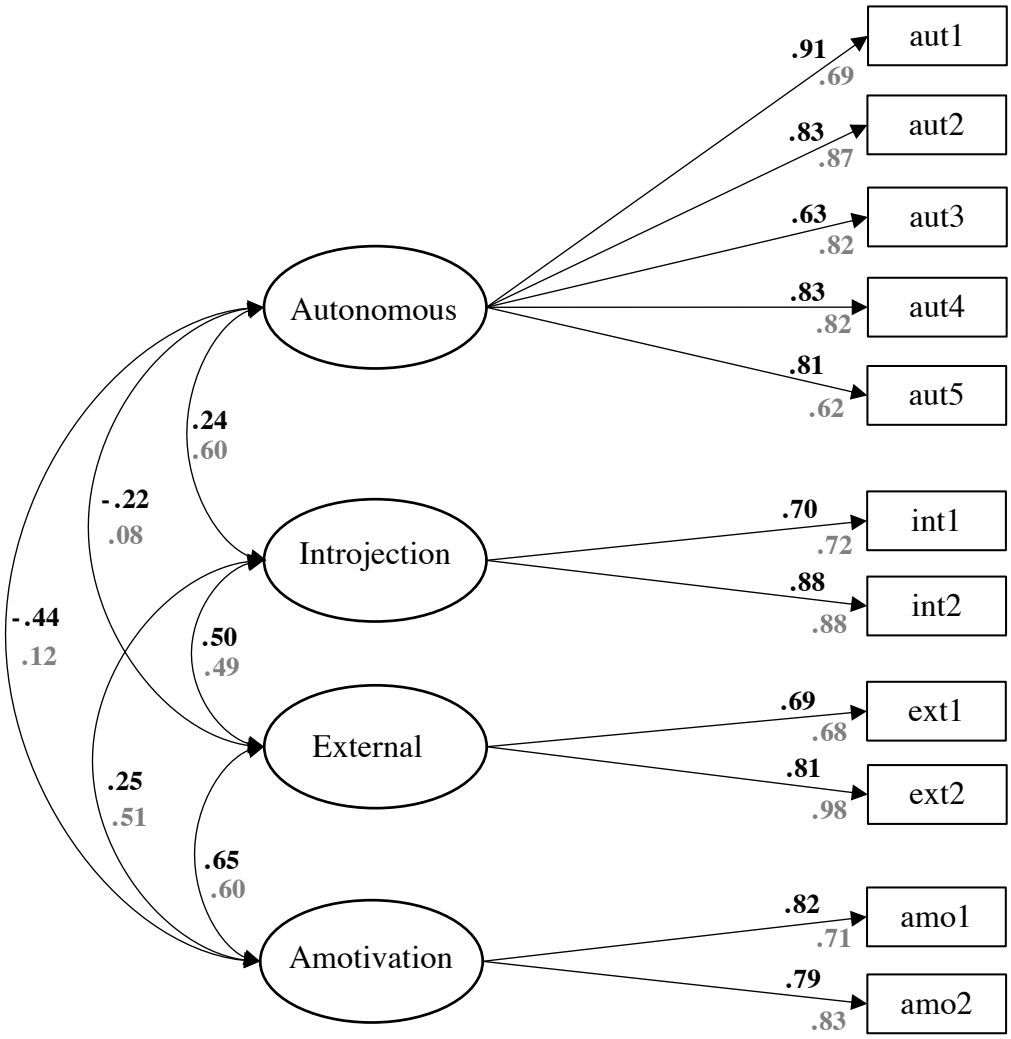
measured on the factor loadings, assesses the equivalence of psychological interpretation of the observed items across groups. Establishing metric invariance is important for meaningful inferences of subsequent testing (Vandenberg & Lance, 2000). The scalar level of measurement invariance refers to the intercepts of the hypothesized model across groups and assesses whether "mean differences in the latent construct capture all mean differences in the shared variance of the items" (Putnick & Bornstein, 2016, p. 5). Lastly, the strict level of measurement invariance refers to the residuals of the hypothesised model, accounting for differences in the item's variance not shared with the latent construct and its corresponding error variance. Unlike the incrementally restrictive measurement invariance levels preceding, strict invariance is not fundamental for testing mean differences between groups (Putnick & Bornstein, 2016).

Past behaviours for flu vaccination uptake are strong indicators of intention formation (Ernsting et al., 2011). Therefore, the incremental levels of invariance across past vaccination uptake behaviour (e.g., those who did, or did not get the flu vaccination last flu season, *Yes* = 1, *No* = 0) were assessed. The measurement invariance test using *semTools* (Jorgensen et al., 2019) requires a minimum sample size of 100 per group, therefore analyses were conducted using *Sample 2*. The change in chi-square can be used as an evaluative measure for changes within the consecutive invariance models. However, chi-square is sensitive to sample size and non-normality, and an alternative assessment value for changes in the invariance models is the ΔCFI (for a review, see Putnick & Bornstein, 2016). Rutkowski and Svetina (2014) suggest changes in the ΔCFI < .02 for metric invariance, whereas the more conservative ΔCFI < .01 suggestion by Cheung and Rensvold (2002) is more suitable at the scalar level (Putnick & Bornstein, 2016; Rutkowski & Svetina, 2014). The configural model fit indices indicated a favourable fit, CFI = .956, RMSEA = .076 [90% CI: .068, .085], SRMR = .066. Metric invariance was

achieved, ΔCFI < .02, CFI = .942, RMSEA = .083[90% CI: .075, .092], SRMR = .077. Finally, invariance at the scalar level was achieved, ΔCFI < .01, CFI = .938, RMSEA = .083 [90% CI: .075, .091], SRMR = .081. Figure 3 displays the item loadings for the TSRQ-Flu scale by past vaccination behaviour grouping.

Figure 3

Four-Factor Model Loadings and Covariances by Past Vaccination Behaviour



Note. Vaccinators in black, Non-vaccinators in grey.

In consideration of the competing ΔCFI cut-offs, items were examined in order to establish which may be problematic for achieving the conservative cut-off ΔCFI < .01. Item 3 "It's important to get the jab to protect my colleagues and patients from the flu.", indicated lower loadings in the 'Non-vaccinators' group (β = .578), compared to 'Vaccinators' (β =. 781). This item was a new measure for the TSRQ-Flu scale, and it is plausible that at the group level the importance of protecting patients and colleagues could convey a stronger internalised belief (autonomous regulation) for those who vaccinate compared to those do not. Subsequently, partial invariance was conducted using item 3, leading to the achievement of metric and scalar invariance ΔCFI < .01. Partial invariance relaxes imposed constraints on specified items across groups and is acceptable at the metric level when two or more indictors are equal across groups (Byrne et al., 1989; Vandenberg & Lance, 2000). Given that metric invariance was achieved for ΔCFI < .02, coupled with scalar invariance ΔCFI <.01, item 3 was retained and it was concluded that mean scores may be interpreted equally across groups.

Phase 4: Model Reliability and Validity

Scale reliability refers to the extent that the observed items variation is representative of the true shared variance in latent score (Hair Jr. et al., 2013). Scale validity refers to the accuracy in the causal relationship between the covariances of the items and the latent construct (DeVellis, 2012; Hair Jr. et al., 2013). However, reliability and validity are not synonymous, meaning that a scale can be reliable but not valid. Using *Sample 2* and *Sample 3*, the TSRQ-Flu scale internal consistency (reliability) and construct validity, convergent and discriminant validities were assessed following the methods suggested by Critchley et al. (2013). Using *Sample 4*, the influence of socially desirable responses confounding reliability coefficients (Maul, 2013) was also assessed.

Data Preparation. The method used in Phase 2 was applied to assess the new dataset (*Sample 4*) for missing values and outliers. A total of 117 student nurses responded to the questionnaire, 29 questionnaires were discarded as they left before responding to the TSRQ-Flu items (n = 88). There were an absence of influential outliers, missing values and simple nondifferentiation cases. Next the data distributions, univariate normality, multicollinearity, linearity, homogeneity and normality of the standardized residuals were examined (see Appendix B).

Reliability. The average scales' reliabilities across the *Sample 2*, *3* and *4* were favourable as indicated by Cronbach's (1951) coefficient alpha (Autonomous, α = .947; Introjection, α = .794; External, α = .808; Amotivation, α = .745). Reliability estimates exceeding .70 indicate good internal consistency between the items and that they are reflecting the same latent construct (Hair Jr. et al., 2013). However, coefficient alpha may represent the lower-bound reliability estimates when uncorrelated errors are present (Raykov & Marcoulides, 2011), and may underestimate the true reliability for a two-item scale. To check for this possibility, the Spearman-Brown measure of reliability was also examined. This measure uses items correlations to determine the reliability coefficient (DeVellis, 2012), as the "The underestimation by coefficient alpha is, on average, larger than the misestimation by the Spearman-Brown statistic" (Eisinga et al., 2013, p. 640). The average Spearman-Brown reliabilities for the two-item latent variables were also favourable, Introjection, ρ = .885; External, ρ = .880; Amotivation, ρ = .853.

The potential confounds for socially desirable responses were examined using partial zero-order partial correlation *Sample 4*. Six participants did not respond to the BIDR-16 scale and were omitted from analysis listwise (n = 82). Self-Deception Enhancement (SDE) demonstrated a significant correlation with External regulation

(r = - .283, p = .010). The squared correlation coefficient between SDE and External regulation was R^2 = .07, suggesting a limited impact of socially desirable responses on the TSRQ-Flu scores. For a summary of the BIDR-16 scale reliabilities and social desirability analysis see Table 7.

Table 7

Zero-Order Correlations Between the Constructs of BIDR-16 Scale and the TSRQ-Flu Scale

				Correlations			
	M	*SD*	α	Autonomy	Introjection	External	Amotivation
Self-Deception Enhancement	5.13	1.06	.697	.002	-.144	-.283*	-.175
Impression Management	5.68	1.08	.657	-.058	-.105	-.157	-.128

Note. *p < .05

Validity. Next, convergent and discriminant validities were assessed. Convergent validity refers to the shared proportion of variance between the set items measuring their intended latent construct (Hair Jr. et al., 2013). One indicator for the assessment of convergence validity is the average variance extracted (AVE), which is a calculation of the mean item loadings on a given construct. An AVE exceeding .5 indicates adequate convergence validity (Hair Jr. et al., 2013). Another indicator of convergence is composite reliability, which adopts Cronbach's alpha (α) reliability cut-off of .70 (Hair Jr. et al., 2013). Although Cronbach's alpha may be considered an estimate of composite reliability, it does not account for correlated errors (Raykov & Marcoulides, 2014). Therefore, Raykov's (1997) estimation of composite reliability is reported as this serves to correct positive bias within the α estimation (Macdougall, 2011). Discriminant validity is concerned with the uniqueness of one construct compared to another (Hair Jr. et al., 2013). A rigorous indictor for assessment of discriminant validity is to compute the Fornell-

Larcker criterion (Fornell & Larcker, 1981), in which the AVE for two constructs is larger than the squared correlation estimates (maximum shared variance) between two constructs, and the square root of the AVE on each construct is larger than the correlations of other constructs. Overall the four factors were discriminant, and the observed variables adequately explained the latent variables. Estimates were calculated using the R package *semTools* (Jorgensen et al., 2019). The AVE for each latent variable exceeded .50, and the Raykov's rho (1997) CR exceeded .70 suggesting adequate convergence validity and construct reliability. Good evidence for discriminant validity was established, as the AVE was greater than the maximum shared variance (MSV) between each latent construct. In addition, the square root of the AVE was greater than inter-construct correlations, providing further evidence of discriminant validity (Fornell & Larcker, 1981). Validity and reliability estimates for *Sample 2* and *Sample 3* are presented in Table 8, *Sample 4* was not included in this analysis due to sample size.

Table 8

Four-factor Model Reliability and Validity Estimates for Samples 2 and 3

						Correlations			
	α	*ρ*	CR	AVE	MSV	1	2	3	4
Sample 2									
Autonomous	.95		.95	.78	.31	**.88**			
Introjection	.80	.89	.84	.73	.31	.56	**.85**		
External	.78	.85	.74	.59	.40	-.12	.36	**.77**	
Amotivation	.77	.87	.77	.63	.40	-.22	.22	.63	**.79**
Sample 3									
Autonomous	.95		.95	.80	.47	**.90**			
Introjection	.79	.88	.80	.68	.47	.69	**.82**		
External	.83	.91	.83	.71	.23	-.11	.30	**.84**	
Amotivation	.72	.83	.72	.56	.23	-.21	.15	.48	**.75**

Note. Cronbach's alpha (α); = Spearman Brown Split half reliability (*ρ*); Composite reliability (CR), Average Variance Extracted (AVE), Maximum Shared Variance (MSV). MSV = maximum standardised correlation^2. Square root of the AVE is shown on the diagonal in bold.

Phase 5: Criterion-Related Validity

Criterion-related validity refers to the empirical association between a 'gold-standard' measure and the new measure in question (Boateng et al., 2018). Common estimations of criterion-related validity are concurrent or predictive validity, or both. Concurrent validity refers to the strength of the relationship between the criterion (gold-standard) and the new measure. However, 'gold standard' criterion variables may not always be available particularly when developing scales within new theoretical domains (Boateng et al., 2018). Predictive validity refers to the new measure's ability to predict future outcomes (Boateng et al., 2018). An additional measure of criterion-related validity is incremental validity, which refers to the contribution of new predictors above and beyond a criterion measure (Meyer, 2007). See Appendix B for the data distributions of criterion-related measures.

Concurrent Validity. To examine the relationship of the four TSRQ-Flu constructs with the criterion-related variables (the MoVac-flu score of *Cognitive Empowerment*, and a score of *Vaccine Attitudes* taken from the pH1N1 Vaccine Attitude Scale), Pearson's correlation coefficients were computed across *Sample 2*, *Sample 3* and *Sample 4* (see Table 9). Next, to examine the strength of association between variables, correlation coefficients were compared following the procedure outlined by Meng, Rosenthal, & Rubin (1992). The comparison of correlations revealed that Cognitive Empowerment was more strongly related to Autonomous regulation than Introjection ($z_{Sample2} = 13.76$, $p < .001$; $z_{Sample3} = 9.94$, $p < .001$; $z_{Sample4} = 6.18$, $p < .001$), External regulation ($z_{Sample2} = 17.11$, $p < .001$; $z_{Sample3} = 13.15$, $p < .001$; $z_{Sample4} = 7.53$, $p < .001$), and Amotivation ($z_{Sample2} = 18.82$, $p < .001$; $z_{Sample3} = 14.06$, $p < .001$; $z_{Sample4} = 9.05$, $p < .001$). Cognitive Empowerment was more strongly related to Introjection than External regulation ($z_{Sample2} = 8.30$, $p < .001$; $z_{Sample3} = 6.49$, $p < .001$; $z_{Sample4} = 2.84$, $p < .01$), and

Amotivation ($z_{Sample2} = 10.04$, $p < .001$; $z_{Sample3} = 7.21$, $p < .001$; $z_{Sample4} = 5.16$, $p < .001$). Cognitive Empowerment was more strongly related to external regulation than Amotivation ($z_{Sample2} = 2.84$, $p < .01$; $z_{Sample4} = 3.03$, $p < .01$), but was equally related to External regulation and Amotivation in *Sample 3* ($z_{Sample3} = 1.44$, $p = .15$).

Across *Sample 3*, Vaccine Attitudes were more strongly related to Autonomous regulation than Introjection ($z = 5.40$, $p < .001$), External ($z = 8.59$, $p < .001$), and Amotivation ($z = 9.12$, $p < .001$). Vaccine Attitudes were more strongly related to Introjection than External regulation and Amotivation ($z = 5.85$, $p < .001$; $z = 6.25$, $p < .001$, respectively), but were equally related to External regulation and Amotivation ($z = 0.99$, $p = .32$).

Table 9

Correlations Among the MoVac-flu, Vaccine Attitudes and TSRQ-Flu Scales

	Autonomous			Introjection			External			Amotivation		
	s2	s3	s4	s2	s3	s4	s2	s3	s4	s2	s3	s4
Cognitive Empowerment	.83***	.908***	.853***	.361***	.515***	.376***	-.121**	-.100	.016	-.257***	-.230**	-.356**
Vaccine Attitudes	-	.769***	-	-	.493***	-	-	-.072	-	-	-.161*	-

Note. *$p < .05$, **$p < .01$, ***$p < .001$

The validity coefficients demonstrated good consistency across samples. As expected, Cognitive Empowerment was positively correlated with Autonomous regulation, and negatively correlated with External regulation and Amotivation. One directional exception was observed between External regulation and Cognitive Empowerment in *Sample 4*. In line with expectations, Vaccine Attitudes were positively correlated with Autonomous regulation, and negatively correlated with External regulation and Amotivation. The positive correlation between Introjection, Cognitive Empowerment and Vaccine Attitudes were not surprising given the item loadings during Phase 2.

Additionally, from a theoretical perspective introjection may 'somewhat' relate to internalised forms of motivation (as indicated by measures of autonomous regulation) and externalized forms of motivation (as indicated by measures of external regulation). The extent of this overlap remains undetermined within SDT (Dettweiler et al., 2015).

Predictive Validity. Multinomial logistic regression analyses as a function of future vaccination behaviour were conducted to assess the predictive validity of the TSRQ-Flu scale. Analyses were conducted using RStudio (2019) version 1.2.5019, and the *mlogit* (Croissant, 2019), *BaylorEdPsych* (Beaujean, 2012), *mvnmle* (Gross & Bates, 2018), *mice* (Buuren & Groothuis-Oudshoorn, 2011), and *mctest* (Imdadullah et al., 2016, 2019) packages.

Evaluation of Models. There was an absence of missing data, or multicollinearity as indicated by the variance inflation factor (VIF). The highest score was for Introjection regulation ($VIF_{Sample3} = 1.91$). The final analysis was conducted using self-reported likelihood of future vaccination as the categorical outcome variable, coded as 0 = *Not vaccinated* ($n = 107$), 0.5 = *Hesitant* ($n = 45$), 1 = *Vaccinated* ($n = 260$), see Appendix B for data distributions and assumptions. Table 10 provides a summary of the multinomial logistic regression analyses. Across the three samples, Autonomous regulation was positively associated with the likelihood to get vaccinated, compared to those who would not get vaccinated ($OR_{Sample2} = 8.91$, $p < .001$; $OR_{Sample3} = 7.28$, $p < .001$; $OR_{Sample4} = 5.77$, $p < .001$) or were uncertain ($OR_{Sample2} = 3.35$, $p < .001$; $OR_{Sample3} = 2.71$, $p < .001$; $OR_{Sample4} = 2.96$, $p = .037$). In *Sample 2*, Introjection was positively associated with the likelihood to get vaccinated, compared to those who would not get vaccinated ($OR_{Sample2} = 1.54$, $p = .030$) or were uncertain ($OR_{Sample2} = 1.36$, $p = .040$); no significant associations of Introjection were found in samples 3 and 4. In *Sample 2*, External regulation was

negatively associated with the likelihood to get vaccinated, compared to those who were uncertain to vaccinate ($OR_{Sample2}$ = .70, p = .021); no significant associations of External regulation were found in samples 3 and 4. No significant associations of Amotivation were found in across the three samples.

Table 10

Summary of the Multinomial Logistic Regression Results Predicting Flu Vaccination Behaviour

Predictor	Hesitant				Not vaccinated			
	b	*s.e.*	OR [95% CI]	*p*	*b*	*s.e.*	OR [95% CI]	*p*
Sample 2 (n = 412)								
Autonomous	-1.21	.19	.30 [0.20, 0.44]	***	-2.19	.25	.11 [0.07, 0.18]	***
Introjection	-.32	.16	.73 [0.54, 0.99]	**.040**	-.43	.20	.65 [0.44, 0.96]	**.030**
External	.35	.15	1.42 [1.05, 1.92]	**.021**	.30	.17	1.35 [0.97, 1.88]	.071
Amotivation	.08	.15	1.08 [0.80, 1.46]	.611	-.12	.18	.89 [0.62, 1.26]	.502
Sample 3 (n = 152)								
Autonomous	-1.00	.28	.37 [0.21, 0.64]	***	-1.99	.38	.14 [0.07, 0.29]	***
Introjection	-.29	.23	.75 [0.48, 1.18]	.217	-.14	.27	.87 [0.51, 1.47]	.598
External	.03	.19	1.04 [0.72, 1.50]	.854	.23	.20	1.26 [0.84, 1.88]	.264
Amotivation	.41	.23	1.50 [0.96, 2.36]	.075	.12	.26	1.13 [0.67, 1.89]	.650
Sample 4 (n = 88)								
Autonomous	-1.08	.52	.34 [0.12, 0.94]	**.037**	-1.75	.49	.17 [0.07, 0.46]	***
Introjection	.25	.39	1.29 [0.60, 2.76]	.517	.25	.35	1.29 [0.65, 2.56]	.469
External	-.18	.39	.83 [0.39, 1.78]	.634	.17	.33	1.18 [0.62, 2.26]	.617
Amotivation	.26	.43	1.30 [0.56, 3.01]	.540	-.28	.35	.76 [0.38, 1.51]	.433

Note. Reference level = Vaccinated. For *Sample 2*, LR $\chi^2(10) = 394.56$, $p < .001$, $R^2 = .54$ (McFadden), -2LL = -332.6. Percent correct = 84%. For *Sample 3*, LR $\chi^2(10) = 124.03$, $p < .001$, $R^2 = .43$ (McFadden), -2LL = -163.3. Percent correct = 78%. For *Sample 4*, LR $\chi^2(10) = 41.45$, $p < .001$, $R^2 = .38$ (McFadden), -2LL = -68.9. Percent correct = 85%.
Bold denotes $p < .05$; ***$p < .001$.

Incremental validity. To assess to incremental validity of the TSRQ-Flu scale above and beyond Motors of Vaccination Flu, a hierarchical binary logistic regression analysis was conducted using *Sample 2*. Analysis were carried out using RStudio (2019) version 1.2.5019, and the *stats* (R Core Team, 2019), *BaylorEdPsych* (Beaujean, 2012), *mctest* (Imdadullah et al., 2016, 2019), *psych* (Revelle, 2018), *finalfit* (Harrison et al.,

2019), *mvnmle* (Gross & Bates, 2018), *mice* (Buuren & Groothuis-Oudshoorn, 2011), and *ResourceSelection* (Lele et al., 2019) packages.

Data preparation. Predictor variables were screened for missing data. Of the 412 participants, 21.8% of participants did not report their age, 18.9% did not report their gender, and 3.4% did not report knowledge of their line manager vaccination status. Little's (1988) Missing Completely at Random Test (MCAR) indicated that data could be assumed missing at random $\chi^2(37) = 39.89$, $p = .343$. Therefore, cases were excluded pairwise prior to analyses, the remaining sample was $n = 314$. There was an absence of multicollinearity as indicated by the variance inflation factor (VIF). The highest scores were autonomous regulation (VIF = 5.68) and cognitive empowerment (VIF = 3.96). The final analysis was conducted using past vaccination behaviour as the dichotomous outcome variable Not vaccinated ($n = 116$), Vaccinated ($n = 198$), see Appendix B for full analysis.

Model Evaluation. For a summary of incremental validity see Table 11. At step 1, results indicated that demographics did not significantly predict vaccination behaviour, Step LR $\chi^2(3) = 2.39$, $p = .496$. At step 2, knowing a line manager's flu vaccination status, significantly predicted vaccination behaviour over and above demographic variables, Step LR $\chi^2(2) = 22.25$, $p < .001$. Specifically, knowing that a line manager had received the flu vaccination (compared to not knowing) increased the odds of being vaccinated by a factor of 2.57, 95% CI [1.55, 4.33], Wald $\chi^2(1) = 3.59$, $p < .001$. Knowing that a line manager had not been vaccinated (compared to not knowing) decreased the odds of vaccination by 0.35, 95% CI [0.12, 0.94], Wald $\chi^2(1) = -2.01$, $p = .044$. At step 3, the addition of the measure for cognitive empowerment further improved the predictability of vaccination behaviour, Step LR $\chi^2(1) = 145.88$, $p < .001$. Cognitive Empowerment was the strongest predictor, a 1-point increase on the 7-point Likert scale increased the odds of being

vaccinated by a factor of 3.54, 95% CI [2.74, 4.74], Wald $\chi^2(1) = 9.07$, $p < .001$. Knowing that a line manager had received the flu vaccination remained an important predictor OR = 2.48, 95% CI [1.26, 4.99], Wald $\chi^2(1) = 2.60$, $p = .009$.

At the final step, adding the TSRQ-Flu constructs contributed to the improved predictability of flu vaccination behaviour, Step $\chi^2(4) = 70.74$, $p < .001$. Specifically, the strongest significant predictors were the measure of Autonomous regulation and Introjection, a 1-point increases on the 7-point Likert scale increased the odds of being vaccinated: Autonomous regulation, OR = 2.69, 95% CI [1.79, 4.33], Wald $\chi^2(1) = 4.44$, $p < .001$; Introjection, OR = 1.51, 95% CI [1.10, 2.13], Wald $\chi^2(1) = 2.45$, $p = .014$. The overall model contributed to the predictability of HCP flu vaccination behaviour over and beyond the baseline model, Model LR $\chi^2(10) = 241.26$, $p < .001$, -2LL = -172.37, and provided a good fit to the observed data, Hosmer and Lemeshow's $\chi^2(8) = 6.89$, $p = .548$.

Table 11

Summary of the Hierarchical Binary Logistic Regression Results Predicting Flu Vaccination Behaviour

	Step 1			Step 2			Step 3			Step 4			Step 4		
	b	*s.e.*	*p*	*b*	*s.e.*	*p*	*b*	*s.e.*	*p*	*b*	*s.e.*	*p*	OR	95% CI for OR	
														Lower	Upper
Step 1: Demographics variables															
Gender (self-describe)	-1.73	1.31	.189	-1.18	1.35	.383	-1.11	1.96	.571	0.02	2.08	.993	1.02	0.02	42.67
Gender (female)	-0.54	0.49	.273	-0.62	0.51	.217	-1.20	0.69	.083	-1.61	0.89	.070	0.20	0.03	1.11
Age	0.00	0.01	.846	-0.01	0.01	.587	0.01	0.02	.400	0.02	0.02	.345	1.02	0.98	1.06
Step 2: Social variable															
Line manager not vaccinated				-1.04	0.52	**.044**	-0.27	0.70	.696	-0.76	0.92	.407	0.47	0.08	2.78
Line manager vaccinated				0.94	0.26	***	0.91	0.35	**.009**	0.91	0.42	**.031**	2.50	1.10	5.88
Step 3: Criterion-related variable															
Cognitive empowerment							1.27	0.14	***	0.36	0.25	.156	1.43	0.85	2.33
Step 4: Motivation regulations															
Autonomous										0.99	0.22	***	2.69	1.79	4.33
Introjection										0.41	0.17	**.014**	1.51	1.10	2.13
External										-0.27	0.15	.071	0.77	0.57	1.02
Amotivation										0.21	0.16	.199	1.23	0.90	1.71
Model fit															
Hosmer and Lemeshow test			13.62			9.23			8.16			6.89			
Sig.			.092			.323			.418			.548			
Nagelkerke R^2			.01			.10			.57			.73			

Note. For Step 1, Step LR χ^2 (3) = 2.39, p = .496, -2LL = -411.24, percent correct = 63.38%. For Step 2, Step LR χ^2 (5) = 24.64, p < .001, -2LL = -388.99, percent correct = 65.61%. For Step 3, Step LR χ^2 (6) = 170.52, p < .001, -2LL = -243.11, percent correct = 83.44%. For Step 4, Step LR χ^2 (10) = 241.26, p < .001, -2LL = -85.8, percent correct = 89.17%.
Gender is compared to males; Line manager is compared to not knowing a line manager's vaccination status.
OR = Odds Ratio. *Bold* denotes significance p < .05; *** p < .001.

Exploratory analysis of Introjection regulation. From a theoretical perspective introjection may 'somewhat' relate to internalised forms of motivation (as indicated by measures of autonomous regulation) and 'somewhat' relate externalised forms of motivation (as indicated by measures of external regulation). The extent of this overlap remains open within SDT (Ünlü & Dettweiler, 2015). As introjection appeared to be consistently positivity associated with an increased likelihood of vaccination (see Table 8, 9, 10 and 11), the proportion of internalisation or externalisation of introjection was assessed across samples and is summarised in Table 12. Analyses were conducted using the SDT package which uses convex quadratic programming to assess the optimal shares of selected factors. It is suggested that "the computed shares are larger for motivation regulation types theoretically closer to one another" (Ünlü, 2019, p. 8).

Table 12

Internalization of Introjection Regulation as a Shared Proportion Across Samples and Past Vaccination Behaviour

	Extent of Internalisation of Introjection	
	Internal Share	External Share
Overall		
Sample 2	0.417	0.583
Sample 3	0.531	0.469
Sample 4	0.347	0.653
Past Behaviour (Vaccinated)		
Sample 2 (n = 270)	0.368	0.632
Sample 3 (n = 94)	0.424	0.576
Sample 4 (n = 70)	0.311	0.689
Past Behaviour (Not vaccinated)		
Sample 2 (n = 142)	0.664	0.336
Sample 3 (n = 58)	0.849	0.151
Sample 4 (n = 18)	0.810	0.190

Note. Extent of internalization is measured relative to autonomous regulation and external regulation using the method described by Ünlü & Dettweiler (2015).

Overall, the share of Introjection was more externalised in *Sample 2* (0.58) and *Sample 4* (0.65). The extent of externalisation was explored as a function of past vaccination behaviour. A consistent pattern emerged across all samples, suggesting that introjection was more internalised for those who did not vaccinate during the previous flu season.

Discussion

Summary of Evidence

The primary objective of this study was to establish reliability and validity evidence for an adapted version of the Treatment Self-Regulation Questionnaire (TSRQ) assessing HCP motivations of flu vaccination uptake. The underlying factor structure was supported through CFA analyses across two independent samples, and reflected outcomes similar to other TSRQ measures applied to different health behaviours (Levesque et al., 2006). Invariance analysis indicated that factor structure could be considered equivalent for groups of HCP who did vaccinate against the flu (vaccinators) and who did not get vaccinated against (non-vaccinators). One new item *"It's important to get the jab to protect my colleagues and patients from the flu."* had a stronger factor loading within the vaccinator group, suggesting a stronger internalised motivation to protect patients and colleagues against the flu. Factors were discriminant, with directional correlations and associations consistent to SDT and other TSRQ measures (Denman et al., 2016; Levesque et al., 2006). Additionally, the scale demonstrated good reliability and responses were not found to be significantly affected by social desirability biases. The four factors were distinct from, and contributed over and beyond other psychosocial measures of flu vaccination behaviour.

Cognitive Empowerment and Vaccine Attitudes were most strongly related to Autonomous motivation. Correlations among External regulation and Vaccine Attitudes were low, but consistent with other TSRQ validations (Denman et al., 2016). Thus, previous recommendations that autonomous regulation may be of particular importance when collectively measuring psychosocial drivers of vaccination decisions (Denman et al., 2016) were supported. In light of the results, this study adds that introjection and external regulation may also be of particular importance for understanding HCP decisions to vaccinate against the flu.

Exploratory analysis of the extent of internalisation for introjection revealed that Introjection was on average more externalised than an internalised form of motivation for getting the flu vaccination. However, consistent differences emerged between those who stated that they previously were or were not vaccinated against the flu. For those not vaccinated, Introjection had a higher contextual share with internalised regulations. Additionally, Introjection was positively associated with self-report measures of Cognitive Empowerment. Specifically, a one-unit increase of Introjection regulation increased the likelihood of those unwilling or uncertain to vaccinate next flu season. Taken together these findings support each other, as not only can introjection can be considered 'somewhat internal', but more internalised forms of regulation are associated with improved behavioural outcomes (Deci & Ryan, 2000).

Future research could further investigate the role of introjection regulation in HCP decisions to vaccinate against the flu. However, the approach to addressing the role of introjection regulation should be done so with caution. The items in the TSRQ-Flu measuring introjection were framed in accordance with guilt avoidance (i.e., internal punishment) for example, "I'd feel guilty if I didn't get the flu jab.". Attempts to increase

perceived feelings of guilt may be met with backfire effects or increased negative perceptions and higher feelings of anger (Coulter & Pinto, 1995; Miller et al., 2007). For example, emotional responses towards messages using varied levels of appeals to guilt found that high-level guilt appeals provoked increased feelings of anger and reduced happiness. Although guilt appeal was found to be a significant predictor of increased behavioural intention, higher levels of guilt may lead to rejection of persuasive messages (Coulter & Pinto, 1995). In other words, the opposite behaviour occurs to that of the intended target behaviour. Psychological reactance theory (S. S. Brehm & Brehm, 1981) offers that this rejection may be a result of psychological attempts to restore threats to perceived freedoms (further discussed in Chapter 5 and Chapter 6). Therefore, rather than attempt to experimentally manipulate increased guilt perception, perhaps future research could first investigate the role of introjection using qualitative studies. It would be interesting to gain insight into how messages appealing to guilt are perceived given the distinct pattern for the extent of internalisation between HCP who had vaccinated or not vaccinated in the past.

Another avenue that future research could explore, which would complement this scale validation, is the computation of the Relative Autonomy Index (see Grolnick & Ryan, 1989; Williams et al., 1996) for HCP decisions to vaccinate against the flu. This measure applies different weightings to each construct of extrinsic motivation, to compute a direct measure of motivational autonomy (see Vaz et al., 2016). However, the computation of this measure is not without its limitations, as the biasing effects of internal and external share of the constructs are not accommodated (Ünlü, 2019). However, the recently developed R package *SDT* (Ünlü, 2019) provides an avenue for future computation. Nevertheless, it was not within the parameters of this research program to compute a Relative Autonomy Index as additional samples would be preferable to

corroborate the stability of the measure; in particular the support of an organisational sample with access to actual vaccine uptake rates would be preferable.

Limitations

This scale, to the best of our knowledge, is the first attempt to measure HCP motivation regulations to get the flu vaccine, as indicated by self-determination theory. Although the results are promising they are not without limitations. First, data was based on convenience sampling of HCP, and the majority of HCP across all samples stated that they had previously received the flu vaccination in the past. Second, group invariance analysis was conducted in the largest sample only as the R package required a minimum group membership of n =100 (Jorgensen et al., 2019). Therefore, measurement invariance could not be corroborated against additional samples. Third, the strength of evidence for predictive validity cannot be certain, particularly as group membership for hesitant vaccinators was disproportionate. Although predictive validity analysis was exploratory and conducted to examine the association with self-reported future behaviour, the outcomes were not based on actual vaccination uptake rates, nor did they account for additional demographic or psychosocial measures which may account for additional variance accounted for in outcome predictions. Future research should look to corroborate findings using organisation-specific populations, enabling access to actual uptake rates of the flu vaccination, thus strengthening predictive validity and overcoming potential issues associated with the intention-behaviour gap (Chung et al., 2018). Fourth, item reduction resulted in two-item subscales for introjection, external and motivation, which may be considered problematic in securely assessing latent constructs (Eisinga et al., 2013). Although our findings demonstrated good reliability, and are in-line with other TSRQ scales whereby two-item scales are used (Denman et al., 2016; Levesque et al., 2006), future research could look to use a larger set of items to measure external regulation and

introjection, particularly as introjection demonstrated associations with both self-reported past and future vaccination behaviour.

Implications for Policy and Practice

The use of the TSRQ-Flu scale provides a promising insight into understanding HCP motivation to get the flu vaccination. It adds to previous studies seeking to understand why HCP may want to get vaccinated (Kassianos et al., 2018; Vallée-Tourangeau et al., 2018), by extending beyond cognitive empowerment and typical determinations of perceived benefits and risks. According to SDT, positive behavioural outcomes are associated with improved perceptions of autonomy (Ryan & Deci, 2000). The TSRQ-Flu may provide healthcare managers a deeper insight into the energising component of vaccination behaviour (e.g., internalized value or guilt avoidance) but also may help to understand the extent to which autonomy may be perceived as thwarted (apathy or acting to satisfy external pressure). Improving the understanding of what drives HCP flu vaccination decisions may help to develop tailored interventions seeking to improve vaccination uptake.

Conclusions

Applying the SDT framework to understand the role of autonomy in HCP decisions to vaccinate against the flu afforded promising outcomes. The measure presented within this chapter provides a useful and valid tool to assess HCP flu vaccination decision-making, and may be used equally to evaluate those who do and do not vaccinate against the flu. To strengthen reliability and validity, future research should corroborate findings using organisation-specific populations whereby actual vaccination uptake rates are available.

Chapter 5: Communicating the Request to Vaccinate Against the Flu: A Brief Content Analysis of the NHS Flu Fighter Campaign

Within this chapter the steps taken to develop the experimental materials used in Chapter 6 are presented. Materials were developed over two phases: Phase 1 is a content analysis of NHS flu Fighter materials, whereby eight themes from 21 unique messages available online during May 2018 were identified. Phase 2 presents the initial phase for the development of communication materials that aim to reflect a high-controlling versus low-controlling communication style. A total of 38 messages were developed in preparation for the experimental phase presented in Chapter 6. Within this chapter, theoretical approaches to designing promotional health messages are acknowledged, however at this preparatory stage such applied uses of the frameworks or approaches were not purposefully implemented. Rather, the approach was to understand if key themes would be present within the NHS Flu Fighter messages. Then, adapt those messages to increase controlling or autonomy-supportive language while ensuring that the message remained as close to the original NHS Flu Fighter message structure as possible. In other words, it was not within the scope of this Chapter to specifically design theoretically driven promotional health messages.

The Present Study

Health communication often aims to influence, support or encourage and enhance healthy choices. Multiple frameworks and approaches such as framing, social norms and the use of emotional appeal can support the designing of health messages (Edgar & Volkman, 2012; M. M. Turner, 2012). Each approach is briefly discussed, as within the NHS annual flu campaigns use health promotion messages encouraging HCP to receive the

flu vaccination (recall the NICE recommended incentives described in Chapter 1). However, it is important to note that the approaches described are not an exhaustive list.

The effectiveness of health messages using emotional appeals have demonstrated mixed effects for the acceptance of messages and the activation of target health behaviours. For example, negative emotional responses such as disgust and fear, were associated with improved effectiveness of smoking cessation messages (Hammond et al., 2004). Induced feelings of regret (that is failing to act) within influenza vaccination related health message are perceived as patronising (Mowbray et al., 2016), and increased guilt appeals have been associated with reduced HPV vaccination intentions (Carcioppolo et al., 2017). Health messages attempting to evoke emotional responses may have important implications for decision making and behavioural outcomes (Lipkus, 2007), leading to an increased likelihood of message rejection (Graton & Mailliez, 2019). This rejection of promotional health messages may be explained by the theory of psychological reactance (S. S. Brehm & Brehm, 1981) whereby psychological arousal occurs when behavioural freedoms are threatened.

Loss-framed messages (which emphasise negative effects of noncompliance) have been found to be slightly more persuasive in achieving activation disease detection behaviours than gain-framed messages (which emphasise positive effects of compliance), although the differences remain small (for a meta-analysis, see O'Keefe & Jensen, 2007). In addition, gain-framed promotional health messages encouraging flu vaccination revealed reduced behavioural intention to receive the flu vaccine compared to loss-framed messages (Kim et al., 2019).

Social norms have a predictive role in understanding behaviour regulations (Mollen et al., 2010) and are behaviours enacted due to the influence of others at the

collective level (for a review see Lapinski & Rimal, 2005). Within communication campaigns, targeting social norms may increase the likelihood of positive behavioural changes. For example, posters appealing to normative behaviours (that is the desire the to obtain social approval) reduced students' likelihood of alcohol consumption (J. Turner et al., 2008). However, the use of social norms within communication campaigns may have negative consequences for those already inclined to engage with target behaviour. For example, the use of descriptive norms which informed participants of the average household energy consumption in their area, increased energy consumption within households already pertaining to have low energy consumption (Schultz et al., 2007). As such, messages attempting to use social norms to change behaviour may also have unintended or opposite effects on the target behaviour and decision making.

Phase 1: Content analysis

The aim of the preparatory study described next was to understand how appeals to receive the flu vaccination are communicated within NHS Flu Fighter campaigns.

Procedure and Results

Twenty-nine short promotional flu vaccine messages aimed at HCP were identified and downloaded from the NHS Employers website [https://www.nhsemployers.org/flufighter]. Both graphics and text were included representing email banners, screensavers and posters. Of the 29 messages downloaded, 21 contained a unique message. Next using a thematic approach to analysis, eight key themes were identified from the 21 short messages see Table 13 for a description of the themes). As this analysis was intended as a preliminary step to develop experimental materials, an inductive approach was used without any prior coding structure was not specifically developed. However, it is important to acknowledge that the research within this thesis

seeks to explore HCP vaccination behaviour using the theoretical lens of SDT. Therefore, there was a prior research-led consideration for identifying phrases seeking to support or thwart a feeling of choice using words previously adopted with the interventions identified in Chapter 3 such as 'should or 'could' (Moustaka et al., 2012).

First, common phrasing within the messages were identified and then short messages were revisited to address overlapping of themes (for specific theme identification and a full list of unique messages see Appendix C). It was not apparent that phrases appealed to the regulations of autonomy and therefore this was not included as a theme.

Table 13

Description and Examples of Themed Categories

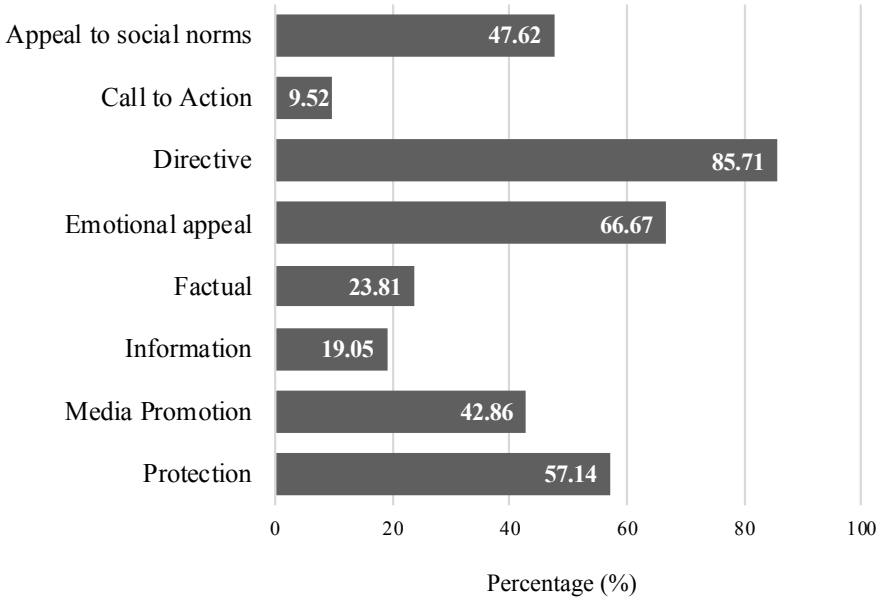
Theme	Description	Example phrases
Appeal to social norms	Encourages social norms.	*"7 out of 10 people with flu have no symptoms. **What about you**?"*
Call to Action	Instruction intending to provoke an immediate response.	*"go to [website] to find"*
Directive	An order or an instruction.	*"don't take flu with you"* *"get your flu jab."*
Emotional appeal	Personal appeal inciting an emotional response that encourages action.	*"do you realise how important you are?"*
Factual	Provides factual information.	*"7 out of 10 people with flu have no symptoms"*
Information	Provides or directs to information sources.	*"find out why getting your flu jab matters"*
Media promotion	Use of social media i.e., hashtags.	*"#flufighter"*
Protection	Refers to protection against the flu virus, for the self or others.	*"protect yourself and those around you"*

Short messages were then individually assessed for the number of the themed categories present (see Figure 4). The most common theme to occur was directedness (86%), in which the short message communicated an order or instruction such as "don't"

or “get”. Next was emotional appeal (67%) which included messages such as “your loved ones”, and “do you realise how important you are”. Messages incorporating facts about the flu such as “7 out of 10 people with flu have no symptoms” were proportionally less prevalent (24%). Messages containing further sources of information (19%) or calls to action (10%) were also limited.

Figure 4

Percentage Counts of the Eight Themes Within the 21 NHS Flu Fighter Campaign Messages



Discussion

Within the NHS flu fighter campaign, it could be considered that messages such as “protect yourself, your family, colleagues and patients” or “protect your loved ones” attempt to appeal to feelings of guilt. Given that the role of guilt has demonstrated positive and negative associations with behavioural activation including phrases appealing to guilt should be done so with caution. For example, experimental studies exploring the role of guilt have been linked with the increases in pro-social behaviour for bargaining games

(Ketelaar & Tung Au, 2003). Whereas, increased appeals to guilt have been associated with reduced HPV vaccination intentions (Carcioppolo et al., 2017). Moreover, within the TSRQ-Flu scale study presented in Chapter 4 the role of injection (framed as guilt avoidance) emerged as having positive association with the likelihood of vaccination, and other determinants of vaccination behaviour. However, within *Sample 4* the association was negative suggesting that increased introjection reduced positive behavioural outcomes. Although this latter finding was non-significant, the role of introjection should be further examined without the confound of other manipulations.

To this end, it was considered that within the development of experimental materials appeals to guilt should be examined separately, as this may act as a confound in attempts to successfully develop autonomy-supportive versus controlling health communication. However, as the role of guilt was not within the scope of this research, it is recommended that future research investigate the role of guilt from an SDT perspective in communication campaigns aimed at increasing flu vaccination uptake among HCP.

Phase 2: Development of Communication Materials

Next through the lens of SDT, NHS Flu Fighter messages were adapted to include a discourse which could be considered either autonomy-supportive or controlling.

Procedure and Results

Using the themes which emerged during analysis of flu fighter materials, messages were directly adapted to represent a more controlling or autonomy-supportive communication style. The approaches taken with the communication based behavioural interventions identified in Chapter 3 were considered in the designing of materials. Autonomy-supportive versus controlling styled text-message campaigns were used to

promote increased physical activity (Coa & Patrick, 2016; Kinnafick et al., 2016), and tailored newsletters adopting an autonomous verses directive communication style promoted health screening (Resnicow et al., 2014). In addition, literature for other health behaviours, that were not rooted in SDT, but made use of low-controlling and high-controlling language in communication campaigns, was identified. For example, Miller et al. (2007) manipulated the level of controlling language within short physical activity health messages aimed at young adults. Significant differences for the perceived threat to freedom between low-controlling and high-controlling messages were evident. Therefore, the methods outlined in Miller et al. (2007) for manipulating autonomy-supportive versus controlling messages were adopted in the adaption of the NHS Flu Fighter materials. 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". In addition, new messages were created, see Table 14 for an example of the comparison between the original NHS Flu Fighter messages and those manipulated to be more autonomy-supportive of controlling.

Table 14

Example of the Level of Control Adapted Within NHS Flu Fighter messages

Original	[Number] STAFF AT [Hospital] GOT THEIR FLU JAB LAST YEAR. WHAT ABOUT YOU? GET THE FLU JAB
Autonomy-supportive	75% of staff got their flu jab last year, **if you** were one of them, **thank you!**
Controlling	75% of staff got their flu jab last year, **were you** one of them?
Original	Don't take flu with you. Be a flu fighter, get your flu jab. Protect yourself and those around you
Autonomy-supportive	**You could be** taking the flu with you, **together we can** reduce the risk of infection. **Consider getting** the flu vaccine this winter.
Controlling	**Don't** take the flu with you, **you must** reduce the risk of infection. **Make sure that you get** the flu vaccine this winter.

Note. Difference between messages are in bold.

To minimize the risk of message length confounding results (Blandford et al., 2008), the word count for each message pair did not differ substantially between the different communication styles, allowing up to a three-word difference for grammatical sentence structure. To reduce the risk that message complexity would act as a confounding variable, we assessed the Flesch readability score (Flesch, 1948). Improved readability in health-related materials may lead to better understanding and co-operation (Ley & Florio, 1996). Overall, readability scores for autonomy-supportive messages were 71.6% (word count = 348), and controlling messages were 78.3 % (word count = 347), for a full list of adapted materials see Table 15.

Table 15

Pilot Statements and Readability Scores

	Readability %	Word Count
Autonomy-Supportive		
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. Consider getting the flu jab.	71.6	32
You can protect yourself against the flu virus reducing your risk of developing flu-related health complications.	64.4	16
75% of staff got their flu jab last year, if you were one of them, thank you!	100	17
It's flu season, have you considered getting the flu jab?	78.2	10
You could protect yourself and those around you.	82.3	8
We all have a duty of care to our patients, consider having the flu jab to protect against the spread of the infection.	65.7	23
We have a duty to protect ourselves, our families, colleagues and patients.	60.7	12
You could be taking the flu with you, together we can reduce the risk of infection. Consider getting the flu vaccine this winter.	70.1	23
Vaccines are readily available. You could book your appointment today!	41	10
Delaying the flu jab may put you at more risk of catching the flu. Have you considered booking your flu appointment?	79.3	21
You could get the flu vaccine to lower the chance of you catching or spreading the virus to vulnerable patients in your care.	65.7	23
Let's avoid the ones we love becoming the ones we treat. Consider getting the flu jab.	71.8	16
You could be part of the solution to prevent premature death, you could get a flu jab.	80	17
Flu kills, but you could help to fight it. Consider having the flu jab this season.	92.9	16
Let's not spread the flu. Let's get the flu jab to reduce the risk to patients in our care!	100	19
The flu virus can cause mild to severe illnesses, even death. As Healthcare Professionals we have a responsibility to reduce the risk of infection. Will you get the flu vaccine this season?	61.1	32
Having the flu vaccine can help to lower the chance of you catching or spreading the flu.	80	17
The flu vaccination may be considered as one of the best ways to protect against the spread of infection.	62.8	19
By choosing to protect ourselves against the virus we'll reduce our risk of developing flu-related health complications.	30.3	17

	Readability %	Word Count
Controlling		
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. Get the flu jab.	81.2	30
You must protect yourself against the flu virus reducing your risk of developing flu-related health complications.	26.6	16
75% of staff got their flu jab last year, were you one of them?	100	14
It's flu season, you should get the flu jab!	100	9
You must protect yourself and those around you.	82.3	8
You have a duty of care to your patients, you ought to have the flu jab to protect against the spread of the infection.	76.7	24
It is your duty to protect yourself, your family, colleagues and patients.	60.7	12
Don't take the flu with you, you must reduce the risk of infection. Make sure that you get the flu vaccine this winter.	92.1	23
Vaccines are readily available. Don't delay, book your appointment today!	32.5	10
Delaying the flu jab will put you at more risk of catching the flu. Don't delay it, book your flu appointment today.	84.1	22
You should get the flu vaccine to lower the chance of you catching or spreading the virus to vulnerable patients in your care.	65.7	23
Don't let the ones you love become the one's you treat. Get the flu jab.	97.7	15
You should be part of the solution to prevent premature death. Get the flu jab today!	82.3	16
Flu kills and you should be helping to fight it. Make sure you have the flu jab this season!	100	19
Don't be the one to spread the flu. Get the flu jab to reduce the risk to patients in your care!	100	21
The flu virus can cause mild to severe illnesses, even death. As a Healthcare Professionals you have a responsibility to reduce the risk of infection. You must get your flu vaccine this season!	62.3	33
You should get the flu vaccine to lower the chance of you catching or spreading the flu.	85	17
The flu vaccination ought to be seen as one of the best ways to protect against the spread of infection.	72.3	20
You must protect yourself against the virus to reduce your risk of developing flu-related health complications.	31.9	16

Discussion

The aim of this preparative study was to determine common phrasing used within the NHS 2019 Flu Fighter campaign. A second aim was to apply central tenets of extrinsic motivation so that the information presented would take on either an autonomy-supportive or controlling discourse. Eight themes emerged from analysis of the NHS communication campaign, of which emotional appeal and directive language were most prominent in communicating the request to get the flu vaccination. Then, 38 messages were developed (19 autonomy-supportive and 19 controlling) in preparation for the experimental phase.

Due to the timeline of the research program, the search scope was conducted 3 months prior to the start of the flu season, this may have meant that all Flu Fighter campaigns materials were not fully available. In addition, only materials available online were assessed, meaning that the analysis was limited to a small sample. However, given that the website was a primary source for leading a flu campaign it was considered an appropriate avenue in order to adapt materials. A third limitation of this study was that it was not intended to be an exhaustive thematic content analysis, rather it evidenced and demonstrated the development of experimental materials.

Chapter 6: Examining the Moderating Effect of Autonomy on Promotional Health Messages

The present chapter uses the 38 short promotional health messages developed in Chapter 5, and outlines a pilot study examining the effectiveness of the message threating the freedom of choice, and an experimental study examining if the effect of the promotional health messages depended on the prior motivation to vaccinate against the flu. The pilot study enabled single sentence messages to be combined into one short paragraph requesting annual flu vaccination. HCP were exposed to one of two conditions that used either a low-controlling message or high-controlling message. Differences in participants certainty to get vaccinated after having read either an autonomy-supportive message (low-controlling) or a controlling message (high-controlling) were examined. Secondary analyses sought to determine if any changes within the certainty to get vaccinated depended upon the inherent motivation to get the flu vaccine (as measured by the TSRQ-Flu scale developed in Chapter 4).

The Present Study

Recall that self-determination theory (SDT) is a central theory of human motivation, which has been applied across various domains such as health, education and work. For behavioural outcomes to be realised three basic psychological needs should be satisfied: the need for autonomy, competence and relatedness (Deci & Ryan, 2000). The theory identifies that the root of behaviour ownership manifests in the fundamental need for autonomy, whereby an individual who perceives choice within a situation will experience higher levels of autonomy, which in turn has a positive effect on behavioural outcomes and can improve the sustainment of behaviour change (Ryan & Deci, 2000). Autonomy is distinguished by two forms of motivation, *intrinsic* and *extrinsic*. Recall that,

intrinsic motivation refers to a behaviour initiated for one's own sake, interest and or enjoyment. Extrinsically motivated behaviours are initiated to satisfy external demands or imposed rewards (external regulation), or the avoidance of guilt or attainment of pride (introjected regulation). These two regulations form part of controlled regulation, which can result in short-lived behaviour change (Ryan & Deci, 2000).

A common approach to address low vaccination uptake is the use of information campaigns providing arguments for vaccination. Yet, educational campaigns aimed at HCP have only seen small effects (Lehmann et al., 2015). Such approaches may fail because they rely on a limited understanding of the drivers of vaccination behaviours among HCP. An alternative approach originates from behavioural sciences and seeks to identify psychosocial drivers that may determine vaccination behaviour (Bíró, 2013; Vallée-Tourangeau et al., 2018; Wheelock et al., 2014). Through a comprehensive assessment of HCP attitudes and underlying motivations, bespoke intervention strategies would likely be more successful in the improvement of vaccination uptake (Akan et al., 2016; Bíró, 2013; Rashid et al., 2016; Seale et al., 2016; Vallée-Tourangeau et al., 2018). Moreover, messaging interventions grounded in behavioural theories can offer an improved understanding of the mechanisms motivating behavioural change (van 't Riet et al., 2010).

Recall that in Chapter 3, behaviour change interventions aimed at increasing physical activity have manipulated levels of autonomy in health messages designed to communicate directly with the end user, such as text messages or newsletters (Kinnafick et al., 2016; Resnicow et al., 2014). These manipulations have provided promising results, with participants who received autonomously motivated messages having a significant increase of physical activity. As far as we are aware, information campaigns or interventions targeting HCP feelings of autonomy for getting the flu vaccine do not yet

exist. Therefore, the present study sought to advance our understanding of the role of autonomously motivated messages aimed at HCP, and if how the approach may encourage the decision to receive the flu vaccination.

RQ1: Do promotional health messages appealing to freedoms of choice have a positive impact on the decision to vaccinate against the flu?

As previously mentioned, the violation of choice in HCP vaccination decisions has been reported as a potential barrier to uptake (Baron-Epel et al., 2013; Hakim et al., 2011). Health related messages advocating behaviour are usually directive and persuasive. However, the use of explicit and directive language can be construed as controlling (McLaughlin et al., 1980), thus threatening perceived autonomy (Miller et al., 2007). For example, overtly persuasive messages designed to discourage smoking among young adults increased the likelihood of engaging with smoking behaviours (Grandpre et al., 2003). As discussed in Chapter 5, using an autonomy-supportive discourse (Vansteenkiste et al., 2006) emphasises choice and self-initiation, which reduces perceived threats to freedom or self-determination. Promotional health messages which make use of more autonomy-supportive language can reduce the perceived threat to autonomy. For example, participants who read a low-controlling promotional message regarding exercise and physical activity, demonstrated a reduced perceived threat to freedom compared to those who read a high-controlling promotional message (Miller et al., 2007). The use of forceful or persuasive language may lead to increased negative attitudes, elicit unintentional emotional responses such as fear, guilt or anger, and reduce positive behavioural intentions (for a review, see Steindl et al., 2015). In light of this, the following hypotheses were developed:

H1: Messages adopting an autonomy-supportive language will be perceived as a lower threat to freedom than messages using a controlling language.

H2a: Low-controlling messages will increase behavioural intentions to vaccinate against the flu, compared to baseline intentions.

H2b: High-controlling messages will decrease behavioural intentions to vaccinate against the flu, compared to baseline intentions

Arguably, it is permissible to consider that those who readily vaccinate against the flu may be more intrinsically motivated to do so. For example, higher levels of autonomy, framed as intrinsic motivation using the cognitive empowerment framework, have been identified as an important predictor for increased levels of flu vaccination uptake among HCP (Vallée-Tourangeau et al., 2018). Additionally, Chapter 4 provided examples of a positive association between autonomous regulation, past vaccination behaviour and future intentions to vaccinate against the flu. While external regulation was on average negatively associated with the likelihood of vaccinating against the flu, although this was not always a significant predictor. In light of this, the following hypotheses were developed:

H3a: Higher autonomous regulation will be positively associated with baseline behavioural intentions to vaccinate against the flu.

H3b: Higher external regulation will be negatively associated with baseline behavioural intentions to vaccinate against the flu.

Feelings of autonomy have been shown to moderate the effect of health-risk information. Participants with a higher level of autonomy reported greater autonomous motivation to quit smoking after reading health-risk information in comparison to reading neutral information (Pavey & Sparks, 2008). Further, autonomy has demonstrated

moderating effects of health messages on behaviour, between messages presented as either: positively promoting benefits of healthy food choices (gained-framed messages) or focussing on negative aspects of not engaging with the health behaviour (loss-framed) (Churchill & Pavey, 2013). Recall, the motivation continuum discussed in Chapter 3 comprises autonomy as six regulations: amotivation, external, introjected and autonomous (identified and integrated) and intrinsic regulation. As previously discussed, that intrinsic motivation relates to behaviours initiated out of enjoyment, and therefore this form of regulation is not considered within in the scope of this research. The TSRQ-Flu scale developed in Chapter 4 attempted to measure extrinsic motivation and included amotivation. As far as we are aware, prior to this research programme this measure of autonomy has not been formally validated and assessed in HCP flu vaccination decisions. However, in light of previous research exploring the moderating and mediating effects of autonomy in health-related, work and education contexts, it was considered that autonomy may play a similar role in the decision to vaccinate. For example, higher levels of perceived autonomy reduced negative response to information (Pavey & Sparks, 2012). Therefore, the present study sought to understand if the effect of promotional health messages depended on the prior motivation to vaccinate against the flu, the following secondary research questions were developed:

S-RQ2: Will the effect of controlling communication style be moderated by motivation as measured by the four dimensions of the TSRQ-Flu?

S-RQ2b: Will past vaccination behaviours moderate the effect of the communication style on intentions to vaccinate in the future?

Negative behavioural outcomes have been associated with promotional health messages that use controlling language (Miller et al., 2007). Previous research has found

increased levels of perceived anger towards promotional health messages that use controlling rather than autonomy supportive language (Miller et al., 2007). In addition, persuasive messages appealing to guilt have also been met with significantly higher feelings of anger (Coulter & Pinto, 1995), and it is suggested that this can lead to the rejection of the persuasive message (Graton & Mailliez, 2019). Such negative outcomes, or rejections of persuasive messages may be attributable to arousal of psychological reactance, a motivated state serving to restore perceived threats to freedom (Brehm, 1966). In light of this, the study sought to understand the perception and impact of the developed controlling communication styled messages. Therefore, the following secondary research questions were developed, forming part of secondary analyses described later in Experiment 1.

S-RQ3: Will low-controlling messages have a positive impact on behavioural intentions to vaccinate against the flu, compared to high-controlling messages?

S-RQ4: What are the perceived feelings associated with the communication styles?

S-RQ5: Are extreme baseline intentions immune to the level of control in communication styles?

Procedural Overview

The study was registered on AsPredicted.org prior to data collection [available to view at https://aspredicted.org/blind.php?x=u2zx39]. Phase 1 was a pilot study assessing low-controlling (autonomy supportive) and controlling messages developed from the content analysis described in Chapter 5. Participants were asked to rate the perceived level to threat of freedom using a 4-item scale and state their past and future vaccination behaviour. Phase 2 investigated the effect of controlled versus autonomy supportive

messages on the behavioural intention to vaccinate against the flu. Participants were randomly assigned to one of two conditions (low-controlling vs. high-controlling). Behavioural intentions were measured before and after exposure to experimental materials. Prior to viewing the experimental materials, participant's motivation toward vaccinating against the flu was assessed using the TSRQ-Flu scale. After reading the message participants were asked to rate perceived threat to freedom, feeling toward the message, and provide demographic information including past vaccination behaviour. Kingston University's Faculty of Business and Social Sciences Research Ethics Committee conferred a favourable opinion on the research protocol.

Measures

Measures to Establish Perceived Threat to Freedom. Four items developed by Dillard and Shen (2005) were used to assess the perceived threat to freedom (PTF): "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.". Responses were measured on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*); $\alpha = .927$.

Measures to Establish Perceived Self-Regulation. The 11-item TSRQ-Flu scale developed in Chapter 4 was used to asses participants' motivation towards getting the flu vaccination. It captures four regulations of autonomy: Autonomous ($\alpha = .936$), Introjection ($\alpha = .854$), External ($\alpha = .666$), and Amotivation ($\alpha = .727$). Responses were measured on a 7-point Likert scale ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

Measures to Establish Appeal to Feelings. Perceived appeals to feelings within the messages were assessed by adapting a statement used by Coulter and Pinto (1995). Participants were asked "In your opinion, how was the message attempting to make the

reader feel?". Responses to four categories ("Happy", "Guilty" "Accountable" and "Angry") were measured on a 5-point Likert scale ranging from 1 (*Not at all*) to 5 (*Very*).

Behavioural Measures. Participants were asked if they had been vaccinated against the flu during the 2018/2019 flu season categorically measured by "Yes" or "No". Participants were required to state how certain they were that they would vaccinate against the flu during the next flu season, rated on sliding scale ranging through -100 (I absolutely certain that I WILL NOT vaccinate against the flu), to 100 (I am absolutely certain that I WILL vaccinate against the flu), 0 represented (I have absolutely no idea whether I will or will not vaccinate against the flu).

Phase 1: Pilot

The aim of the pilot study was two-fold: to establish (1) if promotional health messages adopting a controlling or autonomy supportive style would be perceived differently; (2) which of the promotional health messages would be most effective in threatening the freedom of choice.

Method

Participants. Seventy-three participants responded to the online study. Participants were recruited from online social networks such as Facebook, Twitter and LinkedIn. As the invitation to participate was available to the general public, to safeguard that our sample reflected HCP only, we excluded participants who did not provide information on workplace or role (n = 19). The final sample consisted of 54 HCP (35 females) with a mean age of 42.23 years old (SD = 10.62). The majority of participants worked within an NHS Hospital setting (68.5%), were doctors (40.7%), and 87% had direct patient contact (see Table 16 for a complete list of participant demographics for the pilot and experiment studies). Participants were randomly assigned to one of two conditions.

Table 16

Participant Demographic Information Across the Pilot and Experimental Samples

	Pilot sample		Experiment Sample	
	n	%	*n*	%
N	54		90	
Age				
Range	23-73		22-64	
M (years)	42.23		42.82	
SD	10.62		10.67	
Gender				
Female	35	64.8	86	95.6
Male	19	35.2	4	4.4
Occupation				
Doctor	22	40.7	2	2.2
Nurse	18	33.3	28	31.1
Clinical specialist			3	3.3
Allied health professional	5	9.3	22	24.4
Admin and clerical staff	3	5.6	11	12.2
Volunteer				0.2
Student	2	3.7	3	3.3
Other	4	7.4	21	23.3
Place of Work				
NHS Hospital	37	68.5	45	51.1
Community/GP Practice	1	1.9	27	30
Private Hospital	9	16.7	1	1.1
Care Home	1	1.9	7	7.7
Other	6	11.1	16	17.8
Direct Patient Contact				
Yes	47	87	68	75.6
No	7	13	22	24.4

Materials and Procedure. Thirty-eight promotional health messages were developed in response to previous analyses of NHS Flu Fighter Campaign messages (as previously mentioned in Chapter 5). Nineteen messages sought to reflect an autonomy-supportive style of communication (Condition 1), whereas the remaining 19 sought to reflect a controlling style of communication (Condition 2). Recall that, the messages were manipulated by altering the levels of controlling language used. For example, Condition 1 included terms such as “could”, “consider” and “choosing”, whereas Condition 2 included imperatives such as “should”, “ought” and “must” (Miller et al., 2007). The risk of message length confounding results (Blandford, Cox, & Cairns, 2008) was minimised

through ensuring that the word count for each message pair did not differ substantially. In addition, message complexity was assessed using the Flesch (1948) readability score. Overall, readability scores for autonomy-supportive messages were 71.6% (word count = 348), and controlling messages were 78.3 % (word count = 347). Table 17 presents example statements, for the full list of statements with readability estimates, refer back to Chapter 5, Table 15.

Table 17

Promotional Health Messages Autonomy vs. Controlling Communication Styles

	Readability %	Word Count
Autonomy-Supportive		
It's flu season, have you considered getting the flu jab?	78.2	10
You could protect yourself and those around you.	82.3	8
We have a duty to protect ourselves, our families, colleagues and patients.	60.7	12
Flu kills, but you could help to fight it. Consider having the flu jab this season.	92.9	16
Controlling		
It's flu season, you should get the flu jab!	100	9
You must protect yourself and those around you.	82.3	8
It is your duty to protect yourself, your family, colleagues and patients	60.7	12
Flu kills and you should be helping to fight it. Make sure you have the flu jab this season!	100	19

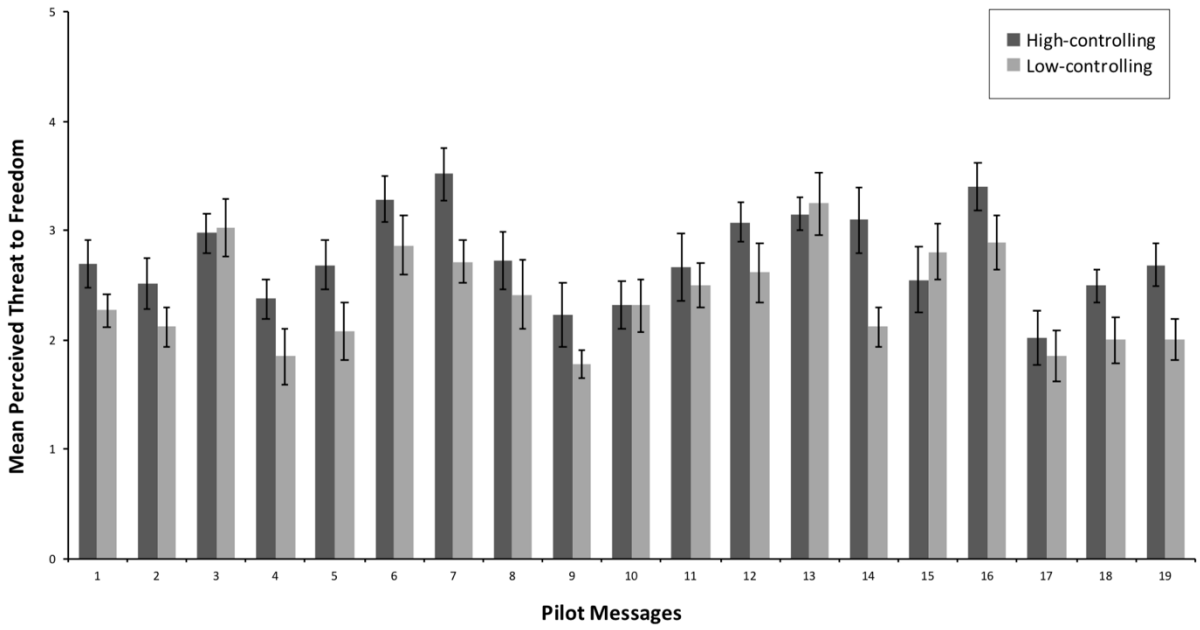
Data collection occurred over 2 weeks (May 2019). Participants were presented with 10 of 19 randomised promotional health messages. They were asked to read the message in full and immediately rate their perceived threat to freedom (PTF) using four items from the Threat to Freedom Scale (Dillard & Shen, 2005). Responses were rated on a 5-point Likert scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). Cronbach's alpha for the PTF scale for the autonomy supportive condition and the controlling condition were .850 and .838, respectively. Participants were also asked to rate their likelihood of getting vaccinated next flu season.

Results

First, the mean PTF scores were examined across each promotional health message (see Appendix D, Table S15 for data distributions). To establish which of the 19 were most appropriate to use within the final promotional health messages experiment, the accuracy of the mean scores were assessed using the standard error (McDonald, 2014). Through a visual examination of the standard errors of each statement, eight statements were identified (4, 5, 7, 9, 14, 16, 18 and 19) with the largest distance between the standard errors of each condition. The mean PTF score for each statement is presented in Figure 5. Selected statements are presented in Table 18 for a complete list of statements see Chapter 5, Table 15.

Figure 5

Mean Perceived Threat to Freedom for Pilot Promotional Health Messages



Note. Errors bars represent standard errors.

Table 18

Selection of Experimental Materials Based on Pilot Study Ordered by Bayes Factor

Item	BF	Low-controlling	High-controlling
14	13.94	Flu kills, **but** you **could** help to fight it. **Consider** having the flu jab this season.	Flu kills and you **should** be helping to fight it. Make sure you have the flu jab this season!
19	8.76	**By choosing to protect ourselves against the virus we'll** reduce **our** risk of developing flu-related health complications.	**You must protect yourself against the virus to** reduce **your** risk of developing flu-related health complications.
7	7.22	**We have a** duty to protect **ourselves**, **our** families, colleagues and patients.	**It is your** duty to protect **yourself**, **your** family, colleagues and patients
4	5.16	It's flu season, **have you considered** getting the flu jab?	It's flu season, **you should** get the flu jab!
1	5.14	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. Consider getting the flu jab.	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. Get the flu jab.
5	2.52	You **could** protect yourself and those around you.	You **must** protect yourself and those around you.
18	2.19	The flu vaccination may be considered as one of the best ways to protect against the spread of infection.	**The f**lu vaccination ought to be seen as one of the best ways to protect against the spread of infection.
9	1.37	Vaccines are readily available. **You could** book your appointment today!	Vaccines are readily available. **Don't delay**, book your appointment today!
12	1.35	**Let's avoid** the ones **we** love becoming the ones **we** treat. **Consider getting** the flu jab.	**Don't let** the ones **you** love become the one's **you** treat. **Get** the flu jab.
2	1.22	You **can** protect yourself against the flu virus reducing your risk of developing flu-related health complications.	You **must** protect yourself against the flu virus reducing your risk of developing flu-related health complications.
16	1.09	The flu virus can cause mild to severe illnesses, even death. As Healthcare Professionals **we** have a responsibility to reduce the risk of infection. **Will you get the** flu vaccine this season?	The flu virus can cause mild to severe illnesses, even death. As a Healthcare Professionals **you** have a responsibility to reduce the risk of infection. **You must get your** flu vaccine this season!

Note. Bold denotes differences between conditions. BF = Bayes Factor.

Next, using JASP (2019) version 0.9.2, a series of independent *t*-tests were conducted to test the hypothesis that controlling messages would be perceived as a greater threat to freedom than autonomy-supportive messages. Five messages met the assumptions of normality and variance (see Appendix D Table S16 and S17); therefore, Mann Whitney U *t*-tests were conducted on the remaining 14 messages. Results revealed that 8 messages suggested significant differences of PTF between condition (*p's* < .05, see Table 19); however, any meaningful statistical inferences drawn should be made so with caution, given the small sample sizes (Cohen, 1988). To understand the strength evidence for the alternative hypothesis, aiding the appropriate selection of experimental materials, we conducted Bayesian *t*-tests on all messages using the default prior width parameter of 0.707. Bayesian statistics are a complementary alternative to classical hypothesis testing (Wagenmakers, 2007). The Bayes factor (BF) provides a clearer estimate for the strength evidence within the data compared to the classical *p*-value (Jarosz & Wiley, 2014) and can guard against overinterpretation of the findings (Verhagen & Wagenmakers, 2014). Whereas the *p*-value is associated with the fit of data under the null hypothesis, the BF is conveyed as the probability of the observed data fitting under the null and the alternative hypothesis (see Wagenmakers, Love, et al., 2018; Wagenmakers, Marsman, et al., 2018). The strength of evidence can be assessed as either having evidence in favour of the null hypothesis (BF_{01}), or evidence in favour of the alternative hypothesis (BF_{10}). Therefore, when choosing to assess the strength of evidence for the alternative hypothesis, the higher the BF the stronger the evidence of true effect (Jarosz & Wiley, 2014). Using the default prior width of 0.707 in JASP (2019), four messages had a $BF_{10} > 3$ suggesting moderate evidence in favour of the alternative hypothesis (Jeffreys, 1961). Message 14 had a $BF_{10} = 13.94$, suggesting strong evidence for the alternative hypothesis. All *t*-tests, including their respective BF, are reported in Table 19.

Table 19

Perceived Threat to Freedom differences between Autonomy-Supportive and Controlling Styled Promotional Health Messages

	Condition 1			Condition 2							95% CI		
Message	*n*	*M*	*SD*	*n*	*M*	*SD*	*df*	*t*	*p*	Cohen's *d*	*Lower*	*Upper*	BF_{10}
Student's t-test													
2	17	2.12	0.76	15	2.52	0.87	30	-1.381	.089	-.489	-∞	.106	1.22
7	15	2.72	0.78	12	3.52	0.82	25	-2.592	**.008**	-1.004	-∞	-.317	**7.22**
11	16	2.50	0.80	12	2.67	1.07	26	-.473	.320	-.181	-∞	.451	0.51
14	16	2.13	0.70	12	3.10	1.05	26	-2.956	**.003**	-1.129	-∞	-.441	**13.94**
15	17	2.81	1.04	11	2.55	1.01	26	.661	.743	.256	-∞	.893	0.24
Mann Whitney U t-test								*W*	*p*	r_{rb}			
1	30	2.27	0.80	15	2.70	0.84		148.5	**.032**	-.340	-∞	-.050	2.13
3	18	3.03	1.11	12	2.98	0.63		113.0	.593	.046	-∞	.385	0.29
4	18	1.85	1.05	15	2.38	0.71		74.5	**.014**	-.448	-∞	-.144	**4.17**
5	18	2.08	1.09	12	2.69	0.81		62.0	**.026**	-.426	-∞	-.095	**2.05**
6	17	2.87	1.11	14	3.29	0.78		94.0	.162	-.210	-∞	.134	0.84
8	16	2.42	1.24	13	2.73	0.94		79.0	.140	-.240	-∞	.115	.75
9	18	1.78	0.57	12	2.23	1.01		74.0	.075	-.315	-∞	.034	1.70
10	18	2.32	1.01	15	2.32	0.86		134.0	.493	-.007	-∞	.318	0.34
12	15	2.62	1.06	12	3.08	0.62		52.5	**.035**	-.417	-∞	-.069	1.50
13	15	3.25	1.12	15	3.15	0.57		120.0	.632	.067	-∞	.396	0.27
16	18	2.89	1.06	10	3.40	0.70		62.0	.090	-.311	-∞	.059	1.26
17	14	1.86	0.88	11	2.02	0.83		67.5	.308	-.123	-∞	.260	0.57
18	17	2.00	0.88	9	2.50	0.45		41.5	**.030**	-.458	-∞	-.095	2.68
19	17	2.02	0.80	13	2.69	0.72		47.5	**.004**	-.570	-∞	-.284	**7.29**

Note: BF_{10} = Bayes Factor in support of the alternative hypothesis. Bold denotes $p < .05$ and $BF_{10} > 3$. r_{rb} = rank-biserial coefficient.

Discussion

The pilot study indicated a distinction between the two conditions (autonomy-supportive vs. controlling). Further, results supported the aim of the pilot manipulation check, as the majority of controlling styled messages (58%) were perceived as a significantly greater threat to freedom than their counterpart of autonomy supportive messages (for 15 of the 19 messages differences between the message were in the

predicted direction). Thus, enabling a set of promotional health messages appropriate for the development of Experiment 1 materials.

Phase 2: Experiment 1

The aim of the experiment was to establish the impact of controlling communication styles on the healthcare professionals' behavioural intentions to vaccinate against the flu. A secondary aim was to explore if baseline motivation to get the flu vaccination moderated the effect of the communication style (controlling or autonomy-supportive) on HCP perceived level of certainty to get the flu vaccination next flu season.

Method

Participants. A priori power analysis was computed using G*Power (version 3.1.9.4) (Faul et al., 2007). Previous research assessing the perceived threat to freedom of high-controlling and low-controlling messages in exercise-related health behaviours found a medium effect size ($\eta_p^2 = .05$) (Miller et al., 2007, p. 231). Therefore, to address Hypothesis 1 which constituted a manipulation check of experimental materials, G*Power analysis for the independent *t*-test determined a minimum sample size of 116 ($n = 58$ per condition) based on a medium effect size**,** 80% power and an alpha criterion of .05.

Healthcare professionals from the UK were recruited via Prolific Academic and were financially rewarded for their participation prior to data screening. Data collection occurred between June and July 2019, a total of 130 HCP responded to the study. Forty participants were excluded from analysis as they completed the experiment in under 180 seconds ($n = 36$) or indicated that they were not HCP ($n = 4$). Of the remaining 90 participants, 86 were female ($M_{age} = 42.55$, $SD_{age} = 10.63$) and four were male ($M_{age} = 48.75$, $SD_{age} = 11.44$). The majority of participants mainly worked within NHS Hospitals (51.1%), were nurses (31%), and 75.6% had direct patient contact (see Table 16 for the

complete list of participant demographics for the pilot and experiment studies). Participants were randomly assigned to one of two conditions (see Appendix D, Figure S8 for participant exclusion and condition assignment flow).

Materials and Procedure. Two promotional messages were devised by including items based on the strength of evidence for the perceived threat to freedom found within the pilot study. Statements were ranked according to (1) Bayes Factor, (2) the highest and lowest mean perceived threat to freedom, and (3) the variation within the standard errors (see Appendix D, Table S15). Statements were then structured into a short paragraph, one paragraph for the high-controlling condition, and one paragraph for the low-controlling condition. For example, the high-controlling message read: *"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.",* whereas the low-controlling message read: "*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 two messages were closely matched in terms of overall length, sentence length and ease of readability (see Appendix D for a complete transcript of the experimental materials and readability scores).

After reviewing the information sheet and providing informed consent, participants were first asked to state their past vaccination behaviour, and then their level of certainty to whether they would or would not vaccinate next flu season. Next participants provided an answer to the TRSQ-Flu scale, and were then randomly assigned to the low-controlling (n = 43) or high-controlling condition (n = 47). After reading the experimental statement, participants were asked to consider the message and restate their certainty to get vaccinated

against the flu. Next, responses toward perceived threat to freedom and appeal to feeling were recorded. The experimental message remained visible for participants to refer to. Finally, demographic information was recorded, and participants were automatically redirected to Prolific Academic after viewing the debrief form.

Results

Data Distributions and Assumptions. Prior to assessment of evidence, relevant data distributions and assumptions check for corresponding statistical tests were assessed. For a more detailed overview of statistical assumption testing and associated data distributions of each hypotheses, see Appendix D. Next, summary results are provided.

Perceived Threat to Freedom. Data distributions for the perceived threat to freedom at each level of condition (high-controlling and low-controlling) revealed approximate normality as indicated by skewness and kurtosis (see Appendix D, Table S18 for data distributions). Therefore, a one-tailed independent *t*-test was conducted given that the *t*-test is fairly robust to deviations of normality (skewness and kurtosis was within the range of +/- 3) and that the sample size exceeded $n = 30$ (Field, 2013). The assumption for homogeneity of variance was met, as assessed by Levene's test of equal variances ($p = .458$). Results revealed that low-controlling communication was perceived as a significantly lower threat to freedom ($M = 2.73$, $SD = 1.12$) than high-controlling communication ($M = 3.48$, $SD = 1.07$), $t(88) = 3.29$, $p < .001$, $d = 0.69$, $BF_{10} = 43.41$, suggesting strong evidence in favour of the alternative hypothesis. Thus, Hypothesis 1 (which constituted the manipulation check) was supported.

Communication Styles and Vaccination Certainty. The difference scores between pre-test behavioural intention (Time 1) and post-test behavioural intentions (Time 2) revealed non-normality for both conditions, as indicated by large skewness and kurtosis

(maximum kurtosis = 20.40) (see Appendix D, Table S18 for data distributions). Therefore, one-tailed Wilcoxon signed rank tests were conducted. For the low-controlling condition, behavioural intentions to vaccinate against the flu were significantly higher at Time 2 (*Median* = 85) compared to Time 1 (*Median* = 82), $W = 76$, $p = .010$, $d = -.30$, $BF_{10} = 1.91$, suggesting anecdotal evidence in favour of the alternative hypothesis. Thus, Hypothesis 2a was supported, as exposure to low-controlling communication increased behavioural intentions to vaccinate against the flu, compared to baseline intentions. Results from the high-controlling condition suggested that behavioural intentions to vaccinate against the flu were not significantly lower at Time 2 (*Median* = 76), compared to Time 1 (*Median* = 65), $W = 144.5$, p = .979, $d = -.11$, $BF_{01} = 3.10$, which constitutes moderate evidence in favour of the null hypothesis. Thus, Hypotheses 2b was not supported.

Predictors of Behavioural Intentions. Prior to examining the evidence for Hypothesis 3 that baseline behavioural intentions to vaccinate against the flu will (a) be positively associated with autonomous regulation and (b) be negativity associated with external regulation, data distributions and assumptions for multiple linear regression were assessed (see Appendix D) following guidelines from Field et al. (2012).

Multiple regression analysis indicated that the model was significant $F(4,85) = 24.08$, $p < .001$, Adjusted $R^2 = .509$ (see Table 20). Autonomous regulation was positively associated with baseline intentions to get vaccinated against the flu ($\beta = .621$, $t(85) = 6.64$, $p < .001$). Such that, on average a one unit increase in autonomous regulation was associated with a 29.48% increased intention to vaccinate when all other motivation regulations were held constant. Thus, Hypothesis 3a was supported. External regulation was also positively associated with baseline intentions to vaccinate against the flu ($\beta = 0.07$), however, it was a non-significant predictor of behavioural intentions, $t(85) =$

0.64, $p = .527$. Thus, Hypothesis 3b was not supported. The additional TSRQ-Flu predictors of introjection and amotivation were also non-significant predictors of baseline behavioural intentions to vaccinate against the flu.

Table 20

Multiple Regression Results Using Baseline Intentions as the Criterion

Predictor	*b*	*b* 95% CI	*Bootstrapped b* 95% CI	β	β 95% CI	sr^2	sr^2 95% CI	*r*
(Intercept)	-147.06**	[-191.97, -102.15]	[-184.90, - 106.20]					
Autonomous	29.48**	[20.64, 38.31]	[19.57, 37.40]	0.62	[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	0.33	[-9.55, 10.22]	[-9.15, 8.75]	0.01	[-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. β indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation.
*$p < .05$. ** $p < .01$. $R^2 = .531$, 95% CI [.36, .62].

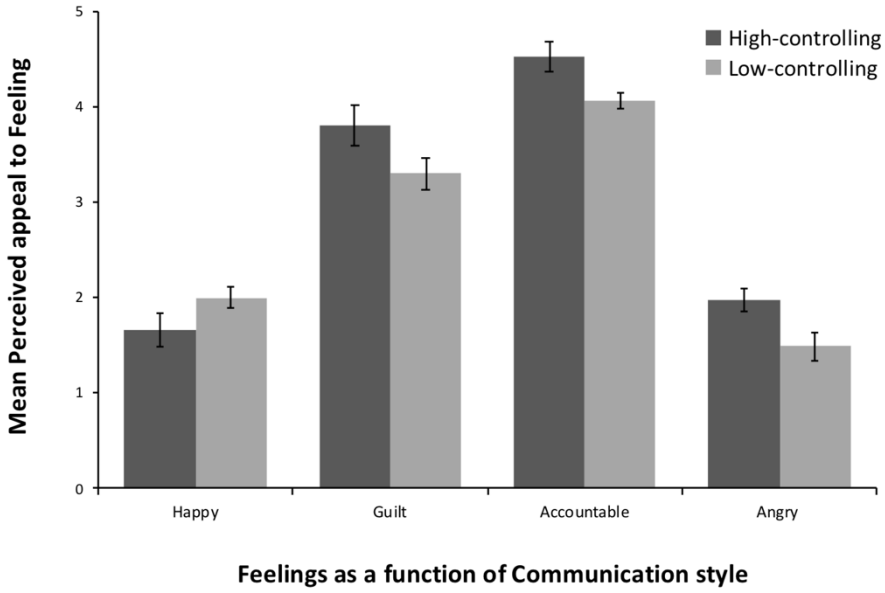
Secondary Analyses

Impact of Different Communication Styles. To assess the effect of the different communication style, a change in certainty variable was computed (Time 2 – Time 1). The assumption for homogeneity of variance was met, as assessed by Levene's test of equal variances ($p = .837$). However, change in certainty at each level of condition (high-controlling and low-controlling) revealed non-normality as indicated by skewness and kurtosis (see Appendix D, Table S18 for data distributions). In both conditions the change in certainty was highly kurtotic (minimum kurtosis = 13.04), therefore a one-tailed Mann-Whitney U test was conducted (for data distributions see Appendix D). Results revealed no significant positive impact on behavioural intentions after exposure to low-controlling communication ($M = 9.02$, $SD = 29.76$, $Median = 0$), compared to high-controlling communication, ($M = 4.32$, $SD = 38.50$, $Median = 0$), $W = 1007.5$, $p = .492$, $BF_{01} = 3.70$, which constitutes moderate evidence in favour of the null hypothesis.

Appeal to Feelings. Figure 6 presents the mean perceived appeals to feelings within each communication style. Data distributions for the four feelings at each level of condition (high-controlling and low-controlling) revealed approximate normality as indicated by skewness and kurtosis (see Appendix D, Table S18). Therefore two-tailed independent *t*-tests were conducted. There was no significant difference between the mean appeal of happiness (low-controlling: $M = 2.00$, $SD = 1.09$; high-controlling: $M = 1.66$, $SD = 0.76$), $t(88) = -1.73$, $p = .087$, $d = -.36$, $BF_{01} = 1.21$, which constitutes anecdotal evidence in favour of the null hypothesis. In addition there were no significant differences between the mean appeal of guilt (low-controlling: $M = 3.30$, $SD = 1.35$; high-controlling: $M = 3.81$, $SD = 1.19$), $t(88) = 1.89$, $p = .063$, $d = 0.40$, $BF_{10} = 1.04$, which constitutes moderate evidence in favour of the alternative hypothesis. The observed means within each condition demonstrated significant differences between the mean perceived appeal to accountability (low-controlling: $M = 4.07$, $SD = 1.03$; high-controlling: $M = 4.53$, $SD = 0.62$), $t(88) = 2.60$, $p = .011$, $d = 0.55$, $BF_{10} = 4.06$, and mean appeal to anger (low-controlling: $M = 1.49$, $SD = 0.77$; high-controlling: $M = 1.98$, $SD = 1.05$), $t(88) = 2.50$, $p = .014$, $d = 0.53$, $BF_{10} = 3.32$. These results suggest that on average, high-controlling communication appealed to significantly higher levels of perceived feeling of accountability and anger, suggesting moderate evidence in favour of the alternative hypotheses.

Figure 6

Perceived Appeal to Feelings Different Communication Styles



Note. Mean perceived appeal to feeling of happiness, guilt, accountability and anger for the two communications styles (high-controlling and low-controlling). Error bars represent standard errors.

Robustness Check of Hypotheses 2. To examine if the findings from Hypotheses 2a and 2b still held after excluding extreme baseline behavioural intentions (i.e., those who scored -100 or 100 at baseline), four Wilcoxon tests were conducted. First, extreme negative baseline intentions were excluded from analysis (n = 5). Results remained consistent with the findings from Hypothesis 2a that after exposure to a low-controlling communication style (n = 42), behavioural intentions improved W = 76, p = .018, d = -.26, BF_{10} = 1.14. Results also remained consistent with Hypothesis 2b, as there was no significant decrease in behavioural intentions after exposure to a high-controlling communication style (n = 43), W = 144.5, p = .966, d = 0, BF01 = 6.25. Next, extreme positive baseline intentions were excluded from analysis (n = 29). Results revealed that

after exposure to a low-controlling communication style (n = 28), behavioural intentions improved, W = 57.5 p = .004, d = -0.40, BF_{10} = 2.67. There was no significant decrease in behavioural intentions after exposure to a high-controlling communication style (n = 33), W = 108.5, p = .991, d = -0.15, BF_{01} = 9.21. Thus, regardless of inclusion or exclusion of extreme views, behavioural intention remained in line with the findings of Hypotheses 2a and 2b.

Moderating Effect of Four Motivation Regulations. A series of hierarchical multiple regressions were conducted to assess if the effect of different communication styles was moderated by inherent motivation to receive the flu vaccination. For a summary of the moderation analysis see Table 21, and for graphical representation of simple slopes analysis see Figure 7. The motivation regulations (as measured by the TSRQ-Flu) were individually assessed to explore the unique interaction between the motivation regulations and the impact that different communication styles have on the level of certainty to vaccinate against the flu. Impact of condition represented the difference score between the level of certainty to vaccinate at Time 2 and Time 1. Analyses were conducted using RStudio (2019) 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. For an overview of assumption checks see Appendix D.

There was a significant moderator effect of autonomous regulation, on the change in certainty to get vaccinated against the flu after exposure to different communication styles, b = -10.63, ΔR^2 =.048, $F(1,86) = 4.32$, p = .041. Examination of the interaction plot (Figure 7) suggested exposure to low-controlling communication improved behavioural intentions when autonomous regulation is low to average. Whereas exposure to high-

controlling communication suggested improvement of behavioural intentions when autonomous regulation was high. From a theoretical perspective the visually observed changes in certainty are logical, aligning with the suggestion that supporting the need for autonomy is associated with positive behavioural outcomes (Deci & Ryan, 2000). However, simple slopes analysis revealed that only when autonomous regulation was low (≤ 3.86), did low-controlling communication significantly improve behavioural intentions to vaccinate against the flu, compared to high-controlling communication (b = 22.33, p = .048).

There was a significant moderator effect of introjection regulation (i.e., guilt avoidance), b = -8.42, ΔR^2 =.049, $F(1,86) = 4.53$, p = .036. Graphical representation of the interaction (Figure 7) suggested that exposure to a low controlling-communication style improved behavioural intentions when introjection was low to average. Whereas those with high levels of introjection had improved behavioural intentions when exposed to high-controlling communication. Simple slopes analysis revealed that only when introjection was low ($M \leq 1.81$), low-controlling communication significantly improved behavioural intentions to vaccinate against the flu, compared to high-controlling communication (b = 21.19, p = .043).

There was no significant moderation effect of external regulation, b = 1.78, ΔR^2 =.002, $F(1,86) = 0.16$, p = .691. There was a significant moderator effect of amotivation, b = 12.95, ΔR^2 =.059, $F(1,86) = 5.39$, p = .023. Graphical representation of the interaction (Figure 7) suggested that exposure to a low-controlling communication style improved behavioural intentions when amotivation was average to high. Whereas, those with low levels of amotivation had increased behavioural intentions when exposed to high-controlling communication. Simple slopes analysis revealed that only when amotivation was high ($M \geq 3.55$), did low-controlling communication significantly improve

behavioural intentions to vaccinate against the flu, compared to high controlling communication ($b = 21.46$, $p = .038$).

Table 21

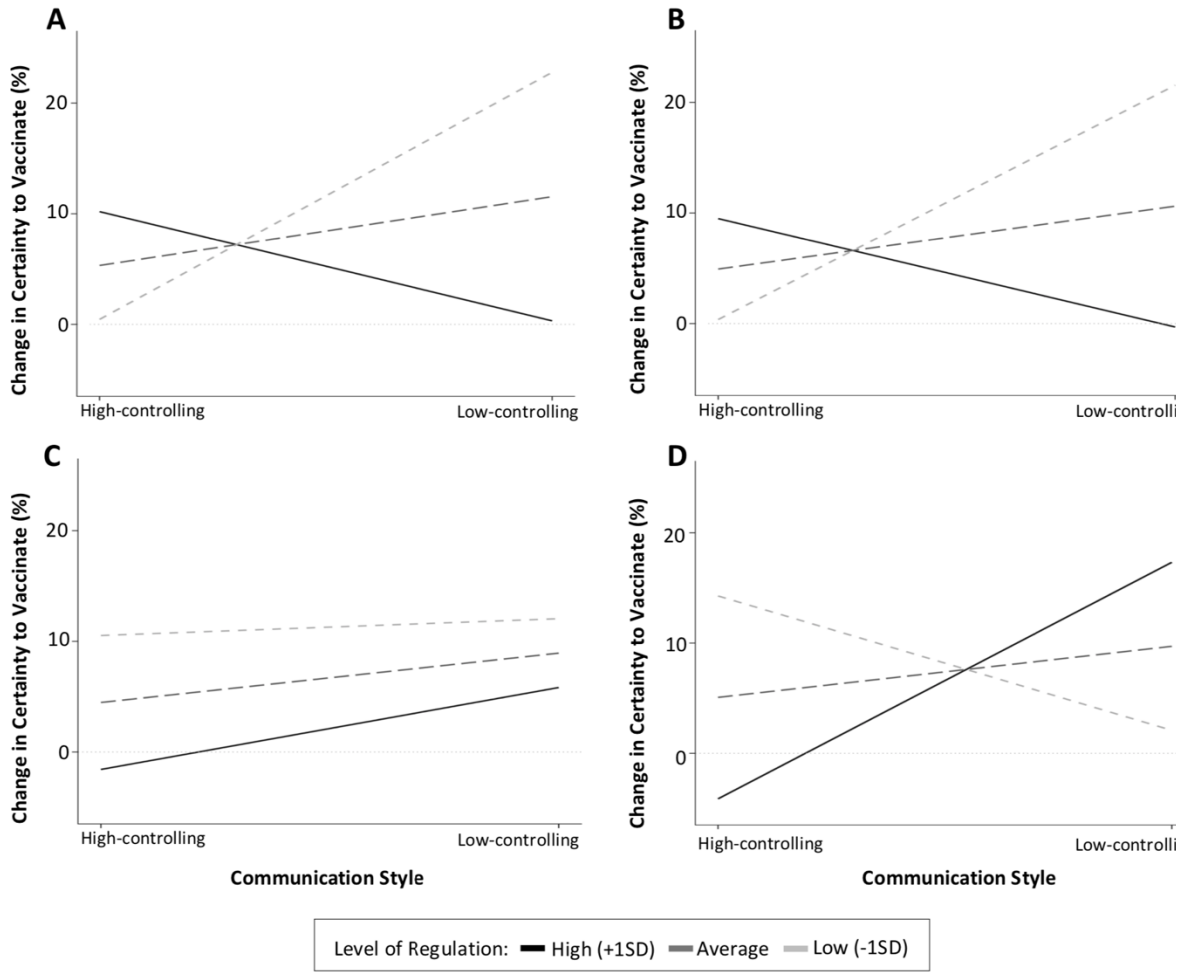
Summary of Moderation and Simple Slopes Analysis of the Four TSRQ-Flu Motivation Regulations Using Change of Certainty as the Criterion

			b 95% CI				
	b	S.E.	Lower	Upper	β	*t*	Sig.
Moderation 1 Autonomous							
(Constant)	-11.96	16.22	-44.19	20.28		-0.74	.463
Condition	63.34	28.98	5.73	120.94	.922	2.19	**.032**
Autonomous	3.22	3.05	-2.85	9.28	.141	1.06	.294
Condition*Autonomous	-10.63	5.11	-20.80	-0.47	-.155	-2.08	**.041**
BCa (Condition*Autonomous)			-24.90	-3.73			
One *SD* 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	.400
One *SD* below mean (3.86)	22.33	11.11	0.25	44.41		2.01	**.048**
Moderation 2 Introjection							
(Constant)	-4.13	10.61	-25.22	16.96		-0.39	.698
Condition	36.43	16.23	4.16	68.71	.531	2.24	**.027**
Introjection	2.48	2.76	-2.99	7.96	.132	0.90	.370
Condition*Introjection	-8.42	3.96	-16.29	-0.55	-.123	-2.13	**.036**
BCa (Condition*Introjection)			-19.21	-3.49			
One *SD* above mean (5.49)	-9.81	10.22	-30.12	10.51		-0.959	.340
Mean (3.65)	5.69	7.25	-8.72	20.10		.785	.434
One *SD* below mean (1.81)	21.19	10.33	0.65	41.72		2.05	**.043**
Moderation 3 External							
(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*External	1.78	4.46	-7.09	10.65	.026	0.40	.691
BCa (Condition*External)			-4.02	15.07			
Moderation 4 Amotivation							
(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*Amotivation	12.95	5.58	1.87	24.04	.189	2.32	**.023**
BCa (Condition*Amotivation)			0.13	35.50			
One *SD* above mean (3.55)	21.46	10.20	1.19	41.73		2.10	**.038**
Mean (2.26)	4.63	7.19	-9.67	18.93		0.64	.521
One *SD* 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 $N = 2000$ iterations. Condition: 0 = High, 1 = Low.
Bold denotes $p < .05$.

Figure 7

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 (High-controlling or Low-controlling) 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.

Moderating Effect of Past Behaviour. A multiple regression was conducted to assess if the effect of different communication styles was moderated by past vaccination behaviour on the certainty to receive the flu vaccination. For a summary of the moderation analysis see Table 22, and Figure 8 for graphical representation of the interaction. Homogeneity of variances across groups of condition and past-behaviour vaccination status was met as indicated by the Levene's test (p = .593). For assessment of residuals and normality assumption see (see Appendix D).

Table 22

Summary of Moderation and Simple Slopes Analysis of Past Vaccination Status Using Change of Certainty as the Criterion

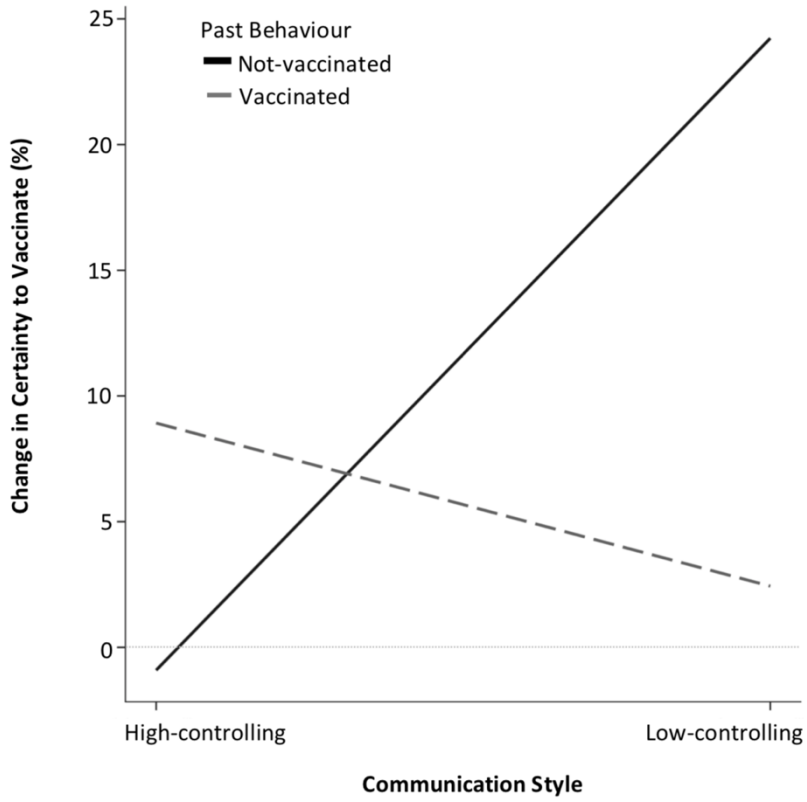
			b 95% CI				
	b	S.E.	*Lower*	*Upper*	β	*t*	Sig.
(Constant)	18.75	15.45	-11.97	49.47		-0.74	.463
Condition (Low)	-38.11	21.98	-81.81	5.58	-.555	2.19	**.032**
Past Behaviour (Not Vax)	-9.83	9.97	-29.64	9.98	-.140	1.06	.294
Condition*Past Behaviour	31.63	15.08	1.65	61.61	-.461	-2.08	**.041**
BCa (Condition*Past Behaviour)			6.46	80.29			
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	**.038**

Note. b represents unstandardized regression weights. CI = confidence interval. BCa = bias-corrected and accelerated confidence interval for N = 2000 iterations. Reference level of Condition = Low-controlling; Past Behaviour = Not-Vaccinated. Bold denotes $p < .05$

There was a significant moderator effect of past-vaccination behaviour, on the change in certainty to get vaccinated against the flu, after exposure to different communication styles, b = - 31.62, ΔR^2 =.048, $F(1,86) = 4.40$, p = .039. Examination of the interaction plot (Figure 8) suggested exposure to low-controlling communication had a positive impact on the behavioural intentions to vaccinate in the future for those who had reported a history of non-vaccination. Simple slopes analysis revealed that lower controlling communication significantly improved behavioural intentions to vaccinate against the flu, but only for those who had a past vaccination status of Not-vaccinated (b = 25.14, p = .038).

Figure 8

Simple Slopes for the Moderation Effect of Past Behaviour



Note. Simple slopes analysis for each level of past vaccination behaviour status (Not-vaccinated or Vaccinated) moderating the effect of communication style (high-controlling or low-controlling) on the change in certainty to vaccinate against the flu. Dotted line at 0 represents no change in the certainty to vaccinate.

Discussion

Summary of Findings. The primary objectives of this study were to establish the impact of controlling communication styles on the HCP behavioural intentions to vaccinate against the flu, and to explore the moderating effect of motivation to get the flu vaccine. As a first step, the communication materials developed from Chapter 5 and Phase 1 of Chapter 6 demonstrated significant differences in threatening the freedom of choice in

relation to getting vaccinated against the flu. Whereby low-controlling communication was perceived as significantly lower threat to freedom compared to high-controlling communication. Therefore, suggesting that simply changing words or phrases within written text can have negative or positive consequences for how the message is perceived by the user. This finding supports the findings from other health-related campaigns seeking to threaten freedom and evoke psychological reactance (Dillard & Shen, 2005; Miller et al., 2007). Further, the high-controlling messages on average appealed to feelings of anger and feelings of accountability. Previous research has found that feelings of induced anger may weaken the impact of messages on the intention to vaccinate (Betsch & Böhm, 2016). Although significant differences in guilt were not found between conditions, it is interesting to note that the design of experimental materials did not purposefully seek to appeal to feeling of guilt, yet this was the second highest appeal to feelings within the different communication styles. This observation serves to echo previous suggestions from Chapter 4 and Chapter 5 that the role of guilt in the HCP decisions to vaccinate against the flu should be investigated in future research. If exact or conceptual replication studies were looking to address aspect of this study, the mean PTF scores of the messages could serve as a usual baseline for future communication manipulations.

One important finding from this study was the role of motivation to receive the flu vaccination on the impact of promotional health messages. While exposure to low-controlling communication significantly increased the certainty to vaccinate, high controlling communication did not reveal any decrease in behavioural intentions. Perhaps an explanation for this is that explicit and direct communication is often preferred to ambiguous communication (Miller et al., 2007). In addition, at a superficial level, significant differences between the impact of different communication styles was not supported. This finding is in line with previous research of exercise-related promotional

health messages (Miller et al., 2007). However, motivation regulations demonstrated interesting moderation effects on the impact of communication. In particular, when autonomous regulation was low, meaning that motivation to receive the flu vaccination was not fully internalised, exposure to communication that supported the need for autonomy significantly improved the intention to vaccinate.

From a the SDT perspective (Ryan & Deci, 2000), if a person adopts a point of regulation on the motivation continuum for any given behaviour (autonomous, introjection, external, or amotivation), then behavioural activation is driven by that point of motivation. Ideally, the more internalised the motivation (autonomous), the more likely positive behavioural outcomes will occur. However, the point of regulation is changeable. The key to improving behavioural outcomes may transpire within supporting the need for autonomy, meaning that individuals are encouraged to act out of internalised beliefs. This study did not measure prior and post motivation, therefore concrete conclusions drawn about the potential change in motivation can only be anecdotal. However, findings from this study do suggest that supporting the need for autonomy via the medium of autonomy-supportive language can improve behavioural intentions, regardless of which motivation regulation is driving behaviour. For example, when HCP were presented with low-controlling communication there was a positive trend towards improved behavioural intentions, particularly for those who were less inclined to be driven by internalised regulations. Whereas high-controlling language did not change intentions for those less inclined to be driven by internalised regulations, it did have a detrimental impact on behavioural intentions for those driven by externalised regulations such as amotivation. Moreover, the use of autonomy-supportive language had a positive impact on behavioural intentions for those that had not vaccinated in the past, whereas high-controlling language revealed a slight negative impact on behavioural intentions. Therefore, not only do these

preliminary findings suggest that the prior motivation may play a subtle yet important role in how communication campaigns are perceived and then subsequently acted upon; they also signal that adopting an autonomy supportive narrative may mitigate behaviours driven by externalised behavioural regulations.

Limitations. To the best of our knowledge, this is the first occurrence of communication campaigns specifically seeking to increase autonomy-support within short promotional messages aimed at increasing flu vaccination among HCP. Although the results are promising, they are not without their limitations. First, data was based on convenience sampling and experimental analyses were conducted online, rather than in controlled laboratory settings. Initial power analysis had suggested a minimum of 58 participants per condition, however, after data screening the final sample size was 43 and 47. Replication studies are needed, as this study only provides a pathway for future research seeking to design tailored behavioural interventions that may include communication campaigns. The generalizability of results could be improved by using organizational-specific samples are used in the future, so that actual uptake rates can be corroborated strengthening the findings for actual impact of communication interventions. Second, although participants were randomly allocated to a low or high-controlling communication conditions, the majority of HCP exposure to low-controlling communication were inclined to have received the flu vaccination or have positive intentions to receive the flu vaccination in the future. This may have limited the change in certainty to vaccinate against the flu. However, one inference that may be drawn is that exposure to low-controlling communication did not negatively impact the intention to get vaccinated. Rather on average, regardless of past flu vaccination status, or post-test intentions to vaccinate against the flu, low-controlling communication either significantly improved intentions to vaccinate or provided little change, depending upon the level of

prior motivation to vaccinate against the flu. A third potential limitation of this study was the breadth of scaling used to assess certainty. It was the intention that using a percentile scale would enable granular exploration of certainty levels, however it is arguable that the scaling was too large (ranging from -100 to 100) and introduced added variance within the measurement comparative to the sample size. Perhaps future studies could assess the change in certainty using either Likert scales or alternative presentation formats, with qualitative follow-up questions related to ease of use. Nevertheless, changes to certainty were adequately detected, albeit effect sizes were small. For example, after reading low-controlling communication behavioural intentions to get vaccinated against to flu were significantly higher than baseline intentions. Interpretation of the Cohen's *d* effect size (see Magnusson, 2020) indicates that in order for one more HCP to have an improved intention to get vaccinated, 10 HCP would have to read low-controlling communication. Therefore if 100 HCP were to read a request to vaccinate which supported the need for autonomy, nine more HCP would have improved intentions to vaccinate. Whereas, if high-controlling communication was used to affect the vaccination intention of one more HCP, 30 HCP would have to read the high-controlling communication. Therefore, this would mean that if 100 HCP were to read high-controlling communication, only three more HCP would have improved intentions to vaccinate.

Implications for Policy and Practice. Recall in Chapter 1, the new 2019/20 CQUIN scheme aims to draw attention to evidence-based interventions which are simple, and do not pose a significant cost to implementation (NHS England, 2020). The evidence presented within in the chapter potentially answers the need for such an intervention, as adopting an autonomy-supportive style within future promotional communication campaigns could help to enhance HCP vaccination decisions without contributing to significant financial implications of implementation. Moreover, this could be particularly

beneficial for those less likely to get vaccinated, as when HCP who had not previously vaccinated read autonomy-supportive communication their intentions toward receiving the flu vaccination improved by 25%.

Conclusions. The presence of an autonomy-supportive narrative within communication campaigns which appeal to HCP to receive the flu vaccination highlighted promising outcomes for impacting vaccination decisions. The evidence presented within this chapter provides a useful foundation for future research to build upon, and also highlights avenues for further exploration, such as the role of introjection. Using an autonomy-supportive approach may indeed be an important component within a multi-faceted approach to improving HCP flu vaccination uptake.

Chapter 7: General Discussion

This program of research set out to extend what is known about HCP flu vaccination behaviour, by shifting focus to understanding what motivates the behavioural decision to vaccinate against the flu. It applied the psychological framework of SDT, to explore the role of autonomous motivation. A new measure was developed to capture indicators of extrinsic motivation (the extent to which one perceives autonomy), and I empirically tested whether encouraging the need for autonomy can impact HCP intentions to vaccinate against the flu. Thus, this program of research attempted to answer the call for theoretically-grounded and empirically driven behavioural interventions that look beyond the identification of predicting HCP flu vaccine uptake (see Corace et al., 2016).

Chapter 1 provided a contextual background to HCP flu vaccination coverage in the UK, introduced current approaches to addressing low vaccination uptake, and offered an overview of theoretical frameworks applied to identifying and understanding psychological determinants of uptake. It also provided an overview of current governmental policies and initiatives, and introduced the importance for acknowledging the need for autonomy. Chapter 2 introduced the philosophical and practical approach to the research program, it set out the aims and research questions and provided a discussion of methodological approaches used to address the needs of the research. Chapter 3 identified health-related behavioural interventions rooted in SDT, and found the SDT could offer a promising framework to understand the reasons why HCP choose, or do not choose, to vaccinate against the flu. Across four studies, SDT was identified as an appropriate framework for exploring HCP flu vaccination decisions, a new tool measuring extrinsic motivation (as proposed by SDT) was empirically established, and the causal role of autonomous regulation in HCP vaccination intentions was identified. Taken together,

these contributions for the research program provide a foundation for future directions of behaviour change interventions aiming to encourage flu vaccination coverage among HCP. Additionally, this research supports and adds to existing literature discerning that the role of autonomy is important within health-related decision-making processes, and provides an avenue for future research that wishes to explore impactful ways of achieving behavioural change.

Summary of Findings

Study 1 was a systematic review which identified evidence-based health-related behaviour interventions rooted in SDT, and provided insights into strategies that could be adopted to improve flu vaccination decisions such as the use of communication supporting the need for autonomy. Therefore, answering the need to address the demand for a free choice which was previously identified as a significant association with the increased likelihood of vaccine uptake (Baron-Epel et al., 2012). Additionally, it drew attention to the need for future research to explore health-related interventions that do not call for prolonged sustained changes in behaviour (such as exercise). Receiving the flu vaccination is an annual request in which behavioural activation need only occur once. Yet the approaches taken by policy-makers, healthcare managers, and stakeholders in the lead up to that request may be key to ensuring positive behavioural outcomes, such as the delivery of promotional health campaigns.

Across five phases, Study 2 provided a validated and reliable measure which can be used to understand the importance of extrinsic motivation in driving the decision to vaccinate against the flu. The new 11-item TSRQ-Flu scale contributed to the understanding of HCP flu decision's above and beyond existing related tools available to measure determinants of flu vaccination decisions, and was useful for reliably assessing

both vaccinators and non-vaccinators (in this case non-vaccinators refers to both those who did not vaccinate in the past or who were uncertain as to whether they would vaccinate in the future). The TSRQ-Flu was developed and validated across four different samples of HCP working within hospital and community-based setting and included doctors, nurses and medical students. This phase of the research program highlighted the importance for understanding the role of introjection (framed as guilt avoidance) and provided initial insight into the strength of such importance between vaccinators and non-vaccinators. Further, autonomous regulation was highlighted as important to vaccination intention as well as a strong predictor of past vaccination behaviour, which is consistent with previous findings related to the parental motivations for adolescents receiving the HPV vaccine (Denman et al., 2016). Similarly to previous research assessing health-related behaviours such as diet, exercise and smoking (Levesque et al., 2006), positive associations of associations of autonomous regulation were present for intention and behaviour.

Study 3 acted as a preliminary introduction to Study 4. The content analysis provided insights into understanding how current NHS communication campaign materials were used to encourage HCP to vaccinate against the flu. In addition, the study offered a clear narrative on the process taken to develop experimental communication materials so that the causal role of supporting the need for autonomy could be empirically tested. Finally, across two phases, Study 4 provided initial evidence that HCP decisions to vaccinate against the flu may be influenced by supporting the need for autonomy, affording a promising foundation for a future behaviour change intervention. This premise aligns with previous health-related interventions identified within Chapter 3. For example, supporting the need for autonomy through the use of short messages (Kinnafick et al., 2016), or instructional styles (Moustaka et al., 2012) was of benefit to improved behavioural outcomes, and autonomous styled communication increased the likelihood of

health screening uptake (Resnicow et al., 2014). In addition, findings supported previous conclusions from Chapter 4 that introjection may also play an important role in the decision to vaccinate against the flu. However, deeper exploration was not within the scope of the research program.

Strengths and Limitations

The individual study strengths and limitations have already been discussed in their corresponding chapter. This next section provides a general overview for the strengths and limitations of the research program.

A first strength is that, to the best of our knowledge this is the first instance in which SDT has been formally validated and applied to understanding HCP flu vaccination decisions. In addition, not only has the research program identified new predictors of HCP flu vaccination decision but it also attempted to understand the causal mechanisms motivating these decisions and provided a pathway as to how they may be harnessed to produce improved behavioural outcomes.

A central aspect, and indeed a second strength of this research program, was the methodological rigour undertaken in order to produce the empirical findings presented. It was important, not only to the movement of open science (see Rouder, 2016), but also to personal and supervisory integrity that the process of science was rigorous, transparent and reproducible. It made use of preregistration, enhanced data analysis applications and presented significant and null findings, and where appropriate, looked beyond the classical *p*-value to provide the strength of evidence for the alternative hypothesis (i.e., Bayes Factor). Careful consideration was taken in every step of the research program to ensure that the formulation of research questions were first and foremost led with the research problem, but were also based on the emerging evidence preceding the next stage of

research. This strength particularly relates to the research phase for the scale adaptation and validation. While there are existing measures of the TSRQ scale for other health-related behaviours it was important that this research program did not simply rely on loose adaptations which made use of simple reliability measures such as Cronbach's alpha and zero-order correlations. Rather rigorous steps in analysis and design were taken to ensure that the TSRQ-Flu scale could be a valid and reliable. Future research could look to replicate findings before generalizable inferences to the wider HCP population are drawn.

However, this program of research was not without its limitations. For example, we were unable to secure an organization-specific sample in which actual vaccination uptake rates could corroborate findings of predictive validity. In addition, it is acknowledged that replication of the communication experiment is needed to further support our findings. That said, in general the evidence presented in the thesis aligns with previous validations of the TSRQ scale (Denman et al., 2016; Levesque et al., 2006), and associates itself with the premise that supporting the need for autonomy provides improved behavioural outcomes (Deci & Ryan, 2000). Moreover, this research demonstrates that perceived choice or autonomy plays a key role in HCP flu vaccination decisions and offers a wider scope to understanding the need for choice previously been identified (Kassianos et al., 2018) or alluded to (Baron-Epel et al., 2013; Hakim et al., 2011; Lehmann et al., 2015). The next section provides a discussion on the potential next steps for this line of research.

Further Directions for Research

A major challenge within this research program was access to HCP. At the beginning of the research program we had secured partnership with a large NHS trust consisting of over 4000 employees. It was the intention of this research program to explore and understand the role of autonomous motivation from an organization-specific

perspective. However, due to unforeseen circumstances beyond our control, access became a challenge and therefore sampling was sought using online panels and social media. Therefore, future research could look to corroborate findings within an organization-specific sample (Chung et al., 2018) before specific inferences to different healthcare sectors or demographics are drawn. By partnering with NHS Trusts or organization such as Public Health England, other determinants of flu vaccination uptake could be accounted for as the research may have easier access to community networks (see Thomson et al., 2016), Trust-led incentives and organization-specific communication campaigns.

Varying levels of care are offered throughout the NHS ranging from acute care to community services. Our studies do not focus on one such setting such as Intensive Care Units or General Practice surgeries. In addition, there are varying flu vaccine coverage rates across different types of care setting. For example, some of the lowest reported vaccination coverage rates are reflected in NHS Trusts offering mental health services (Public Health England, 2019a). Mental health conditions are often linked with weakened immunity (Coughlin, 2012) and an increased likelihood of restrictive lung function (R. D. Goodwin et al., 2006). Future research set in an organization-specific sample could address if differences in autonomous and introjection regulation remain dependent on levels of care provided and the care needs of patients. Undoubtedly this would only help to strengthen and add to the solid foundation provided in this thesis. Moreover, within an organization-specific sample future research could look to add to the constructs of external and introjection regulation by using a larger set of items, particularly as introjection demonstrated associations with both self-reported past and future vaccination behaviour.

In summary, to better understand the implication of the results presented within this research program, future studies could address the importance of autonomy-supportive

communication campaigns among hesitant vaccinators, drawing conclusions of impact that are based on actual vaccination uptake rates. Or, future studies could address the role of introjection (framed as guilt avoidance) in communication campaigns. The findings from Chapter 4 suggest that introjection is an important predictor among vaccine-deniers and those who are hesitant. However, this appears less of an internalized mechanism shared among those who readily vaccinate against the flu. This warrants further investigation particularly as current flu related communication campaigns highlight the importance of 'protecting yourself, your family, your patients'. Could this type of message be perceived as increasing the feeling of guilt? How does inducing feelings of guilt impact the intention to get vaccinated? Could vaccination intention among these two groups simply be strengthened by not threatening the freedom of choice in communication campaigns, regardless of the role of guilt-avoidance? Messages seeking to evoke intense feelings of guilt reduce behavioural intentions and attitudinal changes compared with moderate appeals to guilt (Coulter & Pinto, 1995).

Wider Implications and Transferability of Research

During the course of this research program, I had the opportunity to communicate the findings from Chapter 4 to NHS employees, stakeholders and council representatives at the NHS Flu Fighter Conference in March 2019. It was then that the implications and wider transferability of this research program became apparent. Healthcare managers were keen to understand how the research may be implemented within their organization and were keen to try out supporting the need for choice at the conversational level. The preliminary evidence shared from Chapter 4 and 6 received positive and encouraging feedback.

The TSRQ-Flu scale is a short tool that could easily be implemented within healthcare organizations enabling a snapshot into the type of motivation energizing vaccination uptake. Additionally, it could be used in conjunction with other existing measures of vaccination behaviour such as the MoVac-Flu scale (Vallée-Tourangeau et al., 2018) or constructs from the health belief model such as the Vaccine Attitude scale (Corace et al., 2013). This new scale affords the benefit of gaining a deeper insight into the energising component of vaccination behaviour, by offering insight into the motivating reason as to why a HCP might get the flu vaccine. While the experimental study (Chapter 6) has only provided preliminary evidence that adopting an autonomy-supportive style in communication materials leads to increased certainty to vaccinate against the flu, it also highlighted an opportunity for Healthcare Managers, and policy-makers to consider how the request to receive the flu vaccination is communicated. On average, an autonomy-supportive communication style improved behavioural intentions when internalised beliefs were limited, and safeguarded intentions to vaccinate when behavioural regulations were strongly internalised. Moving forward Public Health England will be regulating the annual request for HCP to get vaccinated against the flu. The 2019/20 CQUIN scheme has indicated a need for evidence-based practices that do not pose a significant burden of implementation (NHS England, 2020). Incorporating an autonomy-supportive style within future government-led communication campaigns may help to enhance and encourage HCP flu vaccine uptake, with the caveat that this research should be replicated and tested within a healthcare setting.

Concluding Remarks and Contribution

Improving flu vaccination uptake among HCP remains a challenge. Flu vaccination uptake across the UK remain variable, particularly within care homes (Public Health

England, 2019b). The recent introduction of opt-out mechanism for the 2019/20 flu season may indeed lead to increased flu vaccination uptake (see Stead et al., 2019). It could also be argued that introducing a blanket hard-mandate policy could eradicate this issue of suboptimal flu vaccine coverage among HCP. However, unlike the MMR vaccine which provides > 90 % effectiveness and lifelong immunisation (Center For Disease Control and Prevention, 2019), the seasonal flu vaccination struggles to achieve high levels of effectiveness across all age groups (Public Health England, 2017, 2018); moreover it remains an annual request. Until a highly effective, universal flu vaccination is developed there is a need to look to behavioural sciences to provide alternative ways to understand ways in which HCP can be encouraged to receive the flu vaccination.

This research programme provides one such alternative as it adds to much needed understanding of not only what drivers of HCP flu vaccination decisions exist, but why HCP choose to vaccinate against the flu. This thesis contributed to knowledge by (1) empirically validating a measure of extrinsic motivation for HCP flu vaccination decisions, (2) providing preliminary evidence for the causal role of autonomous regulation in healthcare professionals' intentions to get vaccinated against the flu, and (3) providing the foundations of a behavioural change intervention, specifically targeting support of autonomous regulation in healthcare professionals' decisions to vaccinate against the flu.

As a final remark, perhaps it is not too far reaching to say that the findings presented within this research program suggest that supporting the need for autonomy can improve behavioural intentions. For example, the use of autonomy-supportive language (Chapter 6), indicates that regardless of what point of motivation regulation a person adopts, behavioural intentions (particularly for those less willing or less motivated) can only be improved. Replication studies are needed and findings need to be explored across

other samples, with the limitations of each study considered. However, it remains that this programme of research demonstrates that autonomy matters.

References

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology*, *27*(3), 379–387. https://doi.org/10.1037/0278-6133.27.3.379

Agor, J. K., & Özaltın, O. Y. (2018). Models for predicting the evolution of influenza to inform vaccine strain selection. *Human Vaccines & Immunotherapeutics*, *14*(3), 678–683. https://doi.org/10.1080/21645515.2017.1423152

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Akan, H., Yavuz, E., Yayla, M. E., Külbay, H., Kaspar, E. Ç., Zahmacıoğlu, O., & Badur, S. (2016). Factors affecting uptake of influenza vaccination among family physicians. *Vaccine*, *34*(14), 1712–1718. https://doi.org/10.1016/j.vaccine.2016.01.057

Andre, F., Booy, R., Bock, H., Clemens, J., Datta, S., John, T., Lee, B., Lolekha, S., Peltola, H., Ruff, T., Santosham, M., & Schmitt, H. (2008). Vaccination greatly reduces disease, disability, death and inequity worldwide. *Bulletin of the World Health Organization*, *86*(2), 140–146. https://doi.org/10.2471/BLT.07.040089

Anikeeva, O., Braunack-Mayer, A., & Rogers, W. (2009). Requiring Influenza Vaccination for Health Care Workers. *American Journal of Public Health*, *99*(1), 24–29. https://doi.org/10.2105/AJPH.2008.136440

Armitage, C. J., & Talibudeen, L. (2010). Test of a brief theory of planned behaviour-based intervention to promote adolescent safe sex intentions. *British Journal of Psychology*, *101*(1), 155–172. https://doi.org/10.1348/000712609X431728

Atkinson, J. W. (1957). Motivational determinants of risk-taking behavior. *Psychological Review*, *64*(6), 359–372. https://doi.org/10.1037/h0043445

Babcock, H. M., Gemeinhart, N., Jones, M., Dunagan, W. C., & Woeltje, K. F. (2010). Mandatory Influenza Vaccination of Health Care Workers: Translating Policy to Practice. *Clinical Infectious Diseases*, *50*(4), 459–464. https://doi.org/10.1086/650752

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, *37*(2), 122–147. https://doi.org/10.1037/0003-066X.37.2.122

Baron-Epel, O., Bord, S., Madjar, B., Habib, S., & Rishpon, S. (2012). What lies behind the low rates of vaccinations among nurses who treat infants? *Vaccine*, *30*(21), 3151–3154. https://doi.org/10.1016/j.vaccine.2012.02.074

Baron-Epel, O., Madjar, B., Grefat, R., & Rishpon, S. (2013). Trust and the demand for autonomy may explain the low rates of immunizations among nurses. *Human Vaccines & Immunotherapeutics*, *9*(1), 100–107. https://doi.org/10.4161/hv.22503

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Beaujean, A. A. (2012). *BaylorEdPsych: R Package for Baylor University Educational Psychology Quantitative Courses*. https://cran.r-project.org/package=BaylorEdPsych

Behrman, A., & Offley, W. (2013). Should influenza vaccination be mandatory for healthcare workers? *BMJ*, *347*(Nov12, 1), F6705. https://doi.org/10.1136/bmj.f6705

Bernard, D., Martin, J. J., & Kulik, N. (2014). Self-Determination Theory and Well-Being in the Health Care Profession. *Journal of Applied Biobehavioral Research*, *19*(3),

157–170. https://doi.org/10.1111/jabr.12023

Betsch, C., & Böhm, R. (2016). Detrimental effects of introducing partial compulsory vaccination: experimental evidence. *The European Journal of Public Health*, *26*(3), 378–381. https://doi.org/10.1093/eurpub/ckv154

Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PLOS ONE*, *13*(12), e0208601. https://doi.org/10.1371/journal.pone.0208601

Bíró, A. (2013). Determinants of H1N1 vaccination uptake in England. *Preventive Medicine*, *57*(2), 140–142. https://doi.org/10.1016/j.ypmed.2013.04.017

Blandford, A., Cox, A., & Cairns, P. (2008). Controlled Experiments. In P. Cairns & A. Cox (Eds.), *Research Methods for Human Computer Interaction* (pp. 1–16). Cambridge University Press.

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. *Frontiers in Public Health*, *6*(149), 1–18. https://doi.org/10.3389/fpubh.2018.00149

Bouton, M. E. (2014). Why behavior change is difficult to sustain. *Preventive Medicine*, *68*, 29–36. https://doi.org/10.1016/j.ypmed.2014.06.010

Brehm, J. W. (1966). *A theory of psychological reactance.* Academic Press.

Brehm, S. S., & Brehm, J. W. (1981). *Psychological Reactance: A Theory of Freedom and Control*. Academic Press.

Brewer, N. T., Chapman, G. B., Rothman, A. J., Leask, J., & Kempe, A. (2017). Increasing Vaccination: Putting Psychological Science Into Action. *Psychological Science in the Public Interest*, *18*(3), 149–207. https://doi.org/10.1177/1529100618760521

Briner, R. B., & Denyer, D. (2012). Systematic Review and Evidence Synthesis as a Practice and Scholarship Tool. In D. M. Rousseau (Ed.), *The Oxford Handbook of Evidence-Based Management*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199763986.013.0007

Brooks, J. M., Iwanaga, K., Chiu, C.-Y., Cotton, B. P., Deiches, J., Morrison, B., Moser, E., & Chan, F. (2017). Relationships between self-determination theory and theory of planned behavior applied to physical activity and exercise behavior in chronic pain. *Psychology, Health & Medicine*, *22*(7), 814–822. https://doi.org/10.1080/13548506.2017.1282161

Bryman, A., & Bell, E. (2015). *Business Research Methods* (4th ed.). Oxford University Press.

Bryne, B. (2010). *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming* (2nd ed.). Routledge.

Buuren, S. van, & Groothuis-Oudshoorn, K. (2011). mice : Multivariate Imputation by Chained Equations in R. *Journal of Statistical Software*, *45*(3), 1–67. https://doi.org/10.18637/jss.v045.i03

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin*, *105*(3), 456–466. https://doi.org/10.1037/0033-2909.105.3.456

Cabigao, E. P., & Hahklotubbe, D. (2014). Promoting Staff Rentention and Satisfaction. In D. Yee-Melichar, C. M. Flores, & E. P. Cabigao (Eds.), *Long-Term Care Administration and Management: Effective Practices and Quality Programs in Eldercare* (pp. 163–184). Springer Publishing Company, LLC.

Canty, A., & Ripley, B. D. (2019). *boot: Bootstrap R (S-Plus) Functions*.

Capolongo, M. J., DiBonaventura, M. daCosta, & Chapman, G. B. (2006). Physician vaccinate thyself: why influenza vaccination rates are higher among clinicians than among nonclinicians. *Annals of Behavioral Medicine*, *31*(3), 288–296. https://doi.org/10.1207/s15324796abm3103_11

Carcioppolo, N., Li, C., Chudnovskaya, E. V., Kharsa, R., Stephan, T., & Nickel, K. (2017). The Comparative Efficacy of a Hybrid Guilt-Fear Appeal and a Traditional Fear Appeal to Influence HPV Vaccination Intentions. *Communication Research*, *44*(3), 437–458. https://doi.org/10.1177/0093650215616457

Cattell, R. B. (1966). The Scree Test For The Number Of Factors. *Multivariate Behavioral Research*, *1*(2), 245–276. https://doi.org/10.1207/s15327906mbr0102_10

Center For Disease Control and Prevention. (2019). *Questions About Measles*. https://www.cdc.gov/measles/about/faqs.html

Center for Self-Determination Theory. (2019). *Self-Regulation Questionnaires*. http://selfdeterminationtheory.org/self-regulation-questionnaires

Champion, V. L., & Skinner, C. S. (2015). The Health Belief Model. In K. Glanz, B. K. Rimmer, & K. Viswanath (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice* (4th ed., pp. 45–66). John Wiley & Sons, Inc.

Chan, D. K.-C., Yang, S. X., Mullan, B., Du, X., Zhang, X., Chatzisarantis, N. L. D., & Hagger, M. S. (2015). Preventing the spread of H1N1 influenza infection during a pandemic: autonomy-supportive advice versus controlling instruction. *Journal of Behavioral Medicine*, *38*, 416–426. https://doi.org/10.1007/s10865-014-9616-z

Chatzisarantis, N. L. D., Hagger, M. S., Kamarova, S., & Kawabata, M. (2012). When effects of the universal psychological need for autonomy on health behaviour extend to a large proportion of individuals: A field experiment. *British Journal of Health Psychology*, *17*, 785–797. https://doi.org/10.1111/j.2044-8287.2012.02073.x

Chen, F. F. (2008). What happens if we compare chopsticks with forks? The impact of making inappropriate comparisons in cross-cultural research. *Journal of Personality and Social Psychology*, *95*(5), 1005–1018. https://doi.org/10.1037/a0013193

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating Goodness-of-Fit Indexes for Testing Measurement Invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Chung, P.-K., Zhang, C.-Q., Liu, J.-D., Chan, D. K.-C., Si, G., & Hagger, M. S. (2018). The process by which perceived autonomy support predicts motivation, intention, and behavior for seasonal influenza prevention in Hong Kong older adults. *BMC Public Health*, *18*(65), 1–9. https://doi.org/10.1186/s12889-017-4608-x

Churchill, S., & Pavey, L. (2013). Promoting fruit and vegetable consumption: The role of message framing and autonomy. *British Journal of Health Psychology*, *18*(3), 610–622. https://doi.org/10.1111/bjhp.12007

Coa, K., & Patrick, H. (2016). Baseline Motivation Type as a Predictor of Dropout in a Healthy Eating Text Messaging Program. *JMIR MHealth and UHealth*, *4*(3), e114.

https://doi.org/10.2196/mhealth.5992

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Lawrence Erlbaum Associates.

Corace, K. M., & Garber, G. E. (2014). When knowledge is not enough: Changing behavior to change vaccination results. *Human Vaccines & Immunotherapeutics*, *10*(9), 2623–2624. https://doi.org/10.4161/21645515.2014.970076

Corace, K. M., Prematunge, C., McCarthy, A., Nair, R. C., Roth, V., Hayes, T., Suh, K. N., Balfour, L., & Garber, G. E. (2013). Predicting influenza vaccination uptake among health care workers: What are the key motivators? *American Journal of Infection Control*, *41*(8), 679–684. https://doi.org/10.1016/j.ajic.2013.01.014

Corace, K. M., Srigley, J. A., Hargadon, D. P., Yu, D., MacDonald, T. K., Fabrigar, L. R., & Garber, G. E. (2016). Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine*, *34*(28), 3235–3242. https://doi.org/10.1016/j.vaccine.2016.04.071

Cornally, N., Deasy, E. A., McCarthey, G., McAuley, C., Moran, J., & Weathers, E. (2013). Student nurses' intention to get the influenza vaccine. *British Journal of Nursing*, *22*(21), 1207–1211. https://doi.org/10.12968/bjon.2013.22.21.1207

Coughlin, S. S. (2012). Anxiety and depression: linkages with viral diseases. *Public Health Reviews*, *34*(2). https://doi.org/10.1007/BF03391675

Coulter, R. H., & Pinto, M. B. (1995). Guilt appeals in advertising: What are their effects? *Journal of Applied Psychology*, *80*(6), 697–705. https://doi.org/10.1037/0021-9010.80.6.697

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.). Sage Publications, Inc.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed.). Sage Publications, Inc.

Creswell, J. W., & Plano Clark, V. L. (2010). *Designing and Conducting Mixed Methods Research* (2nd ed.). SAGE Publications Inc.

Croissant, Y. (2019). *mlogit: Multinomial Logit Models*. https://cran.r-project.org/package=mlogit

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334. https://doi.org/10.1007/BF02310555

Davison, A. C., & Hinkley, D. V. (1997). *Bootstrap Methods and Their Applications*. Cambridge University Press. http://statwww.epfl.ch/davison/BMA/

de Charms, R. (1968). *Personal Causation: The Internal Affective Determinants of Behavior*. Lawrence Erlbaum Associates, Inc.

de Vaus, D. (2001). *Research Design in Social Research*. Sage Publications, Ltd.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, *18*(1), 105–115. https://doi.org/10.1037/h0030644

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. Plenum Press. https://doi.org/10.1007/978-1-4899-2271-7

Deci, E. L., & Ryan, R. M. (2000). The 'What' and 'Why' of Goal Pursuits: Human Needs

and the Self-Determination of Behavior. *Psychological Inquiry*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Deci, E. L., & Ryan, R. M. (2012). Self-determination theory in health care and its relations to motivational interviewing: a few comments. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 24. https://doi.org/10.1186/1479-5868-9-24

Denman, D. C., Baldwin, A. S., Marks, E. G., Lee, S. C., & Tiro, J. A. (2016). Modification and validation of the Treatment Self Regulation Questionnaire to assess parental motivation for HPV vaccination of adolescents. *Vaccine*, *34*(41), 4985–4990. https://doi.org/10.1016/j.vaccine.2016.08.037

Denyer, D., & Tranfield, D. (2009). Producing a systematic review. In D. A. Buchanan & A. Bryman (Eds.), *The Sage handbook of organizational research methods* (pp. 671–689). Sage Publications Ltd.

Department of Health & Social Care. (2019). *Government Response to the House of Commons Science and Technology Committee Report on Flu Vaccination in England: Ninth Report of Session 2017-19*. www.gov.uk/government/publications

Department of Health, & Public Health England. (2019). Influenza: the green book, chapter 19. In *Immunisation against infectious disease - 'The Green Book'*. https://www.gov.uk/government/publications/influenza-the-green-book-chapter-19

Dettweiler, U., Ünlü, A., Lauterbach, G., Becker, C., & Gschrey, B. (2015). Investigating the motivational behavior of pupils during outdoor science teaching within self-determination theory. *Frontiers in Psychology*, *6*, 125. https://doi.org/10.3389/fpsyg.2015.00125

DeVellis, R. F. (2012). *Scale development: Theory and applications*. Sage Publications.

Dillard, J. P., & Shen, L. (2005). On the Nature of Reactance and its Role in Persuasive Health Communication. *Communication Monographs*, *72*(2), 144–168. https://doi.org/10.1080/03637750500111815

Edgar, T., & Volkman, J. E. (2012). Using Communication Theory for Health Promotion: Practical Guidance on Message Design and Strategy. *Health Promotion Practice*, *13*(5), 587–590. https://doi.org/10.1177/1524839912450879

Eisinga, R., Grotenhuis, M. Te, & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, *58*(4), 637–642. https://doi.org/10.1007/s00038-012-0416-3

Ernsting, A., Lippke, S., Schwarzer, R., & Schneider, M. (2011). Who Participates in Seasonal Influenza Vaccination? Past Behavior Moderates the Prediction of Adherence. *Advances in Preventive Medicine*, *2011*, 1–6. https://doi.org/10.4061/2011/148934

Fall, E., Izaute, M., & Chakroun-Baggioni, N. (2018). How can the health belief model and self-determination theory predict both influenza vaccination and vaccination intention ? A longitudinal study among university students. *Psychology & Health*, *33*(6), 746–764. https://doi.org/10.1080/08870446.2017.1401623

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Fidell, L. S., & Tabachnick, B. G. (2003). Preparatory Data Analysis. In I. B. Weiner, J. A.

Schinka, & W. F. Velicer (Eds.), *Handbook of Psychology, Volume 2 Research Methods in Psychology* (pp. 115–142). John Wiley & Sons, Inc.

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th ed.). Sage Publications Ltd.

Field, A., Miles, J., & Field, Z. (2012). *Discovering Statistics Using R*. Sage Publications Ltd.

Fishbein, M. (Ed.). (1967). *Readings in attitude theory and measurement.* Wiley.

Flesch, R. (1948). A new readability yardstick. *Journal of Applied Psychology*, *32*(3), 221–233. https://doi.org/10.1037/h0057532

Fletcher, T. D. (2012). *QuantPsyc: Quantitative Psychology Tools*. https://cran.r-project.org/package=QuantPsyc

Flora, D. B., LaBrish, C., & Chalmers, R. P. (2012). Old and New Ideas for Data Screening and Assumption Testing for Exploratory and Confirmatory Factor Analysis. *Frontiers in Psychology*, *3*(55), 1–21. https://doi.org/10.3389/fpsyg.2012.00055

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39. https://doi.org/10.2307/3151312

Fox-Wasylyshyn, S. M., & El-Masri, M. M. (2005). Handling Missing Data in Self-Report Measures. *Researchin Nursing & Health*, *28*, 488–495. https://doi.org/110.1002/nur.20100

Gagné, M., & Deci, E. L. (2005). Self-determination theory and work motivation. *Journal of Organizational Behavior*, *26*(4), 331–362. https://doi.org/10.1002/job.322

Gerend, M. A., & Shepherd, M. A. (2013). Message framing, it does a body good: Effects of message framing and motivational orientation on young women's calcium consumption. *Journal of Health Psychology*, *18*(10), 1296–1306. https://doi.org/10.1177/1359105312463587

Godin, G., Vézina-Im, L.-A., & Naccache, H. (2010). Determinants of Influenza Vaccination among Healthcare Workers. *Infection Control & Hospital Epidemiology*, *31*(7), 689–693. https://doi.org/10.1086/653614

Goins, W. P., Talbot, H. K., & Talbot, T. R. (2011). Health Care–Acquired Viral Respiratory Diseases. *Infectious Disease Clinics of North America*, *25*(1), 227–244. https://doi.org/10.1016/j.idc.2010.11.010

Gollwitzer, P. M., & Oettingen, G. (2001). Motivation: History of the Concept. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of the Social & Behavioral Sciences* (pp. 10109–10112). Elsevier. https://doi.org/10.1016/B0-08-043076-7/00134-0

Goodwin, C. J. (2010). *Research in Psychology: Methods and Design* (6th ed.). John Wiley & Sons Inc.

Goodwin, R. D., Chuang, S., Simuro, N., Davies, M., & Pine, D. S. (2006). Association between Lung Function and Mental Health Problems among Adults in the United States: Findings from the First National Health and Nutrition Examination Survey. *American Journal of Epidemiology*, *165*(4), 383–388. https://doi.org/10.1093/aje/kwk026

Grandpre, J., Alvaro, E. M., Burgoon, M., Miller, C. H., & Hall, J. R. (2003). Adolescent Reactance and Anti-Smoking Campaigns: A Theoretical Approach. *Health Communication*, *15*(3), 349–366. https://doi.org/10.1207/S15327027HC1503_6

Graton, A., & Mailliez, M. (2019). A Theory of Guilt Appeals: A Review Showing the Importance of Investigating Cognitive Processes as Mediators between Emotion and Behavior. *Behavioral Sciences*, *9*(12), 117. https://doi.org/10.3390/bs9120117

Groff, R. (2004). *Critical Realism, Post-positivism and the Possibility of Knowledge*. Routledge. https://doi.org/10.4324/9780203417270

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology*, *81*(2), 143–154. https://doi.org/10.1037/0022-0663.81.2.143

Grolnick, W. S., Ryan, R. M., & Deci, E. L. (1991). Inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology*, *83*(4), 508–517. https://doi.org/10.1037/0022-0663.83.4.508

Gross, K., & Bates, D. (2018). *mvnmle: ML Estimation for Multivariate Normal Data with Missing Values*. https://cran.r-project.org/package=mvnmle

Gruben, V., Siemieniuk, R. A., & McGeer, A. (2014). Health care workers, mandatory influenza vaccination policies and the law. *Canadian Medical Association Journal*, *186*(14), 1076–1080. https://doi.org/10.1503/cmaj.140035

Hagger, M. S., & Chatzisarantis, N. L. D. (2009). Integrating the theory of planned behaviour and self-determination theory in health behaviour: A meta-analysis. *British*

Journal of Health Psychology, *14*(2), 275–302. https://doi.org/10.1348/135910708X373959

Hair Jr., J. F., Black, William, C., & Babin, B. J. (2013). *Multivariate Data Analysis* (7th ed.). Pearson.

Hakim, H., Gaur, A. H., & McCullers, J. A. (2011). Motivating factors for high rates of influenza vaccination among healthcare workers. *Vaccine*, *29*(35), 5963–5969. https://doi.org/10.1016/j.vaccine.2011.06.041

Hammond, D., McDonald, P. W., Fong, G. T., Stephen Brown, K., & Cameron, R. (2004). The Impact of Cigarette Warning Labels and Smoke-free Bylaws on Smoking Cessation: Evidence from Former Smokers. *Canadian Journal of Public Health*, *95*(3), 201–204. https://doi.org/10.1007/BF03403649

Harrison, E., Drake, T., & Ots, R. (2019). *finalfit: Quickly Create Elegant Regression Results Tables and Plots when Modelling*. https://cran.r-project.org/package=finalfit

Hart, C. M., Ritchie, T. D., Hepper, E. G., & Gebauer, J. E. (2015). The Balanced Inventory of Desirable Responding Short Form (BIDR-16). *SAGE Open*, *5*(4), 1–9. https://doi.org/10.1177/2158244015621113

Heinrich-Morrison, K., McLellan, S., McGinnes, U., Carroll, B., Watson, K., Bass, P., Worth, L. J., & Cheng, A. C. (2015). An effective strategy for influenza vaccination of healthcare workers in Australia: Experience at a large health service without a mandatory policy. *BMC Infectious Diseases*, *15*(1), 42. https://doi.org/10.1186/s12879-015-0765-7

Higgins, E. T. (2012). Motivation science in social psychology: A tale of two histories. In

A. W. Kruglanski & W. Stroebe (Eds.), *Handbook of the history of social psychology* (pp. 199–218). Psychology Press.

Hochbaum, G. (1958). *Public participation in medical screening programs: A socio-psychological study*. U.S. Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services, Division of Special Health Services, Tuberculosis Program, 1958.

Hogan, V., Lenehan, M., Hogan, M., & Natin, D. P. (2019). Influenza vaccine uptake and attitudes of healthcare workers in Ireland. *Occupational Medicine*, *69*(7), 494–499. https://doi.org/10.1093/occmed/kqz124

Hollmeyer, H., Hayden, F., Mounts, A., & Buchholz, U. (2013). Review: interventions to increase influenza vaccination among healthcare workers in hospitals. *Influenza and Other Respiratory Viruses*, *7*(4), 604–621. https://doi.org/10.1111/irv.12002

House of Commons Science and Technology Committee. (2018). *Flu vaccination programme in England Ninth Report of Session 2017-19 Report, together with formal minutes relating to the report*. www.parliament.uk/science

Howitt, D., & Cramer, D. (2007). *Introduction to Research Methods in Psychology* (2nd ed.). Pearson Education Ltd.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Huang, C., Liao, H., & Chang, S.-H. (1998). Social desirability and the clinical self-report

inventory: Methodological reconsideration. *Journal of Clinical Psychology*, *54*(4), 517–528. https://doi.org/10.1002/(SICI)1097-4679(199806)54:4<517::AID-JCLP13>3.0.CO;2-I

Imdadullah, M., Aslam, M., & Altaf, S. (2016). mctest: An R Package for Deteection of Collinearity among Regressors. *The R Journal*, *8(2)*, 499–509. https://journal.r-project.org/archive/2016/RJ-2016-062/index.html

Imdadullah, M., Aslam, M., & Altaf, S. (2019). *mctest: Multicollinearity Diagnostic Measures*. https://cran.r-project.org/package=mctest

Jackson, D. L., Gillaspy, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods*, *14*(1), 6–23. https://doi.org/10.1037/a0014694

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A Decade Later. *Health Education Quarterly*, *11*(1), 1–47. https://doi.org/10.1177/109019818401100101

Jarosz, A. F., & Wiley, J. (2014). What Are the Odds? A Practical Guide to Computing and Reporting Bayes Factors. *The Journal of Problem Solving*, *7*(1), 2–9. https://doi.org/10.7771/1932-6246.1167

JASP Team. (2019). *JASP (Version 0.11.1)[Computer software]*. https://jasp-stats.org/

Jeffreys, H. (1961). *The Theory of Probability* (3rd ed.). Oxford University Press.

Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., & Rosseel, Y. (2019). *semTools: Useful Tools for Structural Equation Modeling*. https://cran.r-project.org/package=semTools

Kassianos, G., Kuchar, E., Nitsch-Osuch, A., Kyncl, J., Galev, A., Humolli, I., Falup-Pecurariu, O., Thomson, A., Klein, C., & Vallée-Tourangeau, G. (2018). Motors of influenza vaccination uptake and vaccination advocacy in healthcare workers: A comparative study in six European countries. *Vaccine*, *36*(44), 6546–6552. https://doi.org/10.1016/j.vaccine.2018.02.031

Ketelaar, T., & Tung Au, W. (2003). The effects of feelings of guilt on the behaviour of uncooperative individuals in repeated social bargaining games: An affect-as-information interpretation of the role of emotion in social interaction. *Cognition and Emotion*, *17*(3), 429–453. https://doi.org/10.1080/02699930143000662

Kim, S., Pjesivac, I., & Jin, Y. (2019). Effects of Message Framing on Influenza Vaccination: Understanding the Role of Risk Disclosure, Perceived Vaccine Efficacy, and Felt Ambivalence. *Health Communication*, *34*(1), 21–30. https://doi.org/10.1080/10410236.2017.1384353

Kim, Y., Dykema, J., Stevenson, J., Black, P., & Moberg, D. P. (2019). Straightlining: Overview of Measurement, Comparison of Indicators, and Effects in Mail–Web Mixed-Mode Surveys. *Social Science Computer Review*, *37*(2), 214–233. https://doi.org/10.1177/0894439317752406

King, M. F., & Bruner, G. C. (2000). Social desirability bias: A neglected aspect of validity testing. *Psychology and Marketing*, *17*(2), 79–103. https://doi.org/10.1002/(SICI)1520-6793(200002)17:2<79::AID-MAR2>3.0.CO;2-0

Kinnafick, F.-E., Thøgersen-Ntoumani, C., & Duda, J. (2016). The effect of need supportive text messages on motivation and physical activity behaviour. *Journal of Behavioral Medicine*, *39*(4), 574–586. https://doi.org/10.1007/s10865-016-9722-1

Kirkland, R. A., Karlin, N. J., Stellino, M. B., & Pulos, S. (2011). Basic Psychological Needs Satisfaction, Motivation, and Exercise in Older Adults. *Activities, Adaptation & Aging*, *35*(3), 181–196. https://doi.org/10.1080/01924788.2011.596764

Korkmaz, S., Goksuluk, D., & Zararsiz, G. (2014). MVN: An R Package for Assessing Multivariate Normality. *The R Journal*, *6*(2), 151–162. https://journal.r-project.org/archive/2014-2/korkmaz-goksuluk-zararsiz.pdf

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology* (2nd ed.). Sage Publications, Inc.

Lai, M. H. C., & Zhang, J. (2017). Evaluating Fit Indices for Multivariate t-Based Structural Equation Modeling with Data Contamination. *Frontiers in Psychology*, *8*(JUL). https://doi.org/10.3389/fpsyg.2017.01286

Lapinski, M. K., & Rimal, R. N. (2005). An Explication of Social Norms. *Communication Theory*, *15*(2), 127–147. https://doi.org/10.1111/j.1468-2885.2005.tb00329.x

Lehmann, B. A., Ruiter, R. A. C., Wicker, S., Chapman, G. B., & Kok, G. (2015). Medical students' attitude towards influenza vaccination. *BMC Infectious Diseases*, *15*(1), 185. https://doi.org/10.1186/s12879-015-0929-5

Lele, S. R., Keim, J. L., & Solymos, P. (2019). *ResourceSelection: Resource Selection (Probability) Functions for Use-Availability Data*. https://cran.r-project.org/package=ResourceSelection

Levesque, C. S., Williams, G. C., Elliot, D., Pickering, M. A., Bodenhamer, B., & Finley, P. J. (2006). Validating the theoretical structure of the Treatment Self-Regulation Questionnaire (TSRQ) across three different health behaviors. *Health Education*

Research, *22*(5), 691–702. https://doi.org/10.1093/her/cyl148

Ley, P., & Florio, T. (1996). The use of readability formulas in health care. *Psychology, Health & Medicine*, *1*(1), 7–28. https://doi.org/10.1080/13548509608400003

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*(3), 936–949. https://doi.org/10.3758/s13428-015-0619-7

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLoS Medicine*, *6*(7), e1000100. https://doi.org/10.1371/journal.pmed.1000100

Lipkus, I. M. (2007). Numeric, Verbal, and Visual Formats of Conveying Health Risks: Suggested Best Practices and Future Recommendations. *Medical Decision Making*, *27*(5), 696–713. https://doi.org/10.1177/0272989X07307271

Little, R. J. A. (1988). A Test of Missing Completely at Random for Multivariate Data with Missing Values. *Journal of the American Statistical Association*, *83*(404), 1198–1202. https://doi.org/10.1080/01621459.1988.10478722

Little, T. D., Slegers, D. W., & Card, N. A. (2006). A Non-arbitrary Method of Identifying and Scaling Latent Variables in SEM and MACS Models. *Structural Equation Modeling: A Multidisciplinary Journal*, *13*(1), 59–72. https://doi.org/10.1207/s15328007sem1301_3

Logan, J., Nederhoff, D., Koch, B., Griffith, B., Wolfson, J., Awan, F. A., & Basta, N. E.

(2018). ‘What have you HEARD about the HERD?’ Does education about local influenza vaccination coverage and herd immunity affect willingness to vaccinate? *Vaccine*, *36*(28), 4118–4125. https://doi.org/10.1016/j.vaccine.2018.05.037

Long, J. A. (2019a). *interactions: Comprehensive, User-Friendly Toolkit for Probing Interactions*. https://cran.r-project.org/package=interactions

Long, J. A. (2019b). *jtools: Analysis and Presentation of Social Scientific Data*. https://cran.r-project.org/package=jtools

Lytras, T., Kopsachilis, F., Mouratidou, E., Papamichail, D., & Bonovas, S. (2016). Interventions to increase seasonal influenza vaccine coverage in healthcare workers: A systematic review and meta-regression analysis. *Human Vaccines & Immunotherapeutics*, *12*(3), 671–681. https://doi.org/10.1080/21645515.2015.1106656

Macdougall, M. (2011). Moving beyond the nuts and bolts of score reliability in medical education: Some valuable lessons from measurement theory. *Advances and Applications in Statistical Sciences*, *6*(7), 643–664.

Magnusson, K. (2020). *Understanding Cohen’s d | R Psychologist*. https://rpsychologist.com/d3/cohend/

Malhotra, Y., & Galleta, D. F. (2003). Role of commitment and motivation in knowledge management systems implementation: theory, conceptualization, and measurement of antecedents of success. *Proceedings of the 36th Annual Hawaii International Conference on System Sciences*, 10 pp. https://doi.org/10.1109/HICSS.2003.1174264

Mardia, K. V. (1970). Measures of multivariate skewness and kurtosis with applications.

Biometrika, *57*(3), 519–530. https://doi.org/10.1093/biomet/57.3.519

Maul, A. (2013). Method Effects and the Meaning of Measurement. *Frontiers in Psychology*, *4*, 169. https://doi.org/10.3389/fpsyg.2013.00169

McDonald, J. H. (2014). *Handbook of Biological Statistics* (3rd ed.). Sparky House Publishing.

McLaughlin, B., Schutz, C., & White, D. (1980). Parental Speech to Five-Year-Old Children in a Game-Playing Situation. *Child Development*, *51*(2), 580. https://doi.org/10.2307/1129297

Meng, X., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin*, *111*(1), 172–175. https://doi.org/10.1037/0033-2909.111.1.172

Meyer, R. D. (2007). Incremental Validity. In S. Rogelberg (Ed.), *Encyclopedia of Industrial and Organizational Psychology* (pp. 340–341). SAGE Publications, Inc. https://doi.org/10.4135/9781412952651

Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: evidence-based or evidence-inspired? *Psychology & Health*, *19*(1), 29–49. https://doi.org/10.1080/0887044031000141199

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1). https://doi.org/10.1186/1748-5908-6-42

Michie, S., West, R., Campbell, R., Brown, J., & Gainforth, H. (2014). *ABC of Behaviour Change Theories (ABC of Behavior Change): An Essential Resource for Researchers,*

Policy Makers and Practitioners. Silverback Publishing.

Miller, C. H., Lane, L. T., Deatrick, L. M., Young, A. M., & Potts, K. A. (2007). Psychological Reactance and Promotional Health Messages: The Effects of Controlling Language, Lexical Concreteness, and the Restoration of Freedom. *Human Communication Research*, *33*(2), 219–240. https://doi.org/10.1111/j.1468-2958.2007.00297.x

Mitchell, M. L., & Jolley, J. M. (2013). *Research Design Explained, Eighth Edition* (8th ed.). Wadsworth Cengage Learning.

Mo, P. K. H., Wong, C. H. W., & Lam, E. H. K. (2019). Can the Health Belief Model and moral responsibility explain influenza vaccination uptake among nurses? *Journal of Advanced Nursing*, *75*(6), 1188–1206. https://doi.org/10.1111/jan.13894

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Mollen, S., Ruiter, R. A. C., & Kok, G. (2010). Current issues and new directions in Psychology and Health : What are the oughts? The adverse effects of using social norms in health communication. *Psychology & Health*, *25*(3), 265–270. https://doi.org/10.1080/08870440903262812

Moller, A. C., Deci, E. L., & Ryan, R. M. (2006). Choice and ego-depletion: the moderating role of autonomy. *Personality & Social Psychology Bulletin*, *32*(8), 1024–1036. https://doi.org/10.1177/0146167206288008

Moller, A. C., McFadden, H. G., Hedeker, D., & Spring, B. (2012). Financial Motivation

Undermines Maintenance in an Intensive Diet and Activity Intervention. *Journal of Obesity*, *2012*, 1–8. https://doi.org/10.1155/2012/740519

Montaño, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In K. Glanz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior : Theory, research, and practice.* (5th ed., pp. 95–124). John Wiley & Sons, Inc. https://ebookcentral.proquest.com

Morse, J. M. (1991). Approaches to Qualitative-Quantitative Methodological Triangulation. *Nursing Research*, *40*(2), 120–123. https://doi.org/10.1097/00006199-199103000-00014

Moustaka, F. C., Vlachopoulos, S. P., Kabitsis, C., & Theodorakis, Y. (2012). Effects of an Autonomy-Supportive Exercise Instructing Style on Exercise Motivation, Psychological Well-Being, and Exercise Attendance in Middle-Age Women. *Journal of Physical Activity and Health*, *9*(1), 138–150. https://doi.org/10.1123/jpah.9.1.138

Mowbray, F., Marcu, A., Godinho, C. A., Michie, S., & Yardley, L. (2016). Communicating to increase public uptake of pandemic flu vaccination in the UK: Which messages work? *Vaccine*, *34*(28), 3268–3274. https://doi.org/10.1016/j.vaccine.2016.05.006

Myers, L. B., & Goodwin, R. (2011). Determinants of adults' intention to vaccinate against pandemic swine flu. *BMC Public Health*, *11*(1), 15. https://doi.org/10.1186/1471-2458-11-15

NHS. (2019). *Who should have the flu jab?* https://www.nhs.uk/conditions/vaccinations/who-should-have-flu-vaccine/

NHS Employers. (2019). *Flu fighter*. https://www.nhsemployers.org/flu

NHS England. (2019). *Commissioning for Quality and Innovation (CQUIN): Guidance for 2019-2020*. https://www.england.nhs.uk/publication/commissioning-for-quality-and-innovation-cquin-guidance-for-2019-2020/

NHS England. (2020). *Commissioning for Quality and Innovation (CQUIN): CCG Indicator Specifications for 2019-2020*. https://www.england.nhs.uk/publication/ccg-cquin-2019-20-indicators-specifications/

NICE, & Public Health England. (2018). *Flu vaccination: increasing uptake. NICE guideline [NG103]*. www.nice.org.uk/guidance/ng103

O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instruments, & Computers*, *32*(3), 396–402. https://doi.org/10.3758/BF03200807

O'Keefe, D. J., & Jensen, J. D. (2007). The Relative Persuasiveness of Gain-Framed Loss-Framed Messages for Encouraging Disease Prevention Behaviors: A Meta-Analytic Review. *Journal of Health Communication*, *12*(7), 623–644. https://doi.org/10.1080/10810730701615198

O'Reilly, F. W., Cran, G. W., & Stevens, A. B. (2005). Factors affecting influenza vaccine uptake among health care workers. *Occupational Medicine*, *55*(6), 474–479. https://doi.org/10.1093/occmed/kqi099

O'Reilly, K. (2012). *Ethnographic Methods* (2nd ed.). Routledge.

Patrick, H., & Williams, G. C. (2012). Self-determination theory: its application to health

behavior and complementarity with motivational interviewing. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 18. https://doi.org/10.1186/1479-5868-9-18

Pavey, L., & Sparks, P. (2008). Threats to autonomy: Motivational responses to risk information. *European Journal of Social Psychology*, *38*(5), 852–865. https://doi.org/10.1002/ejsp.477

Pavey, L., & Sparks, P. (2012). Autonomy and defensiveness: Experimentally increasing adaptive responses to health-risk information via priming and self-affirmation. *Psychology & Health*, *27*(3), 259–276. https://doi.org/10.1080/08870446.2011.556251

Peretti-Watel, P., Ward, J. K., Schulz, W. S., Verger, P., & Larson, H. J. (2015). Vaccine Hesitancy: Clarifying a Theoretical Framework for an Ambiguous Notion. *PLOS Currents Outbreaks*, *Edition 1*. https://doi.org/10.1371/currents.outbreaks.6844c80ff9f5b273f34c91f71b7fc289

Petticrew, M., & Roberts, H. (2006). *Systematic Reviews in the Social Sciences: A Practical Guide*. Blackwell Publishing.

Plans-Rubió, P. (2012). The vaccination coverage required to establish herd immunity against influenza viruses. *Preventive Medicine*, *55*(1), 72–77. https://doi.org/10.1016/j.ypmed.2012.02.015

Pless, A., Shaw, D., McLennan, S., & Elger, B. S. (2017). Nurses' attitudes towards enforced measures to increase influenza vaccination: A qualitative study. *Influenza and Other Respiratory Viruses*, *11*(3), 247–253. https://doi.org/10.1111/irv.12441

Plotkin, S. L., & Plotkin, S. A. (2013). A short history of vaccination. In S. A. Plotkin, W. A. Orenstein, & P. A. Offit (Eds.), *Vaccines* (6th ed., pp. 1–13). Elsevier Health Sciences.

Prematunge, C., Corace, K. M., McCarthy, A., Nair, R. C., Pugsley, R., & Garber, G. E. (2012). Factors influencing pandemic influenza vaccination of healthcare workers—A systematic review. *Vaccine*, *30*(32), 4733–4743. https://doi.org/10.1016/j.vaccine.2012.05.018

Public Health England. (2016). *Seasonal influenza vaccine uptake amongst frontline healthcare workers (HCWs) in England: Winter season 2015 to 2016.* https://www.gov.uk/government/statistics/seasonal-flu-vaccine-uptake-in-healthcare-workers-in-england-winter-season-2015-to-2016

Public Health England. (2017). *Influenza vaccine effectiveness (VE) in adults and children in primary care in the United Kingdom (UK): provisional end-of-season results 2016-17*. https://www.gov.uk/government/publications/influenza-vaccine-effectiveness-seasonal-estimates

Public Health England. (2018). *Influenza vaccine effectiveness (VE) in adults and children in primary care in the United Kingdom (UK): provisional end-of-season results 2017-18*. https://www.gov.uk/government/publications/influenza-vaccine-effectiveness-seasonal-estimates

Public Health England. (2019a). *Seasonal flu vaccine uptake in HCWs in England: winter season 2018 to 2019*. https://www.gov.uk/government/statistics/seasonal-flu-vaccine-uptake-in-healthcare-workers-winter-2018-to-2019

Public Health England. (2019b). *Surveillance of influenza and other respiratory viruses in*

the UK. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839350/Surveillance_of_influenza_and_other_respiratory_viruses_in_the_UK_2018_to_2019-FINAL.pdf

Public Health England. (2019c). *Uk Measles and Rubella elimination strategy 2019*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769970/UK_measles_and_rubella_elimination_strategy.pdf

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review*, *41*, 71–90. https://doi.org/10.1016/j.dr.2016.06.004

R Core Team. (2019). *R: A Language and Environment for Statistical Computing*. https://www.r-project.org/

Rashid, H., Yin, J. K., Ward, K., King, C., Seale, H., & Booy, R. (2016). Assessing Interventions To Improve Influenza Vaccine Uptake Among Health Care Workers. *Health Affairs*, *35*(2), 284–292. https://doi.org/10.1377/hlthaff.2015.1087

Raykov, T. (1997). Estimation of Composite Reliability for Congeneric Measures. *Applied Psychological Measurement*, *21*(2), 173–184. https://doi.org/10.1177/01466216970212006

Raykov, T., & Marcoulides, G. A. (2011). *Introduction to Psychometric Theory* (1st ed.). Routledge. https://doi.org/10.4324/9780203841624

Redding, C. A., Rossi, J. S., Rossi, S. R., Veliver, W. F., & Prochaska, J. O. (2000). Health behavior models. *The International Electronic Journal of Health Education*, *3*(Special

Issue), 180–193.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion*, *28*(2), 147–169. https://doi.org/10.1023/B:MOEM.0000032312.95499.6f

Resnicow, K., Zhou, Y., Hawley, S., Jimbo, M., Ruffin, M. T., Davis, R. E., Shires, D., & Lafata, J. E. (2014). Communication preference moderates the effect of a tailored intervention to increase colorectal cancer screening among African Americans. *Patient Education and Counseling*, *97*(3), 370–375. https://doi.org/10.1016/j.pec.2014.08.013

Revelle, W. (2018). *psych: Procedures for Psychological, Psychometric, and Personality Research*. https://cran.r-project.org/package=psych

Riccò, M., Cattani, S., Casagranda, F., Gualerzi, G., & Signorelli, C. (2017). Knowledge, attitudes, beliefs and practices of Occupational Physicians towards seasonal influenza vaccination: a cross-sectional study from North-Eastern Italy. *Journal of Preventive Medicine and Hygiene*, *58*(2), E141–E154. http://www.ncbi.nlm.nih.gov/pubmed/28900354

Rose, S., Spinks, N., & Canhoto, A. I. (2014). *Management Research: Applying the Principles*. Routledge. https://doi.org/10.4324/9781315819198

Rosella, L., Bowman, C., Pach, B., Morgan, S., Fitzpatrick, T., & Goel, V. (2016). The development and validation of a meta-tool for quality appraisal of public health evidence: Meta Quality Appraisal Tool (MetaQAT). *Public Health*, *136*, 57–65. https://doi.org/10.1016/j.puhe.2015.10.027

Rosseel, Y. (2012). lavaan : An R Package for Structural Equation Modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Rouder, J. N. (2016). The what, why, and how of born-open data. *Behavior Research Methods*, *48*(3), 1062–1069. https://doi.org/10.3758/s13428-015-0630-z

RStudio. (2019). *RStudio: Integrated Development Environment for R*. http://www.rstudio.com/

Rubinstein, H., Marcu, A., Yardley, L., & Michie, S. (2015). Public preferences for vaccination and antiviral medicines under different pandemic flu outbreak scenarios. *BMC Public Health*, *15*(1), 190. https://doi.org/10.1186/s12889-015-1541-8

Rutkowski, L., & Svetina, D. (2014). Assessing the Hypothesis of Measurement Invariance in the Context of Large-Scale International Surveys. *Educational and Psychological Measurement*, *74*(1), 31–57. https://doi.org/10.1177/0013164413498257

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*(5), 749–761. https://doi.org/10.1037/0022-3514.57.5.749

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, *66*(4), 507–514. https://doi.org/10.1007/BF02296192

Schafer, J. L. (1997). *Analysis of Incomplete Multivariate Data*. CRC Press.

Schafer, J. L. (1999). Multiple imputation: a primer. *Statistical Methods in Medical Research*, *8*(1), 3–15. https://doi.org/10.1177/096228029900800102

Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M.-L. (2017). Barriers of Influenza Vaccination Intention and Behavior – A Systematic Review of Influenza Vaccine Hesitancy, 2005 – 2016. *PLOS ONE*, *12*(1), e0170550. https://doi.org/10.1371/journal.pone.0170550

Schmidtke, K. A., Nightingale, P. G., Reeves, K., Gallier, S., Vlaev, I., Watson, S. I., & Lilford, R. J. (2019). Randomised controlled trial of a theory-based intervention to prompt front-line staff to take up the seasonal influenza vaccine. *BMJ Quality & Safety*, 1–9. https://doi.org/10.1136/bmjqs-2019-009775

Schreier, M. (2012). *Qualitative Content Analysis in Practice*. SAGE Publications.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., Griskevicius, V., & Schultz, W. (2007). The Constructive, Destructive, and Reconstructive Power of Social Norms. *PSYCHOLOGICAL SCIENCE*, *18*(5), 429–434. https://doi.org/10.1111/j.1467-9280.2007.01917.x

Seale, H., Kaur, R., Lajoie, K., Dixon, J., & Gallard, J. (2016). Examining the role of a decision aid in reducing decisional conflict amongst hospital healthcare workers towards receiving the influenza vaccine. *BMC Health Services Research*, *16*(1), 84. https://doi.org/10.1186/s12913-016-1339-0

Stead, M., Critchlow, N., Eadie, D., Sullivan, F., Gravenhorst, K., & Dobbie, F. (2019). Mandatory policies for influenza vaccination: Views of managers and healthcare workers in England. *Vaccine*, *37*(1), 69–75. https://doi.org/10.1016/j.vaccine.2018.11.033

Steindl, C., Jonas, E., Sittenthaler, S., Traut-Mattausch, E., & Greenberg, J. (2015). Understanding Psychological Reactance: New Developments and Findings. *Zeitschrift Für Psychologie*, *223*(4), 205–214. https://doi.org/10.1027/2151-2604/a000222

Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics* (5th ed.). Pearson Education. Inc.

Teixeira, P. J., Carraça, E. V, Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 78. https://doi.org/10.1186/1479-5868-9-78

Thomas, K. W., & Velthouse, B. A. (1990). Cognitive Elements of Empowerment: An "Interpretive" Model of Intrinsic Task Motivation. *Academy of Management Review*, *15*(4), 666–681. https://doi.org/10.5465/amr.1990.4310926

Thomson, A., Robinson, K., & Vallée-Tourangeau, G. (2016). The 5As: A practical taxonomy for the determinants of vaccine uptake. *Vaccine*, *34*(8), 1018–1024. https://doi.org/10.1016/j.vaccine.2015.11.065

To, K. W., Lai, A., Lee, K. C. K., Koh, D., & Lee, S. S. (2016). Increasing the coverage of influenza vaccination in healthcare workers: review of challenges and solutions. *Journal of Hospital Infection*, *94*(2), 133–142. https://doi.org/10.1016/j.jhin.2016.07.003

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, *14*(3), 207–222. https://doi.org/10.1111/1467-8551.00375

Turner, J., Perkins, H. W., & Bauerle, J. (2008). Declining negative consequences related to alcohol misuse among students exposed to a social norms marketing intervention on a college campus. *Journal of American College Health*, *57*(1), 85–93. https://doi.org/10.3200/JACH.57.1.85-94

Turner, M. M. (2012). Using Emotional Appeals in Health Messages. In H. Cho (Ed.), *Health communication message design : theory and practice* (pp. 59–72). SAGE Publications.

Ünlü, A. (2019). Self-determination motivation theory in R: The software package SDT. *Archives of Psychology*, *3*(9). https://doi.org/10.31296/aop.v3i9.131

Ünlü, A., & Dettweiler, U. (2015). Motivation Internalization and Simplex Structure in Self-Determination Theory. *Psychological Reports*, *117*(3), 675–691. https://doi.org/10.2466/14.PR0.117c25z1

Vallée-Tourangeau, G., Promberger, M., Moon, K., Wheelock, A., Sirota, M., Norton, C., & Sevdalis, N. (2018). Motors of influenza vaccination uptake and vaccination advocacy in healthcare workers: Development and validation of two short scales. *Vaccine*, *36*(44), 6540–6545. https://doi.org/10.1016/j.vaccine.2017.08.025

van ’t Riet, J., Ruiter, R. A. C., Werrij, M. Q., & de Vries, H. (2010). Investigating message-framing effects in the context of a tailored intervention promoting physical activity. *Health Education Research*, *25*(2), 343–354. https://doi.org/10.1093/her/cyp061

Van den Broeck, A., Vansteenkiste, M., De Witte, H., Soenens, B., & Lens, W. (2010). Capturing autonomy, competence, and relatedness at work: Construction and initial validation of the Work-related Basic Need Satisfaction scale. *Journal of Occupational*

and Organizational Psychology, *83*(4), 981–1002. https://doi.org/10.1348/096317909X481382

van Prooijen, J.-W., & van der Kloot, W. A. (2001). Confirmatory Analysis of Exploratively Obtained Factor Structures. *Educational and Psychological Measurement*, *61*(5), 777–792. https://doi.org/10.1177/00131640121971518

Vandenberg, R. J., & Lance, C. E. (2000). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, *3*(1), 4–70. https://doi.org/10.1177/109442810031002

Vansteenkiste, M., Lens, W., & Deci, E. L. (2006). Intrinsic Versus Extrinsic Goal Contents in Self-Determination Theory: Another Look at the Quality of Academic Motivation. *Educational Psychologist*, *41*(1), 19–31. https://doi.org/10.1207/s15326985ep4101_4

Vaz, A., Pratley, P., & Alkire, S. (2016). Measuring Women's Autonomy in Chad Using the Relative Autonomy Index. *Feminist Economics*, *22*(1), 264–294. https://doi.org/10.1080/13545701.2015.1108991

Verhagen, J., & Wagenmakers, E.-J. (2014). Bayesian tests to quantify the result of a replication attempt. *Journal of Experimental Psychology: General*, *143*(4), 1457–1475. https://doi.org/10.1037/a0036731

Wagenmakers, E.-J. (2007). A practical solution to the pervasive problems of p values. *Psychonomic Bulletin & Review*, *14*(5), 779–804. https://doi.org/10.3758/BF03194105

Wagenmakers, E.-J., Love, J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., Selker, R., Gronau, Q. F., Dropmann, D., Boutin, B., Meerhoff, F., Knight, P., Raj, A., van Kesteren, E.-J., van Doorn, J., Šmíra, M., Epskamp, S., Etz, A., Matzke, D., … Morey, R. D. (2018). Bayesian inference for psychology. Part II: Example applications with JASP. *Psychonomic Bulletin & Review*, *25*(1), 58–76. https://doi.org/10.3758/s13423-017-1323-7

Wagenmakers, E.-J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., Love, J., Selker, R., Gronau, Q. F., Šmíra, M., Epskamp, S., Matzke, D., Rouder, J. N., & Morey, R. D. (2018). Bayesian inference for psychology. Part I: Theoretical advantages and practical ramifications. *Psychonomic Bulletin & Review*, *25*(1), 35–57. https://doi.org/10.3758/s13423-017-1343-3

West, R., & Brown, J. (2013). *Theory of Addiction*. Wiley.

Wheelock, A., Parand, A., Rigole, B., Thomson, A., Miraldo, M., Vincent, C., & Sevdalis, N. (2014). Socio-Psychological Factors Driving Adult Vaccination: A Qualitative Study. *PLoS ONE*, *9*(12), e113503. https://doi.org/10.1371/journal.pone.0113503

Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org

Wilkerson, J. M., Noor, S. W., Galos, D. L., & Rosser, B. R. S. (2016). Correlates of a Single-Item Indicator Versus a Multi-Item Scale of Outness About Same-Sex Attraction. *Archives of Sexual Behavior*, *45*(5), 1269–1277. https://doi.org/10.1007/s10508-015-0605-2

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and*

Social Psychology, *70*(4), 767–779. https://doi.org/10.1037/0022-3514.70.4.767

Williams, G. C., Freedman, Z. R., & Deci, E. L. (1998). Supporting Autonomy to Motivate Patients With Diabetes for Glucose Control. *Diabetes Care*, *21*(10), 1644–1651. https://doi.org/10.2337/diacare.21.10.1644

Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology*, *70*(1), 115–126. https://doi.org/10.1037/0022-3514.70.1.115

Williams, G. C., McGregor, H. A., Sharp, D., Levesque, C. S., Kouides, R. W., Ryan, R. M., & Deci, E. L. (2006). Testing a self-determination theory intervention for motivating tobacco cessation: Supporting autonomy and competence in a clinical trial. *Health Psychology*, *25*(1), 91–101. https://doi.org/10.1037/0278-6133.25.1.91

Williams, G. C., McGregor, H. A., Zeldman, A., Freedman, Z. R., & Deci, E. L. (2004). Testing a Self-Determination Theory Process Model for Promoting Glycemic Control Through Diabetes Self-Management. *Health Psychology*, *23*(1), 58–66. https://doi.org/10.1037/0278-6133.23.1.58

World Health Organization. (2015). *WHO | Influenza*. WHO; World Health Organization. https://www.who.int/immunization/diseases/influenza/en/

World Health Organization. (2017). *Health topics: Vaccines*. World Health Organization. http://www.who.int/topics/vaccines/en/

World Health Organization. (2019a). *Pandemic influenza*. World Health Organization. http://www.euro.who.int/en/health-topics/communicable-

diseases/influenza/pandemic-influenza

World Health Organization. (2019b). *Ten threats to global health in 2019*. https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019

World Health Organization. (2019c, September 8). *Pandemic influenza*. World Health Organization. http://www.euro.who.int/en/health-topics/communicable-diseases/influenza/pandemic-influenza

Yaqub, O., Castle-Clarke, S., Sevdalis, N., & Chataway, J. (2014). Attitudes to vaccination: A critical review. *Social Science & Medicine*, *112*, 1–11. https://doi.org/10.1016/j.socscimed.2014.04.018

Youngblut, J. M., & Casper, G. R. (1993). Focus on psychometrics single-item indicators in nursing research. *Research in Nursing & Health*, *16*(6), 459–465. https://doi.org/10.1002/nur.4770160610

Zeileis, A., & Hothorn, T. (2002). Diagnostic Checking in Regression Relationships. *R News*, *2*(3), 7–10. https://cran.r-project.org/doc/Rnews/

Ziegler, T., Mamahit, A., & Cox, N. J. (2018). 65 years of influenza surveillance by a World Health Organization-coordinated global network. *Influenza and Other Respiratory Viruses*, *12*(5), 558–565. https://doi.org/10.1111/irv.12570

Appendix A

Ethical Approval of studies

CHAPTER 4
Phase 1
(pilot with organizational sample)

Kingston University London

Kingston Business School [redacted] Kingston Hill [redacted]

29 June 2017

RE: FREC 17 24

Exploring healthcare workers' motivations and attitudes toward vaccinating against the flu in the [redacted] NHS Foundation Trust

The above named project was submitted by Karis Moon on 22 June 2017 for review by the Faculty Research Ethics Committee. On the basis of the information provided the Committee has given approval.

With kind regards

[redacted]

Chair

Faculty Research Ethics Committee

Kingston Business School

Result - England 22/06/2017, 10:16

Go straight to content.

MRC Medical Research Council — NHS Health Research Authority

Do I need NHS REC approval?

To print your result with title and IRAS Project ID please enter your details below:

Title of your research:

Exploring HCWs' motivations and attitudes toward flu vaccination.

IRAS Project ID (if available): [redacted]

Your answers to the following questions indicate that **you do not need NHS REC approval for sites in England.** However, **you may need other approvals.**

Phase 2
Track of amendments to place ad on Social media for recruitment

To: "Moon, Karis A" <[redacted]>
Cc: "Riege, Anine C" <[redacted]>, Gaelle Vallee-Tourangeau <[redacted]>, "Gourdon - Kanhukamwe, Amelie" <[redacted]>
Subject: RE: FREC 17 24: Amendment to an ethics application - Flu Study for Facebook

Hi Karis

I have confirmation that there is no issue with the ad.

Best wishes

Phase 3, 4 and 5

Thursday, November 22, 2018 at 9:51:09 AM Greenwich Mean Time

Subject: RE: 1828 Amendment: Ethics application study 3 and 4 Flu-TSRQ
Date: Friday, 9 November 2018 at 14:50:53 Greenwich Mean Time
From: [redacted]
To: Moon, Karis
CC: Vallee-Tourangeau, Gaelle
Attachments: RE4-Supplementary-information-TSRQ-updated.docx, Result - NOT Research.pdf, Nursing-RE4-Supplementary-information-TSRQ-.docx

Dear Karis

Thank you for calling this afternoon to remind me about your request for an amendment to your ethics application 1828. Apologies for the delay in responding.

I am pleased to confirm that the Chair on behalf of the FBSS Research Ethics Committee has conveyed a favourable ethical approval for your amendment to application 1828 attached, entitled: 'Understanding your sentiments and motivation regarding the flu vaccination'.

Kind regards

[redacted]
Research Operations Manager (FBSS)
[redacted]

197

CHAPTER 6

From: [redacted]
Date: Wednesday, 1 May 2019 at 10:11
To: "Moon, Karis" <[redacted]>
Cc: Gaelle Vallee-Tourangeau <[redacted]>, "Riege, Anine C" <[redacted]>, "Gourdon-Kanhukamwe, Amelie N" <[redacted]>
Subject: FW: 181954: Research Ethics Application

Dear Karis

To confirm that the Faculty Research Ethics committee has conveyed a favourable opinion on your research ethics application 181954 attached, entitled: 'Promotional health messages: The moderating effect of motivation on Healthcare. Professionals Flu vaccine decisions'.

Please note: 'If any changes are made to the research plan that you submitted to us for review and if these raise any new ethical issues, you are required to seek the Committee's opinion on these before implementing them. Also, as part of our quality control process, we shall contact a random selection of applicants for ethical review before the end of the current academic year and ask for a report on the ethical conduct of their research (including adherence to ethical commitments and reflections on ethical challenges, where relevant). Please keep a record of these matters to help you complete this report if you are selected for this exercise.'

Kind regards

[redacted]
[redacted]
Research Operations Manager (FBSS/KSA)
[redacted]

Appendix B

Chapter 4: Initial Validity Evidence for the Treatment Self-Regulation Questionnaire assessing HCP flu Vaccination Behaviour Questionnaire (Flu-TSRQ).

Table S1

Bivariate correlations between the Motivation regulation items of Vaccinators and Non-vaccinators (Pilot sample)

Item	*M*	*SD*	Skewness	Kurtosis	Correlations																
					1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
Vaccinators (*n* = 42)																							
Controlled Regulation																							
1. Other people would be mad at me if I didn't.	1.48	1.25	2.98	9.27																			
2. I would feel guilty if I didn't do what was recommended by my line-manager.	1.93	1.61	1.77	2.29	**.282**																		
3. I want my line-manager to think I'm a good employee.	2.48	2.16	1.14	-0.14	.311	.774																	
4. I would feel bad about myself if I didn't get the flu jab.	3.74	2.21	-0.08	-1.42	**.020**	.309	.344																
5. I don't want other people to be disappointed in me.	1.90	1.57	1.94	3.52	**.234**	.852	.819	.371															
6. Other people would be upset with me if I didn't get the flu jab.	1.69	1.33	2.35	5.79	.732	.386	.332	**.195**	.357														
7. I would be ashamed of myself if I didn't get the flu jab.	2.57	1.98	0.81	-0.72	**.084**	**.258**	**.261**	.638	.441	**.272**													
8. It is easier to do what I'm told than to think about it.	1.33	0.87	2.96	8.75	.408	**.121**	**.224**	**.210**	.307	.425	.437												
9. I want others to see that I can have the flu vaccine and stay healthy.	4.02	2.10	-0.22	-1.17	**.153**	**.209**	**.207**	**-.114**	**.229**	**.064**	**.149**	**.115**											
10. I just do it because my line-manager recommends to.	1.40	1.01	2.49	5.08	.497	**.272**	.401	**.179**	.407	.618	.454	.835	**.202**										
11. I'd feel guilty if I didn't get the flu jab.	2.67	1.97	0.81	-0.68	**.046**	.330	.308	.663	.516	**.275**	.826	.462	**.120**	.448									
Autonomous Regulation																							
12. I find it a personal challenge to do so.	2.10	1.87	1.59	1.25	**-.020**	.333	**.164**	.549	**.276**	**.051**	.637	**.278**	**.148**	**.198**	.643								
13. I personally believe that having the flu vaccine will protect my health.	6.07	1.14	-1.09	0.20	**.096**	**-.024**	**-.074**	**.047**	**-.133**	**.047**	**.079**	**-.221**	.337	**-.068**	**-.098**	**.020**							
14. It's important to get vaccinated to protect myself from the flu virus.	6.12	1.15	-1.05	-0.02	**-.125**	**-.074**	**-.122**	**.089**	**-.168**	**-.087**	**-.009**	-.404	**.251**	**-.272**	**-.132**	**-.119**	.870						
15. It's important to get the jab to protect my colleagues and patients from the flu.	6.17	1.29	-1.63	2.01	**-.111**	**.076**	**.067**	**.290**	**.104**	**.017**	**.192**	**-.181**	**.278**	**-.109**	**.292**	**.155**	.409	.497					
16. I personally believe it's important to do so in order to stay healthy.	5.88	1.27	-1.33	1.40	**.067**	**.126**	**.137**	**.162**	**.128**	**.078**	**.212**	**-.095**	.485	**.038**	**.110**	**.077**	.817	.742	.489				
17. I've carefully thought about flu vaccination and believe it's the right thing to do.	5.90	1.32	-1.08	0.50	**-.207**	**-.186**	**-.069**	**.233**	**-.133**	**-.238**	.339	**-.162**	.370	**-.098**	**.175**	**.152**	.558	.584	.540	.559			
18. I feel personally that getting vaccinated against the flu is the best thing for me.	6.21	1.26	-2.04	4.36	**-.236**	**-.100**	**-.021**	**.196**	**-.076**	**-.177**	**.224**	**-.089**	.348	**-.089**	**.079**	**-.092**	.569	.654	.414	.534	.642		
19. Having the flu vaccination is a choice I really want to make.	5.86	1.41	-1.39	2.03	**-.071**	**.038**	**.128**	.302	**.104**	**-.115**	.381	**.059**	.430	**.093**	**.255**	**.191**	.633	.628	.634	.726	.766	.720	
20. It's a challenge to deal with the consequences of getting sick with the flu.	5.64	1.79	-1.49	1.44	**.045**	**.016**	**.121**	**.222**	**.126**	**.106**	**.252**	**.062**	**.002**	**.068**	**.214**	**-.048**	**.097**	**.257**	**.058**	**.131**	**.129**	**.218**	**.182**
Non-Vaccinators (*n* = 24)																							
Controlled Regulation																							
1. Other people would be mad at me if I did.	1.04	0.20	4.90	24.00																			
2. I would feel guilty if I did what was recommended by my line-manager.	1.45	1.10	2.48	5.43	**.111**																		
3. It won't make my line-manager think I'm a good employee.	1.35	0.83	2.35	4.64	**.168**	.529																	
4. I would feel bad about myself if I got the flu jab.	1.54	1.32	3.44	13.37	**.067**	**-.029**	**.011**																
5. I don't want other people to be disappointed in me.	1.25	0.74	3.11	9.37	**.212**	**.128**	**.206**	.882															
6. Other people would be upset with me if I got the flu jab.	1.13	0.45	3.80	14.65	.413	.336	.470	**.240**	.555														
7. I would be ashamed of myself if I got the flu jab.	1.29	0.75	2.81	7.77	**.195**	**-.121**	.321	.440	.405	**.006**													
8. I do not want to do what I'm told without thinking about it.	3.17	2.51	0.55	-1.47	.357	**-.069**	**.098**	**-.045**	**.037**	.322	**.084**												
9. I want others to see that I don't get the flu vaccine and stay healthy.	1.79	1.77	2.14	3.41	**.017**	**.197**	**.003**	**-.099**	**-.142**	**-.088**	**.298**	.406											
10. I do not just do it because my line-manager recommends to.	2.67	2.24	0.96	-0.50	.312	**-.136**	**.060**	**-.101**	**.002**	**.248**	**.195**	.864	.518										
11. I'd feel guilty if I got the flu jab.	1.38	0.82	2.22	4.16	**.155**	**.046**	.377	**.028**	**.185**	.450	.367	.528	.676	.602									
Autonomous Regulation																							
12. I find it a personal challenge to do so.	2.58	2.06	1.01	-0.22	**.149**	**.063**	**-.046**	.385	.455	**.108**	**.286**	**.220**	**-.114**	**.142**	**-.088**								
13. I personally believe that having the flu vaccine will not protect my health.	3.58	1.91	0.25	-0.63	**.146**	**-.063**	.324	**.203**	**.144**	**.200**	.475	.389	.545	.435	.685	**.024**							
14. It's not important to get vaccinated to protect myself from the flu virus.	3.08	1.98	0.46	-0.72	**.083**	**-.082**	**.023**	**.079**	**.075**	**.009**	.533	**.293**	**.263**	.310	**.130**	.467	.368						
15. It's not important to get the jab to protect my colleagues and patients from the flu.	2.58	2.02	1.01	-0.21	**.139**	**-.132**	**.142**	**.162**	**.171**	**.090**	.622	**.223**	**.281**	**.233**	**.257**	.391	.466	.743					
16. I personally believe it's not important to do so in order to stay healthy.	3.79	2.13	0.06	-1.14	**-.005**	**.033**	**.100**	**.229**	**.114**	**-.107**	.471	.477	.576	.464	.427	.482	.689	.619	.539				
17. I've carefully thought about flu vaccination and believe it's not the right thing to do	3.42	2.23	0.25	-1.34	**.247**	-.306	**-.074**	.346	**.247**	**.068**	.418	.628	.408	.581	.456	.434	.713	.527	.503	.833			
18. I feel personally that not vaccinating myself against the flu is the best thing for me.	3.42	2.38	0.35	-1.35	**.129**	**-.025**	**.236**	.394	.478	.349	.324	.665	.318	.588	.526	.495	.604	.435	.470	.737	.820		
19. Declining flu vaccination is a choice I really want to make.	3.67	2.26	0.11	-1.34	**.214**	**-.117**	**.085**	.417	.383	**.203**	**.248**	.583	**.267**	.506	.382	.301	.480	.406	.335	.617	.720	.783	
20. It's not a challenge to deal with the consequences of getting sick with the flu.	2.88	2.03	0.66	-0.63	**-.005**	**-.201**	**.018**	**.041**	**-.039**	**-.207**	**.261**	.410	**.257**	.381	**.126**	**.104**	.327	.619	.334	.563	.502	.499	.751

Note: Correlation coefficients in bold denote correlations between -.3 and .3.

Phase 1: Initial items for TSRQ-Flu Developed After the Pilot Study.

Table S2

Reformulated TSRQ-Flu Items Following Pilot Study

Opening statement There are a variety of reasons why healthcare workers may choose to have the flu jab. Please consider if you were to have the flu jab next season (autumn/winter 2018), how true would each of these statements be for you? If I were to have the flu jab next season it would be because:
1. I feel pressure from others to get the flu jab. (External)
2. I personally believe that having the flu vaccine will protect my health. (Autonomy)
3. I would feel guilty if I didn't do what was recommended by my line-manager. (Introjection)
4. I want my line-manager to think I'm a good employee. (External)
5. I would feel bad about myself if I didn't get the flu jab. (Introjection)
6. It's important to get vaccinated to protect myself from the flu virus. (Autonomy)
7. I don't want other people to be disappointed in me. (External)
8. It's important to get the jab to protect my colleagues and patients from the flu. (Autonomy)
9. Other people would be upset with me if I didn't get the flu jab. (External)
10. I personally believe it's important to do so in order to stay healthy. (Autonomy)
11. It is easier to do what I'm told than to think about it. (Amotivation)
12. I've carefully thought about flu vaccination and believe it's the right thing to do. (Autonomy)
13. I want others to see that I can have the flu vaccine and stay healthy (Autonomy)
14. I just do it because my line-manager recommends to. (Amotivation)
15. I feel personally that getting vaccinated against the flu is the best thing for me. (Autonomy)
16. I'd feel guilty if I didn't get the flu jab. (Introjection)
17. Having the flu vaccination is a choice I really want to make for myself (Autonomy)
18. I personally believe the consequences of getting sick with the flu are a hassle. (Autonomy)

Note. All responses were recorded using a 7-point Likert scale ranging from 1 = Not at all True, 4 = Somewhat True, to 7 = Very True.

Phase 2: Data Screening

Data Missing at Random. Two cases were identified as having missing data accounting for 0.48% of the sample (see Table S3). To establish the extent of missingness as a first step, we conducted a Little's (1988) Missing Completely at Random (MCAR) test which indicated that missing values were not MCAR, χ^2 (30, N = 416) = 75.713, $p < .001$.

Table S3

Missing Values for TSRQ-Flu Items

Item	N	*M*	*SD*	Missing	
				N	%
1.	416	3.06	2.19	.	.
2.	416	4.62	2.08	.	.
3.	416	2.44	1.79	.	.
4.	416	3.15	2.09	.	.
5.	416	3.22	2.10	.	.
6.	416	4.58	2.17	.	.
7.	416	2.41	1.80	.	.
8.	416	5.05	2.04	.	.
9.	416	2.45	1.67	.	.
10.	416	4.15	2.23	.	.
11.	416	1.82	1.48	.	.
12.	416	4.70	2.24	.	.
13.	415	3.93	2.30	1.00	0.20
14.	416	1.70	1.43	.	.
15.	415	4.45	2.38	1.00	0.20
16.	415	2.78	2.03	1.00	0.20
17.	414	5.94	1.70	2.00	0.50
18.	415	5.45	1.91	1.00	0.20

Next, we examined the patterns of missing data as these may have an impact of parameter estimates and generalisability (Schafer, 1997). Following Fox-Wasylyshyn and El-Masri, (2005) review of methods to determine missing data patterns we examined the

correlations of those variables missing data with other items (see Table S4). Dummy variables for each of the items with missing values were created (coded *missing* = 0, *non-missing* = 1). Item 8 and 10 were identified as having very weak significant correlations, r (416) = .098, p = .46; r (416) = .098, p = .045, respectively. Only strong significant correlations are considered to indicate non-randomness. However, there is little consensus on what constitutes a strong significant correlation within missing data analysis (Fox-Wasylyshyn & El-Masri, 2005). Considering that the technique used to handle missing data are inconsequential when proportions of missing data are below 5% (Schafer, 1999; Tabachnick & Fidell, 2007) we removed cases listwise.

Table S4

Bivariate Correlation for the TSRQ-Flu Items With Missing Values.

Item	Correlations				
	Dummy variable item 13	Dummy variable item 15	Dummy variable item 16	Dummy variable item 17	Dummy variable item 18
1.	.046	.046	-.021	.018	-.021
2.	.086	.086	.015	.071	.015
3.	.039	.039	-.043	-.002	-.043
4.	.051	.051	-.020	.022	-.020
5.	-.089	-.089	-.018	-.076	-.018
6.	.013	.013	-.009	.003	-.009
7.	.038	.038	.038	.054	.038
8.	**.098***	**.098***	-.047	.036	-.047
9.	-.046	-.046	-.046	-.065	-.046
10.	.069	.069	.069	**.098***	.069
11.	.027	.027	-.072	-.032	-.072
12.	-.050	-.050	.015	-.025	.015
14.	.024	.024	-.079	-.039	-.079

Note. *Correlation is significant at the .05 level (2-tailed).

Phase 2: Multivariate Outlier Analysis

Table S5

Detection of Multivariate Outliers (p < .001)

Case No.	Mahalonobis Distance	Cook's Distance (C.R = .50)	Leverage (C.R = .14)
Iteration one.			
38.	**61.78**	**.048**	**.150**
2.	55.65	.003	.135
72.	55.25	.006	.134
1.	53.54	.027	.130
5.	52.70	.033	.128
31.	52.61	.045	.128
6.	51.02	.043	.124
49.	50.49	.028	.123
3.	49.19	.012	.120
147.	48.73	.007	.119
106.	48.09	.000	.117
288.	46.08	.013	.112
169.	43.40	.003	.106
4	43.06	.017	.105
28	42.36	.001	.103
32	41.54	.022	.101
114	40.57	.007	.099
108	38.97	.000	.095
11	38.60	.014	.094
153	38.52	.001	.094
62	38.25	.008	.093
16	36.74	.001	.089
21	36.57	.012	.089
47	36.48	.007	.089
103	35.92	.010	.087
378	35.79	.008	.087
7	35.79	.001	.087
20	35.72	.020	.087
55	35.48	.014	.086
100	35.46	.001	.086
22	34.77	.011	.085
36	34.41	.003	.084
52	33.60	.022	.082
35	33.53	.012	.082
61	33.43	.004	.081
30	33.41	.005	.081
Iteration two.			
224	45.51	.001	.121
65	45.03	.005	.120
8	43.87	.002	.117

Note. CR = Critical ratio

Phase 2. Data Distributions (Sample 2)

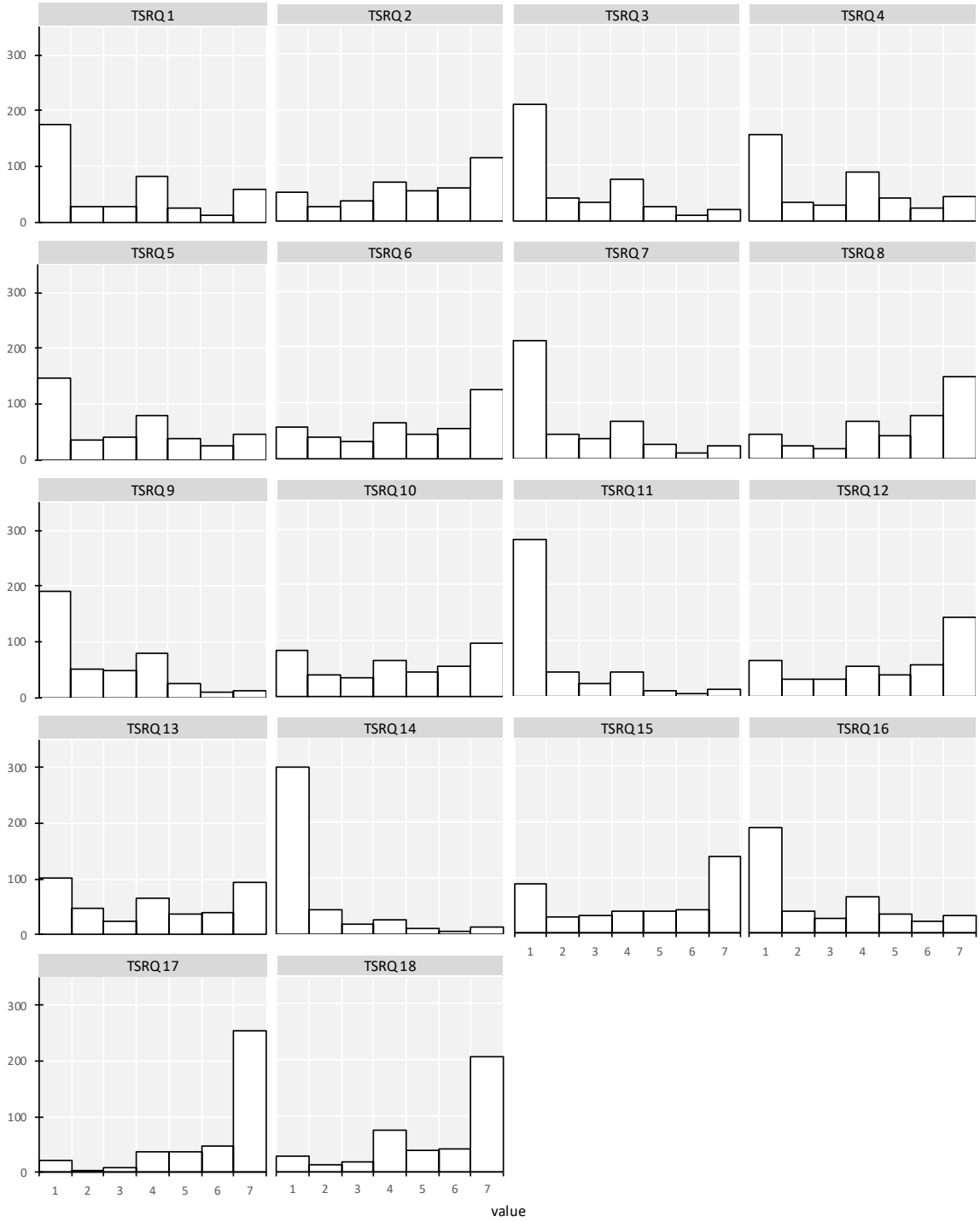
Table S6

Data Distribution and Collinearity Statistics for the TSRQ-Flu items Sample 2 (N = 412)

Item	M	*SD*	Skewness (*SE* = 0.12)	Kurtosis (*SE* = 0.24)	Tolerance	VIF
Autonomous						
1. I personally believe that having the flu vaccine will protect my health.	4.65	2.07	-0.44	-1.05	.178	5.62
2. It's important to get vaccinated to protect myself from the flu virus.	4.60	2.17	-0.39	-1.24	.158	6.35
3. It's important to get the jab to protect my colleagues and patients from the flu.	5.08	2.01	-0.79	-0.62	.261	3.84
4. I personally believe it's important to do so in order to stay healthy.	4.18	2.22	-0.15	-1.40	.196	5.11
5. I've carefully thought about flu vaccination and believe it's the right thing to do.	4.71	2.24	-0.49	-1.23	.239	4.18
6. I feel personally that getting vaccinated against the flu is the best thing for me.	4.46	2.37	-0.32	-1.48	.109	9.19
7. Having the flu vaccination is a choice I really want to make for myself.	5.97	1.67	-1.73	2.18	.812	1.23
8. I personally believe the consequences of getting sick with the flu are a hassle.	5.48	1.88	-1.01	-0.07	.654	1.53
Introjection						
9. I would feel bad about myself if I didn't get the flu jab.	3.22	2.09	0.44	-1.09	.401	2.49
10. I would feel guilty if I didn't do what was recommended by my line-manager.	2.44	1.80	0.99	-0.10	.506	1.98
11. I'd feel guilty if I didn't get the flu jab.	2.79	2.04	0.74	-0.79	.449	2.23
External						
12. I feel pressure from others to get the flu jab.	3.07	2.19	0.60	-1.02	.494	2.02
13. I want my line-manager to think I'm a good employee.	3.17	2.09	0.43	-1.12	.558	1.79
14. I don't want other people to be disappointed in me.	2.42	1.80	1.05	0.03	.490	2.04
15. Other people would be upset with me if I didn't get the flu jab.	2.45	1.67	0.91	-0.09	.592	1.69
16. I want others to see that I can have the flu vaccine and stay healthy.	3.95	2.30	0.02	-1.49	.372	2.69
Amotivation						
17. It is easier to do what I'm told than to think about it.	1.83	1.48	1.89	2.91	.503	1.99
18. I just do it because my line-manager recommends to.	1.70	1.43	2.29	4.64	.493	2.03

Figure S1.

Histograms of Individual Responses to TSRQ-Flu Items in Sample 2



Phase 2: Full Exploratory Factor Analysis for Sample 2 (*N* = 412).

An initial examination of the correlation matrix revealed strong correlations between items 6, 12, 2 and 4 ($r > .8$) and moderate off-diagonal elements on the anti-image correlation matrix ($r = -.322$). It is suggested that for a good factor model, elements should be small and close to zero (Field, 2013). These items formed part of the expected autonomy subscale. In addition, the determinant value fell short of the .00001 threshold suggesting the presence of multicollinearity. Collinearity diagnostics identified item 6 as having a variance inflation factor (VIF) of 9.189, with a Tolerance of 0.109. A VIF value exceeding 10, or a Tolerance value lower than 0.1 may be a cause for concern, suggesting that multicollinearity may bias outcomes (Field, 2013). Although both of the values fall within the recommended threshold of VIF < 10 and Threshold > 0.1 (Field, 2013) they stand apart from other items (see Table S6). Item 6 was removed from analysis and the correlation matrix and collinearity diagnostics were re-run.

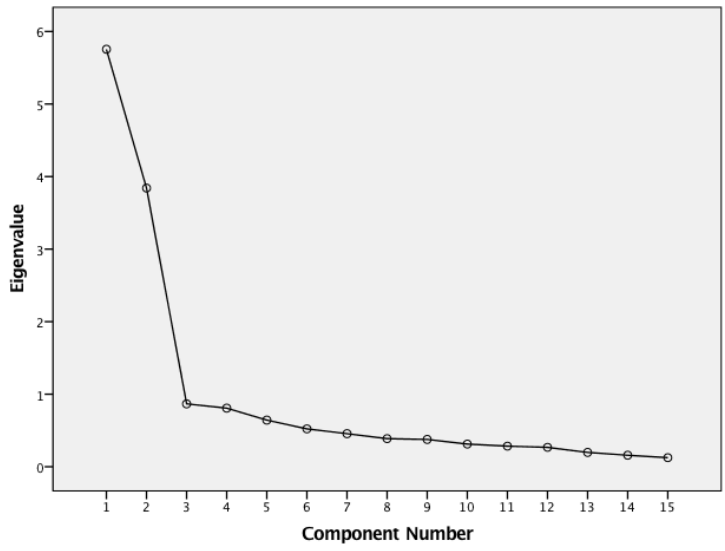
The removal of this item improved the determinant score (0.0000176) suggesting no issue of multicollinearity. The sampling was adequate for an EFA with an overall KMO value of .905 and all KMO values for individual items were above .50. Next, a check of the communalities revealed that item 7 had the lowest communality of .165, meaning that this item accounts for 16.5% of the shared variance. In addition, item 8 had a communality of .375. It is suggested that communalities should exceed 0.4 (Field, 2013) therefore both items were removed respectively.

The determinant score improved (.00003201), KMO = .900 remained stable with individual item values above .50. Communalities exceeded the expected .40 threshold. Two factors were extracted. The first factor had an eigenvalue of 5.76 and accounted for 38.37% of the variance. Factor two had an eigenvalue of 3.84 accounting for an additional 25.61% of the variance. The combination of factors explained 63.98% of the variance. A

check of the residuals revealed 42% nonredundant residuals with absolute values > .05, which falls below the upper threshold of 50% suggesting a good factor model (Field, 2013). However, the pattern matrix revealed cross loadings on the introjected item 9 and 11. As introjection and autonomous regulation are closest on the motivation continuum therefore it is plausible that there may be some overlap. The scree plot indicated a presence of 4 factors (see *Figure S3*). A decision was made to force the extraction of four factors based on recent models of the TSRQ (Denman et al., 2016; Levesque et al., 2006) and the levelling off of eigen values on the scree plot (Cattell, 1966).

Figure S2.

Scree plot Suggesting a two or Four Factor Structure

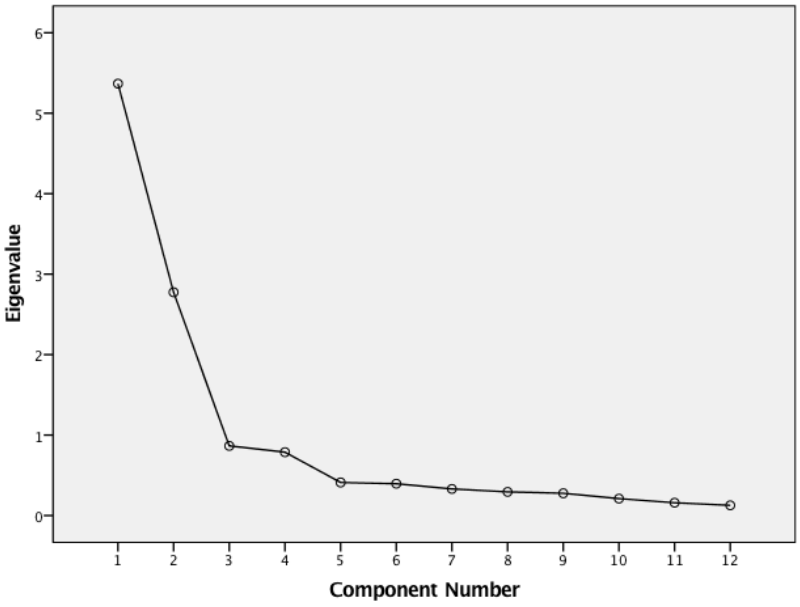


Within the four-factor structure, item 15 revealed 3 low cross loadings (-.302, .306 and -.366) and was subsequently removed. Item 10 and 12 also had cross loadings and deviated from the other loadings within the same factor, these were removed respectively. The determinant improved (.000189), KMO remained meritorious = .885. The scree plot continued to favour the extraction of four factors (see Figure S4*).* However, a subsequent Parallel analysis favoured a two-factor structure. The total variance explained by the

factors improved to 83.16%, with 12% nonredundant residuals. KMO remained meritorious at .862, Bartlett's test of sphericity (χ^2 (55) = 3097.17, $p < .001$). All items had a minimum loading of .760 with no cross loading above .249.

Figure S3

Final Scree Plot Favouring a Four-Factor Structure



Phase 3: Assumptions Sample 2 and Sample 3

Data distribution for Sample 3 are presented in Table S8. Univariate values fall between -2 and 2 for skewness and kurtosis. Amotivation demonstrated a tendency for lower scores. Intercorrelations did not exceed .90, residuals were approximately normally distributed and visual examination of the scatterplot suggested homoscedasticity. The majority of the values were evening spread between -2 and 2. However there was a potential for a decreasing funnel (see Figure S5). The R code for assumption checks is present below.

Table S7

Data Distribution and Univariate Normality of TSRQ-Flu Items in Sample 3 (N =152)

Item	*M*	*SD*	Skewness (*SE* = 0.20)	Kurtosis (*SE* = 0.39)
Autonomous				
I personally believe that having the flu vaccine will protect my health.	4.86	1.81	-0.41	-0.85
It's important to get vaccinated to protect myself from the flu virus.	5.03	1.81	-0.48	-0.89
It's important to get the jab to protect my colleagues and patients from the flu.	5.36	1.63	-0.68	-0.30
I personally believe it's important to do so in order to stay healthy.	4.57	2.10	-0.33	-1.23
I've carefully thought about flu vaccination and believe it's the right thing to do.	4.82	2.00	-0.50	-1.01
Introjection				
I would feel bad about myself if I didn't get the flu jab.	3.55	1.98	0.22	-1.12
I'd feel guilty if I didn't get the flu jab.	3.53	2.01	0.24	-1.14
External				
I want my line-manager to think I'm a good employee.	4.07	2.06	-0.12	-1.20
I don't want other people to be disappointed in me.	3.41	1.92	0.32	-0.95
Amotivation				
It is easier to do what I'm told than to think about it.	2.34	1.51	0.98	0.27
I just do it because my line-manager recommends to.	2.10	1.44	1.45	1.63

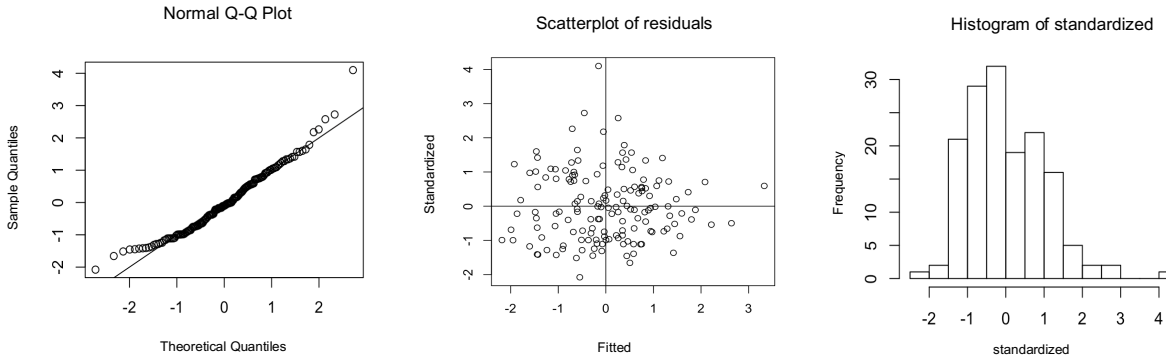
```
DATA SCREENING CHECKS
Code and Output, Sample 3: Assumption of multicollinearity
Note: No correlations above .90

data3<-read.csv("./data/Sample3_152.csv")
tsrqvars = c("tsrq_a2", "tsrq_a1", "tsrq_a4", "tsrq_a5", "tsrq_a3",
             "tsrq_in11", "tsrq_in9", "tsrq_e13", "tsrq_e14", "tsrq_m18", "tsrq_m17")
assumpD3 <- data3[tsrqvars]
assumpCOR = cor(assumpD3, use ="pairwise.complete.obs")
symnum(assumpCOR)
```

```
##           t_2 ts_1 t_4 t_5 t_3 t_11 t_9 t_13 t_14 t_18 t_17
## tsrq_a2   1
## tsrq_a1   +   1
## tsrq_a4   +   +    1
## tsrq_a5   +   ,    +   1
## tsrq_a3   ,   ,    ,   ,   1
## tsrq_in11 .   .    .   .   .   1
## tsrq_in9  ,   .    ,   ,   .   ,    1
## tsrq_e13                              1
## tsrq_e14                        .     ,    1
## tsrq_m18                                   1
## tsrq_m17                              .    .    .    1
## attr(,"legend")
## [1] 0 ' ' 0.3 '.' 0.6 ',' 0.8 '+' 0.9 '*' 0.95 'B' 1
```

Figure S4

Visual Assessment of Linearity, Homogeneity and Normality of the Standardized Residuals for TSRQ Items in Sample 3 (n = 152).



Data distributions for Sample 2 are already provided in Table S6. Visual examination of the residuals suggested a potential deviation from normality with increased skewness and kurtosis particularly compared to Sample 3. However, visual examination of the scatterplot suggested homoscedasticity (see Figure S6) and intercorrelations did not exceed .90. The R code for assumption checks is present below.

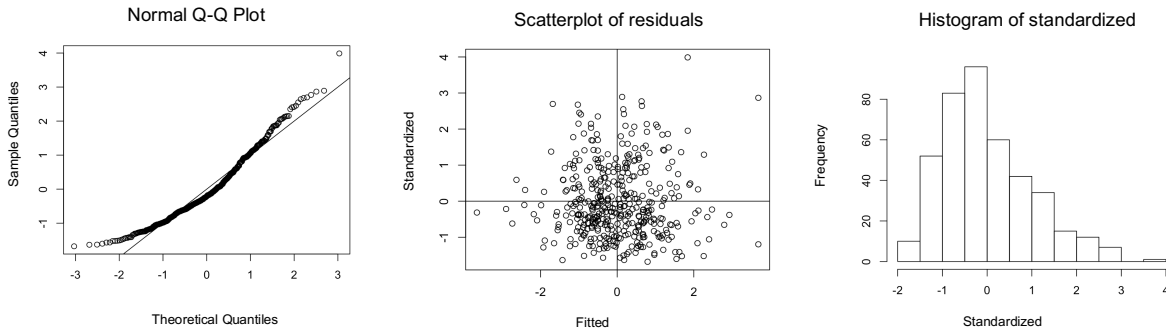
```
DATA SCREENING CHECKS
Code and Output, Sample 2: Assumption of multicollinearity
Note: No correlations above .90
```

```
data2<-read.csv("./data/Sample2_412.csv")
tsrqvars = c("tsrq_a2", "tsrq_a1", "tsrq_a4", "tsrq_a5", "tsrq_a3",
             "tsrq_in11", "tsrq_in9", "tsrq_e13", "tsrq_e14", "tsrq_m18", "tsrq_m17")
assumpD2 <- data2[tsrqvars]
assumpCOR2 = cor(assumpD2, use ="pairwise.complete.obs")
symnum(assumpCOR2)

##           t_2 ts_1 t_4 t_5 t_3 t_11 t_9 t_13 t_14 t_18 t_17
## tsrq_a2   1
## tsrq_a1   +   1
## tsrq_a4   +   +    1
## tsrq_a5   ,   ,    ,   1
## tsrq_a3   ,   ,    ,   ,   1
## tsrq_in11             .   .   1
## tsrq_in9  .   .    .   .   .   ,    1
## tsrq_e13                              1
## tsrq_e14                      .       .    1
## tsrq_m18                              .    .    1
## tsrq_m17                              .    .    ,    1
## attr(,"legend")
## [1] 0 ' ' 0.3 '.' 0.6 ',' 0.8 '+' 0.9 '*' 0.95 'B' 1
```

Figure S5

Visual Assessment of Linearity, Homogeneity and Heteroscedasticity, and Normality of the Standardised Residuals for TSRQ Items in Sample 2



Phase 3: Parameter Estimates

Table S8

Parameter Estimates for Sample 2 and Sample 3

Latent	Indicator	*b*	*s.e.*	*z*	*p*	*Beta*	*Beta* 95% CI Lower	Upper
Sample 2 (N = 412)								
Autonomous	It's important to get vaccinated to protect myself from the flu virus.	1.98	0.06	34.80	.000	.915	0.89	0.94
	I personally believe that having the flu vaccine will protect my health.	1.84	0.07	27.90	.000	.892	0.86	0.93
	I personally believe it's important to do so in order to stay healthy.	1.98	0.06	33.87	.000	.890	0.86	0.92
	I've carefully thought about flu vaccination and believe it's the right thing to do.	1.92	0.07	26.84	.000	.860	0.82	0.90
	It’s important to get the jab to protect my colleagues and patients from the flu.	1.74	0.07	25.51	.000	.865	0.84	0.89
Introjection	I'd feel guilty if I didn't get the flu jab.	1.38	0.09	15.21	.000	.677	0.60	0.75
	I would feel bad about myself if I didn't get the flu jab.	2.07	0.07	28.05	.000	.991	0.94	1.04
External	I want my line-manager to think I'm a good employee.	1.45	0.09	16.33	.000	.690	0.62	0.76
	I don't want other people to be disappointed in me.	1.56	0.10	16.43	.000	.863	0.79	0.94
Amotivation	I just do it because my line-manager recommends to.	1.15	0.10	11.01	.000	.803	0.72	0.89
	It is easier to do what I'm told than to think about it.	1.16	0.11	10.44	.000	.787	0.68	0.89
Sample 3 (N = 152)								
Autonomous	It's important to get vaccinated to protect myself from the flu virus.	1.72	0.08	20.83	.000	.950	0.93	0.97
	I personally believe that having the flu vaccine will protect my health.	1.58	0.10	16.62	.000	.871	0.82	0.92
	I personally believe it's important to do so in order to stay healthy.	1.92	0.09	22.47	.000	.917	0.88	0.95
	I've carefully thought about flu vaccination and believe it's the right thing to do.	1.83	0.09	19.64	.000	.915	0.88	0.95
	It’s important to get the jab to protect my colleagues and patients from the flu.	1.29	0.11	12.02	.000	.790	0.72	0.86
Introjection	I'd feel guilty if I didn't get the flu jab.	1.39	0.15	9.42	.000	.691	0.56	0.82
	I would feel bad about myself if I didn't get the flu jab.	1.86	0.11	17.31	.000	.938	0.86	1.02
External	I want my line-manager to think I'm a good employee.	1.68	0.16	10.60	.000	.818	0.67	0.95
	I don't want other people to be disappointed in me.	1.68	0.13	12.68	.000	.872	0.76	0.98
Amotivation	I just do it because my line-manager recommends to.	1.01	0.16	6.40	.000	.702	0.52	0.88
	It is easier to do what I'm told than to think about it.	1.20	0.16	7.54	.000	.793	0.64	0.95

Phase 4: Data Distributions in Sample 4.

Table S9

Data Distributions of the TSRQ-Flu and the BIDR-16 Scale for Sample 4 (n = 88).

Item	M	*SD*	Skewness	Kurtosis
Flu-TSRQ (n = 88)				
1. I personally believe that having the flu vaccine will protect my health.	4.86	1.81	-0.41	-0.85
2. It's important to get vaccinated to protect myself from the flu virus.	5.03	1.81	-0.48	-0.89
3. It's important to get the jab to protect my colleagues and patients from the flu.	5.36	1.63	-0.68	-0.30
4. I personally believe it's important to do so in order to stay healthy.	4.57	2.10	-0.33	-1.23
5. I've carefully thought about flu vaccination and believe it's the right thing to do.	4.82	2.00	-0.50	-1.01
6. I would feel bad about myself if I didn't get the flu jab.	3.55	1.98	0.22	-1.12
7. I'd feel guilty if I didn't get the flu jab.	3.53	2.01	0.24	-1.14
8. I want my line-manager to think I'm a good employee.	4.07	2.06	-0.12	-1.20
9. I don't want other people to be disappointed in me.	3.41	1.92	0.32	-0.95
10. It is easier to do what I'm told than to think about it.	2.34	1.51	0.98	0.27
11. I just do it because my line-manager recommends to.	2.10	1.44	1.45	1.63
Self-Deception Enhancement (n = 82)				
1. I have not always been honest with myself.	5.23	2.19	-0.30	-1.06
2. I always know why I like things.	6.04	1.67	-0.92	0.50
3. It's hard for me to shut off a disturbing thought.	4.07	2.08	0.21	-0.95
4. I never regret my decisions.	4.04	1.90	0.47	-0.58
5. I sometimes lose out on things because I can't make up my mind soon enough.	4.82	1.87	-0.06	-0.70
6. I am a completely rational person.	5.70	1.66	-0.33	-0.75
7. I am very confident of my judgments	5.93	1.40	-0.48	-0.07
8. I have sometimes doubted my ability as a lover.	5.24	2.02	-0.29	-0.98
Impression Management (n = 82)				
1. I sometimes tell lies if I have to.	5.24	2.02	-0.29	-0.98
2. I never cover up my mistakes.	5.18	2.18	-0.25	-1.15
3. There have been occasions when I have taken advantage of someone.	6.35	2.03	-1.14	0.25
4. I sometimes try to get even rather than forgive and forget.	6.12	1.94	-1.08	0.53
5. I have said something bad about a friend behind his/her back.	5.17	2.16	-0.37	-0.94
6. When I hear people talking privately, I avoid listening.	4.89	2.00	-0.01	-1.10
7. I never take things that don't belong to me.	7.04	1.58	-1.98	3.51
8. I don't gossip about other people's business.	5.44	1.93	-0.33	-0.93

Phase 5: Data Distributions.

Table S10

Data Distributions for Vaccine Attitudes and Motors of Flu Vaccination Scales Across Samples

	Sample 2					Sample 3					Sample 4				
	M	*SD*	Skew	Kurtosis	*s.e.*	*M*	*SD*	Skew	Kurtosis	*s.e.*	*M*	*SD*	Skew	Kurtosis	*s.e.*
Motors of Flu Vaccination															
Impact 1	4.85	1.88	-0.64	-0.61	0.09	5.06	1.61	-0.73	-0.22	0.13	5.31	1.56	-0.72	-0.19	0.17
Impact 3	4.32	2.00	-0.30	-1.02	0.10	4.83	1.77	-0.50	-0.63	0.14	5.01	1.79	-0.69	-0.38	0.19
Impact 2	4.53	1.97	-0.48	-0.90	0.10	5.01	1.69	-0.64	-0.45	0.14	5.12	1.65	-0.70	0.06	0.18
Knowledge 1	5.14	1.73	-0.82	-0.10	0.09	5.28	1.52	-0.75	-0.15	0.12	5.33	1.64	-0.70	-0.38	0.17
Knowledge 3	5.28	1.76	-0.91	-0.11	0.09	5.51	1.57	-0.99	0.22	0.13	5.58	1.57	-1.12	0.70	0.17
Value 1	4.86	2.24	-0.61	-1.14	0.11	5.08	1.87	-0.73	-0.53	0.15	5.45	1.84	-1.25	0.50	0.20
Value 2	4.32	2.18	-0.30	-1.30	0.11	4.78	1.96	-0.56	-0.90	0.16	5.33	1.61	-0.90	0.40	0.17
Value 3	5.03	2.00	-0.77	-0.63	0.10	5.31	1.72	-0.98	0.12	0.14	5.56	1.57	-1.23	1.00	0.17
Choice	6.06	1.66	-1.80	2.15	0.08	6.09	1.35	-1.58	1.92	0.11	6.10	1.46	-1.59	1.61	0.16
Vaccine Attitudes															
HBM_2_sus						2.70	1.37	0.26	-1.13	0.11					
HBM_4_sus						3.30	1.36	-0.24	-1.14	0.11					
HBM_7_sv						2.76	1.43	0.32	-1.26	0.12					
HBM_9_ben						2.28	1.23	0.87	-0.15	0.10					
HBM_11_ben						1.74	1.03	1.36	1.06	0.08					
HBM_12_bar						1.62	1.05	1.71	2.13	0.08					
HBM_14_bar						2.24	1.25	0.69	-0.56	0.10					
HBM_15_cue						2.71	1.36	0.32	-1.03	0.11					
HBM_17_cue						3.16	1.53	-0.12	-1.45	0.12					
HBM_18_cue						2.16	1.24	0.77	-0.43	0.10					
HBM_19_gen						2.33	1.31	0.61	-0.70	0.11					

Phase 5: Data Screening for Predictive Validity

Visual examination of the residuals suggested approximate normality and homoscedasticity (see Figure S7). There were an absence of missing data, influential cases, and multicollinearity as indicated by the variance inflation factor (VIF) see Table S11.

Figure S6

Visual Assessment of Linearity, Homogeneity and Heteroscedasticity, and Normality of the Standardised Residuals for TSRQ Items in Sample 4

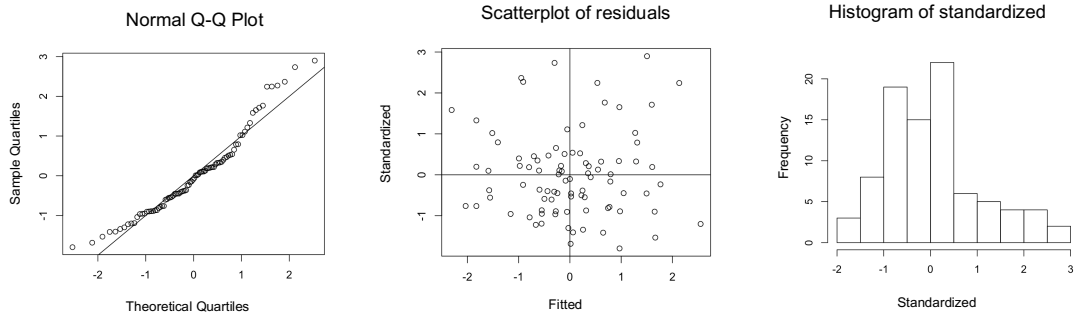


Table S11

Predictive Validity Checks for Multicollinearity Across Samples

		Correlations		
	VIF	1	2	3
Sample 2				
Autonomous	1.54			
Introjection	1.64	.486		
External	1.42	-.108	.303	
Amotivation	1.39	-.195	.210	.478
Sample 3				
Autonomous	1.83			
Introjection	1.91	.593		
External	1.30	-.105	.258	
Amotivation	1.23	-.171	.142	.372
Sample 4				
Autonomous	1.52			
Introjection	1.49	.435		
External	1.24	.041	.332	1.000
Amotivation	1.37	-.323	.145	.337

Phase 5: Data Screening for Incremental Validity

Table S12

Multicollinearity Checks for Incremental Validity Sample 2 (n = 314)

		Correlations							
	VIF	1	2	3	4	5	6	7	8
Age	1.12								
Cognitive Empowerment	3.95	-.059							
Autonomous	5.68	-.035	.855						
Introjection	1.74	-.153	.374	.519					
External	1.48	-.254	-.091	-.087	.290				
Amotivation	1.40	-.174	-.221	-.167	.185	.470			
Past Behaviour	2.50	-.008	.663	.760	.464	-.061	-.058		
Line Manager	1.08	.045	.148	.177	.113	.107	.069	.193	
Gender	1.04	-.128	.022	.007	.037	.058	.039	-.051	.094

Appendix C

Chapter 5: Communicating the request to vaccinate against the flu: A brief content analysis of the NHS Flu Fighter campaign

Table S13

Unique NHS Flu Fighter Campaign Messages

Item	Message
1	Protect yourself and those around you - be a flu fighter, get your flu jab.
2	Be a flu fighter
3	#BE A FLU FIGHTER PROTECT YOURSELF AND THOSE AROUND YOU. GET THE FLU JAB
4	CONCERNED ABOUT THE FLU JAB? #FLUFIGHTER Go to [website] to find answers to commonly asked questions on the flu virus and vaccine, as well as the latest clinical evidence
5	DO YOU REALISE HOW IMPORTANT YOU ARE? PROTECT YOURSELF AND THOSE AROUND YOU. #FLUFIGHTER GET THE FLU JAB
6	DON'T LET THE ONES YOU LOVE BECOME THE ONES YOU TREAT PROTECT YOURSELF AND THOSE AROUND YOU. #FLUFIGHTER GET THE FLU JAB
7	Flu kills Protect yourself, your family, colleagues and patients - be a flu fighter, get your flu jab.
8	#FLUFIGHTER
9	[Number] STAFF AT [Hospital] GOT THEIR FLU JAB LAST YEAR. WHAT ABOUT YOU? GET THE FLU JAB
10	Don't take flu with you Be a flu fighter, get your flu jab Protect yourself and those around you
11	Protect your loved ones from the flu Be a flu fighter, get your flu jab Protect yourself and those around you
12	You could be spreading flu right now Be a flu fighter, get your flu jab Protect yourself and those around you.
13	GET THE FLU JAB SO WE CAN STOP BUGGING YOU #FLUFIGHTER GET THE FLU JAB
14	HEALTHY BODY, HEALTHY MIND HAVING A PHYSICAL ILLNESS CAN STRONGLY AFFECT THE WAY WE THINK AND FEEL. #FLUFIGHTER GET THE FLU JAB
15	Don't delay, book your flu jab early
16	Protect yourself, your family, and your patients - be a flu fighter
17	Find out why getting your flu jab matters #flumatters
18	TAKE ONE FOR THE TEAM BE A #FLUFIGHTER
19	You could be spreading flu right now 7 out of 10 people with flu have no symptoms #FLUFIGHTER GET THE FLU JAB
20	Flu Fighter Infection Prevention Wash your hands Stay away Get your Flu Vaccine
21	Flu Facts vs Fiction 4 facts Protect yourself and those around you

Note. Theme colours = Protection; Appeal to social space; Directive; Information; Call to Action; Emotional appeal; Media Promotion; Factual.

Appendix D

Chapter 6: Examining the moderating effect of autonomy on promotional health messages

Table S14

Pilot Statements and Readability Scores

	Readability %	Word Count
Autonomy-Supportive		
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. Consider getting the flu jab.	71.6	32
You can protect yourself against the flu virus reducing your risk of developing flu-related health complications.	64.4	16
75% of staff got their flu jab last year, if you were one of them, thank you!	100	17
It's flu season, have you considered getting the flu jab?	78.2	10
You could protect yourself and those around you.	82.3	8
We all have a duty of care to our patients, consider having the flu jab to protect against the spread of the infection.	65.7	23
We have a duty to protect ourselves, our families, colleagues and patients.	60.7	12
You could be taking the flu with you, together we can reduce the risk of infection. Consider getting the flu vaccine this winter.	70.1	23
Vaccines are readily available. You could book your appointment today!	41	10
Delaying the flu jab may put you at more risk of catching the flu. Have you considered booking your flu appointment?	79.3	21
You could get the flu vaccine to lower the chance of you catching or spreading the virus to vulnerable patients in your care.	65.7	23
Let's avoid the ones we love becoming the ones we treat. Consider getting the flu jab.	71.8	16
You could be part of the solution to prevent premature death, you could get a flu jab.	80	17
Flu kills, but you could help to fight it. Consider having the flu jab this season.	92.9	16
Let's not spread the flu. Let's get the flu jab to reduce the risk to patients in our care!	100	19
The flu virus can cause mild to severe illnesses, even death. As Healthcare Professionals we have a responsibility to reduce the risk of infection. Will you get the flu vaccine this season?	61.1	32
Having the flu vaccine can help to lower the chance of you catching or spreading the flu.	80	17
The flu vaccination may be considered as one of the best ways to protect against the spread of infection.	62.8	19
By choosing to protect ourselves against the virus we'll reduce our risk of developing flu-related health complications.	30.3	17

	Readability %	Word Count
Controlling		
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. Get the flu jab.	81.2	30
You must protect yourself against the flu virus reducing your risk of developing flu-related health complications.	26.6	16
75% of staff got their flu jab last year, were you one of them?	100	14
It's flu season, you should get the flu jab!	100	9
You must protect yourself and those around you.	82.3	8
You have a duty of care to your patients, you ought to have the flu jab to protect against the spread of the infection.	76.7	24
It is your duty to protect yourself, your family, colleagues and patients.	60.7	12
Don't take the flu with you, you must reduce the risk of infection. Make sure that you get the flu vaccine this winter.	92.1	23
Vaccines are readily available. Don't delay, book your appointment today!	32.5	10
Delaying the flu jab will put you at more risk of catching the flu. Don't delay it, book your flu appointment today.	84.1	22
You should get the flu vaccine to lower the chance of you catching or spreading the virus to vulnerable patients in your care.	65.7	23
Don't let the ones you love become the one's you treat. Get the flu jab.	97.7	15
You should be part of the solution to prevent premature death. Get the flu jab today!	82.3	16
Flu kills and you should be helping to fight it. Make sure you have the flu jab this season!	100	19
Don't be the one to spread the flu. Get the flu jab to reduce the risk to patients in your care!	100	21
The flu virus can cause mild to severe illnesses, even death. As a Healthcare Professionals you have a responsibility to reduce the risk of infection. You must get your flu vaccine this season!	62.3	33
You should get the flu vaccine to lower the chance of you catching or spreading the flu.	85	17
The flu vaccination ought to be seen as one of the best ways to protect against the spread of infection.	72.3	20
You must protect yourself against the virus to reduce your risk of developing flu-related health complications.	31.9	16

Pilot: Data Distributions and Assumption Checks

Table S15

Data Distribution for the PTF of PHM by Condition

	Condition 1						Condition 2					
Message	*n*	*M*	*SD*	*skew*	*kurtosis*	*se*	*n*	*M*	*SD*	*skew*	*kurtosis*	*se*
1	30	2.27	.80	.94	2.47	.15	15	2.70	.84	.00	-.49	.22
2	17	2.12	.76	.44	.19	.18	15	2.52	.87	.12	-.91	.23
3	18	3.03	1.11	-.06	-1.10	.26	12	2.98	.63	-1.57	2.13	.18
4	18	1.85	1.05	1.50	1.93	.25	15	2.38	.71	-.01	-1.00	.18
5	18	2.08	1.09	1.13	.71	.26	12	2.69	.81	.28	-1.31	.23
6	17	2.87	1.11	.00	-1.48	.27	14	3.29	.78	-.69	-.61	.21
7	15	2.72	.78	-.12	-.46	.20	12	3.52	.82	-.11	-.71	.24
8	16	2.42	1.24	.98	-.19	.31	13	2.73	.94	-.03	-1.28	.26
9	18	1.78	.57	.47	.35	.13	12	2.23	1.01	.29	-1.21	.29
10	18	2.32	1.01	.90	.75	.24	15	2.32	.86	.25	-1.33	.22
11	16	2.50	.80	-.12	-.83	.20	12	2.67	1.07	-.30	-1.41	.31
12	15	2.62	1.06	.91	-.18	.27	12	3.08	.62	-.49	-.51	.18
13	15	3.25	1.12	-.20	-.84	.29	15	3.15	.57	.26	-1.30	.15
14	16	2.12	.70	.08	-1.06	.18	12	3.10	1.05	-.27	-1.48	.30
15	17	2.81	1.04	.59	-.98	.25	11	2.55	1.01	.57	-1.14	.30
16	18	2.89	1.06	.21	-1.00	.25	10	3.40	.70	-.34	-1.89	.22
17	14	1.86	.88	.35	-1.68	.23	11	2.02	.83	.09	-1.59	.25
18	17	2.00	.88	.71	-.46	.21	9	2.50	.45	.00	-1.97	.15
19	17	2.01	.80	1.02	1.20	.19	13	2.69	.72	-.72	-.05	.20

Table S16

Test of Normality (Shapiro-Wilk)

	Condition 1		Condition 2	
Message	*W*	*p*	*W*	*P*
1	.888	**.004**	.973	.906
2	.920	.145	.952	.551
3	.979	.943	.771	**.004**
4	.786	**< .001**	.979	.943
5	.860	**.012**	.786	**< .001**
6	.940	.317	.860	**.012**
7	.925	.231	.953	.576
8	.841	**.010**	.937	.458
9	.885	**.032**	.852	**.023**
10	.892	**.042**	.940	.317
11	.961	.683	.925	.231
12	.849	**.017**	.841	**.010**
13	.961	.706	.954	.703
14	.950	.490	.920	.250
15	.904	.079	.923	.314
16	.968	.760	.885	**.032**
17	.843	**.018**	.892	**.042**
18	.915	.123	.961	.683
19	.883	**.036**	.943	.422

Note. Significant results suggest a deviation from normality

Table S17

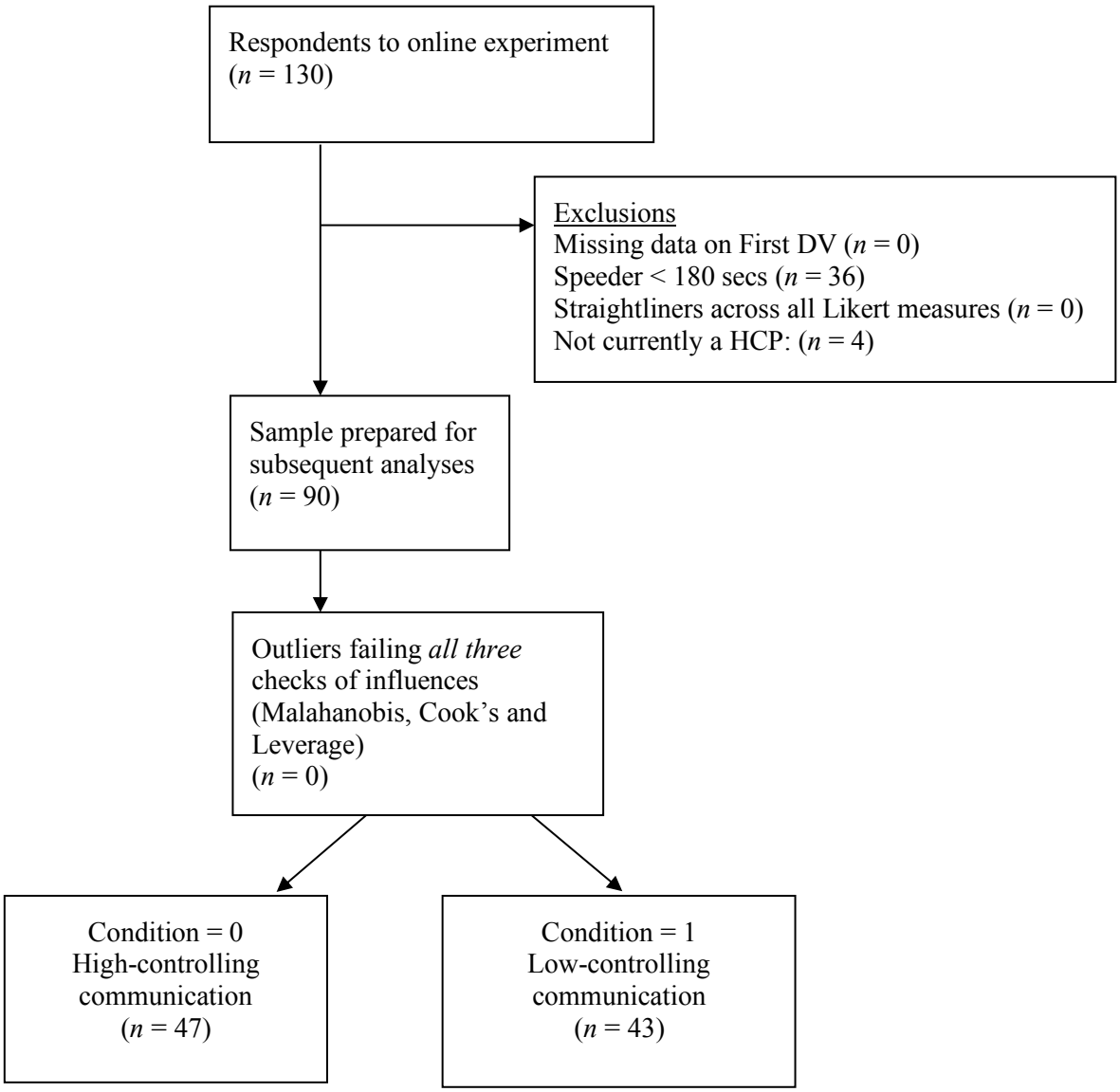
Levene's Test of Equality of Variances

Message	*F*	*df*	*p*
1	.142	1	.708
2	.677	1	.417
3	5.867	1	**.022**
4	.685	1	.414
5	.474	1	.497
6	3.711	1	.064
7	.018	1	.894
8	.131	1	.721
9	3.983	1	.056
10	5.833	1	.981
11	1.922	1	.177
12	2.407	1	.133
13	5.900	1	**.022**
14	3.557	1	.071
15	.039	1	.846
16	1.527	1	.228
17	.370	1	.549
18	2.467	1	.129
19	.008	1	.928

Experiment 1

Figure S7

Exclusion Flow for Experiment 1



Experimental Materials

Numbers [#] correspond to statements in Table S18

Low-controlling condition (word count 114, ease 65.4%, grade level 7)

[4] It's flu season, have you considered getting the flu jab?

> [i16] The flu virus can cause mild to severe illnesses, even death. [19] By choosing to protect ourselves against the virus, we'll reduce our risk of developing flu-related health complications.
>
> [i] The flu is highly infectious and is easily transmitted to others. [1] 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. [7] We have a duty to protect ourselves, our families, colleagues and patients.
>
> [14] Flu kills, but you could help to fight it. Consider having the flu jab this season.

Call to action:
[9] Vaccines are readily available. You could book your appointment today!

High-controlling condition (word count = 113, ease 71.4 %, grade 5.7)

[4] It's flu season. You should get the flu jab!

> [i16] The flu virus can cause mild to severe illnesses, even death. [19] You must protect yourself against the virus to reduce your risk of developing flu-related health complications.
>
> [i] The flu is highly infectious and is easily transmitted to others. [1] 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. 7] It is your duty to protect yourself, your family, colleagues and patients.
>
> [14] Flu kills, and you should be helping to fight it. Make sure you have the flu jab this season.

Call to action:
[9] Vaccines are readily available. Don't delay, book your appointment today!

Experiment Data Distributions

Table S18

Data Distributions for Experiment Hypotheses Testing

Variable	Condition	N	M	SD	Median	Skew	Kurtosis	*s.e.*
Hypothesis 1								
Perceived Threat to Freedom	*High*	47	3.48	1.07	3.75	-0.81	-0.02	0.16
	Low	43	2.73	1.12	2.75	-0.11	-1.13	0.17
Hypothesis 2								
Pre-Test (Time 1)	*High*	47	31.23	75.37	65	-0.72	-1.11	10.99
Post Test (Time 2)	*High*	47	35.55	71.86	76	-0.75	-0.10	10.48
Difference (Time 1 - Time 2)	*High*	47	-4.32	38.5	0	-1.40	20.40	5.62
Pre-Test (Time 1)	*Low*	43	48.14	67.73	82	-1.08	-0.29	10.33
Post Test (Time 2)	*Low*	43	57.16	58.79	85	-1.29	0.36	8.96
Difference (Time 1 - Time 2)	*Low*	43	-9.02	29.76	0	-3.30	13.00	4.54
Hypothesis 3 and 4								
Pre-Test (Time 1)		90	39.31	71.92	77.5	-0.87	-0.80	7.58
Change in certainty (Time 2 – Time 1)		90	6.57	34.49	0	1.91	18.70	3.64
Autonomous		90	5.37	1.51	5.6	-0.65	-0.41	0.16
Introjection		90	3.65	1.84	4	0.23	-0.88	0.19
External		90	3	1.65	2.75	0.53	-0.55	0.17
Amotivation		90	2.26	1.3	2	1.03	0.50	0.14
Secondary Research Question 3								
Change in certainty (Impact)	*High*	47	4.32	38.50	0	1.40	20.43	5.62
	Low	43	9.02	29.76	0	3.30	13.04	4.54
Secondary Research Question 4								
Happy	*High*	47	1.66	0.76	1	0.67	-0.93	0.11
	Low	43	2	1.09	2	0.69	-0.40	0.17
Guilt	*High*	47	3.81	1.19	4	-0.98	-0.15	0.17
	Low	43	3.3	1.35	4	-0.52	-0.93	0.21
Accountability	*High*	47	4.53	0.62	5	-0.98	-0.01	0.09
	Low	43	4.07	1.03	4	-1.23	1.09	0.16
Anger	*High*	47	1.98	1.05	2	0.98	0.33	0.15
	Low	43	1.49	0.77	1	1.20	-0.17	0.12
Secondary Research Question 5								
Extreme negative excluded								
Difference (Time 1 - Time 2)	*High*	47	-4.32	38.5	0	-1.31	17.31	5.62
	Low	42	-6.86	26.47	0	-3.75	17.39	4.08
Extreme positive excluded								
Difference (Time 1 - Time 2)	*High*	33	-6.79	45.8	-3	-0.96	11.21	7.97
	Low	28	-14.36	35.87	-2.5	-2.28	5.53	6.78

Hypothesis 3 Assumption Checks

One case had a standardized residual > 3.29 (see Table S19). However, there were an absence of influential outliers as measured by Cooks > .5, or Leverage > max critical ratio of 0.17, suggesting that the regression line would not be significantly influenced (Field, 2012). Therefore, all cases were retained. There was independence of residuals as assessed by the Durbin-Watson test of 2.05, $p = .854$. There was absence of multicollinearity as assessed by the VIF value (see Table S20). The Q-Q plot (see Figure S9) suggested a deviation from normality, therefore a bootstrap regression was conducted meaning that distributional assumptions could be relaxed (Field, 2012). Bootstrapped confidence intervals (see Chapter 6, Table 19) demonstrated similar parameters widths, thus suggesting that deviations from normality were not problematic to the interpretation of the standard regression model (Field, 2012).

Table S19

Cases Identified with Standardised residuals > 2

Case ID	Std. Residuals	Cooks distance	Leverage	Covariance ratio
8	-2.21	0.046	0.0449	0.826
53	-3.73	0.188	0.0633	0.463
78	-3.26	0.113	0.0504	0.574

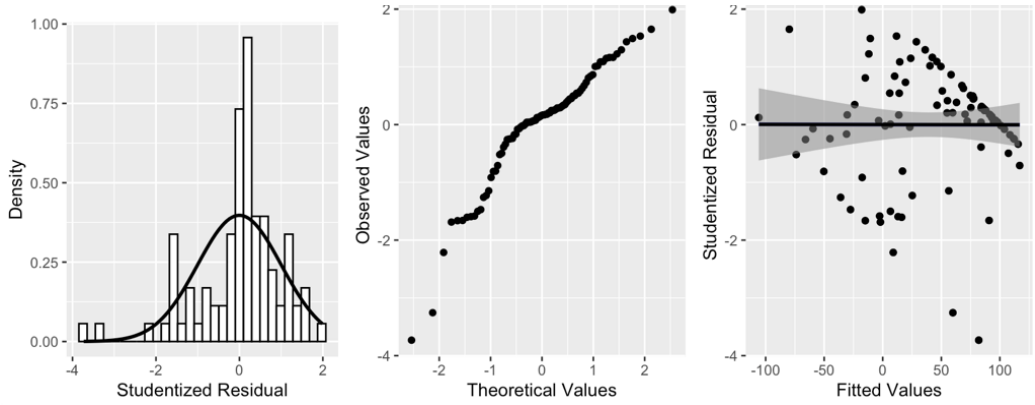
Table S20

Multicollinearity Testing for Moderation analysis

		VIF	Tolerance
Moderation 1	Autonomous	1.05	0.95
	Condition	1.05	0.95
Moderation 2	Introjection	1.02	0.98
	Condition	1.02	0.98
Moderation 3	External	1.00	1.00
	Condition	1.00	1.00
Moderation 4	Amotivation	1.01	0.99
	Condition	1.01	0.99

Figure S8

Multiple Regression Assumption Checks for Hypothesis 3



Moderation Analysis Assumptions

To check the assumptions of linearity (see Figure S10), the R package *interactions* (Long, 2019) was used. This package splits the data were split by level of moderator (motivation regulation). Each plot represents the predicted line (black) which uses the full data set, whereas the loess line (red) uses a subset of data. A curved loess line suggests a non-linear relationship. The majority of loess line appear approximately in line with the predicted lines However, given the small amount of data available, bootstrapping of the confidence intervals was conducted (see Chapter 6, Table 20). There was an absence of multicollinearity (see Table S21) and heteroscedasticity as assessed by scatterplots (see Figure S11).

Figure S9

Assumption of Linearity by Each Level of the Moderator Using R Package Interactions (Long, 2019)

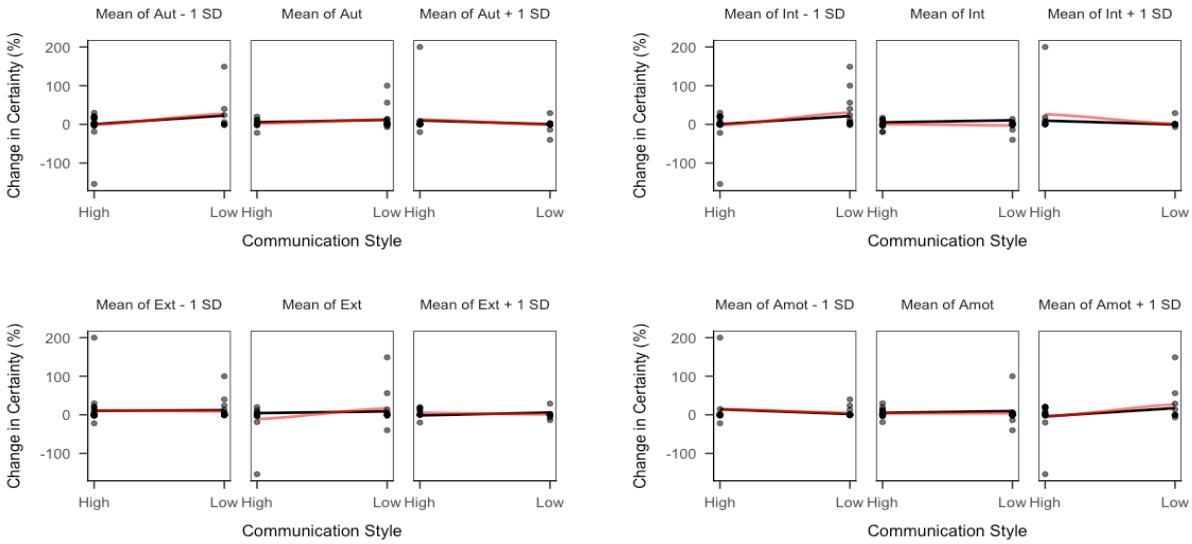


Table S20

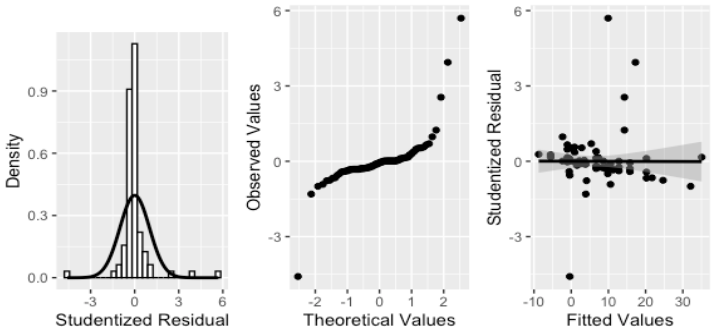
Multicollinearity Testing for Hypothesis 3

	VIF	Tolerance
Autonomous	1.59	0.63
Introjection	2.15	0.46
External	2.03	0.49
Amotivation	1.46	0.68

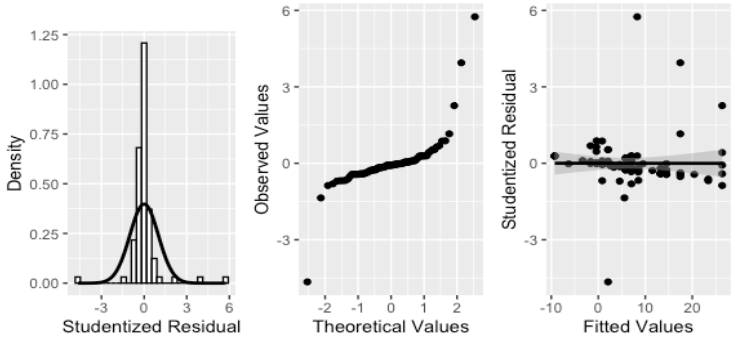
Figure S10

Assumption Checks Showing a Histogram of Residuals, QQ-plot of Residuals, and a Scatterplot of Studentized Residuals Against Predicted Values of Residuals

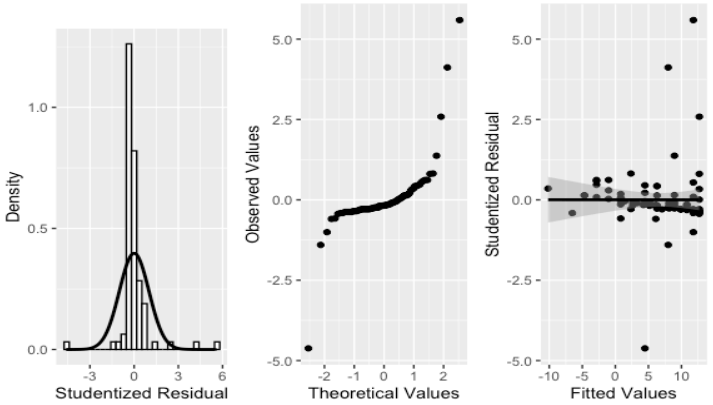
Impact = Condition*Autonomous



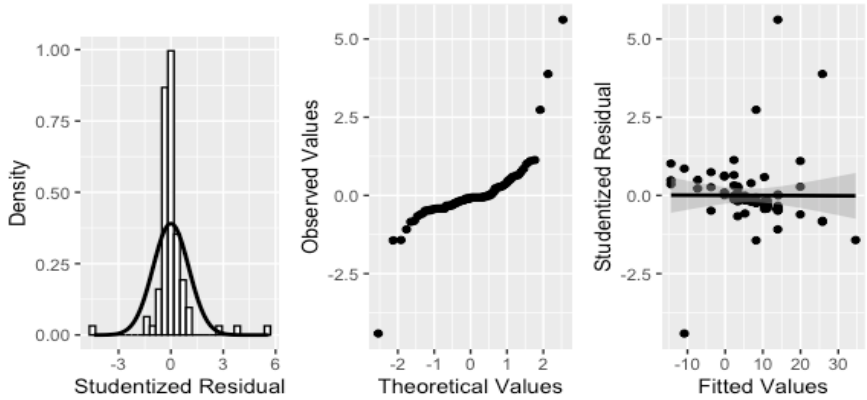
Impact = Condition*Introjection



Impact = Condition*External



Impact = Condition*Amotivation



Past Behaviour

Figure S11

Past Behaviour Moderation Analysis, Histogram of Residuals, QQ-plot of Residuals, and Scatterplot of Studentized Residuals Against Predicted Values of Residuals.