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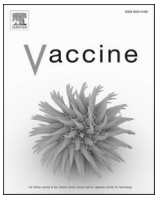

# Comparing COVID-19 booster vaccine acceptance in the United Kingdom, Germany, Austria, and Jordan: The role of protection motivation theory, conspiracy beliefs, social media use and religiosity

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ABSTRACT

*Background:* Coronavirus Disease 2019 (COVID-19) booster vaccine uptake has been lower than that of the initial vaccine doses in many countries. Approaches to vaccination vary, with some countries implementing mandatory vaccination and others not. This study aimed to predict COVID-19 booster vaccination intention using Protection Motivation Theory (PMT), coronavirus conspiracy beliefs, social media use, and sociodemographic factors, comparing the United Kingdom (UK), Jordan, Germany, and Austria.

*Methods:* A cross-sectional online survey was conducted in the UK, Germany, Austria, and Jordan. Convenience sampling was used to recruit 287 fully vaccinated participants. The survey included items measuring PMT constructs, conspiracy beliefs, social media use, and sociodemographic variables. Data were analysed using bivariate analysis and binary logistic regression.

*Results:* Participants with high booster dose intention showed lower religiosity, conspiracy beliefs, perceived rewards of not getting vaccinated, and perceived costs of getting vaccinated. They had higher Twitter use, perceived susceptibility, severity of COVID-19, self-efficacy, and vaccine efficacy. Four PMT constructs (severity, self-efficacy, maladaptive response rewards, and response efficacy) significantly predicted booster dose intention.

*Conclusions:* While PMT constructs predict booster vaccination intention, additional factors such as conspiracy beliefs, social media use, and religiosity need to be taken into account in public health campaigns to increase COVID-19 booster dose uptake.

## 1. Introduction

While Coronavirus Disease 2019 (COVID-19) vaccine uptake globally has been good overall, with around 65 % of the world population fully vaccinated as of October 2023 [1], many countries have been affected by waves of infection due to a combination of viral mutations leading to partial vaccine resistance, and a decline in vaccine-related immunity over time [2]. A programme of booster doses of COVID-19 vaccines has been instituted by many countries to address this decline in immunity.

The Omicron variant has proven particularly challenging in terms of vaccine development [3]. While the booster dose has shown to be effective, increasing the period of immunity to this variant by 61 % [4], uptake has been variable [5], with differences in the acceptability of the booster dose between different regions of the world. Most national levels of vaccine acceptance are lower than the required threshold for herd immunity [6]. In the United Kingdom (UK), booster dose uptake remains well below the uptake of the first and second dose [7,8], similar to (but still lower than) other Western European countries, such as Austria and Germany [1], despite efforts in all three countries to mandate COVID-19 vaccinations for at least parts of the population. With mandatory vaccination not being planned for the foreseeable future, other strategies need to be implemented to increase booster uptake and it is crucial to understand the factors driving underlying vaccine hesitancy to tailor public health campaigns and interventions accordingly.

Looking beyond Western Europe to the Middle East, booster uptake

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has been particularly low in some countries. In Jordan, uptake stood at just 6.1 % as of October 2022 [1] despite a defence order being issued mandating that both public and private sector employees must be fully vaccinated to work, with penalties for non-compliance [9]. Prior work has identified that misconceptions of and misinformation about the vaccine may be at least partly to blame - many individuals lack confidence in its effectiveness or believe that the booster dose would not be beneficial to them [10,11,48].

Apart from knowledge of vaccines, three drivers of vaccine uptake have been identified: an enabling environment, social influences and motivation [12]. The motivation to respond to COVID-19 as a health threat has been explained by Protection Motivation Theory (PMT) [13] which posits that people's decision to engage in protective behaviours, such as vaccination, when confronted with a threat such as COVID-19, is a product of their beliefs about engaging (or not engaging) in this protective behaviour as well as the threat itself.

PMT assumes that intention most accurately predicts behaviour. Intention, in turn, is a function of threat appraisal and coping appraisal. Three constructs impact on threat appraisal: susceptibility - perceived vulnerability to the negative consequences of the threat; severity – the perceived seriousness of these consequences; and maladaptive response rewards - the perceived benefits of performing behaviour that is in fact dysfunctional in relation to the threat. Three constructs also affect coping appraisal: self-efficacy - confidence in one's perceived ability to successfully perform the preventative behaviour; response efficacy – one's beliefs about how effective this protective behaviour is at preventing the negative consequences of the threat; and response costs - perceived barriers which affect the performance of the protective behaviour. Thus, when faced with a health threat, people are most likely to perform protective behaviours when both threat appraisal and coping appraisal are high, i.e., when they assume that not performing protective behaviours poses a threat to themselves and that engaging in these behaviours will reduce or eliminate that threat.

Several studies have examined PMT and COVID-19 vaccination intention (e.g., [14–17]. These have largely been conducted in the UK or the USA, with few studies applying PMT to COVID-19 vaccination intention in non-English speaking Western countries or the Middle East. Furthermore, although individual social cognition constructs have been applied to predicting COVID-19 booster vaccine intention [18], only one published study has applied PMT to willingness to get the booster dose [19]. Considering the slow uptake of the booster dose in countries such as the UK, Germany, Austria, and Jordan, applying PMT is expected to offer valuable insights into the motivations underlying COVID-19 booster vaccination intention, beyond surveying established sociodemographic factors, on which a wealth of literature exists.

COVID-19 vaccination intention is also impacted by specific threat beliefs in the form of conspiracy beliefs relating to COVID-19 [14]. Such beliefs, present in a significant minority, are linked to lower adherence to coronavirus government guidelines and a lower willingness to get tested and vaccinated [20–22], thereby presenting a potential threat to public health [23]. However, no published research thus far has examined the role of COVID-19 conspiracy beliefs in intention to get the COVID-19 booster dose. Due to their detrimental impact on COVID-19 vaccine uptake it is important to determine the magnitude and nature of the influence of these beliefs on booster dose intention.

Misinformation perpetuated by social media may also play a significant role in the high levels of hesitancy to get the COVID-19 booster vaccine. In 2021, nearly 61 % of Jordan's population, and 79 % of Western Europe's population used social media [24]. Vaccine hesitancy has been exacerbated by social media which has encouraged the spread of misinformation and misconceptions around COVID-19 vaccines [25]. Prior research focusing on the European Union, as well as on Germany specifically, has shown that individuals with higher vaccine hesitancy are more likely to rely on social media as a source of news [26,27]. Facebook and Twitter (X) are among the platforms most commonly used for news and information on COVID-19 [28]. No research has examined how social media use influences intention to receive the booster dose. Efforts to increase uptake need to consider the influence of social media use on vaccination behaviour, understanding the relationship between social media use and booster dose uptake could inform campaigns.

### 1.1. Rationale, aims and hypotheses

The success of the COVID-19 booster programme depends on people's willingness to receive the booster dose. Yet booster vaccination refusal or hesitancy constitutes a substantial barrier towards combating COVID-19. Furthermore, hesitancy to receive the booster dose may exacerbate social inequalities as those from lower socio-economic backgrounds are also most likely to hesitate or refuse to accept a booster vaccine and be seriously affected by the virus [29]. There is a lack of research on the determinants of the intention to take the COVID-19 booster dose so far, exploring factors established in prior research to be significant in the decision to get vaccinated – namely PMT constructs, COVID-19 conspiracy beliefs as a specific type of threat belief, and social media use. The origins of vaccine hesitancy can be country-specific [30]; Jordan, the UK, Germany and Austria have all implemented distinct strategies for their COVID-19 vaccine rollout, which could affect booster intentions [31–34]. However, international comparison studies in this area have usually focused on sociodemographic factors or willingness to pay for vaccination [11].Given the lack of studies applying PMT to COVID-19 booster vaccination intention in non-English speaking Western countries and Middle Eastern countries, in light of the cultural differences and differing levels of religiosity [35], we examined whether country of residence had an impact on COVID-19 booster vaccination intention.

Predictors of COVID-19 booster vaccination uptake may be similar to those of the first and second dose [8], but currently little is known about this. The current study therefore aimed to examine determinants of the intention of adults in Germany, Austria, the UK, and Jordan, four countries with similar human development indices [36] but cultural differences, including religion, to receive a booster dose using PMT, conspiracy beliefs, as well as social media use.

We hypothesised that COVID-19 booster vaccination intention would have significant positive relationships with.

H1. perceived susceptibility to COVID-19.

H2. perceived severity of contracting COVID-19.

H3. perceived efficacy of the COVID-19 vaccine (response efficacy); and.

H4. confidence in ability to obtain a COVID-19 vaccine (self-efficacy).

We hypothesised that COVID-19 booster vaccination intention would have significant negative relationships with.

H5. response costs.

H6. maladaptive response rewards; and.

H7. coronavirus conspiracy beliefs.

H8. A significant relationship was expected between COVID-19 booster vaccination intention and Twitter intensity of use.

H8. A significant relationship was expected between COVID-19 booster vaccination intention and Facebook intensity of use.

Additionally, the influence of sociodemographic factors, including religiosity, on intention to receive the COVID-19 booster vaccination was examined. Due to the inconsistent findings on the influence of these variables and a lack of studies involving international comparisons on these variables, we aimed to assess any influence of these on intention to receive the booster vaccine generally.

## 2. Methods

### 2.1. Participants

This was a cross-sectional study. A questionnaire was created on the survey platform Qualtrics, and the link was distributed via social media,

the researchers' own networks, and word of mouth. Inclusion criteria included being resident in the UK, Germany, Austria, or Jordan, aged 18 or above and fully vaccinated (received the two doses against COVID-19). To ensure that participants met the inclusion criteria several screening questions were presented at the start of the survey regarding COVID-19 vaccination history, place of residency, and age.

Convenience sampling was adopted. The minimum sample size required to conduct this study was calculated based on a confidence level (Cl) of 95 % and margin of error of 5 %. Therefore, the minimum required sample size was 384. As binary and multinomial regression model were used to analyse the data, the rule of Events Per Variable criterion (EPV) $\geq$ 10 was applied [37].

### 2.2. Study instruments

The survey was created in English and translated into German for the Austrian and German versions, and into Arabic for the Jordanian version. An adapted version [14,15] of the PMT questionnaire [38] was used to measure the PMT constructs. While the original items are worded to assess PMT constructs in relation to the seasonal influenza vaccine, the adapted version assessed these constructs about the COVID-19 vaccine. All subscales have previously been shown to have moderate to high internal consistency [14,15,38]. On all subscales, participants indicated their agreement on a five-point Likert scale, ranging from 1 = strongly disagree, to 5 = strongly agree. Scores on each subscale were calculated as the total of the items on each subscale. Items were reversed where necessary. Higher scores on each subscale indicated higher levels of the construct.

*Intention* to receive the booster dose was assessed with three items in relation to COVID-19 vaccination intention (e.g., *"I intend to have a COVID-19 booster vaccination"*). *Susceptibility* was measured with two items assessing in how far individuals perceived themselves as being vulnerable to the negative consequences of contracting COVID-19 (e.g., "*Without being vaccinated for COVID-19, I am vulnerable to contracting COVID-19"*), and one item related to lack of perceived susceptibility (*"Even if I don't get vaccinated for COVID-19, I don't think I'm likely to get COVID-19"*). *Severity* was measured by three items (e.g., *"COVID-19 can be a life-threatening illness"*). *Maladaptive response rewards* were assessed with three items measuring perceived benefits to not getting a COVID-19 vaccination (e.g., *"Not being vaccinated for COVID-19 would have some advantages for me"*). *Self-efficacy* was assessed with two statements related to whether individuals felt capable of getting a COVID-19 vaccination (e.g., *"I'm sure that being vaccinated for COVID-19 would be effective in reducing my personal risk of contracting COVID-19"*), and one item on ease of obtaining a COVID-19 vaccination (*"Being vaccinated for COVID-19, once it's offered to me, would be difficult for me"*). *Response efficacy* was measured with three items indicating that receiving the vaccine would reduce vulnerability to and severity of the illness (e.g., *"I'm sure that being vaccinated for COVID-19 would be effective in reducing my personal risk of contracting COVID-19"*). *Response costs* were assessed with three items about financial and non-financial costs by receiving a COVID-19 vaccination (e.g., "*Being vaccinated for COVID-19 is painful"*).

We assessed conspiracy beliefs with the 7-item OCEANS Coronavirus Conspiracy Scale [20]. Items included statements on general beliefs about the coronavirus (e.g., *"The virus is a hoax"*). Participants indicated their agreement on a five-point Likert scale ranging from 1 = strongly disagree, to 5 = strongly agree. Social media use was assessed using the Facebook Intensity (FBI) scale and the Twitter Intensity (TI) scale [39,40]; these contain measures of frequency of site visits and duration of these visits, as well as emotional connectedness to the social media platforms and their integration into individuals' daily activities.

Age was measured as a continuous variable. The remaining demographic variables were assessed using multiple-choice items. Education was assessed in line with the relevant census guidelines for each country and dichotomised prior to analysis into 'no qualifications' and 'high school or higher'. Religiosity was assessed using a single item from the Oxford Coronavirus Explanations, Attitudes, and Narratives Survey II [21]('How important is religion in your life?', measured on a scale ranging from 1 = not important at all to 5 = extremely important), in line with previous literature in this area [14,15].

### 2.3. Procedure

Ethics approval was granted by the institution of the last author. A website was set up containing separate pages for each country. These provided information on the study and a link to the survey on the online survey platform, Qualtrics.

Data were collected from December 2021 to the end of April 2022. Upon completing the survey, respondents were presented with a screen thanking them for their time and providing a list of websites that could be accessed for more information on COVID-19 and vaccination.

### 2.4. Statistical analysis

Data were analysed using the Statistical Package for the Social Sciences, version 27 [41]. Categorical variables are presented as frequencies and percentages while continuous variables were presented as means and standard deviations.

Ten different scores on scales/sub-scales were computed based on participants' responses. The scales were: intention to receive the booster dose, severity, susceptibility, maladaptive response rewards, response efficacy, self-efficacy, and response costs. Additionally, scores were computed for Facebook intensity of use, Twitter (X) intensity of use, and COVID-19 conspiracy beliefs. The internal consistency of the ten scales was evaluated by computing Cronbach's alpha values. The participants were categorised into high-intention and low-intention groups based on their scores on intention to receive the booster dose; those with scores higher than the mean (9.61) were included in the high-intention group while the rest were included in the low-intention group. Bivariate analysis using Mann-Whitney U and Chi-square tests was performed to evaluate variables' association with the intention to receive the booster dose. Variables that were statistically significant in the bivariate analysis ($p < 0.05$) were included as independent variables in the binary regression model while booster dose intention was included as a dependent variable.

## 3. Results

### 3.1. Participants' sociodemographic demographic characteristics

The study was conducted on a total of 287 participants residing in Jordan, the UK, Germany, and Austria. Participants in Germany and Austria were combined into one sample (GA) due to the similarities in both countries' approaches to COVID-19 vaccination. The mean ages of the samples in GA and the UK were comparable (42.30 and 43.48 respectively; Table 1) however, the Jordanian sample significantly younger (24.43). The highest mean religiosity was found in the Jordanian sample with 4 ($\pm$ 1) when compared to the UK and GA. Most participants were females (64.0 %). All the participants from the studied countries (Jordan, UK, and GA) all had high school or higher qualifications (100 %). The majority of participants of all studied countries had not previously had COVID-19 (68.6 %) and had not received the booster dose (77.7 %). Furthermore, most respondents used Facebook (87.5 %), while most of the participants in Jordan and GA did not use Twitter (X) (80.7 % and 90.6 %, respectively) whereas most UK participants (68.4 %) did.

### 3.2. Participants' intention to receive the COVID-19 booster dose and PMT

Intention to receive the booster dose had a mean score of 9.61 ($\pm$ 3.78), which included 3 items with a mean score of 3 ($\pm$1). Severity had

**Table 1**
Sociodemographic characteristics of the participants.

| | | Nationality | | | Total |
|---|---|---|---|---|---|
| | | Jordan | UK | Germany and Austria | |
| | | Frequency (%) or Mean (± SD) | Frequency (%) or Mean (± SD) | Frequency (%) or Mean (± SD) | Frequency (%) or Mean (± SD) |
| Age | | 24.43 (± 4.37) | 43.48 (± 12.66) | 42.30 (± 13.31) | 32.21 (±12.81) |
| Religiosity | | 4 (± 1) | 2 (± 1) | 2 (± 1) | 3.38 (± 1.56) |
| Sex | Male | 71 (42.8 %) | 22 (25.9 %) | 9 (25.7 %) | 102 (35.7 %) |
| | Female | 95 (57.2 %) | 62 (72.9 %) | 26 (74.3 %) | 183 (64.0 %) |
| | Prefer not to say | 0 (0.0 %) | 1 (1.2 %) | 0 (0.0 %) | 1 (0.3 %) |
| Previously infected with COVID-19 | Yes | 58 (34.9 %) | 30 (34.9 %) | 2 (5.7 %) | 90 (31.4 %) |
| | No | 108 (65.1 %) | 56 (65.1 %) | 33 (94.3 %) | 197 (68.6 %) |
| Received the booster dose | Yes | 10 (6.0 %) | 39 (45.9 %) | 14 (42.4 %) | 63 (22.2 %) |
| | No | 156 (94.0 %) | 46 (54.1 %) | 19 (57.6 %) | 220 (77.7 %) |
| Facebook User | Yes | 162 (97.6 %) | 62 (77.5 %) | 20 (60.6 %) | 244 (87.5 %) |
| | No | 4 (2.4 %) | 18 (22.5 %) | 13 (39.4 %) | 35 (12.5 %) |
| Twitter (X) User | Yes | 32 (19.3 %) | 54 (68.4 %) | 3 (9.4 %) | 89 (32.1 %) |
| | No | 134 (80.7 %) | 25 (31.6 %) | 29 (90.6 %) | 188 (67.9 %) |

a mean score of 10.21 (± 3.28) and included 3 items, of which the lowest mean score was 3 (±1) on the item "COVID-19 is a serious illness for someone like me" (Table 2). Moreover, susceptibility had a mean score of 10.60 (± 2.69) and included 3 items; the highest mean score was 4 (±1) on the item "Even if I don't get vaccinated for COVID-19, I think I'm unlikely to get COVID-19". Maladaptive response rewards had a mean score of 8.02 (± 3.26) and included 3 items with a mean of 3 (±1). Furthermore, response efficacy had a mean score of 8.24 (± 3.19) and included 3 items; the item "Being vaccinated for COVID-19 would guarantee that I will not get COVID-19" had the lowest mean with 2 (±1). Self-efficacy had a mean score of 11.74 (± 2.38), which included 3 items with a mean of 4 (±1). Response costs had a mean score of 7.27 (± 2.72) and included 3 items; the item "The COVID-19 vaccine is expensive for me" had the lowest mean with 2 (±1). The Cronbach's alpha of the PMT scale was 0.72 indicating acceptable internal consistency.

### 3.3. COVID-19 conspiracy beliefs

The Coronavirus Conspiracy Scale had a mean score of 16.03 (±7.33; Table 3). The highest mean was 3 on the item "The virus is man-made". Most participants (76.3 %) strongly disagreed or somewhat disagreed with the item "The virus is a hoax", followed by the item "The spread of the virus is a deliberate attempt by one nation to destabilize another" (54.1 %). The lowest responses ('strongly disagree' or 'somewhat disagree') were for the items "The virus is man-made" (34.4 %) and "The spread of the virus is a deliberate attempt by global companies to take control" (52.3 %). The Cronbach's alpha value of the Coronavirus Conspiracy Scale was 0.95 indicating good internal consistency.

### 3.4. Social media intensity of use

Facebook intensity of use had a mean score of 14.50 (±7.91) and included 6 items with a mean score of 3 (Table 4). Most respondents (46.7 %) strongly disagreed or somewhat disagreed with the item "I would be sorry if Facebook shut down", followed by the items "I feel out of touch when I haven't logged onto Facebook for a while" and "I feel I am part of the Facebook community" (42.6 %).The items "Facebook has become part of my daily routine" and "Facebook is a part of my everyday activity" had the lowest strongly disagree/somewhat disagree response (27.3 % and 28.1 %, respectively). The Cronbach's alpha value of the Facebook scale was 0.89 indicating good internal consistency.

Furthermore, the Twitter (X) intensity of use score, which included 6 items with a mean of 3, had a mean of 5.18 (± 8.40). Most participants (50.6 %) strongly disagreed or somewhat disagreed with the item "I feel out of touch when I haven't logged onto Twitter for a while", followed by the item "I feel I am part of the Twitter community" (44.9 %). The items "I am proud to tell people I'm on Twitter" and "I would be sorry if Twitter shut down" both had the lowest strongly disagree/somewhat disagree response (22.5 % and 34.8 %, respectively). The Cronbach's alpha value of the Twitter (X) intensity of use scale was 0.95 indicating good internal consistency.

### 3.5. Variables associated with intention to receive the COVID-19 booster dose

Bivariate analysis was conducted using Chi-square and Mann-Whitney *U* tests to determine the variables associated with intention to receive a booster dose. The significant variables were age ($p < 0.001$) as the mean age of the higher intention group was 35.93 (14.20) versus 27.13 (8.32) in the low-intention group. The high-intention group had significantly lower religiosity, conspiracy beliefs, maladaptive response rewards and response costs. The high-intention group also had significantly higher Twitter (X) intensity of use, susceptibility, severity, self-efficacy, and response efficacy. The highest booster vaccination intention rate was found in participants in Germany and Austria, followed by participants in the UK, while participants in Jordan had the lowest intention to receive the COVID-19 booster dose (see Table 5).

### 3.6. Binary regression of variables associated with the intention to receive the COVID-19 booster dose

A binary regression was conducted to identify variables associated with intention to receive the booster dose. Higher scores in severity, self-efficacy and response efficacy significantly increased the odds of being in the high-intention group to receive the COVID-19 booster dose. On the other hand, having high scores on the maladaptive response rewards items decreased the odds of being in the high-intention group to receive the COVID-19 booster dose (see Table 6).

## 4. Discussion

Our study aimed to examine determinants of the intention of adults in Germany, Austria, the UK, and Jordan to receive the COVID-19 vaccine booster dose. In particular, we focused on PMT constructs, conspiracy beliefs, and social media intensity of use, in addition to religiosity and sociodemographic variables.

Four PMT constructs (severity, self-efficacy, maladaptive response rewards, and response efficacy) predicted intention to receive the booster dose. Higher perceived severity of COVID-19, self-efficacy, and response efficacy predicted high intention to receive the booster dose. On the other hand, high perceived maladaptive response rewards predicted low intention to receive the booster dose. Previous work has found similar associations between PMT constructs and vaccine hesitancy in relation to the influenza vaccine [38] as well as the first and second dose of the COVID-19 vaccine [14–17], but little is known about PMT in relation to booster dose intention; thus, our study provides an indication of the importance of PMT to understanding booster dose hesitancy.

**Table 2**
Participants' responses on the items related to intention to receive the COVID-19 booster dose and Protection Motivation Theory (PMT) subscales.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree | Mean (± SD) |
|---|---|---|---|---|---|---|
| | Frequency (%) | | | | | |
| **Booster dose vaccination intention** | | | | | | 9.61 (± 3.78) |
| I intend to have a COVID-19 booster vaccination. | 34 (15.7 %) | 29 (13.4 %) | 57 (26.3 %) | 54 (24.9 %) | 43 (19.8 %) | 3 (±1) |
| I plan to have a COVID-19 booster vaccination. | 35 (16.1 %) | 28 (12.9 %) | 61 (28.1 %) | 53 (24.4 %) | 40 (18.4 %) | 3 (±1) |
| I expect to have a COVID-19 booster vaccination | 31 (14.3 %) | 26 (12.0 %) | 54 (24.9 %) | 69 (31.8 %) | 37 (17.1 %) | 3 (±1) |
| **Severity** | | | | | | 10.21 (± 3.28) |
| The negative impact of COVID-19 is very severe. | 20 (8.8 %) | 15 (6.6 %) | 42(18.4 %) | 89 (39.0 %) | 62 (27.2 %) | 4 (±1) |
| COVID-19 can be a life-threatening illness. | 9 (4.1 %) | 8 (3.7 %) | 42 (19.4 %) | 100 (46.1 %) | 58 (26.7 %) | 4 (±1) |
| COVID-19 is a serious illness for someone like me. | 24 (11.1 %) | 47 (21.7 %) | 72 (33.2 %) | 59 (27.2 %) | 15 (6.9 %) | 3 (±1) |
| **Susceptibility** | | | | | | 10.60 (± 2.69) |
| Without being vaccinated for COVID-19, I am vulnerable to contracting COVID-19. | 23(10.6 %) | 24 (11.1 %) | 48 (22.1 %) | 81 (37.3 %) | 41 (18.9 %) | 3 (±1) |
| Even if I don't get vaccinated for COVID-19, I think I'm unlikely to get COVID-19. | 72 (33.2 %) | 65 (30.0 %) | 38 (17.5 %) | 30 (13.8 %) | 12 (5.5 %) | 4 (±1) |
| If I don't get vaccinated for COVID-19 I am at risk of catching COVID-19. | 19 (8.8 %) | 29 (13.4 %) | 41 (19.0 %) | 84 (38.9 %) | 43 (19.9 %) | 3 (±1) |
| **Maladaptive response rewards** | | | | | | 8.02 (± 3.26) |
| Not being vaccinated for COVID-19 would have some advantages for me. | 62 (28.6 %) | 35 (16.1 %) | 60 (27.6 %) | 35 (16.1 %) | 25 (11.5 %) | 3 (±1) |
| If I am not vaccinated for COVID-19, then I will not have to worry about the safety of the vaccine. | 45 (20.7 %) | 44 (20.3 %) | 51 (23.5 %) | 51 (23.5 %) | 26(12.0 %) | 3 (±1) |
| If I am not vaccinated for COVID-19, then I will not have to spend time and money getting vaccinated. | 61 (28.2 %) | 41 (19.0 %) | 65 (30.1 %) | 40 (18.5 %) | 9 (4.2 %) | 3 (±1) |
| **Response efficacy** | | | | | | 8.24 (± 3.19) |
| I'm sure that being vaccinated for COVID-19 would be effective in reducing my personal risk of contracting COVID-19. | 31 (14.3 %) | 30 (13.8 %) | 67 (30.9 %) | 54 (24.9 %) | 35 (16.1 %) | 3 (±1) |
| Being vaccinated for COVID-19 would stop me from getting COVID-19. | 53 (24.4 %) | 38 (17.5 %) | 61 (28.1 %) | 56 (25.8 %) | 9 (4.1 %) | 3 (±1) |
| Being vaccinated for COVID-19 would guarantee that I will not get COVID-19. | 69 (31.8 %) | 37 (17.1 %) | 70 (32.3 %) | 34 (15.7 %) | 7 (3.2 %) | 2 (±1) |
| **Self-efficacy** | | | | | | 11.74 (± 2.38) |
| I'd be able to be vaccinated for COVID-19 when it's offered to me, if I wanted to. | 12 (5.5 %) | 16 (7.4 %) | 53 (24.4 %) | 79 (36.4 %) | 57 (26.3 %) | 4 (±1) |
| Being vaccinated for COVID-19 is difficult. | 97 (44.7 %) | 59 (27.2 %) | 39 (18.0 %) | 20 (9.2 %) | 2 (0.9 %) | 4 (±1) |
| Being vaccinated for COVID-19 is easy. | 7 (3.2 %) | 11 (5.1 %) | 35 (16.1 %) | 91 (41.9 %) | 73 (33.6 %) | 4 (±1) |
| **Response costs** | | | | | | 7.27 (± 2.72) |
| Being vaccinated for COVID-19 would have some disadvantages for me. | 43 (19.8 %) | 34 (15.7 %) | 69 (31.8 %) | 49 (22.6 %) | 22 (10.1 %) | 3 (±1) |
| Being vaccinated for COVID-19 is painful. | 54 (24.9 %) | 49 (22.6 %) | 58 (26.7 %) | 48 (22.1 %) | 8 (3.7 %) | 3 (±1) |
| The COVID-19 vaccine is expensive for me. | 116 (53.5 %) | 48 (22.1 %) | 31 (14.3 %) | 19 (8.8 %) | 3 (1.4 %) | 2 (±1) |

**Table 3**
Participants' responses on the Coronavirus Conspiracy Scale items.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree | Mean (± SD) |
|---|---|---|---|---|---|---|
| | Frequency (%) | | | | | |
| The virus is a hoax. | 154 (55.2 %) | 59 (21.1 %) | 48 (17.2 %) | 11 (3.9 %) | 7 (2.5 %) | 2 (±1) |
| The virus is man-made. | 63 (22.6 %) | 33 (11.8 %) | 111 (39.8 %) | 52 (18.6 %) | 20 (7.2 %) | 3 (±1) |
| The spread of the virus is a deliberate attempt to reduce the size of the global population. | 108 (38.7 %) | 52 (18.6 %) | 80 (28.7 %) | 26 (9.3 %) | 13 (4.7 %) | 2 (±1) |
| The spread of the virus is a deliberate attempt by governments to gain political control. | 103 (36.9 %) | 44 (15.8 %) | 84 (30.1 %) | 35 (12.5 %) | 13 (4.7 %) | 2 (±1) |
| The spread of the virus is a deliberate attempt by a group of powerful people to make money. | 101 (36.2 %) | 46 (16.5 %) | 83 (29.7 %) | 35 (12.5 %) | 14 (5.0 %) | 2 (±1) |
| The spread of the virus is a deliberate attempt by one nation to destabilize another. | 104 (37.3 %) | 47 (16.8 %) | 87 (31.2 %) | 30 (10.8 %) | 11 (3.9 %) | 2 (±1) |
| The spread of the virus is a deliberate attempt by global companies to take control. | 101 (36.2 %) | 45 (16.1 %) | 82 (29.4 %) | 39 (14.0 %) | 12 (4.3 %) | 2 (±1) |
| COVID-19 conspiracy beliefs score | | | | | | 16.03 (±7.33) |

Higher levels of conspiracy beliefs were associated with low intention to receive the booster dose. This replicates previous findings for the first and second dose [14,15] and indicates that conspiracy beliefs continue to be an important factor in the decision to get vaccinated, even after receiving previous doses of the COVID-19 vaccine. The potential influence of conspiracy beliefs on individuals to get the booster dose, across countries, and having previously been vaccinated for COVID-19, shows that it is of paramount importance to tackle these beliefs in efforts to increase booster uptake.

High levels of Twitter (X) intensity of use (but not of Facebook) were

**Table 4**
Participants' responses to the Facebook and Twitter (X) intensity of use items.

| | Strongly disagree | Somewhat disagree | Neither agree nor disagree | Somewhat agree | Strongly agree | Mean (± SD) |
|---|---|---|---|---|---|---|
| | Frequency (%) | | | | | |
| **Facebook** | | | | | | |
| Facebook is a part of my everyday activity. | 23 (9.5 %) | 45 (18.6 %) | 55 (22.7 %) | 99 (40.9 %) | 20 (8.3 %) | 3 (±1) |
| I am proud to tell people I'm on Facebook. | 27 (11.2 %) | 64 (26.4 %) | 111 (45.9 %) | 32 (13.2 %) | 8 (3.3 %) | 3 (±1) |
| Facebook has become part of my daily routine. | 25 (10.3 %) | 41 (16.9 %) | 47 (19.4 %) | 109 (45.0 %) | 20 (8.3 %) | 3 (±1) |
| I feel out of touch when I haven't logged onto Facebook for a while. | 43 (17.8 %) | 60 (24.8 %) | 70 (28.9 %) | 64 (26.4 %) | 5 (2.1 %) | 3 (±1) |
| I feel I am part of the Facebook community. | 39 (16.1 %) | 64 (26.4 %) | 75 (31.0 %) | 55 (22.7 %) | 9 (3.7 %) | 3 (±1) |
| I would be sorry if Facebook shut down. | 47 (19.4 %) | 66 (27.3 %) | 71 (29.3 %) | 46 (19.0 %) | 12 (5.0 %) | 3 (±1) |
| Facebook intensity of use score | | | | | | 14.50 (±7.91) |
| **Twitter (X)** | | | | | | |
| Twitter is part of my everyday activity. | 19 (21.3 %) | 16 (18.0 %) | 17 (19.1 %) | 27 (30.3 %) | 10 (11.2 %) | 3 (±1) |
| I am proud to tell people I'm on Twitter. | 9 (10.1 %) | 11 (12.4 %) | 40 (44.9 %) | 20 (22.5 %) | 9 (10.1 %) | 3 (±1) |
| Twitter has become part of my daily routine. | 15 (16.9 %) | 17 (19.1 %) | 23 (25.8 %) | 23 (25.8 %) | 11 (12.4 %) | 3 (±1) |
| I feel out of touch when I haven't logged on to Twitter for a while. | 25 (28.1 %) | 20 (22.5 %) | 29 (32.6 %) | 13 (14.6 %) | 2 (2.2 %) | 2 (±1) |
| I feel I am part of the Twitter community. | 21 (22.6 %) | 19 (21.3 %) | 35 (39.3 %) | 11 (12.4 %) | 3 (3.4 %) | 3 (±1) |
| I would be sorry if Twitter shut down. | 20 (22.5 %) | 11 (12.4 %) | 30 (33.7 %) | 22 (24.7 %) | 6 (6.7 %) | 3 (±1) |
| Twitter (X) intensity of use score | | | | | | 5.18 (± 8.40) |

**Table 5**
Variables associated with intention to receive a booster dose for COVID-19 vaccine.

| Variables | | Low Intention group | High intention group | *p*-value |
|---|---|---|---|---|
| | | Mean (SD) or Frequency (%) | Mean (SD) or Frequency (%) | |
| Age | | 27.13 (8.32) | 35.93 (14.20) | <0.001*** |
| Religiosity | | 4 (1) | 3 (2) | <0.001 |
| Sex | Male | 37 (30.8 %) | 65 (39.2 %) | 0.193 |
| | Female | 82 (68.3 %) | 102 (60.8 %) | |
| Nationality | Jordan | 93 (77.5 %) | 73 (43.7 %) | <0.001 |
| | England | 21 (17.5 %) | 65 (38.9 %) | |
| | Germany and Austria | 6 (5.0 %) | 29 (17.4 %) | |
| Previously infected with COVID-19 | Yes | 39 (32.5 %) | 51 (30.5 %) | 0.724 |
| | No | 81 (67.5 %) | 116 (69.5 %) | |
| Conspiracy beliefs | | 19.51 (6.73) | 13.44 (6.68) | <0.001 |
| Facebook intensity of use | | 15.61 (7.25) | 13.70 (8.28) | 0.075 |
| Twitter (X) intensity of use | | 2.95 (6.51) | 6.79 (9.22) | <0.001 |
| Susceptibility | | 9.51 (2.54) | 11.96 (2.33) | <0.001 |
| Severity | | 9.50 (2.43) | 11.00 (3.88) | <0.001 |
| Maladaptive response rewards | | 8.98(2.83) | 6.84 (3.38) | <0.001 |
| Self-efficacy | | 10.98 (2.41) | 12.68 (1.98) | <0.001 |
| Response efficacy | | 6.88 (2.87) | 9.92 (2.73) | <0.001 |
| Response costs | | 7.97 (2.35) | 6.40 (2.90) | <0.001 |

**Table 6**
Multivariable analysis for variables association with the intention to receive COVID-19 booster dose.

| | *p* | OR | CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| **Nationality** | | | | |
| UK | 0.60 | 0.57 | 0.07 | 4.55 |
| Germany and Austria | 0.480 | 2.05 | 0.28 | 15.11 |
| Jordan | Reference | | | |
| Age | 0.35 | 1.03 | 0.97 | 1.10 |
| Religiosity | 0.17 | 1.40 | 0.87 | 2.26 |
| Twitter (X) intensity of use | 0.13 | 1.04 | 0.99 | 1.10 |
| Conspiracy beliefs | 0.97 | 1.00 | 0.93 | 1.07 |
| Severity | 0.001 | 1.44 | 1.16 | 1.79 |
| Maladaptive response rewards | 0.037 | 0.83 | 0.70 | 0.90 |
| Self-efficacy | 0.04 | 1.23 | 1.01 | 1.51 |
| Response efficacy | <0.001 | 1.49 | 1.26 | 1.76 |
| Susceptibility | 0.80 | 0.97 | 0.79 | 1.20 |
| Response costs | 0.92 | 0.99 | 0.79 | 1.23 |

associated with low intention to receive the booster dose. While both Twitter (X) and Facebook are among the most commonly used social media platforms for COVID-19 news and information [28], it appears that Twitter (X) carries more weight when it comes to booster vaccination intention. This finding suggests that the role of Twitter (X) in making decisions about COVID-19 vaccination needs to be examined more closely. It may also be worth considering using Twitter (X) as part of campaigns to increase uptake of the booster dose in the countries we surveyed.

In relation to sociodemographic factors, age and religiosity were significantly associated with intention to receive the booster vaccine. Older age was associated with high intention, while higher religiosity was associated with low intention to receive the booster dose. Whilst this association with age has been shown in previous research on the first and second doses of the vaccine [14,42], religiosity is poorly researched in relation to COVID-19 vaccination. In our sample, Jordanian participants had higher levels of religiosity than UK and German/Austrian participants. They were also more likely to have low intention to get the booster vaccine. Our study therefore has important implications for the potential role of religiosity in individuals' decision to get the COVID-19 booster dose.

### 4.1. Strengths and limitations

Our study is the first study to assess the role of PMT, COVID-19 conspiracy beliefs, social media use and sociodemographic factors on intention to receive the booster dose and has important implications for any efforts to increase uptake of the booster dose. Nevertheless, some limitations need to be acknowledged. The sample of Austrian and German participants was smaller than that of UK and Jordanian participants, and these countries were therefore less represented. Also, our study was somewhat underpowered with 287 participants, as a prospective power analysis yielded 384 as the required sample size to detect a medium effect size. While it needs to be emphasised that despite this, significant findings did still emerge and that our study represents the first effort to compare booster acceptance between these countries, further research which recruits larger, more evenly matched samples across countries is necessary to strengthen our findings. Furthermore,

there were differences between the samples in terms of age and gender distribution. Whilst our findings in relation to PMT and COVID-19 conspiracy beliefs are in line with previous research and therefore suggest that these sample characteristics are unlikely to have had an adverse impact on our findings, future research would benefit from ensuring a more even distribution of age and gender.

The convenience sampling approach used in the present study resulted in uneven numbers of participants across the different countries and may have led to selection bias. Recruitment was facilitated by the use of social media. Convenience sampling has been used by other major studies in this area (e.g., [43–46]. Still, future research comparing booster vaccine uptake in these countries may benefit from different sampling approaches to ensure greater representativeness and similar numbers of participants for each country.

Whilst the measure of religiosity used in the present study was in line with prior literature in this area, the single item used to assess this predictor may not have been appropriate for respondents in Jordan [47], as this measure had previously only been employed in Western settings. Future research would benefit from exploring the use of a culturally sensitive measure of religiosity in this population.

### 4.2. Recommendations

We propose several recommendations based on our findings.

- Perceived severity of COVID-19, perceived ability to get vaccinated, perceived efficacy of the vaccine, and perceived rewards of not getting the booster dose all played a role in booster vaccination intention regardless of nationality. These factors therefore need to be addressed in future campaigns to increase uptake.
- Conspiracy beliefs have consistently emerged as a predictor of intention to get vaccinated for COVID-19 in the UK [14,15,42]. Our research shows that these beliefs are relevant across countries, and that conspiracy beliefs continue to influence decisions on COVID-19 vaccination beyond the first and second dose. Campaigns and interventions to increase uptake must therefore address these as a matter of urgency.
- Similar to the first and second doses, young people reported lower levels of intention to get the booster dose and therefore need to be targeted specifically in campaigns and interventions tailored to this demographic.
- High levels of religiosity may be an indicator of low intention to get the booster dose. Campaigns to increase uptake may benefit from using religious leaders and places of worship to encourage individuals to get the booster dose.
- The use of Twitter (X) needs to be examined in relation to COVID-19 vaccine hesitancy, as our study showed a relationship between high intensity of Twitter (X) use and low levels of booster vaccination intention. As social media are often used to propagate COVID-19 conspiracy beliefs, this needs to be addressed as part of booster vaccination campaigns, possibly using Twitter (X) itself to combat booster vaccine hesitancy.

## 5. Conclusions

Efforts to administer the COVID-19 booster vaccination are ongoing globally, but uptake has been slower than that of the first and second dose. Our findings highlight that while some factors, such as PMT and conspiracy beliefs, influence booster vaccination intention regardless of country or culture, there are other factors, such as religiosity, which may be specific to country or culture. Campaigns to increase uptake of the COVID-19 booster dose should be designed to take these differences into account.

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None.

## Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

## CRediT authorship contribution statement

**Judith Eberhardt:** Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Walid Al-Qerem:** Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Jonathan Ling:** Conceptualization, Methodology, Writing – review & editing.

## 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.

## Data availability

The data that has been used is confidential.

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