Title

Predicting intention to uptake H1N1 influenza vaccine in a university sample.

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Abstract

Objective: Global pandemic H1N1 was atypical of influenza in that it was associated with high symptom severity among young adults. Higher education institutions were therefore understandably concerned about the potential for high infection rates among students. This study examined intention to uptake H1N1 vaccine between November and December 2009, when the virus was classified by the WHO as being in the pandemic phase.

Design: A cross-sectional survey design was employed.

Method: Two-hundred university students completed a questionnaire battery comprised of health, belief/attitudes, and behavioural intention measures.

Results: Findings suggested that non-intention to vaccinate is associated with a strong disbelief in its efficacy, in negative attitudes towards vaccinations, and in lack of perceived threat, which is underscored by a disinterest in others' opinions, including authoritative bodies. Findings also suggested that there is resistance to the idea of vaccinations being mandatory.

Conclusions: Vaccination intent is in some way linked to a range of attitudes and beliefs. The implication for health practitioners is that behaviour intent may be open to influence where psycho-education can create pro-vaccine attitudes and beliefs.

Keywords: H1N1, HBM, swine influenza, TPB, vaccination.

1. Introduction

Influenza is a major public health challenge, affecting 5-30 percent of the global population each year (WHO, 2003). The World Health Organisation (WHO) estimates that annual influenza epidemics cause between three and five million cases of severe illness worldwide, and potentially half a million deaths (WHO, 2009). On June 11, 2009 WHO declared a phase 6 pandemic alert for influenza A (H1N1), commonly referred to as 'swine flu', a novel recombinant of previously identified viruses. H1N1 was atypical of influenza in that it disproportionately impacted those under the age of 35. By mid-September 2009 H1N1 had spread to over 70 countries with 500,000 confirmed cases and in excess of 3,000 deaths (Girard, Tam, Assossou, & Kieny, 2010).

The global response to H1N1 was to introduce immunisation programmes. In the Republic of Ireland vaccines were initially made available to key target groups (October-December 2009) and later the broader population (early 2010). By August 10th, 2010, when the WHO declared H1N1 to be in post-pandemic phase, more than 1000 people had been hospitalised suffering from H1N1-related complications in the Republic of Ireland, 100 had been treated in intensive care units (ICUs) and 27 deaths had been recorded (Department of Health and Children, 2010). Eighty percent of all cases recorded by the Health Protection Surveillance Centre (HPSC) here were among those under the age of 35.

The success of immunisation programmes is moderated by the level of vaccine uptake in the population, and thus considerable effort has been invested in investigating factors that influence and predict intention to uptake vaccines. A

number of social cognitive theories have been applied to this behaviour in the past, in particular the Theory of Planned Behaviour (TPB) (Ajzen, 1985) and the Health Belief Model (HBM) (Becker, 1974; Becker & Rosenstock, 1987). The TPB is an extensively applied health psychology model and postulates that the most immediate determinant of a person's behaviour is 'behavioural intent'. Although it has been successfully applied to many health behaviours in the past (e.g. Hagger, Chatzisarantis, & Biddle, 2001; Mason & White, 2008), recent research on intentions to vaccinate against influenza revealed that the only TPB variable that significantly predicted intention to vaccinate was subjective norm, explaining 48% of the variance in intention (Gallagher & Povey, 2006).

The HBM has been applied in many contexts including response to illness symptoms, preventive screening, and obtaining vaccinations (Becker & Rosenstock, 1987; Chen, Fox, Cantrell, Stockdale, & Kagawa-Singer, 2007; de Wit, Vet, Schutten, & van Steenbergen, 2005; Harrison, Mullen, & Green, 1992; Lewis & Marlow, 1997; Stretcher & Rosenstock, 1997; Umeh & Rogan-Gibson, 2001; Weinstein et al., 2007). The underlying concept of the HBM is that beliefs about a disease, and strategies to reduce its occurrence, determine health behaviour. The HBM contains four main components: perceived susceptibility to, and perceived severity of a disease; and perceived barriers and perceived benefits of preventative strategies (e.g. vaccinating) against a disease.

Zijtregtop *et al*. recently examined intention to uptake vaccination for a pre-pandemic influenza ('avian flu'; H5N1) in a national sample from the Netherlands (Zijtregtop et al., 2010). The study outcomes were an intention to vaccinate 'if there was a pandemic' or 'at the moment' if requested by the government – both hypothetical scenarios. The research was heavily influenced

by the HBM. Coincidentally the time of survey administration (April 2009) coincided with the WHO pre-pandemic alert for H1N1. Of 508 respondents, 34.5 percent reported a negative intention to vaccinate. Negative intention was significantly associated with low: perceived risk of infection; risk of death if infected; certainty that vaccination will protect against future infection; perceived risk among those 'close' to the participant; and willingness to accept advice from the government. Being 'against a pandemic influenza vaccination in particular' was also associated with negative intent. These six factors correctly classified 80% of the sample (Zijtregtop et al., 2010).

The present research builds on this theme, but differs in a number of respects. First, it examines intention to uptake vaccine during a declared pandemic, and at the height of that pandemic alert. This improves the validity of findings in that the cross-sectional snap-shot was taken at a time when media campaigns promoting vaccine up take would normally be disseminated.

Second, the outcome variable, intention to vaccinate, was not hypothetical. The Irish government was actively promoting vaccination from H1N1 and participants were asked about their actual behavioural intent rather than presenting a 'what if' scenario.

Third, the study deals with a specific at-risk group, university students, who are at risk of influenza due to life-style, mobility, and social interaction (Henrich & Holmes, 2009; Van, McLaws, Crimmins, MacIntyre, & Seale, 2010), but were of particular concern given the clinical pattern of H1N1.

Fourth, it includes additional variables of interest, including self-efficacy, conscientiousness, comparative optimism and trust-in-authorities which have been associated with health decision making elsewhere (Anderson & Tverdova,

2001; Bogg & Roberts, 2004; Colgrove & Bayer, 2005; Friedman et al., 1995; Goodwin & Freidman, 2006; Jerusalem & Schwarzer, 1992; Raynor & Levine, 2005; Walton & Roberts, 2004; Wilson, Schneider, Arnold, Bienias, & Bennett, 2007). Trust in authorities, a measure of the perceived trustworthiness of the Government and its agents, was included speculatively as the Republic of Ireland was in a period of economic decline and increased public dissatisfaction with the Government. Trust in authorities may be associated with a willingness to vaccinate when recommended to do so by the State. Self-efficacy has been shown to predict a wide range of health behaviours including weight control, contraception, smoking and exercise and research suggests that interventions targeting self-efficacy can have an impact on behaviour change (Strecher, McEvoy DeVellis, Becker & Rosenstock, 1986).

Optimistic bias, in the context of health behaviour, refers to a belief that the chance of experiencing an illness is lower for oneself than others. It is believed that the bias influences motivation to engage in preventative health behaviours and has been shown to predict perceived susceptibility to a range of illnesses (for a review see Helweg-Larsen & Shepperd, 2001). Conscientiousness was measured as there is a considerable body of literature suggesting that the trait, and related traits, are related to longevity and this has been supported by a meta-analysis in the area (Bogg & Roberts, 2004).

Based on the literature cited earlier (Gallagher & Povey, 2006; Zijtregtop et al., 2010), we examined the predictive utility of health belief variables (susceptibility, severity, barriers to vaccination and benefits of prevention), and explored the additional value of including subjective social norms relating to vaccination (Gallagher & Povey, 2006). We hypothesised that measures of

individual difference (conscientiousness and optimism bias) and the HBM variables would be significant predictors of behavioural intent, and that subjective social norms, would add additional explanatory value to the initial model.

2. Method

2.1. Design and participants

A sample of 200 students (142 females and 58 males) in 3rd level education at the National University of Ireland Galway served as study participants in this cross-sectional survey. All participants were undertaking the first semester of an undergraduate program and students were recruited from general arts and health-related studies (medicine, occupational therapy and speech and language therapy) in order to achieve a representative sample. The questionnaire was self-administered in groups.

2.2. Materials and measures

The 106-item questionnaire incorporated elements of the protocol used by Zijtregtop *et al.* (2010) and assessed behavioural determinants of intention to vaccinate based on components of the HBM and other relevant variables of interest, details of which are provided below.

2.3. Outcome measure

The primary outcome was the intention to be immunised against H1N1 which was measured by a single item; "If the government requests all students to have the swine 'flu vaccination (SFV), would you take the vaccination when made available?". Respondents had the choice to reply *yes*, *no*, or *don't know*. Prior to completing the items relating to influenza, the questionnaire described H1N1 as 'a new strain of 'flu (swine influenza) which is known to be pandemic, i.e. it has spread throughout the world'.

Health status (medical determinant) was measured using the Health Service Executive's (HSE) list of at-risk populations for H1N1. The list comprised 10 items including long-term lung disease, diabetes, and immuno-suppression, where replies of *yes* or *no* indicated a positive or negative presence of a chronic illness.

Trust in Authorities was measured using items that addressed trust in the government and in the Health Service Executive (HSE) in providing " the best possible advice regarding my health". Participants reported their agreement with the statement on a scale from 0 to 100, and a mean of the two items was used as a measure of 'trust'.

Comparative optimism was measured using Harris and Middleton's 14-item scale (Harris & Middleton, 1994) to assess the perceived likelihood of contracting, in comparison to another person, 14 medical conditions. Participants rated each potential health problem on a five-point likert-scale from *much more likely* (1), to *much less likely* (5). The mean of each respondent's

fifteen ratings was then taken as a measure of generalized comparative optimism relating to perceived health threats, with a higher score indicating greater optimism.

Conscientiousness was evaluated using a 48-item subscale from the Revised NEO Personality Inventory (Costa & McCrae, 1992). Response options were scored on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1), with reversed scoring where appropriate. A higher score indicates greater levels of conscientiousness.

Self-efficacy was assessed by the Generalised Self-Efficacy Scale (Jerusalem & Schwarzer, 1992) comprising 10 items reflecting an individual's generalized self-efficacy beliefs. Statements were positively phrased suggesting good coping abilities (e.g., "It is easy for me to stick to my aims and accomplish my goals"). Respondents rated statements with scores ranging from *not true at all* (1) to *exactly true* (4). A higher score indicates greater levels of self-belief in ability to cope with a variety of difficult demands in life.

Questions pertaining to the components from the HBM were based on previous influenza research (Zijtregtop et al., 2010), and additional variables measuring attitudes and social influence were also adopted from this source and adapted to relate to H1N1. The measures are as follows:

The *Perceived benefits* of vaccination were assessed by three items – not contracting H1N1 if vaccinated; enduring less severe symptoms if contracted;

and not infecting others. Responses were on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1). A higher score indicates greater perceived benefits of being immunised.

Perceived susceptibility was measured with two items that probed perceived risk of contracting H1N1 and risk of others catching H1N1. The response format was a five-point likert scale from *strongly agree* (5) to *strongly disagree* (1). A higher score indicates greater perceived susceptibility to swine flu.

Perceived severity pertained to the dangers perceived by the respondent if they were to contract H1N1, and included danger to self, to others, risk of infecting others, and risk of dying. Answers were given on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1) for questions with a positive outcome for intention to vaccinate, with reverse scoring for questions with a negative outcome. A higher score indicates greater perceived severity of H1N1.

Perceived barriers towards intention to vaccinate were measured by three items, and responses were given on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1). Barriers included being against vaccination in general, H1N1 vaccination in particular, and a belief that swine 'flu vaccination (SFV) can cause H1N1. As coded during analyses, a higher score indicates greater perceived barriers towards being immunised against H1N1.

Attitudes were evaluated by asking participants to respond to six items which included social and personal beliefs (e.g. 'I can protect myself against SF by taking SFV'; 'It is important to follow the advice of the government about SFV'; and 'If people in my environment get vaccinated against SF, it is unnecessary for me to get a vaccination'). Responses were measured on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1). As coded here, a higher score indicates more positive attitudes towards immunisation against H1N1.

Social influences were indicators of the importance of others and their opinions, and participants were asked to respond to three items on a five-point likert scale ranging from *strongly agree* (5) to *strongly disagree* (1). Social influences were measured by using the stem 'It is important to follow the advice of….' and included a range of significant others, namely trusted authorities (government and doctor), and family and friends. A higher score indicates greater social influence.

2.4. Procedure

Participants were provided with a document explaining the nature and intention of the research as examining psychological predictors of health behaviour among university students. Subsequently they completed an informed consent document and completed the questionnaire battery. Participation in the research was voluntary and students were not required to participate as part of their programme of study.

2.5. Statistical analysis

Data were analysed using SPSS for windows (version 17). Median differences in behavioural determinants based on splits on the outcome measure were analysed using Kruskal-Wallis, associations between intention and categorical variables were analysed using Chi-Square. Logistic regression was performed to assess the impact of the behavioural determinants on intention to be vaccinated.

3. Results

3.1. Group-based comparisons

One-hundred and twenty seven (63.5%) respondents indicated that they intended to be immunised (*yes* group) if the government requested all students to have the swine 'flu vaccination. Thirty-five (17.5%) did not intend to vaccinate (*no* group) and 36 (18%) said they did not know (*don't know* group). Eight (4%) respondents purported not to have heard of swine 'flu, and 190 (96%) said they had. One hundred and twenty (65%) reported that they knew someone in their environment who had had swine 'flu.

Forty-one respondents (29 = *yes* group, 8 = *no* group, 4 = *don't know* group) listed themselves in the at-risk categories as delineated by the HSE representing 20.5 percent of the sample. Twenty-eight of these (68%) suffered long-term lung disease (asthma), while pregnancy, immunosuppression, haemoglobinopathies, morbid obesity, and long-term heart, kidney, liver and

neurological diseases each accounted for less that one percent. The majority of people (71%) who self-reported themselves as 'at-risk' intended to vaccinate.

The means, standard deviations, and Cronbach α for predictor variables are provided in Table 1. No differences across groups emerged for levels of conscientiousness, self-efficacy, optimism, severity and susceptibility. Differences did emerge for attitudes ($H(2) = 69.84$, $p < .0005$), perceived barriers ($H(2) = 46.64$, $p < .0005$), external social influence ($H(2) = 27.06$, $p < .0005$) and perceived benefits ($H(2) = 6.12$, $p < .05$). Post-hoc tests indicated that the *no* group ($M = 15.81$, $SD = 2.83$) expressed significantly less positive attitudes towards the intention to vaccinate than both the *yes* group ($M = 21.53$, $SD = 2.99$, $U = 336$, $z = -7.261$, $p < .005$, $r = -.58$) and the *don't know* group ($M = 18.18$, $SD = 2.71$, $U = 302$, $z = -3.123$, $p = .002$, $r = -.39$). Significant differences were also found between those who said *yes* and *don't know* ($U = 865.5$, $z = -5.281$, $p < .005$, $r = -.42$). Barriers were revealed to be significantly higher in the *no* group ($M = 9.19$, $SD = 2.67$) than the *yes* group ($M = 5.88$, $SD = 1.95$, $U = 609.5$, $z = -6.087$, $p < .005$, $r = -.49$) and the *don't know* group ($M = 7.47$, $SD = 1.67$, $U = 297$, $z = -3.204$, $p = .001$, $r = -.40$). The *don't know* group also perceived more barriers to vaccination than the *yes* group ($U = 1164.5$, $z = -4.039$, $p < .001$, $r = -.32$). Social influence had a lesser impact on the *no* group ($M = 8.60$, $SD = 2.87$) than those who intended to vaccinate ($M = 11.3$, $SD = 1.69$, $U = 967.5$, $z = -5.079$, $p < .001$, $r = -.40$) and the *don't know* group ($M = 10.94$, $SD = 1.64$, $U = 326.5$, $z = -3.536$, $p < .001$, $r = -.42$). Benefits perceived by the *no* group ($M = 8.21$, $SD = 2.23$) and the *yes* group ($M = 9.36$, $SD = 2.13$, $U = 1558$, $z = -2.408$, $p = .016$, $r = -.19$) were just at significance levels.

Age, however, varied with intention to vaccinate ($H(2) = 8.3$, $p < .05$), and Mann-Whitney post hoc tests were used to follow up this finding, with a Bonferroni correction applied. They revealed that the *no* group had the oldest profile ($M = 23.60$, $SD = 8.27$), with significant differences between both them and the *yes* group ($M = 20.45$, $SD = 6.33$, $U = 1555$, $z = -2.832$, $p = .005$, $r = -.22$) and the *don't know* group ($U = 422.5$, $z = -2.446$, $p = .014$, $r = -.29$) who were the youngest ($M = 19$, $SD = 2.19$). A chi-square analysis revealed no association between gender and intention to vaccinate ($\chi^2(2) = .33$, $p > .05$). Trust in authorities was also non-significant.

3.2. Correlation analyses

Subsequent analysis was restricted to those who do intend and do not intend to vaccinate. 'Don't knows' were excluded from the analyses. Biserial correlations were conducted for intention against all the predictors due to the dichotomous nature of the dependent variable (Table 2). All other correlations conducted were Spearman's rho. Multicollinearity diagnostics revealed no strong relationships between the predictor variables ($r < .9$). VIF (< 10) and tolerance (> .1) values were also adequate (Howitt & Cramer, 2008). Zero-order correlations with intention are reported among gender, trust in the authorities, optimism, conscientiousness, self-efficacy, and some components of the HBM. Age ($r_{pb} = -.22$), attitude ($r_{pb} = .58$), social influence ($r_{pb} = .41$), and perceived barriers ($r_{pb} = .49$) were significantly correlated with intention at $p < .01$, and perceived benefits ($r_{pb} = .19$) at $p < .05$.

Logistic regression was performed with intention to vaccinate (yes/no) as criterion and the statistically significant correlates of intention (age, barriers, benefits, attitudes and social influence) as predictors (Table 3). Variables were entered in blocks, with age in block 1, perceived barriers and perceive benefits (HBM) in block 2, and social influence and attitudes in block 3. At 'block 0' the analysis assumed the full sample intended to vaccinate, meaning that at baseline the model correctly identified all those who intend to vaccinate (100%), but none of those who did not intend to vaccinate (0%). Adding age into the analysis at block 1 increased the specificity of the model, correctly predicting 6.7 percent of those who did not intend to vaccinate, and 97.5 percent of those who did, and 79.1 percent of all cases. Adding perceived barriers and perceived benefits in block 2 enabled the model to correctly identify 40.0 percent of those who did not intend to vaccinate, and 94.9 percent of those who did (overall 83.8 percent of cases correctly identified). Finally, adding social influence and attitudes led to a model correctly identifying 73.3 percent of non-intenders, and 96.6 percent of those who did intend to vaccinate (overall 91.9%).

Each stage of the analysis was statistically significant and summary results are presented in Table 3. The full model containing all the predictors was statistically significant $\chi^2(5) = 83.28$, $p < .0005$, indicating that the model could distinguish between those who had a negative intention to vaccinate and those who intended to vaccinate. The model as a whole showed good predictive utility, correctly classifying 91.9 percent of cases, and explaining between 43 percent (Cox and Snell $R^2 = .43$) and 68 percent (Nagelkerke $R^2 = .68$) of the variance for a negative-intention to vaccinate. In the final block only two of the predictor variables, attitudes (*Wald* = 16.6, $p < .0005$ 1.89) and barriers (*Wald* = 7.68, $p <$

.01), emerged as significant predictors, although age had been significant in block 1 (*Wald* = 7.04, p<.005).

Subsequent analyses of the barrier and attitude variables (Table 4) showed that significantly greater doubts are expressed by the *no* group as to the efficacy of vaccinations, and in particular towards the H1N1 vaccine. In contrast, the *yes* group displayed greater positive attitudes toward the vaccination issue.

It is also important to note that in preliminary analysis that excluded 'attitudes' from the regression, social influence was a significant contributor to the model (*Wald*=5.14, p=.023), which may suggest that 'attitudes' occluded the importance of social influence in the model reported here. This is considered in greater detail later in this paper.

4. Discussion

The research identified a number of important aspects of the vaccination climate in the Republic of Ireland at a time when infection was at peak levels and the authorities were engaged in intensive public health campaigns to promote uptake. In this climate, 64 percent of university students in our sample reported an intention to have the vaccination. In the October-December administration window, people were dying in Ireland from H1N1, the virus was in pandemic stage, students were a specific at-risk population, and the authorities were heavily invested in public health campaigns educating audiences about the risks of H1N1 and the importance of vaccination. The finding would suggest that this campaign was working for a large proportion of the student population.

Eighteen percent of our sample did not intend to take up the vaccination. This is considerably lower than that reported in the Dutch study reviewed

earlier (Zijtregtop et al., 2010) probing vaccination intent for H5N1 avian flu, where 34.5 percent of the population sample reported that they would not be vaccinated. This discordance can be explained, at least in part, by the fact that the Dutch figure was for pre-pandemic influenza and by differences in sample designs. Furthermore, the Dutch study posed a hypothetical question where respondents were asked if they would take the vaccination if asked by the authorities. In our study, vaccination for H1N1 was available and the authorities intended to vaccinate the population.

The second important finding here is that a distinct profile emerged for those who did not intend to vaccinate. In comparison to those who intended to vaccinate, those who did not reported significantly fewer positive attitudes towards vaccination (large effect size), greater perceived barriers to vaccination (medium effect size), were less influenced by external influences (GP and family and friends) encouraging vaccination (medium effect size) and perceived less benefits of vaccination (small effect size). This group was also significantly older that those who intend to vaccinate (small effect size).

Looking specifically at components of these behavioural determinants, a number of items emerged as being important. In contrast to those who intended to vaccinate, those who did not reported greater opposition to vaccinations in general, and also specifically to H1N1 vaccination. Conversely, those who intended to vaccinate reported a stronger belief that vaccination for H1N1 protects against the infection and that vaccination should be mandatory. This is inline with research suggesting that where immunization programmes are obligatory, there is a greater uptake in vaccinations (Colgrove & Bayer, 2005).

Of particular interest to health promotion practitioners, those who intended to vaccinate reported higher levels of pro-vaccine attitudes among their GPs and close 'others' than those who did not intend to vaccinate, potentially pointing towards an important social influence mechanism in vaccine behaviour.

These findings are of great importance as they point towards a possible causal link between attitudes and behaviour. While the origins of these attitudes need further exploration, they are likely to be manifestations of previous knowledge garnered from past experience, peers, authoritative bodies, and the media (Jewell, 2001; Zajonc, 1984). There is scope here for further investigation to elucidate how such a belief becomes established and whether or not the findings hold for a nationally representative sample. This investigation should include variables that more closely map onto the Theory of Planned Behaviour (TPB).

In a predictive model containing behavioural determinants of intention, the perceived barriers and attitudes towards vaccination predicted between 43 percent and 68 percent of intention, in line with previous research (Hofmann, Ferracin, Marsh, & Dumas, 2006; Hollmeyer, Hayden, Poland, & Buchholz, 2009). Perceived barriers to vaccination, and a belief that it is important to get vaccinated even if those in the environment are vaccinated, were significant contributors to the model. The former finding resonates with the existent literature, with perceived barriers to action associated with compliance with recommended health behaviour (Hollmeyer et al., 2009; Janz & Becker, 1984; Umeh & Rogan-Gibson, 2001), including inoculation (Hofmann et al., 2006).

Contrary to expectations, perceived benefits of vaccination and social influence did not contribute to this model. This may reflect low internal

consistency of the 2-item benefits scale (α=.52) and a need to reconsider how best to measure perceived benefit. Certainly research and theory is strongly suggestive of the importance of both beliefs and perceived benefits in determining behaviour change (Becker & Rosenstock, 1987).

The role of social influence is less easily explained. The items measuring 'attitude' included one that related to 'following advice', which potentially overlapped with social influence. Moreover, the variables social influence and attitudes were strongly correlated (r=.63, p<.01). This raises the potential for the attitudes variable to occlude the contribution of the social influence variable in the results. When the logistic regression was re-run without the attitudes variable, social influence emerged as a significant contributor. This has important implications for future research, which should carefully consider how attitudes and social influence can be best measured. Certainly the Theory of Planned Behavior (TPB), which ensures that attitudes and social influences are measured as distinct concepts, provides a useful framework for addressing this limitation of the current study.

Self-efficacy, comparative optimism and conscientiousness were non-significant correlates of intention to be vaccinated. On one level, these negative findings may in part reflect the way H1N1 was portrayed in media coverage of the pandemic. The illness was described as easily preventable through vaccination - thus self-efficacy may be less relevant in this specific disease. Similarly, it was portrayed as spreading easily from one individual to the next, so even beliefs that infection is something that is more likely to be experienced by others (optimist bias) would logically increase the likelihood of infection of the respondent.

On a second level, the measures may have lacked sensitivity in predicting intention to vaccinate. Behaviour specific measures of self-efficacy and conscientiousness may have resulted in a better test of the impact of these factors on intended behaviour and this should be considered in future research in this area.

The research would conclude that intention to vaccinate is linked to behavioural determinants that go beyond one theoretical model of behaviour. Perceived barriers towards vaccination emerged from the HBM as a predictor of behaviour intent. 'Attitudes' also emerged as important. While the study did not directly test the Theory of Planned Behaviour (TPB), attitudes is central to this theory and future research should probe this theory more directly.

It is also important to note that the findings reported here are not necessarily valid in understanding other health behaviours. At the time of administration H1N1 was a potentially fatal illness for university students, the danger was immediate, and the barriers to immunization are low (e.g., Painter et al., 2010). This is in contrast to other illness such as coronary heart disease, where prevention requires long-term commitment (Armitage, 2005), and the immediate salience of death by coronary heart disease may be low. For such an illness, perceived behavioural control may be a more powerful predictor of behaviour intent (Johnston et al., 2004).

The external validity of the findings to the broader 3rd level education student population is likely to have been hampered by a marginal under-sampling for probing a predictive model. It is reassuring that the 95% confidence intervals of exp(B) did not span across 1, but it is still anticipated that a larger sample would have been more sensitive to a larger predictive model. As noted

earlier, there is also some concern about the items measuring perceived benefits of vaccination, and we would recommend that future studies re-think how such a concept should be measured. It would also be useful to extend the enquiry and consider affective predictors of behaviour intent, including anticipated regret, which may be particularly important in understanding, and responding to, those who do not intend to vaccinate.

It is important to reiterate that this study targeted a specific at-risk population. The matter of broader population representativeness is not an issue, and no inference as to broader population uptake trends are being made here. We would note, however, that the sample utilised here, while broadly representative of undergraduate students attending a university in the West of Ireland, is not necessarily representative of the student population nationally.

A more pressing limitation of this research is that the items used to measure perceived barriers, severity and attitudes were based largely on research from other jurisdictions (Zijtregtop et al., 2010) and future research should include primary exploratory research to ensure measures are sensitive to cultural-specific beliefs and attitudes.

Despite these limitations, it is clear that vaccination intent is in some way linked to a range of attitudes and beliefs. The implication for health practitioners is that behaviour intent may be open to influence where psycho-education can create pro-vaccine attitudes and beliefs. Even at this early stage it would be useful to expose this conclusion to empirical testing in an intervention design that tests the efficacy of specific types of messages in changing attitudes and beliefs and if such change impacts on vaccine intent.

References

Ajzen, I. (1985). From intention to action: A theory of planned behavior In J. Kuhl & J. Beckmann (Eds.), *Action-control: From cognition to behavior*. New York: Springer.

Anderson, C., & Tverdova, Y. (2001). Winners, losers, and attitudes about government in contemporary democracies. *International Political Science Review, 22*(4), 321-338.

Becker, M. H. (1974). The Health Belief Model and personal behaviour. *Health Education Monographs, 2*(4), 324-508.

Becker, M. H., & Rosenstock, I. M. (1987). Comparing social learning theory and the health belief models. In W. B. Ward (Ed.), *Advances in health education and promotion* (Vol. 2, pp. 245-249). Greenwich, CT: JAI Press.

Bogg, R., & Roberts, B. W. (2004). Conscientiousness and health -related behaviors: A meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin, 130*, 887-919.

Chen, J. Y., Fox, S. A., Cantrell, C. H., Stockdale, S. E., & Kagawa-Singer, M. (2007). Health disparities and prevention: racial/ethnic barriers to flu vaccinations. *J Community Health, 32*(1), 5-20.

Colgrove, J., & Bayer, R. (2005). Could it happen here? Vaccine risk controversies and the specter of derailment. *Health Affairs, 24*(3), 729-739.

Costa, P. T. J., & McCrae, R. R. (1992). *The NEO Personality Inventory - revised* Odessa, FL: Psychological Assessment Resources.

Cox, D. N., Anderson, A. S., Lean, M. E., & Mela, D. J. (1998). UK consumer attitudes, beliefs and barriers to increasing fruit and vegetable consumption. *Public Health Nutrition, 1*(1), 61-68.

de Wit, J. B., Vet, R., Schutten, M., & van Steenbergen, J. (2005). Social-cognitive determinants of vaccination behavior against hepatitis B: an assessment among men who have sex with men. *Prev Med, 40*(6), 795-802.

Department of Health and Children. (2010, 6th Sept 2010
). Pandemic (H1N1) 2009 (Swine Flu). Retrieved 01.12.2010, from http://www.dohc.ie/issues/swine_influenza/

Friedman, H. W., Tucker, J. S., Schwartz, J. E., Tomlin-Keasy, C., Wingard, D. L., & Criqui, M. H. (1995). Psychosocial and behavioral predictors of longevity. *American Psychologist, 50*(2), 69-78.

Gallagher, S. & Povey, R. (2006). Determinants of older adults' intentions to vaccinate against influenza: a theoretical application. *Journal of Public Health, 28*(2), 139-144.

Girard, M. P., Tam, J. S., Assossou, O. M., & Kieny, M. P. (2010). The 2009 A (H1N1) influenza virus pandemic: A review. *Vaccine, 28*, 4895-4902.

Godin, G., Valois, P., Lepage, L., & Desharnais, R. (1992). Predictors of smoking behaviour: an application of Ajzen's theory of planned behaviour. *Br J Addict, 87*(9), 1335-1343.

Goodwin, R. D., & Freidman, H. S. (2006). Health status and the five-factor personality traits in a nationally representative sample. *Journal of Health Psychology, 11*(5), 643-654.

Hagger, M. S., Chatzisarantis, N., & Biddle, S. J. (2001). The influence of self-efficacy and past behaviour on the physical activity intentions of young people. *J Sports Sci, 19*(9), 711-725.
Harris, P., & Middleton, W. (1994). The illusion of control and optimism about health: On being less at risk but no more in control than others. *British Journal of Health Psychology, 33*, 369-386.
Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the Health Belief Model with adults. *Health Educ Res, 7*(1), 107-116.
Henrich, N., & Holmes, B. J. (2009). The public's acceptance of novel vaccines during a pandemic: a focus group study and its application to influenza H1N1. [doi: 10.3134/ehtj.09.008]. *Emerging Health Threats Journal, 2;e8*, doi: 10.3134/ehtj.3109.3008.
Hofmann, F., Ferracin, C., Marsh, G., & Dumas, R. (2006). Influenza vaccination of healthcare workers: A literature review of attitudes and beliefs. *Infection, 34*(3), 142-147.
Hollmeyer, H. G., Hayden, F., Poland, G., & Buchholz, U. (2009). Influenza vaccination of health care workers in hospitals: A review of studies on attitudes and predictors. *Vaccine, 27*(30), 3935-3944.
Howitt, D., & Cramer, D. (2008). *Introduction to SPSS in Psychology: For Version 16 and Earlier* (4 ed.). New York: NY: Prentice Hall.
Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*, 1-47.
Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal process. In R. Schwarzer (Ed.), *Self-Efficacy: Thought control of action*. Washington, DC: Hemisphere.
Jewell, D. (2001). MMR and the age of unreason. *British Journal of General Practice, 51*, 875-876.
Lewis, J., & Marlow, R. (1997). HIV/AIDS risks in heterosexual college students. A review of a decade of literature. *Journal of American College Health, 45*(4), 147-155.
Mason, T. E., & White, K. M. (2008). Applying an extended model of the theory of planned behaviour to breast self-examination. *J Health Psychol, 13*(7), 946-955.
Norman, P., Bennett, P., & Lewis, H. (1998). Understanding binge drinking among young people: an application of the Theory of Planned Behaviour. *Health Educ Res, 13*(2), 163-169.
Raynor, D. A., & Levine, H. (2005). Associations between the Five-Factor model of personality and health behaviors among college students. *Journal of American College Health, 58*(1), 73-81.
Stretcher, V., & Rosenstock, I. M. (1997). *The health belief model*. San Francisco, CA: Jossey-Bass.
Umeh, K., & Rogan-Gibson, J. (2001). Perceptions of threat, benefits, and barriers in breast self-examination amongst young asymptomatic women. *Br J Health Psychol, 6*(Part 4), 361-372.
Van, D., McLaws, M. L., Crimmins, J., MacIntyre, C. R., & Seale, H. (2010). University life and pandemic influenza: attitudes and intended behaviour of staff and students towards pandemic (H1N1) 2009. *BMC Public Health, 10*, 130.

Walton, K. E., & Roberts, B. W. (2004). On the relationship between substance use and personality traits: Abstainers are not maladjusted. *Journal of Research in Personality, 38*, 515-535.

Weinstein, N. D., Kwitel, A., McCaul, K. D., Magnan, R. E., Gerrard, M., & Gibbons, F. X. (2007). Risk perceptions: assessment and relationship to influenza vaccination. *Health Psychol, 26*(2), 146-151.

WHO. (2003). Influenza. 2009, from http://www.who.int/mediacentre/factsheets/2003/fs211/en/

WHO. (2009). Characteristics of the emergent influenza A (H1N1) viruses and recommendations for vaccine development. 2009, from http://www.who.int/mediacentre/factsheets/fs211/en/

Wilson, R. S., Schneider, J. A., Arnold, S. E., Bienias, J. L., & Bennett, D. A. (2007). Conscientiousness and the incidence of Alzheimer diseas and mild cognitive impairment. *Arch Gen Psychiatry, 64*(10), 1204-1212.

Zajonc, R. B. (1984). On the primacy of affect. *American Psychologist, 39*(2), 117-123.

Zijtregtop, E. A., Wilschut, J., Koelma, N., Van Delden, J. J., Stolk, R. P., Van Steenbergen, J., et al. (2010). Which factors are important in adults' uptake of a (pre)pandemic influenza vaccine? *Vaccine, 28*(1), 207-227.

Strecher, V. J., McEvoy DeVellis, B., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behaviour change. Health Eduation and Research, 13(1), 73-92.

Helweg-Larson, M., & Shepperd, J. A. (2001). Do moderators of the optimistic bias affect personal or target risk estimates? A review of the literature. Personality and Social Psychology Review, 51, 74-95.