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Barriers and facilitators to the future uptake of regular COVID-19 booster vaccinations among young adults in the UK

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ABSTRACT

The evidence of waning immunity offered by COVID-19 vaccines suggests that widespread and regular uptake of routine COVID-19 booster vaccines will be needed. In order to understand the hesitancy toward COVID-19 boosters, we examined the barriers and facilitators to receiving regular COVID-19 boosters in a sample of young adults in the UK. A cross-sectional survey was completed by 423 participants ($M = 22.8$; $SD = 8.6$ years) and assessed intention to receive regular COVID-19 boosters, the 7C antecedents of vaccination (i.e. confidence, complacency, constraints, calculation, collective responsibility, and compliance and conspiracy), and any previous experience of side-effects from COVID-19 vaccines. Participants also provided a free text qualitative response outlining their barriers and facilitators to receiving regular COVID-19 boosters. Overall, 42.8% of the sample were hesitant about receiving regular COVID-19 boosters. Multivariate logistic regression analysis showed that intention to accept future boosters was associated with having higher levels of confidence in, and compliance with, vaccines, lower levels of complacency, calculation and perceptions of constraints to vaccination, and having experienced less severe side effects from the COVID-19 vaccines. Qualitative responses highlighted the main barriers included experiencing side effects with previous COVID-19 vaccines and inaccessibility of vaccination services. Key facilitators included protecting the health of friends and family members, protecting personal health, and maintaining regular activities. Our findings suggest that interventions targeted at increasing booster uptake should address the experience of side effects while also emphasizing the positive vaccine benefits relating to the individual's health and the maintenance of their regular work and social activities.

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Introduction

COVID-19 vaccines are highly effective in preventing severe illness and death, but evidence suggests that immunity afforded by the current vaccines diminishes over time.¹ As a result, some countries, including the UK, have introduced booster vaccinations. These booster vaccinations were first rolled out in the UK from September 2021 and offered to everyone aged 16 and over.^{2,3} A further second booster was offered in spring 2022 to certain high-risk groups, including those aged 75 and over and those with a weakened immune system.² In addition, another booster will be offered in autumn 2022, with interim advice from the Joint Committee on Vaccination and Immunization (JCVI) suggesting it be offered to adults aged 50 and over and frontline health and social care workers.⁴ Given the continuing rollout of the booster campaign and evidence of waning immunity offered by COVID-19 vaccines, COVID-19 booster vaccination looks set to become routine and it is likely that widespread and regular uptake of COVID-19 vaccines will be needed across the population. The aim of the current paper is to identify the factors that would influence the future uptake of regular COVID-19 booster vaccinations.

Early research on COVID-19 vaccine acceptance was carried out while COVID-19 vaccines were still in development. Results from the COVID-19 vaccination acceptability study demonstrated that uptake of future hypothetical COVID-19 vaccines

were high (73–83%),^{5,6} but affected by vaccine hesitancy (i.e., the delay or refusal to vaccinate).⁷ Socio-demographic factors such as younger age, lower socio-economic status and belonging to an ethnic minority group were associated with being vaccine hesitant.⁶ Other factors associated with intention to vaccinate included previous influenza vaccination in the past year, perceiving the vaccines as safe and accessing trusted information sources to inform decision-making.^{5,8} Low perceived threat of contracting COVID-19 was among the key barriers to vaccination, along with low trust.^{5,6,8} Research among groups at high-risk for contracting COVID-19 in the UK also found high anticipated uptake of COVID-19 vaccines (85%) but concerns existed regarding the rapid vaccine development process as well as potential vaccine side effects.⁹

With multiple safe and effective two-dose vaccines approved for use in late 2020, mass COVID-19 vaccination campaigns were held throughout the UK in early 2021. Uptake of primary series (i.e., both doses) of COVID-19 vaccines in the UK reached 93.3% uptake of a first dose and 87.5% second doses by July 2022.¹⁰ Many chose to vaccinate to protect personal and community health and alleviate living with COVID-19 public health measures;¹¹ however, variations in uptake were persistent and aligned with factors associated with intention to vaccinate against COVID-19. The COVID-19 Social Study found 36% of adults in the UK were vaccine

hesitant, with low socio-economic status, being female, belonging to an ethnicity minority group, and not vaccinating against influenza during the previous influenza season identified as factors affecting receipt of COVID-19 vaccines.^{11,12} Perceived low perception of contracting COVID-19, concerns about vaccine safety and side effects, low trust in government and inaccessible vaccine services were other key barriers identified in the UK.^{11,13,14}

Despite high uptake rates of the primary series of COVID-19 vaccines in UK, uptake of a COVID-19 booster (or third) dose has lagged in comparison. Research from late 2021 suggested willingness to receive a booster dose in the UK was over 92%;¹⁵ however, even after being available to the public for almost a year only 69.7% of adults have opted to receive a booster as of July 2022.¹⁰ Data from the UK suggested adults who perceived themselves as healthy were less inclined to receive a booster dose, as were adults who were less compliant with COVID-19 public health measures.¹⁵ US data found positive individual attitudes and subjective norms were key factors affecting booster uptake.¹⁶ Subgroups of the UK population have been identified to have lower booster dose uptake, including younger adults and those belonging to ethnic minority groups. Rates of booster dose uptake among those aged 18–34 years have been lower compared to middle (35–64 years) and older (65+ years) adults,¹⁷ while uptake across a range of ethnic groups (e.g., Black Caribbean, Black African, Asian) were consistently lower when compared to white participants.^{17–21} As higher COVID-19 caseloads are affecting younger adults and ethnic minorities in the UK through 2022,¹⁷ priority needs to be placed on understanding and addressing barriers to continued COVID-19 vaccination, to support uptake of future COVID-19 boosters, improve health outcomes and reduce strain on health systems.¹⁵

Vaccine hesitancy has had a clear effect on uptake of COVID-19 vaccines and boosters. As many factors affect the decision to vaccinate, models and frameworks have been developed to help capture the nuances in vaccine hesitancy and decision making. Among these is the 7C model by Geiger et al.²² which was developed during the COVID-19 pandemic to assess individuals' vaccine readiness through seven key constructs: confidence, complacency, constraints, calculation, collective responsibility, compliance, and conspiracy. To date, the 7C scale has been applied to understand the public's knowledge, attitudes and beliefs relating to primary series and booster dose of COVID-19 vaccines.^{22,23}

While there has been research into COVID-19 vaccines and booster dose uptake, the literature has not yet examined factors associated with the intention to receive regular COVID-19 boosters in the future. Given that COVID-19 booster vaccination is becoming routine in order to increase protection against severe disease, we need to understand the factors that may influence the uptake of regular COVID-19 booster vaccines in the future. Therefore, in the current study, we examined the barriers and facilitators to the intention to receive regular

COVID-19 booster vaccinations in a sample of young adults in the UK.

Materials and methods

Participants and procedure

We utilized a cross-sectional online survey and participants were recruited using convenience sampling. Participants could take part if they were aged 18 or older, and living in the UK. The survey ran from December 2021 to March 2022. At this time, the UK was experiencing a surge in COVID-19 cases due to the Omicron variant and booster vaccination was being offered to all adults. Participants were recruited through a university participation panels and social media posts on Facebook and Twitter. All participants were invited to take part in the online survey via Qualtrics. Ethical approval was provided by the University Ethics Committee and all participants provided informed consent. The survey included a free text response to gather qualitative data regarding barriers and facilitators to booster vaccinations.

Measures

The survey consisted of questions that assessed socio-demographic characteristics, including age, gender, ethnicity and annual household income (<£16,000, £16,000–£29,999, £30,000–£59,999, £60,000+). We also asked participants if they had previously contracted COVID-19, and to report on their uptake of previous COVID-19 vaccinations, including primary series and booster. In addition, participants completed the following measures:

Antecedents of vaccination

The short version of the validated 7C scale was used to measure predictors of people's intention to vaccinate.²² The measure is designed to capture factors identified by behavioral and social sciences as being important for vaccination decision-making. The scale assesses the following seven dimensions: confidence (“*I am convinced the appropriate authorities do only allow effective and safe vaccines*”), complacency (“*I get vaccinated because it is too risky to get infected*”), constraints (“*Vaccinations are so important to me that I prioritize getting vaccinated over other things*”), calculation (“*I only get vaccinated when the benefits clearly outweigh the risks*”), collective responsibility (“*I see vaccination as a collective effort to prevent the spread of diseases*”), compliance (“*It should be possible to sanction people who do not follow health authority vaccination recommendations*”), and conspiracy beliefs (“*Vaccinations cause diseases and allergies that are more serious than the diseases they seek to protect us from*”).²² Participants were asked to indicate their agreement with each statement on a 7-point scale ranging from strongly disagree (1) to strongly agree (7), providing a score for each of the dimensions.

COVID-19 vaccination side effects

Participants were asked to indicate which side effects they had experienced from prior COVID-19 vaccines from a list of 15 common side effects (e.g., sore arm, headache, muscle aches) to derive a total score for the number of side effects experienced. In addition, participants were asked to indicate how severe this side effect was, with the response options of “mild” (1), “moderate” (2) and “severe” (3) which allowed us to calculate a score for severity of side effects.

Intention to receive regular COVID-19 vaccine boosters

We asked “*If it was recommended, would you receive a regular COVID-19 booster vaccination (e.g., every 6 months)?*” and provided response options of “I definitely would not” (1), “I probably would not” (2), “I am unsure” (3), “I probably would” (4), and “I definitely would” (5). A free text question was included with this item to capture participants’ perceived barriers and facilitators to receiving regular COVID-19 booster doses (“*What are the factors that would influence this decision [e.g., what would be the main barriers and facilitators to you receiving a regular COVID-19 booster vaccination?]*”) Qualitative responses were analyzed using inductive thematic analysis by a trained researcher. If multiple barriers/facilitators were listed by a participant, each factor was reviewed individually and analyzed with the appropriate themes. Key themes and subthemes were identified based on the frequency the content was identified among the survey comments.

Statistical analysis

Based on a power calculation for logistic regression, we aimed to recruit a minimum sample size of 325 participants, with a maximum of 13 covariates, using the formula $10k/0.4$, where k is the number of covariates.²⁴ Univariate and multivariate binary logistic regression analyses were used to determine the sociodemographic (i.e., age, gender, household income), side effect (i.e., number of side effects, severity of side effects) and psychological factors (i.e., confidence, complacency, constraints, calculation, collective responsibility, compliance, conspiracy) associated with intention to receive regular COVID-19 booster vaccinations (0 = hesitant, 1 = willing). Response options of “I definitely would not,” “I probably would not,” and “unsure” were coded as “vaccine hesitant” and the options “I probably would” and “I definitely would” were coded as “vaccine willing” to create a dichotomous “willing” versus “hesitant” variable. All analyses were conducted using IBM SPSS Statistics (version 25) at 5% significance levels.

Results

Characteristics of participants

Sample characteristics are shown in Table 1. The survey was completed by 423 participants (83% female) with a mean age of 22.8 years old (SD = 8.6). The majority of the sample (95.5%) identified as white and 22.1% of the sample reported a low level of annual household income (<£16,000). The majority of the sample (90.8%) had received both of the doses of the primary

Table 1. Sociodemographic and vaccine uptake variables for the sample.

Variable	N	%
Age (mean years, SD)	M = 22.8	SD = 8.6
Gender		
Male	64	15.1
Female	352	83.2
Transgender Male	1	0.2
Transgender Female	1	0.2
Gender variant/non-conforming	3	0.7
Prefer not to say	2	0.5
Ethnicity		
White	404	95.5
Ethnic minority	19	4.5
Annual household income		
<£16,000	93	22.1
£16,000–£29,999	109	26
£30,000–£59,999	134	31.9
£60,000	84	20
COVID-19 vaccine primary doses uptake		
Both doses	383	90.8
One dose	19	4.5
None	20	4.7
COVID-19 booster uptake		
Accepting	361	85.3
Hesitant	62	14.7
COVID-19 regular booster intention		
Accepting	241	57.2
Hesitant	180	42.8

series of the COVID-19 vaccines, 4.5% had received one of the doses, and 4.7% did not receive either.

In relation to the COVID-19 booster vaccination that was being rolled out in the UK at the time the survey was completed, 85.3% of the sample indicated that they had already received or were willing to receive the initial booster. In response to the question about intention to receive COVID-19 booster vaccinations in the future, 57.2% indicated that they would be willing to receive regular COVID-19 booster vaccinations. The majority of the sample (91.3%) reported that they had experienced side effects, with a sore arm, muscle aches, fatigue, and headache being the most commonly reported symptoms (see Table 2).

Factors associated with intention to receive regular COVID-19 booster vaccinations

Binary logistic regression analysis compared those who are willing to receive regular COVID-19 booster vaccinations ($n = 241$; 57.2%) with those who are hesitant ($n = 180$; 42.8%). Univariate analyses showed that there was a significant effect of household income, each of the 7C subscales and severity of side effects. There was no effect of age, gender, previous COVID-19 infection, or number of side effects experienced (see Table 3).

For the multivariate logistic regression, we entered those variables that were significant in the univariate analysis ($p < .05$) (i.e., household income, confidence, complacency, constraints, calculation, collective responsibility, compliance, conspiracy, and severity of side effects). Confidence, complacency, constraints, calculation, compliance, and severity of side effects remained significantly associated with intention in the multivariate analysis, but household income, collective responsibility, and conspiracy were no longer significant. In the final model, intention was associated

Table 2. COVID-19 vaccine side effects reported by the sample.

Side Effect	N	%	Severity Mean	Severity SD
Sore arm	353	83.5	1.62	.86
Fatigue	237	56.0	1.20	1.14
Muscle aches	217	51.3	.96	1.00
Headache	204	48.2	.95	1.01
Flu-like symptoms	159	37.6	.71	1.02
Chills	127	30.0	.66	1.00
Feeling or being sick	123	29.1	.55	.89
Fever	117	27.7	.58	.96
Decreased appetite	97	22.9	.38	.79
Dizziness	87	20.6	.42	.85
Enlarged lymph nodes	60	14.2	.11	.47
Itchy skin or rash	33	7.8		
Abdominal pain	32	7.6		
Other	25	5.9		

Table 3. Univariate and multivariate analysis of factors associated with intention to receive a regular COVID-19 booster.

Variable	p-value	Comparison	Coefficient	95% CI	p-value
Univariate Analysis					
Age	.169	-	1.02	.99–1.04	-
Gender	.104	Female vs Male	1.56	.91–2.68	-
Household income	.006	£16,000–£29,999 vs. <£16,000	1.01	.58–1.76	.969
		£30,000–£59,999 vs. <£16,000	1.80	1.05–3.08	.034
		£60,000+ vs. <£16,000	2.38	1.28–4.43	.006
Previous COVID-19	.98	Yes vs. No	1.00	.67–1.48	-
Confidence	<.001	-	1.95	1.67–2.27	-
Complacency	<.001	-	1.81	1.59–2.05	-
Constraints	<.001	-	1.93	1.69–2.21	-
Calculation	.014	-	1.15	1.03–1.28	-
Collective responsibility	<.001	-	1.77	1.53–2.05	-
Compliance	<.001	-	1.72	1.50–1.97	-
Conspiracy	<.001	-	1.45	1.27–1.65	-
Number of side effects	.581	-	1.02	.96–1.08	-
Severity of side effects	.024	-	.972	.95–1.00	-
Multivariate Analysis					
Household income	.141	£16,000–£29,999 vs. <£16,000	1.62	.76–3.39	.199
		£30,000–£59,999 vs. <£16,000	2.22	1.08–4.56	.030
		£60,000+ vs. <£16,000	2.12	.96–4.68	.062
Confidence	.049	-	1.22	1.00–1.49	-
Complacency	.011	-	1.27	1.06–1.53	-
Constraints	.004	-	1.32	1.09–1.60	-
Calculation	.004	-	1.28	1.09–1.52	-
Collective responsibility	.247	-	1.14	.91–1.44	-
Compliance	.004	-	1.27	1.08–1.49	-
Conspiracy	.081	-	1.17	.98–1.40	-
Severity of side effects	.032	-	.965	.93–1.00	-

For the multivariate logistic regression, we entered those variables that were significant in the univariate analysis ($p < .05$).

with having higher levels of confidence in, and compliance with, vaccines, lower levels of complacency, calculation and perceptions of constraints to vaccination, and less severe vaccine side effects (see Table 3).

Free text response

A total of 268 (63%) participants provided 352 unique statements relating to barriers and facilitators to regularly receiving COVID-19 booster vaccinations. Barriers and facilitators were grouped under four themes: personal factors ($n = 123$; 34.9%), environmental factors ($n = 97$; 27.5%), vaccine or virus concerns ($n = 77$; 21.9%) and social factors ($n = 55$; 15.6%). Table 4 provides a summary of key themes, subthemes and exemplar quotes.

Personal factors affecting vaccination fell under four sub-themes. The primary personal barrier to regular COVID-19 booster doses was previously experiencing side effects from COVID-19 vaccinations ($n = 26$; 21.1%), with participants noting it was not worth experiencing additional side effects or taking time off work in the future to get additional doses. Being young and having a perceived low risk of contracting COVID-19 ($n = 19$; 15.5%) was other key barrier identified at this level. Protecting personal health was a facilitator in deciding to vaccinate ($n = 23$; 18.7%), as was receiving additional protection from the virus ($n = 8$; 6.5%).

Six key barriers and facilitators were identified at the environmental level. Returning to a sense of 'normalcy' and removing strict public health measures to limit COVID-19

Table 4. Key barriers and facilitators to regular booster vaccinations against COVID-19.

Theme (frequency and percentage of responses)	Key Subtheme (frequency and percentage of responses)	Barrier or Facilitator	Exemplar Quotes
Personal Factors (n = 123; 34.9%)	Previous vaccine side effects (n = 26; 21.1%)	Barrier	<i>"... I was really sick with the booster and that's off-putting for another vaccine"</i>
	Protect personal health (n = 23; 18.7%)	Facilitator	<i>"Regular top-up of protection for my health"</i>
	Perceived low personal risk (n = 19; 15.5%)	Barrier	<i>"Dont think its necessary considering already having 2 jabs"</i> <i>"Young so not so worried about health"</i>
Environmental Factors (n = 97; 27.5%)	Extra protection from COVID-19 (n = 8; 6.5%)	Facilitator	<i>"As it prevents you being as unwell with covid"</i>
	Return to normal (n = 22; 22.7%)	Facilitator	<i>"If it was essential go back to typical way of living without masks ..."</i> <i>"I want to enjoy my life and if getting a booster every now and then would help then I would"</i>
	Attending activities (e.g., work, social events, holidays; n = 20; 20.6%)	Facilitator	<i>"Continue to attend teaching in-person and physically go to work"</i> <i>"If I needed them to go on holiday"</i>
	Inaccessibility of vaccination services (n = 18; 18.6%)	Barrier	<i>"Waiting in long lines, having to take time off work ..."</i> <i>"I have to travel far to receive my vaccines which is difficult with my small income and travel abilities"</i>
	Vaccine mandates (work-related and general; n = 14; 14.4%)	Facilitator	<i>"its important for me to have the booster because of my job"</i> <i>"If there were lawful consequences to not doing it, I would"</i>
	Inconvenient (n = 9; 9.3%)	Barrier	<i>"Too much hassle"</i> <i>"It is an inconvenience"</i>
	Cost (n = 7; 7.2%)	Barrier Facilitator	<i>"If it remains free"</i> <i>"If we had to pay for it or if it was free"</i>
Vaccine or Virus Concerns (n = 77; 21.9%)	Too many doses (n = 18; 23.3%)	Barrier	<i>"It's getting a bit much now the amount of jags they want the public to get"</i> <i>"doesn't seem right that we would need to receive a vaccine so often"</i> <i>"Time between doses, feel as though every 6 months for example is very frequent"</i>
	Potential long-term vaccine effects (n = 13; 16.9%)	Barrier	<i>"Lack of knowledge regarding long term effects"</i> <i>"I still feel uncertain about long-term effects such as fertility, I received two doses as it seemed essential but unsure if I would engage in a regular booster"</i>
	Uncertainty of effectiveness of vaccines (n = 11; 14.2%)	Barrier	<i>"Not sure it works"</i> <i>"Do they really work?"</i>
	Changes in COVID-19 virus or cases (n = 10; 12.9%)	Facilitator	<i>"If there was a new strain of the virus that was potentially more harmful to health"</i> <i>"To keep covid levels down"</i>
Social Factors (n = 55; 15.6%)	Protect health of family and friends (n = 40; 72.7%)	Facilitator	<i>"Ensuring the health of family and friends"</i> <i>"My mum is high risk"</i>
	Protect health of others (community members, vulnerable groups; n = 15; 27.3%)	Facilitator	<i>"[if it] keeps the people around me safe then I'm not bothered to take it"</i> <i>"Health of those around me who cannot get vaccine"</i>

transmission (n = 22; 22.7%) supported uptake of booster doses, while others noted work or general vaccine mandates would affect their decision to vaccinate (n = 14; 14.4%). Participants noted they would opt to get additional COVID-19 booster doses if it was required to continue to attend work, social events, or go on holiday (n = 20; 20.6%). Barriers at this level included the inaccessibility or availability of appointments (n = 18; 18.6%), with participants noting previous difficulties accessing online booking systems, travel distance and associated costs were enough to avoid seeking out additional doses. Similarly, a general sense of inconvenience to vaccinate was a barrier identified by nine participants (9.3%). Finally, the potential cost associated with additional doses of COVID-19 vaccines was viewed as a barrier and facilitator to vaccinating, with seven participants (7.2%) identifying their decision to vaccinate would be improved if the vaccine was free, and deterred if a fee was associated with it.

Four subthemes were relevant to concerns about the COVID-19 virus and associated vaccines (n = 77; 21.9%) and affected the decision to receive additional booster doses. Concerns regarding the recommended frequency of booster doses (e.g., every 6–12 months) was viewed as excessive by participants (n = 18; 23.3%). The potential long-term effects from COVID-19 vaccinations (n = 13; 16.9%) and a sense of limited effectiveness of

vaccines against COVID-19 (n = 11; 14.2%) were also identified. The main facilitator from this theme was maintaining low levels of COVID-19 transmission and protecting against potential future variants of concern (n = 10; 12.9%).

Two key social factors facilitated regular booster vaccination (n = 55; 15.6). First was to protect the health of friends and family (n = 40; 72.7%), which was particularly emphasized among participants who had family members or friends in vulnerable groups. Protecting the health of other community members in general and amongst those in vulnerable or immunosuppressed groups (n = 15; 27.3%), was the second factor which would support regular vaccination against COVID-19.

Discussion

The present study is the first to assess intention to receive regular booster doses of COVID-19 among young adults in the UK. We identified that anticipated uptake of regular COVID-19 boosters was 57.2% in young adults, suggesting that a substantial proportion of this group is hesitant about receiving future COVID-19 boosters. This decision was affected by higher confidence in, and compliance with, vaccines, lower complacency, calculation and constraints to vaccination, and having experienced fewer COVID-19 vaccine side effects. Free text survey responses echoed these findings, with

past experiences of COVID-19 vaccine side effects a main barrier to uptake, while protecting health and returning to regular activities were facilitators. Our findings highlight the complexities of individual, social and environmental factors that influence vaccine decision making, and the need to develop interventions to support regular booster uptake.

Our data identified almost all (91.3%) of participants experienced side effects from a previous COVID-19 vaccination, and that this was among the key barriers to accepting future COVID-19 booster doses. This rate of reported COVID-19 vaccine side effects is consistent with other COVID-19 research in Europe.²⁵ Experiencing minor side effects following vaccination can be common, however it is clear that experiencing these from each dose of a COVID-19 vaccine is a substantial barrier to continued uptake of future doses. Recent research has also shown that those who expected to experience side effects from COVID-19 vaccination believed that the vaccine was less safe and effective.¹³ Developing interventions to provide education to young adults, answer questions about their experiences with vaccine side effects, and emphasize safety and effectiveness, may offer an opportunity to address the barriers associated with the experience of side effects and support uptake.

We identified a number of psychological factors predicted intention to receive COVID-19 booster doses, including confidence, compliance, complacency, calculation and constraints. Similar research with young adults attending university found intention to receive the primary series of COVID-19 vaccines were affected by confidence, complacency, calculation and collective responsibility, but were not affected by constraints.²⁶ While our sample did not comprise solely university students and used a more detailed vaccine scale (7C vs. 5C scale of vaccine antecedents), we did identify consistencies with confidence, complacency and calculation constructs, suggesting these are key factors affecting young adults' COVID-19 vaccination decisions. The research by Dratva et al.²⁶ also found collective responsibility supported COVID-19 vaccine intention, a finding our multivariate analysis did not support. However, our free text responses found vaccinating to protect the health of others (e.g., family, friends, vulnerable groups) was a key facilitator in decision-making. Informing young adults of the broader benefits of vaccination to community health may also support continued vaccine uptake.

Beyond the insights offered by the current study for intervention design, researchers have used a crowdsourcing approach to identify the interventions that would be most effective and acceptable to increase uptake of COVID-19 boosters.²⁷ The most commonly proposed interventions were those that focused on education, persuasion, modeling and psychological enablement. In addition, interventions that rely on sanctions, restrictions, and incentives were also suggested as being effective. However, qualitative research has shown that vaccine mandates can backfire and lead to skepticism and concern.²⁸ While a range of interventions will be needed, the current study emphasizes the importance of addressing side-effects concerns through education and persuasion-based mass media interventions, while balancing this with messages which also emphasize the positive benefits of vaccination (e.g., for maintaining regular activities).

Our findings should be considered in light of some of the study limitations. First, we conducted a cross-sectional study and relied on convenience sampling to reach participants. This may result in our sample not being representative of young adults living in the UK. Additionally, our sample comprised mostly white, younger women. Given the gender and racial disparities identified in COVID-19 infection rates and vaccine inequities,¹⁷ future research needs to focus on engaging with males, gender non-conforming individuals, and ethnic minority groups to ensure their specific vaccine needs and concerns are identified and addressed through multi-level interventions. Finally, our study looked at predicting uptake of regular booster doses of COVID-19 vaccines rather than actual uptake. While our findings suggest intended uptake was suboptimal in young adults when data was collected in winter/spring 2022, the evolving nature of the COVID-19 pandemic, new variants of concern and public health measures to control transmission may affect the decision to vaccinate in the future.

Conclusion

Our study identified that intention to receive regular COVID-19 vaccine booster doses among young adults in the UK is suboptimal. Vaccine confidence and lower complacency were associated with intention to vaccinate. Barriers to uptake included past experiences with COVID-19 vaccine side effects and the belief that excess doses were being offered, while protecting individual and family health, and a return to regular social activities would facilitate uptake. Considering the previously high uptake of COVID-19 vaccine primary doses and diminishing uptake of booster doses in, multi-level interventions which include education on side effects and emphasize the continued benefits to personal and community health are needed to support uptake of future COVID-19 vaccinations.

Authors' contribution

Lynn Williams, Lily Brown, Kathleen Corrigan, Katrina Crowe, and Emma Hendry contributed to the study conceptualization and design. Data collection was performed by Lily Brown, Kathleen Corrigan, Katrina Crowe, and Emma Hendry. Data analysis was performed by Lynn Williams and Allyson Gallant. The first draft of the manuscript was written by Lynn Williams and Allyson Gallant. All authors read and approved the final manuscript.

Data availability

The data that support the findings of this study are publicly available from <https://doi.org/10.17605/OSF.IO/GTVHK>. The qualitative data are not publicly available due to ethical and privacy restrictions.

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