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Older adults' vaccine hesitancy: Psychosocial factors associated with influenza, pneumococcal, and shingles vaccine uptake

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ABSTRACT

Influenza, pneumococcal disease, and shingles (herpes zoster) are more prevalent in older people. These illnesses are preventable via vaccination, but uptake is low and decreasing. Little research has focused on understanding the psychosocial reasons behind older adults' hesitancy towards different vaccines. A cross-sectional survey with 372 UK-based adults aged 65–92 years ($M = 70.5$) assessed awareness and uptake of the influenza, pneumococcal, and shingles vaccines. Participants provided health and socio-demographic data and completed two scales measuring the psychosocial factors associated with vaccination behaviour. Self-reported daily functioning, cognitive difficulties, and social support were also assessed. Participants were additionally given the opportunity to provide free text responses outlining up to three main reasons for their vaccination decisions. We found that considerably more participants had received the influenza vaccine in the last 12 months (83.6%), relative to having ever received the pneumococcal (60.2%) and shingles vaccines (58.9%). Participants were more aware of their eligibility for the influenza vaccine, and were more likely to have been offered it. Multivariate logistic regression analyses showed that a lower sense of collective responsibility independently predicted lack of uptake of all three vaccines. Greater calculation of disease and vaccination risk, and preference for natural immunity, also predicted not getting the influenza vaccine. For both the pneumococcal and shingles vaccines, concerns about profiteering further predicted lack of uptake. Analysis of the qualitative responses highlighted that participants vaccinated to protect their own health and that of others. Our findings suggest that interventions targeted towards older adults would benefit from being vaccine-specific and that they should emphasise disease risks and vaccine benefits for the individual, as well as the benefits of vaccination for the wider community. These findings can help inform intervention development aimed at increasing vaccination uptake in future.
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1. Introduction

Illnesses such as influenza, pneumococcal disease, and shingles are more prevalent in older adults. Due to decreased immunity (immunosenescence) and greater likelihood of existing chronic health conditions, older adults are also at increased risk of acquiring or developing more severe illnesses and experiencing potentially life-threatening complications (e.g. [12,17,28]). However, these illnesses are preventable via vaccination programmes [44]. Given their heightened risk, older adults in the UK, for example, are freely offered the annual influenza (over 65's), one-dose pneumococcal (over 65's), and one-dose shingles (those aged 70–79 yrs) vaccines. Yet, despite the established benefits, and although vaccination coverage varies by country, influenza vaccination coverage almost always falls short of the World Health Organization's (WHO's) target of 75% of older adults [45,8]. Pneumococcal vaccination uptake is around 51–69% in older adults, depending on which country is examined [5,11], and shingles uptake rates can be lower than 50% in some eligible cohorts [32].

'Vaccine hesitancy' refers to delayed acceptance or refusal of vaccines despite their availability [25]. The reasons for vaccine hesitancy are complex and involve socio-demographic, contextual, physical, and psychosocial factors. Increasingly, psychosocial factors are being recognised as providing the best explanations for people not getting vaccinated [36] and, importantly, they are

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amenable to change through intervention [1]. In addition to the specific importance of addressing vaccine hesitancy in older people, reasons for vaccine hesitancy may vary by age. For example, ageing is related to a range of psychosocial factors that can affect health and health-related behaviours, including perceived control [20], personality factors such as conscientiousness [3], risk perceptions/avoidance [27], and social interrelations such as spousal support [34]. Age-related decline in cognition [6] or daily functioning [13] could also be associated with vaccination-related access and decision making, but are often not considered in research investigating older adults' vaccine hesitancy.

In older people, a range of characteristics are associated with influenza vaccine uptake. Related to participant characteristics, such factors include age, gender, education level, living arrangements, social support, socio-economic status, and health factors (including susceptibility to the disease, and cognitive impairment, particularly within community-dwelling older adults). Associated vaccination-related characteristics include having received the vaccination previously, experiences or fears of vaccination side-effects, and vaccination accessibility/convenience [21,41,47]; see [31], for a systematic review). However, vaccination-related knowledge and received advice or recommendations, including by healthcare providers or relatives, as well as participants' general vaccination attitudes, also appear important [30,47]. For example, Klett-Tammen et al. [15] showed that older adults' uptake of the influenza vaccine was most strongly predicted by perceived importance of the vaccine. Similarly, Rikin et al. [33] showed that beliefs that the influenza vaccine was unnecessary, or that its effects were variable, predicted lack of uptake by older adults.

Importantly, factors associated with older adults' vaccination uptake may vary by vaccine [15]; see also [2]. Regarding pneumococcal vaccination, Krueger et al. [17] investigated a range of potential predictors including demographic, co-morbidity, functional status, quality of life, social support, and lifestyle factors. They found that uptake of the influenza vaccine in the last year, as well as age, social support, and health-related factors predicted uptake (see also [10,11,41]). Interestingly, though, research that took attitudes and knowledge into account suggest that knowledge and awareness may be most important for predicting uptake of the pneumococcal vaccine (e.g. the recommendation to receive the vaccine; [15]; see also [11,30]). Indeed, Schneeberg et al. [37] found that the strongest predictor of pneumococcal vaccine uptake in older adults (65+) was being offered it by a healthcare provider. Other predictors were having heard of the vaccine, and strongly agreeing that pneumococcal vaccination is important for older adults.

In the current study, we not only considered influenza and pneumococcal vaccine uptake in the same sample, but also that of the shingles vaccine, which has been investigated to a much lesser extent [4]. Socio-demographic factors have been shown to predict, but not wholly account for, shingles vaccination coverage (i.e. geographical area, level of deprivation, and ethnicity [43]. Although, again, healthcare providers may have a crucial role in shingles vaccine uptake, as key predictors of uptake appear to be awareness of the vaccine and having been offered and recommended it by a healthcare provider [4,24].

The present research was aimed at identifying the reasons for older adults (65+) not getting the influenza, pneumococcal, and shingles vaccines, with the intention to inform future interventions designed to increase vaccination coverage in this vulnerable population. The present study will extend previous research in two key ways. First, we utilised two recently developed measures of vaccine hesitancy [the Vaccination Attitudes Examination (VAX; [26]) and 5C [2] scales] alongside measures of daily functioning, cognitive difficulties, and social support. This was intended to provide a comprehensive understanding of both the vaccination-related and age-related factors that may influence vaccination uptake in older adults. Second, we examined these factors in relation to all three vaccines that older adults are offered in the UK, thus providing an understanding of the vaccine-specificity of the observed barriers. The present study addressed four key research questions (RQs):

RQ1: What proportion of participants were offered, were aware of, and received the influenza, pneumococcal and shingles vaccinations?
RQ2: What vaccination attitudes and psychological antecedents of vaccination were associated with lack of uptake of these vaccinations?
RQ3: Does daily functioning, cognitive functioning, or social support play a role in explaining older adults' vaccination behaviour?
RQ4: Within the context of open-ended responses, what are older adults' main reasons for their vaccination behaviour?

2. Methods

2.1. Participants and procedure

A cross-sectional survey was conducted to identify factors associated with older adults' vaccination behaviours. The research was carried out in accordance with the Declaration of Helsinki [46] for research involving humans, and was ethically approved by the School of Psychological Sciences & Health Ethics Committee at the University of Strathclyde. Informed consent was obtained from participants prior to completing the survey online via Qualtrics, which took place between 8th February and 17th March 2020. Data collection was completed prior to COVID-19 lockdown restrictions were introduced in the UK, so there was no impact on the availability of vaccination services during our period of data collection. Participants were recruited primarily through university participation panels and social media posts (Facebook and Twitter). Participants were eligible to complete the survey if they were aged 65 or older, generally in good health (and, specifically, not diagnosed with a neurological condition), and living independently in the community (i.e., living on their own, with a partner, spouse and/or family members, and not dependent on others such as living in a care facility). Participants could only progress to the survey after confirming these inclusion criteria. The total sample comprised 372 participants aged 65 to 92 years (see Table 1 for socio-demographic characteristics).

2.2. Survey

Participants were first asked to provide their socio-demographic information and self-reported overall health (see Table 1). For influenza and pneumococcal vaccinations, all participants were asked if they were aware that they were eligible for both vaccines and if they had been offered them. Participants aged 70–79 years were also asked these questions regarding the shingles vaccine. Participants were then asked if they had ever received the pneumococcal vaccine, and the influenza vaccine in the previous 12 months. If not, they were asked if they intended to get these vaccines in future. Also, if aged 70–79 years, they were asked if they had received the shingles vaccine and, if not, whether or not they intended to do so in the future.

2.3. Vaccination attitudes examination scale (VAX)

The VAX scale contains 12 questions assessing the attitudes that may underlie vaccine hesitancy [26]. Questions tap into mistrust of vaccine benefit [e.g. 'I feel safe after being vaccinated' (reverse

Table 1
Participants' socio-demographic data.

Variables	n (372 total)
Age	*M* = 70.5 (*SD* = 4.6)
Gender	
Female	184 (49.7%)
Male	184 (49.7%)
Prefer not to say	2 (0.5%)
Marital Status	
Married	248 (66.8%)
Widowed	47 (12.7%)
Separated/Divorced	35 (9.4%)
Co-habiting	21 (5.7%)
Single	20 (5.4%)
Ethnicity	
White-British	360 (97%)
White-Other	9 (2.4%)
Asian	1 (0.3%)
Mixed/Multiple	1 (0.3%)
Self-Rated Overall Health	
Very Good	125 (33.6%)
Good	201 (54%)
Fair	41 (11%)
Poor	5 (1.3%)
Education	
High School	65 (17.5%)
College	114 (30.6%)
University	109 (29.3%)
Postgraduate	84 (22.6%)
Deprivation Quintile	
1 (Most Deprived)	57 (16.3%)
2	83 (23.8%)
3	69 (19.8%)
4	61 (17.5%)
5 (Least Deprived)	79 (22.6%)

NB: % calculations exclude missing data.

scored), worries about unforeseen future effects (e.g. 'although most vaccines appear to be safe, there may be problems that we have not yet discovered'), concerns about commercial profiteering (e.g. 'vaccines make a lot of money for pharmaceutical companies, but do not do much for regular people'), and preference for natural immunity (e.g. 'natural immunity lasts longer than a vaccination')]. Items were scored on a five-point scale (1 = 'strongly disagree' to 5 = 'strongly agree'), and higher scores represent more negative views towards vaccination.

2.4. The 5C scale

The 5C scale of vaccine hesitancy [2] includes 15 items which tap five psychological antecedents of vaccination: confidence (e.g. 'I am completely confident that vaccines are safe'); complacency (e.g. 'vaccination is unnecessary because vaccine-preventable diseases are not common anymore'); constraints (e.g. 'everyday stress prevents me from getting vaccinated'); calculation (e.g. 'when I think about getting vaccinated, I weigh benefits and risks to make the best decision possible'); and collective responsibility ('I get vaccinated because I can also protect people with a weaker immune system'). Items were scored on a seven-point scale (1 = 'strongly disagree' to 7 = 'strongly agree'). Higher scores on the confidence and collective responsibility sub-scales represent facilitators to vaccine uptake, while higher complacency, constraints, and calculation scores represent barriers.

2.5. Instrumental activities of daily living

The Instrumental Activities of Daily Living (IADL; [22]) questionnaire assessed participants' perceived levels of independence in daily functioning. Participants were asked to indicate their level of independence across eight aspects of daily functioning including, for example, ability to use the telephone, shop, and prepare food. All responses indicating independence were scored 1 point (max. = 8), according to Lawton and Brody's scoring criteria for females (originally, males were not scored on some items, e.g. food preparation, housekeeping).

2.6. Multiple ability self-report questionnaire

The Multiple Ability Self-report Questionnaire (MASQ; [39]) assessed cognitive functioning. The MASQ contains 38 questions measuring participants' perceived level of difficulty across five cognitive domains: language (e.g. 'when talking, I have difficulty conveying precisely what I mean'); visual-perceptual ability (e.g. 'I have difficulty locating a friend in a crowd of people'); verbal memory (e.g. 'I forget to mention important issues during conversations'); visual-spatial memory (e.g. 'I have difficulty finding stores in a mall even if I have been there before'); and attention/-concentration (e.g. 'I ask people to repeat themselves because my mind wanders during conversations'). Responses were scored on a five-point scale (1 = 'never' to 5 = 'always') and averaged across items. Higher scores reflect greater difficulty.

2.7. Interpersonal support evaluation

The ISEL-12 [7] assessed social support and contains 12 items across the subscales of availability of appraisal (e.g. 'there is someone I can turn to for advice about handling problems with my family'), belonging (e.g. 'if I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me'), and tangible help/assistance (e.g. 'if I were sick, I could easily find someone to help me with my daily chores'). Responses are provided on a 4-point scale (1 = 'definitely false' to 4 = 'definitely true'). Responses were totalled to give a maximum of 12 for each subscale, and 36 for overall social support, with higher scores indicating more perceived support.

2.8. Free text responses

An open-ended question was used to offer participants the opportunity to provide up to three main reasons for their vaccination decisions.

2.9. Data analyses

Univariate logistic regression analyses were used to determine the association between each potential predictor and whether or not a participant was vaccinated for influenza in the last 12 months, and if they had ever received the pneumococcal and shingles vaccines. Multivariate logistic regression models were then constructed, based on the significant predictors from the univariate analyses, to determine the independent predictors of uptake of each vaccine. Analyses were carried out using SPSS (version 23) and using a 5% significance level.

For responses to the open-ended question, content analysis of participants' comments was undertaken (see [16,38]). Initial descriptive codes were applied to participants' written responses. Subsequent text was compared to previously coded text and either allocated an existing code or provided a new one, thus grouping responses by similarity [23]. Category development was guided by Vaismoradi et al. [42]. The first coder (AG) initially analysed the data, with the review being undertaken by another member of the research team (NC), enabling both category refinement and research rigour. The researchers (AG & NC) returned to the data several times during the analytical process to ensure that the results showed a strong connection to the analysed data [19]. The categories of meaning (key categories) represented the highest

level of abstraction for the reporting of the results. In the final phase, coded data were treated as variables for analysis conducted using descriptive statistics (frequency counts and percentages) in Microsoft Excel.

3. Results

Table 2 provides the data related to uptake of the influenza, pneumococcal, and shingles vaccines. The proportion of participants who had received the influenza vaccine in the last 12 months (83.6%) was considerably higher than the proportion who had ever received the pneumococcal (60.2%) and shingles (58.9%) vaccines. However, awareness of eligibility for those vaccines, along with rates of having ever been offered them, were also lower than for the influenza vaccine (Table 2). Importantly, intention to receive the vaccines in future also showed variation. A relatively large proportion of the participants intended to get the influenza vaccine in the next 12 months (82.1%), but only 27.1% and 34.6% of those who had never received the pneumococcal and shingles vaccines, respectively, intended to receive them in future.

The sample was high-functioning in terms of activities of daily living, with the vast majority (92%) of participants having scored the maximum 8 on IADLs (see Table 3). Although, as would be expected, age was negatively related to IADLs score ($r = -0.13$, $p = .012$). Similarly, age was positively correlated with reported difficulty in three of the five MASQ subscales (language $r = 0.15$, $p = .004$; verbal memory $r = 0.11$, $p = .032$; visual-spatial memory $r = 0.15$, $p = .004$; all other $p > .28$). Regarding social support, age was significantly correlated with the appraisal subscale of the ISEL ($r = -0.12$, $p = .029$), but not with the other subscales or with total ISEL score (all other $p > .105$).

Table 2
Vaccination behaviours related to the influenza, pneumococcal, and shingles vaccines.

Behaviours (by Vaccine)	% (n)
Influenza	
Aware eligible	
Yes	99.5 (370)
No	0.3 (1)
Not sure	0.3 (1)
Offered vaccine (past 12 m)	
Yes	96.2 (354)
No	3.5 (13)
Not sure	0.3 (1)
Received vaccine (past 12 m)	
Yes	83.6 (311)
No	16.4 (61)
Not sure	–
Intend to get vaccine (next 12 m)	
Yes	82.1 (294)
No	15.4 (55)
Not sure	2.5 (9)
Pneumococcal	
Aware eligible	
Yes	69.5 (258)
No	26.1 (97)
Not sure	4.3 (16)
Offered vaccine (ever)	
Yes	61.9 (229)
No	31.9 (118)
Not sure	6.2 (23)
Received vaccine (ever)	
Yes	60.2 (224)
No	36.3 (135)
Not sure	3.5 (13)
Intend to receive vaccine	
Yes	27.1 (39)
No	26.4 (38)
Not sure	46.5 (67)
Shingles	
Aware eligible	
Yes	78.2 (147)
No	18.1 (34)
Not sure	3.7 (7)
Offered vaccine (ever)	
Yes	63.2 (120)
No	32.6 (62)
Not sure	4.2 (8)
Received vaccine (ever)	
Yes	58.9 (113)
No	37.5 (72)
Not sure	3.6 (7)
Intend to receive vaccine	
Yes	34.6 (27)
No	32.1 (25)
Not sure	33.3 (26)

NB: % calculations exclude missing data.

3.1. Influenza vaccine hesitancy

Regarding potential statistical predictors of vaccine hesitancy (Table 3), univariate logistic regression analyses were first conducted to establish whether the following variables predicted participants not receiving the influenza vaccine in the last 12 months: socio-demographic variables (age, gender, deprivation, education, and marital status; note, ethnicity was not considered due to lack of variation); self-rated overall health; 5C subscales; VAX subscales; IADLs; MASQ subscales; and ISEL total score and subscales. Odds ratios and confidence intervals for the significant predictors are listed in Table 4. Marital status was the only significant predictor from the socio-demographic and health variables (all other $p > .07$). Those who reported being single, separated/divorced, or widowed had greater likelihood of not getting vaccinated than those who were married or co-habiting. IADLs, MASQ subscales, and ISEL subscales were not significant predictors (all $p > .22$). However, all 5C and VAX subscales predicted not getting vaccinated. Participants were more likely not to have been vaccinated when they reported greater: calculation of vaccination and disease risks; complacency about vaccine-preventable diseases; perceived structural and psychological constraints; mistrust of vaccine benefit; worries about unforeseen future effects; concerns about commercial profiteering; and preference for natural immunity. They

Table 3
Descriptive data for vaccination attitudes and hesitancy, IADLs, cognitive abilities, and social support.

	M (±*SD*)
5C	
Confidence	5.98 (1.49)
Complacency	2.08 (1.15)
Constraints	1.36 (0.80)
Calculation	5.31 (1.69)
Collective Responsibility	6.14 (1.16)
VAX	
Mistrust	2.05 (0.82)
Worries	2.82 (0.82)
Concerns	1.76 (0.88)
Natural Immunity	2.21 (0.92)
IADLs	7.90 (0.44)
MASQ	
Language	1.59 (0.40)
Visuo-Perceptual	1.47 (0.44)
Verbal Memory	1.78 (0.47)
Spatial Memory	1.67 (0.38)
Attention/Concentration	1.69 (0.42)
ISEL	
Appraisal	7.61 (1.76)
Belonging	8.48 (2.51)
Tangible	9.53 (2.31)
Total	25.62 (5.41)

NB: % calculations exclude missing data.

Table 4
Significant predictors of not getting vaccinated (based on univariate logistic regression analyses).

	Influenza Vaccine		Pneumococcal Vaccine		Shingles Vaccine	
	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*
Age	–	–	0.94 (0.90-0.99)	0.025	–	–
Marital status – single*	1.93 (1.09–3.43)	0.025			–	–
ISEL (total)	–	–	–	–	0.95 (0.90-0.10)	0.048
5C						
Calculation	1.48 (1.17–1.86)	0.001	–	–	–	–
Collective responsibility	0.32 (0.24-0.42)	<0.001	0.61 (0.50-0.74)	<0.001	0.53 (0.40-0.71)	<0.001
Complacency	2.56 (1.97–3.32)	<0.001	1.57 (1.29–1.90)	<0.001	1.72 (1.32–2.24)	<0.001
Constraints	1.91 (1.41–2.58)	<0.001	1.66 (1.24–2.22)	0.001	1.62 (1.13–2.31)	0.008
Confidence	0.61 (0.52-0.72)	<0.001	0.81 (0.70-0.93)	0.003	0.77 (0.63-0.94)	0.011
VAX						
Concerns	3.55 (2.50–5.04)	<0.001	1.96 (1.49–2.56)	<0.001	2.49 (1.69–3.69)	<0.001
Mistrust	4.95 (3.19–7.71)	<0.001	2.07 (1.54–2.79)	<0.001	2.41 (1.55–3.75)	<0.001
Natural immunity	5.29 (3.45–8.10)	<0.001	1.71 (1.34–2.18)	<0.001	2.03 (1.45–2.84)	<0.001
Worries	4.30 (2.83–6.51)	<0.001	1.64 (1.25–2.15)	<0.001	2.45 (1.61–3.73)	<0.001

NB: OR = odds ratio; CI = confidence interval. *Includes those 'single', 'separated/divorced', and 'widowed' compared with those 'married' or 'co-habiting'.

also had a greater likelihood of not getting vaccinated when they reported a lower sense of collective responsibility and less confidence in vaccines and their associated programmes.

Multivariate logistic regression analysis identified that the significant independent statistical predictors of lack of influenza vaccine uptake were greater calculation of vaccination and disease risks, lower sense of collective responsibility, and preference for natural immunity (see Table 5). The model successfully classified 90.9% of cases overall ($R^2_N = 0.52$).

3.2. Pneumococcal vaccine hesitancy

Univariate logistic regression analyses revealed that, of the socio-demographic, health, IADLs, MASQ, and ISEL total score and sub-scales, age was the only factor predicting lack of pneumococcal vaccine uptake (see Table 4; all other $p > .10$). Younger participants had a greater likelihood of not getting vaccinated, reflecting that with increasing age there are more opportunities to have been offered and received the vaccine. Regarding the 5C and VAX subscales, all but the 5C calculation subscale ($p = 0.61$) predicted not getting vaccinated (see Table 4), and these were in the same direction as for the influenza vaccine. Multivariate logistic regression analysis showed that the significant independent predictors of not getting the pneumococcal vaccine were age, sense of collective responsibility, and concerns about commercial profiteering (see Table 5). The model successfully classified 68.6% of cases overall ($R^2_N = 0.16$).

3.3. Shingles vaccine hesitancy

Univariate logistic regression analyses showed that none of the socio-demographic, health, IADLs, MASQ, and ISEL subscales predicted lack of shingles vaccine uptake (all $p > .062$). However, lower perceived social support, as measured by total ISEL, was associated with a greater likelihood of not getting vaccinated (see Table 4). Regarding the 5C and VAX subscales, as was the case for the pneumococcal vaccine, all but the 5C calculation subscale ($p = 0.23$) predicted not getting vaccinated (see Table 4), and these were in the same direction as for the influenza vaccine. Multivariate logistic regression analysis showed that the significant independent predictors of not getting the shingles vaccine were sense of collective responsibility and concerns about commercial profiteering (see Table 5). The model successfully classified 70.9% of cases overall ($R^2_N = 0.22$).

3.4. Free text responses

In total, 341 (91.7%) of participants provided 880 responses regarding their main reasons for their vaccination decisions. The majority of participants referred to factors which enabled their vaccination behaviour, however, one category specifically focused on 'barriers' to vaccination uptake. Overall, responses generated a total of 49 associated codes (sub-codes), resulting in nine categories of meaning (see Table 6). Categories of meaning (key codes) were: (1) personal health (e.g. "to protect myself from disease"); (2) vaccine effectiveness (e.g. "future protection against possible illness"); (3) health of others (e.g. "community benefit"); (4) barriers (e.g. "when I take the flu jab I always end up with the flu"); (5) knowledge (e.g. "I trust the evidence"); (6) health systems (e.g. "I trust the NHS to provide excellent advice"); (7) accessibility (e.g. "freely available"); and (8) social and familial influence (e.g. "my mother was a nurse"). Twenty-two comments were categorised as (9) miscellaneous (e.g. "go with the flow"), as they were too broad or fragmented to categorise.

4. Discussion

To our knowledge, this is the first study aimed at establishing the factors associated with older adults' hesitancy towards receiving the influenza, pneumococcal, and shingles vaccines, and evi-

Table 5
Final multivariate models for lack of uptake of each vaccine, including the independent predictors of not getting vaccinated.

	Influenza Vaccine		Pneumococcal Vaccine		Shingles Vaccine	
	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*	OR (95% CI)	*p-value*
Age	–	–	0.93 (0.88–0.98)	0.010	–	–
5C						
Calculation	1.49 (1.10–2.02)	0.010	–	–	–	–
Collective responsibility	0.42 (0.31–0.58)	<0.001	0.70 (0.56–0.88)	0.002	0.68 (0.49–0.95)	0.023
VAX						
Concerns	–	–	1.62 (1.19–2.21)	0.002	1.96 (1.26–3.04)	0.003
Natural immunity	3.33 (2.04–5.43)	<0.001	–	–	–	–

Table 6
Influences on vaccination behaviour: Categories of meaning (key categories) and associated codes (sub-codes).

	Categories of meaning (key categories)	Number (%) of comments associated with category	Associated codes (sub-codes)
1	Personal Health	183 (20.8%)	Staying healthy Not getting ill Vulnerability due to age/ health status Avoid missing out Staying independent
2	Vaccine Effectiveness	181 (20.6%)	Prevention Safety Eradicate illnesses
3	Health of Others	135 (15.3%)	Herd immunity Health of family Health of others Community health Health of the vulnerable
4	Barriers	125 (14.2%)	Risk of the unknown Unsafe Side-effects Fear Allergies Questioning its effectiveness Conspiracy Mistrust False information Needle phobia Dislike vaccines Scepticism Natural immunity
5	Knowledge	90 (10.2%)	Knowledge of infections Knowledge of vaccinations Common sense Travel vaccinations
6	Health Systems	69 (7.8%)	HCP recommendation Trust in GP/HCP Trust in NHS Invitation Health media
7	Accessibility	57 (6.5%)	Availability Free/no cost Ease Convenience
8	Social and Familial Influence	18 (2.0%)	Parent Children/grandchildren Friends Colleagues Spouse Social influence
9	Miscellaneous	22 (2.5%)	Sense of security Peace of mind Go with the flow (passive acceptance) Whim

N.B.: HCP = healthcare provider; GP = general practitioner; NHS = National Health Service.

dence related to the shingles vaccine is particularly limited. A cross-sectional survey was conducted to measure participants' vaccination behaviour (i.e., previous uptake of the vaccines, awareness of eligibility, whether they had been offered them, and whether they would get vaccinated in future, where relevant). In order to determine potential statistical predictors of vaccine hesitancy, socio-demographic data were also collected, along with self-rated overall health, activities of daily living, cognitive functioning, social support, and psychosocial factors associated with vaccination behaviour. A number of key findings emerged, uniquely contributing to our understanding of older adults' vaccination behaviour and hesitancy, particularly regarding the patterns observed across the three vaccines.

4.1. RQ1 – Vaccine awareness and uptake

There was clear divergence between the influenza vaccine on one hand, and the pneumococcal and shingles vaccines on the other. Uptake of the influenza vaccine was considerably higher (by approximately 24%) than for the other two vaccines [29,43]. Interestingly, while almost all participants were aware of their eligibility for the influenza vaccine, fewer participants were aware of their eligibility for the pneumococcal (69.5%) and shingles (78.2%) vaccines. A similar pattern existed regarding having been offered the vaccines in the past. Therefore, there appears to be a clear distinction between older adults' awareness of healthcare providers' recommendations that they should receive the influenza vs the pneumococcal and shingles vaccines [9,15,18,24,37]. Regarding future intention, while essentially the same proportion of participants who had received the influenza vaccine in the last 12 months intended to do so again in the next 12 months (82.1%), in those who had never received pneumococcal and shingles vaccines, only a small proportion intended to get vaccinated in the future (27% & 35%, respectively). Importantly, though, in each case a considerable proportion of participants who had not yet received these vaccines reported being unsure about whether or not to get the vaccine in the future (pneumococcal = 46.5%, shingles = 33.3%). This suggests that there is promising scope for influencing these decisions and potentially increasing vaccinationmay be associated with being more risk coverage in the future.

4.2. RQ2 – Vaccination attitudes and psychological antecedents of vaccination

Psychosocial factors independently predicted older adults' hesitancy towards the influenza, pneumococcal, and shingles vaccines [1,36]. A lower sense of collective responsibility was associated with lack of uptake of all three vaccines. However, there was divergence in the further predictors. Regarding the influenza vaccine, lack of uptake was associated with greater calculation of vaccine and disease risk, and a preference for natural immunity. Greater calculation may be associated with being more risk-averse generally, and a tendency towards deliberation [2]. However, neither of these factors independently predicted pneumococcal and shingles vaccine uptake. Rather, in addition to collective responsibility, greater concerns about commercial profiteering was associated with lack of uptake of those vaccines. This suggests there is a lack of awareness of, and potentially less available information about, disease and vaccine risks in these cases. Age was also associated specifically with uptake of the pneumococcal vaccine, with younger age associated with a lower likelihood of uptake, reflecting greater opportunity for uptake with time. While both this and the shingles vaccine are 'one-off' vaccines, shingles vaccine eligibility has a narrower window of opportunity (age 70–79 yrs), reducing the effect of participant age.

4.3. RQ3 – Role of daily functioning, cognitive functioning, and social support

Notably, none of the activities of daily living, cognitive functioning, or social support factors independently predicted uptake of any of the vaccines investigated. However, the present sample was relatively high-functioning and included participants living independently in the community only. Future research with older adults should continue to take these factors into account, especially when specific populations are considered (e.g. those with varying levels of daily functioning, mild cognitive impairment, etc. [21,40]).

4.4. RQ4 – Qualitative data

Qualitative data largely supported the above findings, while also contributing further insights. From this set of data, participants' reasons for getting vaccinated included their own and others' health in terms of protection from disease. This wider health benefit corresponds with a sense of collective responsibility, the lack of which was associated with hesitancy towards all three vaccines. Relatedly, participants frequently cited their understanding that vaccines are effective and beneficial, and communicated their trust in healthcare systems and available knowledge, including from social influences, such as family and friends. Accessibility was another reason for uptake, including free availability and convenience of getting vaccinated. Barriers to uptake were also conveyed, however, and these included concerns about side effects, fear, and a sense of mistrust or scepticism. The latter particularly resonates with concern over profiteering, which was associated with lack of uptake of the pneumococcal and shingles vaccines.

4.5. Implications

The findings suggests that, to increase vaccination coverage in older adults, targeted public health action is required, which is to some extent tailored to the requirements of the specific vaccines ([15]). Sense of social responsibility and concern for others' health (collective responsibility) was found to be an important factor in general vaccine uptake in this population [5]. Therefore, public health messaging could usefully highlight the societal benefits of good vaccination coverage. This could additionally help to counteract greater calculation as a reason for lack of vaccine uptake [1]. Rates of pneumococcal and shingles vaccine uptake may benefit from educating the general public regarding awareness of these specific vaccines and the disease symptoms, severity, and risks, which has been suggested as an interventional approach for complacency [1]. Also, given the importance of receiving a healthcare provider's recommendation to vaccinate (e.g. [5]), enhancing healthcare providers' knowledge regarding specific vaccination effectiveness could potentially increase recommendations to vaccinate [9,35,37]. For example, a recent intervention focusing on increasing awareness and knowledge via primary healthcare (i.e. leaflets, etc.), found modest but reliable increases in rates of older adults' influenza and pneumococcal vaccine uptake [14].

Key strengths of the present study include the consideration of multiple vaccines for which UK older adults are eligible, with the extent of existing research on older adults' uptake of the shingles vaccine being particularly limited. We also utilised two recently developed measures of vaccine hesitancy alongside measures of daily functioning, cognitive difficulties, and social support. Doing so allowed us to examine both the vaccination-related and age-related factors that influenced vaccine uptake in older adults. Additionally, although we primarily emphasised quantitative data and findings from multiple logistic regression models, participants were invited to provide free text responses to an open-ended question probing the mains reasons for their vaccination behaviour. This qualitative component largely supported the quantitative findings, but contributed further insights to the range of factors involved in older adults' vaccination behaviours.

5. Conclusions

Older adults exhibited greater uptake and awareness of the influenza vaccine relative to the pneumococcal and shingles vaccines. However, a considerable proportion of participants who had not yet received the latter two vaccines were unsure about whether or not to get vaccinated in future, revealing promising scope for increasing coverage in future. Psychosocial factors were associated with uptake of each of the three vaccines, with a lower sense of collective responsibility associated with lack of uptake of all three vaccines. The community benefits of vaccination programmes should, therefore, be emphasised in future interventions. Greater calculation of vaccine and disease risk and preference for natural immunity were also associated with not getting vaccinated for influenza. In contrast, greater concerns about commercial profiteering was associated with lack of uptake of the pneumococcal and shingles vaccines. Greater awareness and targeted education around disease risk and vaccine benefits may be required to increase vaccination coverage, particularly regarding the pneumococcal and shingles vaccines. It is hoped that our findings will influence future research and intervention development aimed at addressing vaccination coverage in the older adult population.

Data Availability Statement

The quantitative data that support the findings of this study are openly available in Open Science Framework (https://doi.org/10.17605/OSF.IO/JYPN9). The qualitative data are not available due to privacy restrictions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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