Investigating the Relationship Between Vaccine Hesitancy, Trust in Healthcare Providers, and Demographics Factors

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Abstract

Previous research has shown that there are three main determinants influencing the vaccine decision making process: vaccine specific, individual specific, and contextual factors. The current study intended to contribute to the previous literature by evaluating the complexities of vaccine-related trust and generalised vaccine hesitancy, in an Irish healthcare context. The aims were to investigate if a relationship exists between vaccine hesitancy, trust in healthcare providers, and demographic factors, and to determine how important trust in healthcare providers is in predicting vaccine hesitancy. Participants were recruited through social media, using convenience and snowball sampling (N=194), they completed a questionnaire containing demographic information, The SAGE Vaccine Hesitancy Scale, and The Multidimensional Trust in Health Care Systems Subscale 1: Trust in Health Care Providers. Results show a strong negative correlation between trust in healthcare providers and vaccine hesitancy. Trust in healthcare providers also uniquely predicated vaccine hesitancy to a statistically significant degree, while controlling for demographic factors. The role of healthcare professionals in vaccine promotion is clear from this study, and efforts should be made to address the concerns leading to vaccine hesitancy, to share reliable, trustworthy information, and potentially reduce vaccine hesitancy and increase uptake rates.

Contents

Introduction

Immunisation could be considered one of the most important achievements of modern public health medicine, being responsible for the complete eradication of smallpox (Poland & Jacobson, 2011) and the eradication of polio in all but three countries – Pakistan, Afghanistan, and Nigeria (World Health Organisation, 2019). According to Public Health England's publication, "Immunisation against infectious disease" , global reports of tetanus have dramatically declined in recent years following increased tetanus vaccination coverage. Over one million deaths every year were attributable to tetanus in the 1980s, compared to an estimated 59,000 deaths in 2013 (*Immunisation against Infectious Disease - The Green Book: Department of Health - Publications*, 2013.). In Ireland, following the introduction of the Diphtheria vaccine, the number of cases steadily reduced until 1968 when no new cases were reported. Since then there have only been two cases reported, one in 2015 and one in 2016 (Health Protection Surveillance Centre, 2017). Tuberculosis (TB) has also seen a dramatic decrease in reported cases due to increased vaccination coverage. In 1952 there were 6.795 reported cases of TB in Ireland, compared to 2019 which saw just 267 cases reported (HPSC, 2019).

GAVI, the Global Alliance of Vaccines and Immunisations estimates that vaccinations administered between 2011 and 2020 will prevent more than 23 million future deaths (GAVI, n.d.). Despite this fact approximately 19.7 million infants under the age of one did not receive basic vaccinations in 2019 (WHO, 2019). Potential reasons for this include availability issues, war and conflict, financial, and geographical constraints, and attitudes towards vaccinations (World Health Organization, 2013), anti-vaccine views have grown considerably in the past two decades (Larson et al., 2018).

Attitudes towards vaccines are usually measured on a continuum, ranging from vaccine rejectors who are completely anti-vaccine, to vaccine acceptors who are pro-vaccine (Benin et al., 2006). Studies in the USA reported that approximately only 2% of their population are vaccine rejectors, and 70% are vaccine acceptors (Dempsey et al., 2011; Freed et al., 2010; Gust et al., 2008). In between these polarised viewpoints are those individuals - who account for approximately 28% of the population - that are deemed vaccine hesitant (Dempsey et al., 2011; Freed et al., 2010; Gust et al., 2008). Vaccine hesitancy refers to the refusal, reluctance, or delay to vaccinate despite vaccine availability; and has been identified as one of the top threats to global health (WHO, 2019). There are three main determinants influencing the vaccine decision making process; vaccine specific factors, individual specific factors, and contextual factors which will be examined in further detail. (WHO, 2014)

The World Health Organisation have identified a Three C Model for vaccine specific factors – confidence, complacency, and convenience (WHO, 2019). This model mirrors some aspects of the Health Belief Model which attempts to explain vaccination behaviours as a result of disease and disease related perception (Smith et al., 2011). Perceived benefits and self-efficacy are related to the assessment of whether vaccinating can reduce the chance of getting the disease and relates to the confidence factor, as do perceived barriers to vaccination such as safety concerns. Similarly, the perceived disease susceptibility, and the perceived severity features of the Health Belief Model relate to the complacency factor. The identifying cues to action aspect of the Health Belief Model, which may include public health promotion policies, can relate to the convenience factor as do practical barriers such as access to vaccine clinics, in facilitating the vaccination.

The success of vaccines has drastically reduced the number and impact of vaccine preventable diseases over the years (Greenwood, 2014). As a result of this individuals no longer perceive these diseases as a significant threat to their health and underestimate both the severity, and transmission rate of the disease. Another factor affecting the perceived severity is personal history, varicella is a good example of this, many individuals remember having mild varicella during their childhood so are unaware or underestimate the serious complications that can be associated with the disease (Freed et al., 2010). Vaccine safety concerns are a perceived barrier in the vaccine decision making process. Individuals reflect an omission bias for vaccinations, often choosing the potential consequence of the disease by not doing anything, rather than the potential consequence of the vaccine by doing something. Some individuals are preferring to reach immunity naturally through contracting the disease, rather than vaccinating due to safety concerns (Benin et al., 2006; Freed et al., 2010; Poland & Jacobson, 2011).

Vaccine concerns, and anti vaccine views, date back to the 18th century when Jenner first popularised modern-day vaccination with the introduction of the smallpox vaccine (Porter & Porter, 1988), however there have been a small number of cases reporting serious adverse reactions to vaccines, which may cause genuine concern or hesitancy. In 2017, Sanofi announced that their dengue fever vaccine, Dengvaxia predisposed individuals who had never been infected, to significantly higher risks in terms of severity and hospitalisations, than if they had not been vaccinated (Fatima & Syed, 2018). Other notable examples include the increased risk of intestinal problems – intussusception – in infants following the administration of the rotavirus tetravalent vaccine in 1999 (Kramarz et al., 2001; Murphy et al., 2001), and in 1992 the UK's withdrawal of two brands of MMR vaccines after it was noted to be associated with an increased risk of aseptic meningitis (Elliman & Bedford, 2007). There have also been tenuous links which

have falsely connected vaccines to adverse reactions, such as Japan's halting of the HPV vaccine recommendations in 2013 following reports of serious adverse reactions. Despite these events, being found to be unrelated to the vaccine, the programme has not been reinstated and this has impacted the perceived safety of the vaccine (Simms et al., 2020).

A key contributing factor to the rise in antivaccine views appears to be the study conducted by Andrew Wakefield, which was published in a prestigious medical journal The Lancet in 1998. This study falsely claimed that there was a link between the combined Measles, Mumps and Rubella vaccine (MMR) and both autism and Crohn's disease. This study has been discredited quite openly and a ruling by the General Medical Council resulted in the author being struck of the medical register (Deer, 2011). However, this study remains to have a profoundly negative effect on vaccine rates, and in 2018 there were an estimated 142,000 deaths from measles globally (HPSC, 2019).

On a national level, in 2018 there were 76 cases of measles in Ireland compared to 25 cases in 2017. Measles figures for 2019 have still not been released by the Health Protection Surveillance Centre, however there were outbreaks of both measles and mumps reported. The number of mumps cases in 2019 was 2,762 compared to 573 in 2018 (HPSC 2019). In February 2020 the first Irish case of Rubella was confirmed since 2009. These figures may suggest a decrease in vaccination coverage. In 2019 the vaccine uptake rate of the MMR which prevents measles, mumps and rubella was 91%. While this appears to be a good uptake rate, a rate of 95% is needed to prevent measles outbreaks (HPSC 2019). Given the previous literature, it is important to evaluate why this uptake rate is low in Ireland, what factors have influenced it, and what can be targeted to improve this rate.

Previous literature suggests that vaccine hesitant attitudes are often prevalent within the well-educated (Gilles et al., 2011; Hak et al., 2005). Lack of information is not usually cited as a primary cause of vaccine hesitancy, which may explain how level of education could have an effect on vaccine hesitancy. Global studies have found very mixed results, according to a systematic review carried out by Larson et al in 2014, studies in China, Lebanon, Israel, Bangladesh, and USA, found that higher levels of education is a barrier to vaccination, resulting in children remaining unvaccinated (Larson et al., 2014). In this same report studies in Greece, The Netherlands, Nigeria and Pakistan have shown that high levels of education are a promoter of vaccinations resulting in increased vaccination uptakes, and lower levels of vaccine hesitancy. On the other side low education was identified as a barrier resulting in children remaining unvaccinated in Nigeria, India, China, and Kyrgyzstan (Larson et al., 2014). Previous literature is contradictory which suggests that the individual variable level of education cannot be considered on its own.

In the majority of situations parental willingness to vaccinate is the key strategy to improve vaccination coverage, “herd immunity” and to reduce the spread of vaccine preventable diseases through childhood immunisation programmes. Vaccine hesitancy is quite prevalent among new and expectant parents (Benin, 2006; Tomeny et al., 2017). A study conducted by Callaghan, Motta, Sylvester, Trujillo and Blackburn (2019) found that parents with high levels of conspiratorial thinking and needle sensitivity are more likely to show high levels of vaccine hesitancy. This study also examined the relationship between moral purity, sexual deviance and the decision to the delay the HPV vaccination. High levels of moral purity in individuals leads to the fear of biological contamination and the administration of antigens into the body can be seen as corrupting the body’s purity (Clay, 2017). Purity is also associated with predicting attitudes

about sexuality, and high levels of purity are associated with an increased likelihood of individuals having more conservative beliefs about sexuality and, which may lead to the idea of vaccinating against a sexually transmitted disease being viewed as improper. Findings suggested that parents with high moral purity scores were 8% more likely to have delayed their children's HPV vaccination than parents with lower scores (Callaghan et al., 2019).

The focus on the HPV vaccine in Ireland has been mainly on adolescent girls and in recent times boys, and parental consent is needed for the vaccine to be administered, however this vaccine is recommended for females up to the age of 26 as well as for men who have sex with men up to the age of 45. This is not the only vaccination which adults may be recommended to receive, occupational vaccines such as the Hepatitis B vaccine is recommended for all healthcare workers. In addition to this the HSE recommend that all pregnant women receive the Pertussis vaccine, and seasonal vaccinations such as the Influenza and Pneumococcal vaccines are also recommended. However, the previous literature focuses mainly on vaccine hesitancy relating to primary childhood immunisations.

The SAGE working group on vaccine hesitancy stated that contextual factors of vaccine hesitancy include the geographic area, media, historical influences, culture, trust in healthcare professionals and systems, trust in policy makers and trust in the pharmaceutical industry and the vaccine itself (WHO, 2014). An example of this can be seen in Nigeria, one of the three countries where polio remains a concern, and where access to vaccination clinics can be hindered by geographical location particularly the ease of access to these clinics in rural areas (WHO, 2014). Previous research has found that that vaccine hesitancy in Nigeria, was most influenced by supply side factors, maternal availability , and lack of knowledge, however there were also concerns over the number of campaigns and the fear that children could overdose on vaccines.

The political, religious and social resistance to the polio eradication campaign in 2003 played a key role in all of these factors (Babalola, 2011; Odusanya et al., 2008; Oladokun et al., 2010). Geographic factors are less of a concern regarding access to vaccinations in Europe, however there are other influencing factors for example Greece where socioeconomic factors - number of siblings and father's education level - were the most important predictive factors of vaccine hesitancy (Danis et al., 2010).

Specific vaccines may also impact vaccine hesitancy levels. Parents may choose to accept some vaccines, reject others completely or to delay or decline doses of some vaccines. A study in the UK on the catch-up MMR vaccine found that different factors influenced decision making at each dose. In children who did not previously receive the vaccine, the uptake was predicted by receipt of an invitation, younger parent age and residence in a less deprived area. For those children who were previously immunised perceived social desirability, lower parental education level and younger child age predicted uptake (Brown et al., 2011). Other studies have also found that age can influence vaccine hesitancy, along with gender. Previous studies have found that the age of the majority of unvaccinated infant mother's is 30 and under (Birnbaum et al., 2013; Glanz et al., 2009; Kim et al., 2007). Women and expectant mothers were also more likely to be vaccine hesitant, and women were more likely than men to put some trust in vaccine injury claims (Dubé et al., 2013; Siddiqui et al., 2013).

Overall previous literature tends to focus on whether vaccinations were delayed, however it does not differentiate between those who delayed by one month and those who delayed by years. The reasons for these delays may be completely different ranging from sickness to deliberately choosing to delay. Another issue relates to the self-reported behaviour, due to social desirability or memory issues participants may not accurately report their vaccine behaviour. Differences in

environment may also play a role in vaccination behaviour, some countries require vaccinations to be administered before children start formal education while other countries have more relaxed requirements. However, it is not just demographics such as age, gender, parental status and level of education which influence vaccine hesitancy.

A significant factor which influences attitudes toward vaccination is trust, of which there are three main components - trust in the vaccine, trust in healthcare providers, and trust in the government and policy makers (Larson et al., 2014). Trust has been identified as a significant predictor of pro-vaccine behaviours (Justwan et al., 2019; Joslyn, and Sylvester, 2019). In today's society individuals are taking a more active role in their health decisions and not living by "the doctor knows best" attitudes of previous times (Dubé et al., 2013). People tend to consult social media and celebrity views regarding vaccine safety and effectiveness. These views are often misleading and does not aid a reduction in vaccine hesitancy and reduce levels of trust in healthcare professionals and institutions (Benegal, 2018).

Despite this healthcare providers – GP's, Pharmacists, and local hospitals – were listed as being the most trusted source of medical information (Bouder et al., 2015). This group are one of the biggest influences in vaccination decision making, and the importance of their vaccine recommendations is well documented (Wiley et al., 2013). Vaccine hesitancy still exists amongst healthcare providers, mainly relating to seasonal influenza vaccines, however those that were vaccinated, were more likely to recommend vaccinations (Zhang et al., 2012). While healthcare providers remain the most trusted source of vaccine information, the confidence of these individuals is strained (Paterson et al., 2016). Doctors and nurses, are faced with time constraints in their consultations with vaccine hesitant patients and may not be able to answer their concerns satisfactorily.

The healthcare system in Ireland is comprised of both public healthcare and private healthcare systems. This differs to countries like the UK whose healthcare service is mainly publicly funded through the NHS, and the USA whose healthcare is mainly funded through private insurance healthcare payers. Due to this fact primary care services such as GP's are more accessible and attainable and therefore there may be differing levels of trust in healthcare professionals within Ireland. Recent controversies in the Irish healthcare system such as the CervicalCheck scandal may have impacted levels of trust in Irish healthcare providers. Additional pressure caused by the Covid-19 pandemic, on an already strained healthcare system, have led to an increased workload for hospitals, public health, and GPs which has exacerbated the time constraints that healthcare providers currently face.

This research aims to contribute to the literature by further evaluating the complexities of vaccine-related trust, and how trust in healthcare professionals is viewed in an Irish healthcare context as well as aiming to be more representative of general vaccine hesitancy by not solely focusing on parents and childhood immunisations.

This research is being carried out to determine if trust in healthcare providers predicts vaccine hesitancy while controlling for demographic variables. The aims are firstly to investigate if a relationship exists between vaccine hesitancy, trust in healthcare providers, age, gender, level of education, and parental status. Secondly to determine how important the main predictor variable, trust in healthcare providers is in relation to other variables and to investigate whether there are any significant interactions from demographic variables.

Based on previous literature five hypotheses were identified: The first hypothesis is - individuals with a low level of trust in healthcare providers would have high levels of vaccine hesitancy. The second hypothesis is that levels of education will have a significant effect on vaccine hesitancy. The third hypothesis is that parental status will have a significant effect on vaccine hesitancy. The fourth hypothesis is that levels of vaccine hesitancy will differ between gender. Finally, hypothesis five is that age will have a negative relationship with vaccine hesitancy.

Methods

Participants

194 participants were recruited using a mixture of convenience and snowball sampling by distributing links on Social Media (Facebook, and Twitter) and asking participants to share the link. Participants were both male (59) and female (135) ranging in ages from 18 to 84 (mean age of 43.21, SD = 11.74). 39 participants had completed second level education, while 155 had completed third level. Of these 194 participants 136 had children, two were expecting children, and 56 did not have children. All participants provided informed consent prior to completing the questionnaire and data from all participants was included. This sample exceeded the minimum sample size according to both Stevens (as cited in Minke, 1997) and Tabachnick & Fidell, (as cited in Kyriazos, 2018).

Measures

Participants were presented with the Sage Vaccine Hesitancy Scale (Shapiro et al.,2018). Questions on this scale measures levels of vaccines hesitancy in participants on a five-point Likert scale from strongly disagree (1) to strongly agree (5). There were 10 questions on this scale (see appendix A). An example of these questions is “The information I receive about vaccines from the vaccine program is reliable and trustworthy.” Scores on each question are added to obtain an overall score to a maximum of 50. Questions one to seven are reversed scored meaning that a low-level response indicates high levels of vaccine hesitancy. Overall high scores on this scale indicate high levels of vaccine hesitancy. Slight adjustments were made to the wording of the questions for example “Childhood vaccines are important for my child’s health” was changed to “Vaccines are important for my / my child’s health” in order to include

participants who do not have children, and vaccines outside of the childhood schedule however this did not change the conceptual meaning. The SAGE Vaccine-Hesitancy Scale (Shapiro et al.,2018) is widely used and has a Cronbach's alpha of .92 which suggests a high level of validity and reliability.

The Multidimensional Trust in Health Care Systems Subscale 1: Trust in Health Care Providers (Egede & Ellis, 2008) was also used. Questions on this scale measured participants level of trust in healthcare providers on a five-point Likert scale from strongly disagree (1) to strongly agree (5). There were 10 questions on this scale (see appendix B). An example of these questions is "I can trust my health care providers judgements concerning my medical care". Scores on each question are added to obtain an overall score to a maximum of 50. One negatively worded question is used to check answer validity, which is reversed scored. Overall high scores on this scale indicate high levels of trust in health care providers. The Multidimensional Trust in Health Care Systems Scale is widely used and as a whole has a Cronbach's alpha of .89 while the healthcare provider subscale has a Cronbach's alpha of .92 (Egede & Ellis, 2008). This suggests a high level of validity and reliability.

Finally, participants were then asked to complete demographic questoions regarding, age, gender, level of education and parental status (see appendix C), which were presented in a tick box format, apart from age which was a free text option.

Design

This study used a quantitative multivariate cross-sectional design. The aims of this study were to investigate if a relationship exists between the criterion variable - vaccine hesitancy, and the

predictor variables - trust in healthcare providers, age, gender, level of education, and parental status. To determine how important the main predictor variable - trust in healthcare providers - is in relation to other variables and to determine if there are any significant interactions from demographic variables. To investigate these aims a hierarchical regression was used to analysis the data.

Procedure

Stringent checks were conducted to ensure the questionnaire was fully functional and the link was correct, however no pilot study was carried out due to both the SAGE Vaccine-Hesitancy Scale and the Multidimensional Trust in Health Care Systems Scale (Egede & Ellis, 2008; Shapiro et al.,2018) having Cronbach Alpha of above .75 therefore high validity. In addition, the context of this study is not too different to previous studies in vaccine hesitancy. Due to these two points it was decided that the findings would not be significantly affected by use of a pilot study.

The questionnaire was created on Google Forms and a link to the questionnaire was posted on Facebook and Twitter along with the topic and the purpose of the study. Participants were advised to click on the link for further details and to complete the questionnaire. As participants entered the questionnaire page, an information sheet (appendix D) giving a plain language summary of the research and their participation in same was displayed.

At the bottom of this plain language summary participants were presented with a consent form (appendix E). Participants were required to confirm they are over 18, live in Ireland, that they have read and understood the plain language statement, that they have been made aware of the

right to withdraw and that they are willing to participate in the study. This was obtained using a check box feature. If participants did not complete the consent checkboxes, they were unable to proceed to the questionnaire, and were directed to the end of the questionnaire.

Participants were then presented with the Sage Vaccine Hesitancy Scale (see appendix A), and the Multidimensional Trust in Health Care Systems Subscale 1: Trust in Health Care Providers (see appendix B) and were required to and to rate their response on a five-point Likert scale from strongly disagree (1) to strongly agree (5).

Finally, participants were then asked demographic questions (see appendix C), relating to gender, age, level of education, and parental status which were presented in a tick box format, apart from age which was a free text response. Participants were only permitted to give one response to each question and were unable to proceed if answers had been omitted.

When the participants had completed the last question, they were thanked for participating and the debriefing page (see appendix F) was shown on screen. This included information regarding the data collected, as well as the researchers contact details should any concerns or queries relating to the research arisen. In addition to this should participants have any queries or concerns in relation to vaccines they were directed to various reliable sources of information such as the HSE Immunistaion page. The whole process from clicking on the link to submitting the information took less than 10 minutes.

There was minimal risk of harm or distress to participants for this study, other than the inconvenience of taking part due to the anonymity of the data and unbiased wording of the questionnaires.

Results

Descriptive statistics

The relationship between the criterion variable – vaccine hesitancy – and the predictor variables – trust in healthcare providers, age, gender, level of education and parental status – were investigated. The frequencies for gender, level of education and parental status are shown in Table 1. There were a higher proportion of female (69.6%) participants than males, and also a higher proportion of participants had completed tertiary education (79.9%). No participants had only completed primary education. When participants were asked their parental status only two participants were expecting children, therefore the decision was made to combine this with the have children group. There were more participants with children (71.1%) than those without.

Table 1

Frequencies for participants in the current sample (N = 194)

Variable	Frequency	Valid %
Gender		
Male	59	30.4
Female	135	69.6
Level of Education		
Secondary	39	20.1
Tertiary	155	79.9
Parental Status		
Have / Expecting Children	138	71.1
No Children	56	28.9

Descriptive statistics for each of the measured variables in the current study are presented in Table 2. A significant result ($p < .05$) of the Kolmogorov-Smirnov statistic was found for trust in health care providers and vaccine hesitancy indicating that the data is non-normally distributed. Trust in healthcare providers data were negatively skewed while vaccine hesitancy data were positively skewed. The skewness and kurtosis figures were in the acceptable range and the current sample size is large enough to assume the distribution of scores will be treated as normal. Three outliers were identified in the vaccine hesitancy data, however analysis with the outliers removed did not show any variation in results so for the purposes of the current study these outlying scores were retained.

Table 2

Descriptive statistics for all continuous variables (N=194)

Variable	*M* [95% CI]	*SD*	Range
Age	43.21 [41.55, 44.87]	11.74	18-84
Trust in Healthcare Provider	38.26 [37.00, 39.53]	8.92	13-50
Vaccine Hesitancy	17.74 [16.71, 18.76]	7.24	10-45

Inferential Statistics

Hierarchical multiple regression was performed to investigate how well trust in healthcare providers predicts levels of vaccines hesitancy, when controlling for demographic factors, gender, age, level of education, and parental status

Preliminary analyses were conducted to ensure there was no violation of the assumptions of normality, linearity, and homoscedasticity. Additionally, the correlations amongst the predictor variables (gender, age, level of education, parental status, and trust in healthcare providers), were examined and these are presented in Table 3. There were significant weak correlations between age and gender ($r = -.14$, $p < .05$); gender and parental status ($r = -.17$, $p < .05$); moderate correlations between age and parental status ($r = -.45$, $p < .001$), and age and education level ($r = -.32$, $p < .001$); and a strong negative correlation between trust in health care providers and vaccine hesitancy ($r = -.64$, $p < .001$). All other correlations were not statistically significant. Tests for multicollinearity also indicated that all Tolerance and VIF values were in an acceptable range. These results indicate that there was no violation of the assumption of multicollinearity and that the data was suitable for multiple linear regression analysis.

Table 3

Correlations between variables included in the model

Variable	1.	2.	3.	4.	5.	6.
1. Gender	-					
2. Age	-.14*	-				
3. Education Level	-.02	-.32***	-			
4. Parental Status	-.17*	-.45***	.14	-		
5. Trust in HCP	-.08	.09	-.10	.06	-	
6. Vaccine Hesitancy	.00	.00	-.05	-.12	-.64***	-

Note: HCP = healthcare provider N = 194; Statistical significance: *p < .05; **p < .01; ***p < .001

Hierarchical multiple regression was used to assess the ability of levels of trust in healthcare to predict levels of vaccine hesitancy, after controlling for the influence of age, gender, education level, and parental status. In the first step of hierarchical multiple regression, two predictors were entered: age and gender. This was not statistically significant and did not explain any of the variance in vaccine hesitancy scores $F (2, 191) = .001$; $p = .99$. The entry of education level at Step 2 was not statistically significant and did not explain any of the variance in the model. $F (3, 190) = .152$; $p = .928$.

After parental status was entered in Step 3, the total variance explained by the model was 2.1% $F (4, 189) = 1.03$; $p = .40$. The introduction of parental status explained an additional 1.9% of variance in vaccine hesitancy scores, after controlling for age, gender, and education level; however this change was not statistically significant (R^2 Change = .021; $F(1, 189) = 3.64$; $p = .06$. Trust in healthcare providers was entered in Step 4 and the total variance explained by the model was 43% $F (5, 188) = 28.69$; $p = <.001$. The introduction of trust in healthcare providers explained an additional 41.2% of variance in vaccine hesitancy scores, after controlling for age, gender, education level, and parental status; this change was statistically significant (R^2 Change = .412; $F(1, 188) = 136.41$; $p = <.001$ (see Table 4 for full details).

In the final model, one predictor variable uniquely predicted vaccine hesitancy to a statistically significant degree, trust in healthcare providers ($\beta = -.65$, $p = <.001$) while controlling for age, gender, education level, and parental status (see Table 4 for full results).

Table 4

Hierarchal Regression Model of Vaccine Hesitancy

Variable	*R*	R^2	R^2 *Change*	*B*	*SE*	β	*T*
Block 1	.00	.00	.00				
Gender				.04	1.15	.00	.03
Age				.00	.05	.00	.02
Block 2	.05	.00	.00				
Gender				.02	1.15	.00	.02
Age				.01	.05	.01	.20
Level of Education				.93	1.38	.05	.68
Block 3	.15	.02	.02				
Gender				.61	1.19	.04	.51
Age				.06	.05	.09	1.08
Level of Education				.98	1.37	.06	.72
Parental Status				1.27	.67	.16	1.91
Block 4	.66	.43	.41				
Gender				1.05	.91	.07	1.15
Age				.01	.04	.02	.34
Level of Education				1.89	1.05	.11	1.80
Parental Status				.70	.51	.09	1.36
Trust in HCP				.53	.05	.65	11.68

Note: HCP = healthcare provider R2 = R-squared; B = unstandardized beta value; SE = Standard errors of B; β = standardized beta value; N = 194; Statistical significance: *p < .05; **p < .01; ***p < .001

Discussion

The current study aimed to investigate the relationship between vaccine hesitancy, trust in healthcare providers, and demographic factors such as age, gender, level of education, and parental status in an Irish healthcare context. It aimed to determine how important the main predictor variable trust in healthcare providers is in relation to other variables and to examine if there were any significant interactions from demographic variables. Overall, the sample for this study showed lower vaccine hesitancy rates, with only 12.6% showing a higher level of vaccine hesitancy (those with a total score of 25+ out of 50). The sample also showed high levels of trust in health care providers with only 10.3% showing a lower level of trust (those with a total score up to 24 out of 50).

There was a strong significant correlation found between trust in healthcare providers and vaccine hesitancy which supported hypothesis one. These findings are consistent with and provide support to previous research which identified trust as a significant predictor of pro vaccine behaviours (Joslyn & Sylvester, 2017; Justwan et al., 2019; Larson et al., 2014). In addition to this previous research found that healthcare providers were highly trusted (Bouder et al., 2015; Paterson et al., 2016; Wiley et al., 2013; ZHANG et al., 2012), and the findings of the current study reinforce this. The findings from this study along with those of previous research suggest that healthcare providers remain the most trusted source of vaccine information, and that they may be one of the biggest influences on the vaccine decision making process.

Hypothesis two was not supported and only a weak correlation was found between parental status and vaccine hesitancy, however this was non-significant. While previous studies have found that vaccine hesitancy is prevalent amongst parents and expectant parents (Benin et al., 2006; Callaghan et al., 2019; Tomeny et al., 2017), these studies have focused on vaccine

hesitancy in terms of childhood vaccinations which excludes the non-parents. The emphasis on childhood vaccinations is a common theme throughout the previous literature, which does not assess generalised vaccine hesitancy in relation to seasonal vaccinations, or other vaccinations recommended for adults. Surprisingly, only a weak correlation was found between level of education and vaccine hesitancy for hypothesis three, however this was non-significant, so hypothesis three was not supported. Previous literature found a significant correlation between level of education and vaccine hesitancy, although results have been mixed with education acting as both a barrier to and a promoter of vaccination uptakes (Larson et al., 2014). In this study 79.9% of participants had completed third level education, which may suggest that level of education alone in not enough to look at and maybe type of education is important.

Hypothesis four and hypothesis five were also not supported, as results show that there was no relationship between either age or gender and vaccine hesitancy. These findings are not consistent with previous research which identified the "typical" demographic profile of vaccine hesitant individuals to be women aged 30 and under (Birnbaum et al., 2013; Glanz et al., 2009; Kim et al., 2007; Siddiqui et al., 2013). A potential reason for this difference could be due to the contextual factors such as geographical or cultural influences, as the studies which identified this profile were all based in the USA. Similarly, these studies focused solely on childhood vaccinations which may be directed more to females.

The findings of the current study suggested that the main causes of vaccine hesitancy (as shown by highest mean scores) were that new vaccines carry more risks (2.93), and concerns about serious side effects (2.92). This is associated with the confidence factor of the World Health Organisation's Three C Model (WHO, 2019), which is also mirrored in the perceived benefits, and barriers aspect of the Health Belief Model. Another key cause of vaccine hesitancy indicated

in the current study is that vaccines are not needed for diseases that are not common anymore (2.03). This is related to the complacency factor of the World Health Organisation's Three C Model (WHO, 2019), which is also reflected in the perceived susceptibly to and severity of a specific disease, feature of the Health Belief Model.

Implications

Given the strength of the correlation between level of trust in healthcare providers and levels of vaccine hesitancy, and the ability of trust in healthcare providers to predict vaccine hesitancy, their role in vaccine promotion is clear. Efforts are being made to rebuild trust in the Irish healthcare system following issues such as the CervicalCheck scandal. In addition to this, better efforts should be made at addressing vaccine hesitancy which could be done by the National Immunisation Office and HSE holding regular vaccine information clinics in the community, using primary care centres and GP clinics. This would allow healthcare providers address the concerns that vaccine hesitant individuals have, to share reliable, trustworthy information relating to vaccinations and potentially increase vaccine uptake rates.

Strengths and Limitations

One key strength of this study was the wide inclusion criteria. The vaccine hesitancy scale did not focus on particular subpopulations like parents or specific vaccines like the primary immunisation schedule vaccines. This allowed the study to include seasonal vaccinations such as the influenza vaccine, occupational vaccines such as the Hepatitis B vaccine, and the controversial HPV vaccine, and to focus on generalised attitudes towards vaccinations.

Limitations of the study were also identified. While the sample size exceeded the minimum values required, an alternative sampling method, such as quota sampling may have been better

suited, if the time constraints allowed. The sample consisted of only two expectant parents and all participants had completed further education past primary level. The timing of the study may have been an issue, with the Covid vaccine being saturated both in traditional and social media at present. Despite there being no mention of the Covid vaccine in the questionnaires this may have been the vaccine that first came to mind for participants and taken focus away from conventional vaccines.

Future Research

Future research should include a mixed methods design involving structured interviews with participants to give a richer idea of the causes of vaccine hesitancy in Ireland. This could be combined with investigating the rate of vaccine hesitancy in GP clinics, as the majority of vaccinations are given here, and quantifying the number of queries regarding vaccines that are directed to GPs rather than information obtained online. Efforts should be made to identify these vaccine hesitant individuals, including those who vaccinate even though they have concerns.

Conclusion

This study aimed to further evaluate the complexities of vaccine-related trust and, to view trust in healthcare professionals in an Irish healthcare context. In addition, it aimed to be more representative of general vaccine hesitancy by not solely focusing on parents or childhood vaccinations. Results showed that there was no relationship between age or gender and vaccine hesitancy. Neither parental status nor level of education has a significant effect on levels of vaccine hesitancy. These findings are inconsistent with previous research which has found a significant effect of age, gender, parental status, and education level on levels of vaccine hesitancy. Findings suggest that trust in healthcare providers has a strong negative correlation with vaccine hesitancy, that was statistically significant, which supports previous research. In

addition, trust in healthcare providers uniquely predicated vaccine hesitancy to a statistically significant degree, while controlling for age, gender, education level, and parental status. The role of healthcare professionals in vaccine promotion is clear from this study, and holding regular vaccine information clinics would allow healthcare providers address the concerns that vaccine hesitant individuals have, to share reliable, trustworthy information relating to vaccinations and potentially increase vaccine uptake rate.

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Appendix A Sage Vaccine Hesitancy Scale

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
*Childhood vaccines are important for my child's health					
*Getting vaccines is a good way to protect my child/children from disease					
*Childhood vaccines are effective					
*Having my child vaccinated is important for the health of others in my community					
*All childhood vaccines offered by the government program in my community are beneficial					
*The information I receive about vaccines from the vaccine program is reliable and trustworthy					
*Generally I do what my doctor or health care provider recommends about vaccines for my child/children					
New vaccines carry more risks than older vaccines					
I am concerned about serious adverse effects of vaccines					
Vaccines are not needed for diseases that are not common anymore					

* Reverse scored question

(Shapiro et al.,2018)

Appendix B Multidimensional Trust in Health Care Systems Scale Subscale 1: Trust in Health Care Providers

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
My health care provider is usually considerate of my needs and puts them first					
I have so much trust in my health care provider that I always try to follow his/her advice					
I trust my health care provider so much that whatever he/she tells me, it must be true					
*Sometimes, I do not trust my health care provider's opinion and therefore I feel I need a second one					
I can trust my health care providers judgments concerning my medical care					
My health care provider will do whatever it takes to give me the medical care that I need					
Because my health care provider is an expert, he is able to treat medical problems like mine					
I can trust my health care provider's decisions on which medical treatments are best for me					
My health care provider offers me the highest quality in medical care					
All things considered, I completely trust my health care provider					

* Reverse scored question

(Egede & Ellis, 2008)

Appendix C Demographic Questions

hat gender do you most identify with?

- Male
- Female
- Prefer not to say

What age are you?

_____

What is highest level of education you have completed?

- Primary
- Secondary
- Tertiary

What is your Parental Status?

- Have children
- Expecting children
- No children

Appendix D Information Sheet

Thank you for expressing your interest in taking part in this brief research. I am a final year undergraduate Psychology student in National College of Ireland conducting research as part of my final year coursework. This research is looking at people's attitudes to vaccines and levels of trust in healthcare professionals. The aim of this study is to investigate if a relationship exists between vaccine hesitancy, trust in healthcare providers, and demographic characteristics. This research project has been approved by the National College of Ireland's ethic committee and will be supervised by Dr. Matthew Hudson

If you wish to participate in this study, you must be over the age of 18 and living in the Republic of Ireland. You will be presented with questions including basic demographics and asked to indicate your views on vaccines and your views on healthcare providers on a scale from strongly disagree to strongly agree. This should take less than 15 minutes. Your participation in this study is on a voluntary basis and there are no known risks or benefits involved in participating. However, your participation will be greatly appreciated, and your input could be a valuable contribution.

Once you have started the questionnaire you can withdraw by exiting the page at any stage, until you have completed and submitted the data. The data collected will be completely anonymous and you will not be asked for any identifiable information such as your name, or email address. Due to the anonymity of the data you will be unable to retract your data once you have fully submitted your responses.

Data will be collected, protected and stored in full compliance with current GDPR regulations for five years. Data will be used for my final year research project and the possibility of further presentations, publications, or as a basis for further research.

Should you have any questions or concerns relating to this research project please do not hesitate to contact me at x16148096@student.ncirl.ie

Supervisor details: matthew.hudson@ncirl.ie

Appendix E Consent Form

By ticking the below boxes you are agreeing that (1) you have read and understood the Participant Information Sheet, (2) questions about your participation in this study have been answered satisfactorily, (3) you are aware of the right to withdraw at any stage and (4) you are taking part in this research study voluntarily (without coercion).

I am over the age of 18

- ☐ Yes
- ☐ No

I am living in the Republic of Ireland

- ☐ Yes
- ☐ No

I have read and understand the Information Sheet

- ☐ Yes
- ☐ No

My questions (if any) have been answered satisfactorily

- ☐ Yes
- ☐ No

I have been made aware of my right to withdraw

- ☐ Yes
- ☐ No

I agree to participate in the study voluntarily

- ☐ Yes
- ☐ No

Appendix F Debriefing Sheet

Thank you for taking the time to participate in this research.

Due to the anonymity of the data you will not be able to retract your data as you have fully submitted your responses. Data will be protected and stored in full compliance with current GDPR regulations for five years.

Should you have any queries or concerns relating to vaccines, the following websites provide reliable information.

https://www.hse.ie/eng/health/immunisation/

https://www.ecdc.europa.eu/en/immunisation-and-vaccines

https://www.who.int/topics/vaccines/en/

Should you have any concerns relating to this research project please do not hesitate to contact me at x16148096@student.ncirl.ie

Supervisor details: matthew.hudson@ncirl.ie

Your participation in this research is greatly appreciated.