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4

5   **Introduction**

6   Efforts to vaccinate the world population against COVID-19 are ongoing. At the end of May

7   2021, around 1.86 billion doses had been administered worldwide [1]. The COVID-19

8   vaccine programme has been rolled out rapidly across the United Kingdom [UK] [2]. While

9   uptake has been encouraging [3], surveys have indicated that there are a significant number

10   of people who are sceptical of the vaccine, and who would either be hesitant to receive it,

11   or refuse it altogether [4–6]. In the UK, most of the people who have been hospitalised with

12   COVID-19 are those who have not been fully vaccinated [7]. Therefore, to reduce

13   hospitalisations and mortality rates, it is important that as many eligible individuals as

14   possible are fully vaccinated against COVID-19.

15

16   Behavioural research has identified three drivers of vaccine uptake, in addition to

17   possessing the necessary knowledge: an enabling environment, social influences and

18   motivation [8]. Protection Motivation Theory (PMT) [9] is a social cognition theory which

19   attempts to explain motivation to respond to health threats such as COVID-19. According to

20   PMT, the likelihood of engaging in a protective behaviour - such as being vaccinated - when

21   faced with a threat is a product of the beliefs that individuals hold about engaging, or not

22   engaging, in this protective behaviour as well as about the threat itself (see Figure 1).

23

24   In PMT, intention most closely predicts behaviour. Intention itself is determined by both

25   threat appraisal and coping appraisal. Threat appraisal is the result of one's perceived

26   vulnerability to the negative consequences of the threat (susceptibility), how serious one

27   perceives these negative consequences to be (severity), and perceived benefits of engaging

28   in behaviour that is maladaptive in relation to the threat (maladaptive response rewards).

29   Coping appraisal is the product of confidence in one's perceived ability to successfully

30   engage in the preventative behaviour (self-efficacy), beliefs about how effective the

31   protective behaviour is at preventing the negative consequences of the threat (response

32   efficacy), and any barriers affecting performance of the protective behaviour (response

33   costs). PMT posits that, faced with a threat to their health, people are most likely to perform

34   a protective behaviour when they believe that not acting poses a threat to themselves (high

35   threat appraisal) and that engaging in the protective behaviour will reduce that threat (high

36   coping appraisal).

37

38   PMT has been applied to seasonal influenza vaccine acceptability and uptake (e.g., [10–13]),

39   and to predict COVID-19 vaccination intention among Chinese university students [14].

40   However, no published studies examine the use of PMT to predict COVID-19 vaccination

41   intention in the general UK population. COVID-19 is affecting not just the general population

42   of the UK, but the global population. It is important that common theories of health

43   behaviour and health behaviour change, such as PMT, be applied to COVID-19 vaccination

44   intention in the general population, as this will allow for theory-based interventions to be

45   designed to reach as many as possible, to increase vaccine uptake.

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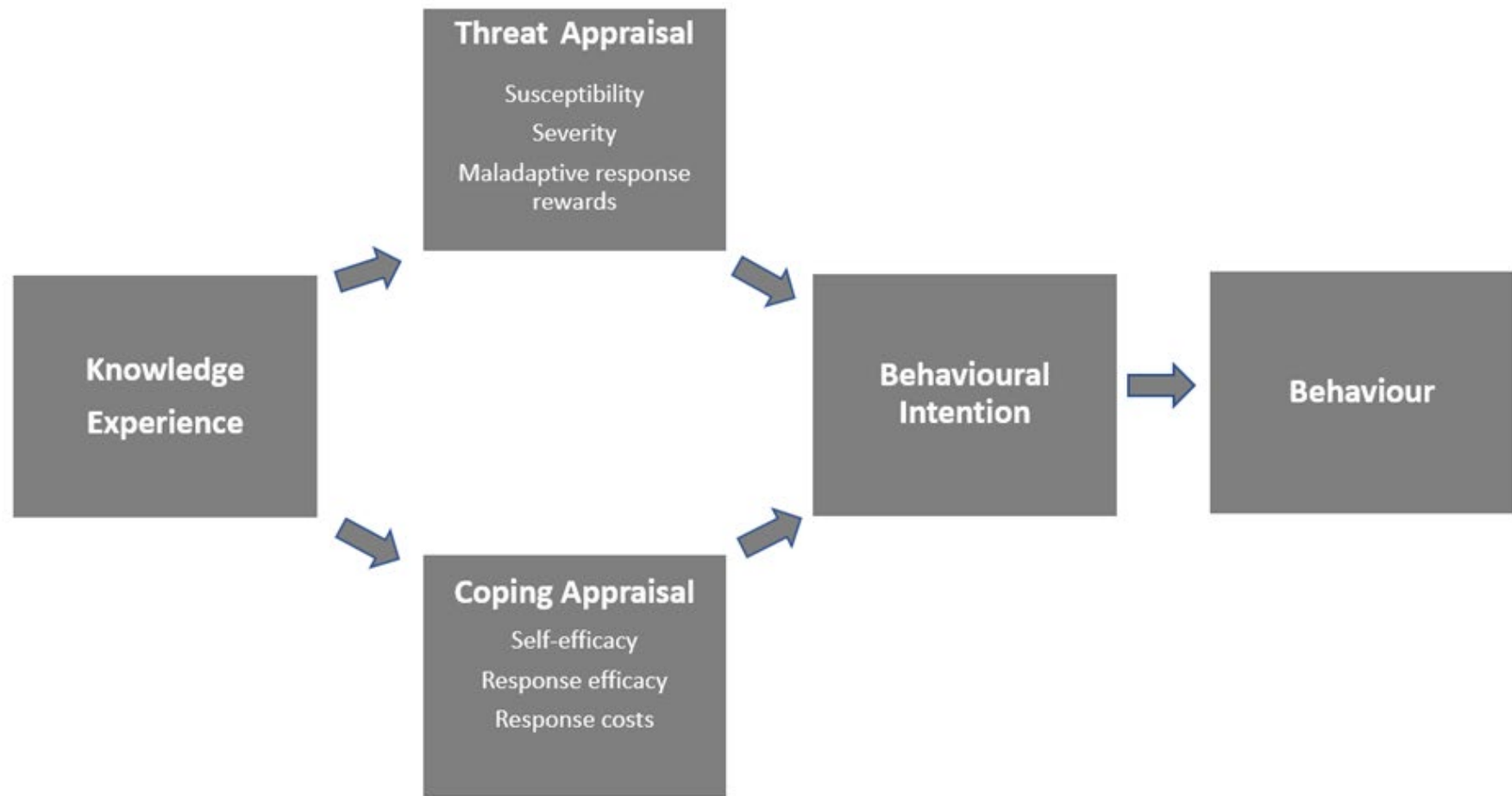
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51   Figure 1: Protection Motivation Theory

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53 Conspiracy beliefs have been examined in relation to beliefs about COVID-19. These have

54 shown to be prevalent in a significant minority and to be associated with less adherence to

55 coronavirus government guidelines and lower willingness to take diagnostic or antibody

56 tests or get vaccinated [4,6]. The role of conspiracy beliefs in intention to receive a COVID-

57 19 vaccination has not yet been explored extensively, nor alongside PMT in vaccination

58 intention more broadly. As such beliefs are prevalent in a significant minority and may lower

59 vaccine uptake [4], determining the extent of their influence on intention to get a COVID-19

60 vaccine is key to developing interventions for COVID-19 vaccine uptake.

61

62 In addition to psychological factors, demographic factors have been shown to be associated

63 with COVID-19 vaccine hesitancy, namely age, gender [4,15,16], ethnicity [4,5,17], and

64 education [15,16]. Furthermore, religiosity has been shown to be negatively correlated with

65 COVID-19 vaccination intention [18]. However, findings on the influence of demographic

66 factors are mixed.

67

68

69 The current study aimed to predict COVID-19 vaccination intention in the UK population

70 using PMT, coronavirus conspiracy beliefs, and demographic factors. We also sought to

71 establish whether there were significant differences between those vaccinated for COVID-

72 19 and unvaccinated individuals in relation to coronavirus conspiracy beliefs.

73 We hypothesised that COVID-19 vaccination intention would have significant positive

74 relationships with

75 H1. perceived susceptibility to COVID-19

76 H2. perceived severity of contracting COVID-19

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

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

79   We hypothesised that COVID-19 vaccination intention would have significant negative

80   relationships with

81   H5. perceived response costs

82   H6. maladaptive response rewards; and

83   H7. coronavirus conspiracy beliefs.

84   H8. A significant difference in levels of coronavirus conspiracy beliefs was expected between

85   individuals who had not been vaccinated for COVID-19 and those who had been vaccinated.

86   Additionally, the influence of demographic factors (ethnicity, age, gender, religiousness, and

87   education) on intention to be vaccinated was also examined. Due to the inconsistent

88   findings on the influence of these demographic variables, no hypotheses were generated for

89   these; we nevertheless aimed to assess their influence on COVID-19 vaccination intention, if

90   any.

91

92   **Method**

93   *Design*

94   The present study was correlational and used an online survey. The criterion variable was

95   COVID-19 vaccination intention. Predictors were the PMT constructs (perceived severity of

96   COVID-19, perceived susceptibility to COVID-19, perceived efficacy of the vaccine [response

97   efficacy], confidence in one's ability to obtain a vaccination [self-efficacy], maladaptive

98   response rewards and perceived response costs) and level of coronavirus conspiracy beliefs.

99   Relevant demographic variables - ethnicity, age, gender, religiosity, and education - were

100   also assessed.

6

101

Participants

Individuals eligible to participate in the study included anyone aged 18 or older and residing

in the UK. Recruitment took place by disseminating the link to the online survey via social

media, email, distributing flyers, and via an interview on a public radio station. Participants

received no monetary or material rewards for their participation. Table 1 shows

demographic characteristics of the respondents.

A prospective power analysis conducted using the G*Power software, version 3.1.9.7 [19]

established that for a power of .80 and with 12 predictors, a sample size of 127 would be

needed to detect a medium effect size in a multiple linear regression analysis. A separate

prospective power analysis for an independent t-test comparing vaccinated to unvaccinated

individuals showed that for a power of .80, 128 respondents would be required to detect a

medium effect size. A total of 382 individuals from nine regions in England, as well as in

Scotland and Wales, completed the survey (77 males, 301 females, one non-binary/third

gender, three preferred not to state their gender). The mean age was 43.78 (SD = 12.58). Of

these, 278 respondents (72.8%) reported having had a COVID-19 vaccination, and 104

(27.2%) reported not having had one. The COVID-19 vaccination programme was being

rolled out in the UK by age groups at the time this study was carried out, with older people

being offered the vaccine before younger ones. At the time data collection ceased, all those

aged 34 and older [20], as well as clinically extremely vulnerable individuals [21], frontline

health and social care workers [22,23], and individuals with underlying health conditions

[24] were being offered the vaccine - a substantial proportion of the adult population. Still,

the mean age of vaccinated individuals was higher (M = 46.98, SD = 12.01), than that of

125   unvaccinated individuals (*M* = 35.25, *SD* = 9.85). An independent t-test established that this

126   age difference was significant, *t*(223.70) = 9.73, *p* < .0001.

127   Table 1: Demographic characteristics of respondents.

		Overall
N		382
- Vaccinated		278
- Unvaccinated		104
Age in years *M* (*SD*)		43.78 (12.58)
Age category		*N* (%)
	18 - 29	59 (15.4)
	30 - 39	81 (21.2)
	40 - 49	114 (29.8)
	50 - 59	84 (22)
	60 - 69	39 (10.2)
	70 - 79	4 (1)
	80+	1 (0.3)
- Mean age of vaccinated *(SD)*		46.98 (12.01)
- Mean age of unvaccinated *(SD)*		35.25 (9.85)
Ethnicity (%)	White	351 (91.9)
	Non-White	31 (8.1)
Level of education (%)	No qualifications	7 (1.8)
	General Certificate of Secondary Education	34 (8.9)
	Advanced level qualifications (completed secondary education)	61 (16.0)
	Higher education (e.g., BA, BSc, or equivalent)	141 (36.9)
	Postgraduate qualifications (e.g., MA, MSc, PhD, DPhil)	139 (36.4)
Religiosity *M* (*SD*)	Single item: 'How important is religion in your life?' (Five-point Likert scale; 1 = not important at all, 5 = extremely important)	1.91 (1.25)

128

129   ***Measures***

130   An adapted version of the PMT questionnaire [13] was used to measure the PMT constructs.

131   Table 2 shows all PMT items by construct with associated internal consistency (Cronbach's

α). All subscales have previously been shown to have moderate to high internal consistency,

ranging from α = 0.57 to α = 0.98 [13]. The original items were worded to assess PMT

constructs in relation to the seasonal influenza vaccine. For the present study, these were

adapted to assess these constructs in relation to the COVID-19 vaccine. 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 mean of the

items on each subscale. Items were reversed where necessary. Higher scores on each

subscale indicated higher degrees of the particular construct.

Intention was assessed with three items in relation to COVID-19 vaccination intention .

Susceptibility was measured with two items indicating in how far individuals perceived

themselves as being vulnerable to the negative consequences of contracting COVID-19 and

one item indicating lack of perceived susceptibility . *Severity* was a composite score

calculated by averaging three items indicating that the negative impact of contracting

COVID-19 is severe (α = 0.74). Higher perceived severity was indicated by higher scores.

Maladaptive response rewards were measured with three items stating that there were

perceived benefits to not getting a COVID-19 vaccination . *Self-efficacy* was assessed with

two items indicating that individuals saw themselves as capable of getting a COVID-19

vaccination, and one item stating that it would be difficult for them to get a COVID-19

vaccination . *Response efficacy* was measured with three items indicating that receiving the

COVID-19 vaccine would be effective in reducing vulnerability to and severity of the illness .

Response costs were assessed with three items indicating that there were both financial and

non-financial costs in relation to receiving a COVID-19 vaccination .

155 Conspiracy beliefs were assessed with the 7-item OCEANS Coronavirus Conspiracy Scale

156 assessing general coronavirus conspiracy beliefs [6]. Items included statements on general

157 beliefs about the coronavirus (e.g., *"The virus is a hoax"*) and participants indicated their

158 agreement on a five-point Likert scale ranging from 1 = strongly disagree, to 5 = strongly

159 agree. In the present study, internal consistency of the scale was high (α = 0.93).

160

161 Demographic variables were measured using multiple-choice items. Age was measured as a

162 continuous variable; gender, ethnicity, and level of education were assessed using the UK

163 census categories [25]. Religiousness was assessed with a single item ('How important is

164 religion in your life?', measured using a five-point Likert scale ranging from 1 = not

165 important at all to 5 = extremely important), in line with the Oxford Coronavirus

166 Explanations, Attitudes, and Narratives Survey II [4].

167

168 Table 2: Protection Motivation Theory items.

Construct and associated internal consistency	Items
Intention (α = .99)	I intend to have a COVID-19 vaccination. I plan to have a COVID-19 vaccination. I expect to have a COVID-19 vaccination.
Susceptibility (α = .78)	Without being vaccinated for COVID-19, I am vulnerable to contracting COVID-19. Even if I don't get vaccinated for COVID-19, I don't think I'm likely to get COVID-19. If I don't get vaccinated for COVID-19 I am at risk of catching COVID-19.
Severity (α = .74)	The negative impact of COVID-19 is very severe. COVID-19 can be a life-threatening illness.

	COVID-19 is a serious illness for someone like me.
Maladaptive response rewards (α = .57)	Not being vaccinated for COVID-19 would have some advantages for me.
	If I am not vaccinated for COVID-19, then I will not have to worry about the safety of the vaccine.
	If I am not vaccinated for COVID-19, then I will not have to spend time and money getting vaccinated.
Self-efficacy (α = .65)	I'd be able to be vaccinated for COVID-19 when it's offered to me, if I wanted to.
	Being vaccinated for COVID-19, once it's offered to me, would be difficult for me.
	Being vaccinated for COVID-19 is easy.
Response efficacy (α = .75)	I'm sure that being vaccinated for COVID-19 would be effective in reducing my personal risk of contracting COVID-19.
	Being vaccinated for COVID-19 would stop me from getting COVID-19.
	Being vaccinated for COVID-19 would guarantee that I will not get COVID-19.
Response costs (α = .47)	Being vaccinated for COVID-19 would have some disadvantages for me.
	Being vaccinated for COVID-19 is painful.
	The COVID-19 vaccine is expensive for me.

169

Procedure

Ethics approval was granted by the institution of the last author. A website was set up to

provide information on the study and a link to the survey on the online survey platform,

Qualtrics. The website provided background information on the study and respondents

were then invited to complete the anonymous online survey by clicking on the survey link.

Respondents were presented with a consent form explaining the nature and aims of the

176 study and were then asked to tick a box confirming that they had read and understood the

177 information provided and that they would like to take part in the study. The survey took an

178 average of five minutes to complete. Upon completion, respondents were presented with a

179 screen thanking them for their time and providing a list of websites that could be accessed

180 for more information on COVID-19 and vaccination. They were also encouraged to contact

181 the National Health Service's 'NHS Direct' website or their general practitioner if they had

182 any coronavirus-related concerns.

183

184 ***Analysis***

185 Version 26 of The Statistical Package for the Social Sciences [SPSS] [26] was used to analyse

186 the data. A three-stage hierarchical multiple linear regression was performed on the survey

187 data of respondents who had not had a COVID-19 vaccine (N = 104) to determine significant

188 predictors of intention to receive a COVID-19 vaccination, as well as the relative

189 contribution of each significant predictor and nature of its relationship to this outcome

190 variable.

191 In line with previous research indicating the influence of PMT constructs on vaccination

192 intention [13], these were entered at the first stage. Level of coronavirus conspiracy beliefs

193 was entered at the second stage, and the demographic variables (age, gender, ethnicity –

194 recoded into a dichotomous variable with two levels, White and non-White -, education,

195 and religiosity) were entered at the third stage. Only respondents who reported not having

196 had a COVID-19 vaccination were included in this analysis.

197 Additionally, an independent t-test was performed to compare individuals who had had a

198 COVID-19 vaccine with those who had not had one in relation to their levels of coronavirus

199 conspiracy beliefs.

Results

Descriptive Statistics

To assess relationships between the PMT constructs, Pearson's product-moment

correlations were performed (see Table 2). As would be expected [13], nearly all constructs

were significantly correlated with each other.

Table 3: Correlations between variables measuring PMT constructs

Construct	*M*	*SD*	1	2	3	4	5	6
1. Intention	3.99	1.50						
2. Susceptibility	3.79	1.07	.68**					
3. Severity	3.89	0.91	.58**	.65**				
4. Maladaptive response rewards	2.37	0.97	-.64**	-.47**	-.37**			
5. Self-efficacy	3.08	1.01	.62**	.49**	.36**	-.38**		
6. Response efficacy	4.22	0.80	.37**	.41**	.17	-.53**	.25*	
7. Response costs	2.15	0.76	-.60**	-.60**	-.37**	.64**	-.41**	-.59**

*$p < .05$; **$p < .01$

Inferential Statistics

Due to the high levels of correlations between PMT constructs, tolerance and variance

inflation factors (VIF) were examined for all predictors. None of the tolerance values were

smaller than .1, and all VIF values were well below 10 [27]; thus, no multicollinearity was

present. Results of the hierarchical multiple regression (see Table 3) showed that at stage 1,

severity, susceptibility, maladaptive response rewards, and self-efficacy all contributed

significantly to the regression model, with 68% of the variance in COVID-19 vaccination

217   intention being accounted for. Adding conspiracy beliefs at stage 2 resulted in an additional

218   2% of the variance being explained, with the four predictors remaining significant, and

219   conspiracy beliefs emerging as an additional and highly significant predictor of COVID-19

220   vaccination intention. Adding the demographic variables (age, gender, religiosity, level of

221   education, and ethnicity) at stage 3 led to an additional 5% (75% in total) of the variance in

222   COVID-19 vaccination intention being explained. Severity and susceptibility were no longer

223   significant predictors, but maladaptive response rewards, self-efficacy, and conspiracy

224   beliefs remained significant, and age emerged as an additional significant predictor of

225   COVID-19 vaccination intention.

226   The final model with all predictors showed that the lower the perceived rewards of not

227   getting vaccinated for COVID-19, and the higher confidence in one's ability to obtain a

228   vaccination, the higher the intention was to get vaccinated for COVID-19. Furthermore, the

229   higher respondents' level of conspiracy beliefs about COVID-19, and the older respondents

230   were, the lower their intention to get vaccinated.

231

232   Table 4: Results of hierarchical multiple linear regression predicting COVID-19 vaccination

233   intention.

Predictor	β	95% *CI*	*t*	R^2	R^2 change	*p*
Stage 1				.68	.68	
Intercept		[.30, 4.58]	2.01			.047*
Severity	.17	[.02, .55]	2.12			.037*
Susceptibility	.23	[.06, .59]	2.46			.016*
Maladaptive response rewards	-.31	[-.73, -.22]	-3.72			.000***
Self-efficacy	.29	[.22, .64]	4.13			.000***
Response efficacy	-.05	[-.38, .20]	-.61			.544
Response costs	-.11	[-.57, .15]	-1.14			.256
Stage 2				.70	.02	
Intercept		[.66, 5.16]	2.57			.012**
Severity	.16	[.01, .52]	2.04			.045*

Susceptibility	.19	[.01, .52]	2.03			.045*
Maladaptive response rewards	-.25	[-.64, -.13]	-3.01			.003**
Self-efficacy	.28	[.21, .61]	4.07			.000***
Response efficacy	-.05	[-.38, .19]	-.67			.506
Response costs	-.07	[-.49, .21]	-.78			.439
Conspiracy beliefs	-.20	[-.62, -.09]	-2.64			.010**
Stage 3				.75	.05	
Intercept		[1.50, 7.74]	2.95			.004**
Severity	.11	[-.08, .43]	1.36			.177
Susceptibility	.16	[-.02, .48]	1.82			.073
Maladaptive response rewards	-.20	[-.56, -.07]	-2.55			.013**
Self-efficacy	.18	[.05, .48]	2.50			.014**
Response efficacy	-.08	[-.42, .14]	-1.02			.312
Response costs	-.03	[-.40, .30]	-.29			.769
Conspiracy beliefs	-.35	[-.93, -.31]	-3.98			.000***
Age	-.24	[-.05, -.01]	-3.23			.002**
Gender	-.01	[-.39, .35]	-.12			.904
Religiosity	.10	[-.03, .27]	1.54			.127
Level of education	.01	[-.16, .20]	.20			.846
Ethnicity	.08	[-.22, 1.13]	1.34			.183

234   *$p < .05$; **$p < .01$; ***$p < .001$

235   Results of the t-test comparing COVID-19 vaccinated and unvaccinated individuals on their

236   coronavirus conspiracy beliefs showed that unvaccinated individuals ($M = 1.83$, $SD = 1.01$)

237   reported significantly higher levels of conspiracy beliefs than those who had been

238   vaccinated ($M = 1.58$, $SD = .78$), $t(138.73) = $, $p < 0.05$.

239

240   **Discussion**

241   The present study aimed to establish the influence of PMT constructs, coronavirus

242   conspiracy beliefs, and demographic factors, on individuals' intention to get vaccinated for

243   COVID-19. Furthermore, we aimed to compare those who had had the COVID-19 vaccine

244   with those who had not been vaccinated in relation to their coronavirus conspiracy beliefs.

245

246   As expected [13], most of the PMT constructs correlated with each other. However,

247   tolerance and VIF for all predictors were all acceptable [27] and did not show

248   multicollinearity to be present. Therefore, these correlations were not of concern. We found

249   that for the full regression model including all predictors, the lower respondents perceived

250   rewards of *not* getting vaccinated for COVID-19 to be (maladaptive response rewards), and

251   the higher their confidence in their ability to obtain a vaccination (self-efficacy), the higher

252   their intention was to get vaccinated. Furthermore, the higher respondents' coronavirus

253   conspiracy beliefs were and the older they were, the lower their intention was to get

254   vaccinated. Thus, in addition to two constructs from PMT – maladaptive response rewards

255   and self-efficacy – coronavirus conspiracy beliefs and age both had independent effects on

256   COVID-19 vaccination intention. Regression models with PMT constructs only, and with PMT

257   constructs plus conspiracy beliefs, yielded additional significant PMT predictors in the form

258   of perceived severity and perceived susceptibility: the higher perceived severity of COVID-19

259   and individuals' perceived susceptibility to the disease, the higher their intention was to get

260   vaccinated. These were non-significant in the full model, which suggests that demographic

261   factors are of limited relevance to explaining COVID-19 vaccination intention; this has also

262   been found in prior research on influenza vaccine intention [13]. Hence, four constructs

263   from PMT predicted COVID-19 vaccination intention. Interventions and health promotion

264   campaigns addressing vaccine uptake may need to aim for increasing individuals' perceived

265   severity of COVID-19, their perceived susceptibility to this illness, and their perceived ability

266   to get the vaccine, while decreasing the perceived rewards of not getting vaccinated.

267   However, it is important to note that emphasising disease severity may backfire, particularly

268   with hesitant individuals; studies on childhood and influenza vaccine messaging have shown

269   that messaging on disease risks is not necessarily effective for increasing intention to

270   vaccinate (e.g., [28,29]). Research is needed to establish if this is the case for the COVID-19

271   vaccine, and any health promotion campaign messaging on the severity of COVID-19 should

272   be pre-tested in target audiences beforehand.

273

274   Our findings on PMT and COVID-19 vaccination intention are similar to previous research on

275   influenza virus vaccination intention [10,12,13]. They contrast with those of a study

276   revealing the influence of only one PMT construct - perceived severity - on coronavirus

277   vaccination intention in Chinese students [14]. This difference may be due to cultural

278   differences, with the present study being conducted in a Western setting and sampling the

279   general UK population. Future research would benefit from cross-cultural comparisons of

280   PMT in relation to COVID-19 vaccination intention.

281

282   Apart from coronavirus conspiracy beliefs being negatively related to vaccination intention,

283   unvaccinated individuals had significantly higher levels of coronavirus conspiracy beliefs

284   than vaccinated individuals. The findings on coronavirus conspiracy beliefs and their

285   relationship to vaccination intention are in line with previous UK research [4,6]. Unlike these

286   previous studies, however, our study was conducted at a time when the COVID-19

287   vaccination programme was well underway. Therefore, in contrast to previous research,

288   respondents in the present study did not have to indicate their beliefs in relation to a future

289   scenario, as the COVID-19 vaccine was already available. This may have led to more accurate

290   responses, as respondents did not have to imagine a hypothetical situation – no vaccines

291   had been approved at the time these earlier studies were conducted - and allowed for a

292   comparison of vaccinated to unvaccinated individuals in relation to their coronavirus

293   conspiracy beliefs. The finding that unvaccinated individuals tended to have higher levels of

294   such beliefs is potentially important for interventions and campaigns addressing COVID-19

295   vaccination uptake, as it indicates that more individuals in the unvaccinated population may

296   hold coronavirus conspiracy beliefs. Furthermore, the role of social media in spreading

297   misinformation about COVID-19 also needs to be considered. In other work, a negative

298   relationship has been found between coronavirus conspiracy beliefs and COVID-19 health-

299   protective behaviours, as well as a positive relationship between such conspiracy beliefs and

300   using social media as a source of information about COVID-19 [30]. Campaigns addressing

301   COVID-19 vaccine uptake should therefore consider using social media to address

302   coronavirus conspiracy beliefs, perhaps using people who are not authority figures and

303   therefore less likely to be perceived as being part of a conspiracy.

304

305   Among the assessed demographic factors, only age emerged as a significant predictor of

306   COVID-19 vaccination intention. The younger respondents were, the higher their intention

307   tended to be. This finding needs to be viewed in light of the fact that younger respondents

308   were more likely to be unvaccinated than the older ones as many of them would not yet

309   have been offered the vaccine. At the time data collection ceased, respondents aged 34 and

310   older were eligible to be vaccinated. Respondents under 34 years of age would usually only

311   have been offered the vaccine if they were part of one of the other priority groups, for

312   example, being deemed clinically vulnerable, or being a frontline health or social care

313   worker [31]. Findings of previous studies in relation to the role of age in COVID-19

314   vaccination intention are mixed [4,6,15,16]. Once the vaccine has been offered across all

315   adult age groups, it would be useful to explore the relationship of age to COVID-19

316 vaccination intention again, as a clearer picture may then emerge, with availability of the

317 vaccine being, at least in principle, the same for individuals of all ages.

318

319 No significant relationship was found between ethnicity and COVID-19 vaccination

320 intention, unlike previous research [4,5,17]. Black, Asian, and minority ethnic (BAME)

321 individuals were not well-represented in the current study, making a comparison difficult

322 and therefore a significant relationship between ethnicity and vaccination intention may not

323 have been detected. The same is the case for religiosity, with the present study failing to

324 detect a relationship with vaccination intention. It is advisable that further research be

325 conducted in this area to ensure that larger numbers of such participants are recruited.

326

327 ***Strengths, Limitations and Future Research***

328 To our knowledge, the present study is the first to assess the influence of PMT, coronavirus

329 conspiracy beliefs and demographic factors on COVID-19 vaccination intention. It offers

330 important insights into potential directions for future research, and highlights issues to

331 consider when devising interventions and campaigns addressing COVID-19 vaccine uptake.

332

333 Some limitations to the present study need to be acknowledged. While power was more

334 than sufficient for the comparison of vaccinated to non-vaccinated respondents, the

335 regression analysis was slightly underpowered to detect a medium effect size. That

336 significant predictors still emerged suggests that the detected associations with COVID-19

337 vaccination intention are likely to be strong. This also means that further research with

338 larger sample sizes would be beneficial.

339

340   The sample in the present study contained a bias towards more highly educated

341   respondents. Although this could have conceivably affected the results, prior UK research

342   has found no association between level of education and COVID-19 vaccination intention

343   [4]. Nevertheless, it would be beneficial to establish whether the present findings hold up

344   using a sample with a more even distribution of level of education. Larger numbers of BAME

345   individuals, as well as religious individuals, should also be included in such research.

346   Furthermore, a more even balance between males and females would be beneficial, as

347   previous studies have found differences between genders in attitudes towards the COVID-

348   19 vaccine [4,15,16].

349

350   While our findings make clear that four of the six PMT constructs as well as coronavirus

351   conspiracy beliefs play a role in COVID-19 vaccination intention, we currently know little

352   about the aetiology of these beliefs, or any other barriers towards vaccination which may be

353   relevant in this context. Qualitative or mixed methods could be employed to examine these

354   beliefs and their origins more closely. This would help devise interventions and campaigns

355   targeting COVID-19 vaccine uptake, ensuring that their effectiveness is maximised.

356

357   **Conclusions**

358   The present study has shown that PMT and coronavirus conspiracy beliefs play an important

359   role in individuals' intention to receive the COVID-19 vaccine. With the possible exception of

360   age, demographic factors do not appear to have any significant influence on this intention.

361   Interventions and health promotion campaigns addressing vaccine uptake should consider

362   employing techniques directed at increasing individuals' perceived severity of COVID-19,

363   their perceived susceptibility to this illness, and their perceived ability to get the vaccine,

364   while decreasing the perceived rewards of not getting vaccinated. Furthermore, conspiracy

365   beliefs should be addressed, as for some who are hesitant towards the vaccine, these may

366   play an important role. No single intervention is likely to be effective [32], and it may take a

367   combination of approaches, tailored to the needs of individuals, to achieve a reduction in

368   COVID-19 vaccine hesitancy.

369

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377

378   **Ethical Standards**

379   The authors assert that all procedures contributing to this work comply with the ethical

380   standards of the relevant national and institutional committees on human experimentation

381   and with the Helsinki Declaration of 1975, as revised in 2008.

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