Systematic Review

Predicting Vaccination Intention against COVID-19 Using Theory of Planned Behavior: A Systematic Review and Meta-Analysis

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Abstract: This study systematically analyzed the literature using the theory of planned behavior (TPB) as a theoretical framework to examine the influence of its constructs on vaccination intention against COVID-19. Quantitative studies were searched in PubMed, CINAHL, Web of Science, and Google Scholar following the PRISMA guidelines. The average rate of COVID-19 vaccination intention was 73.19%, ranging from 31% to 88.86%. Attitude had the strongest association with vaccination intention ($r_+ = 0.487$, 95% CI: 0.368–0.590), followed by subjective norms ($r_+ = 0.409$, 95% CI: 0.300–0.507), and perceived behavioral control ($r_+ = 0.286$, 95% CI: 0.198–0.369). Subgroup analyses showed that the pooled effect sizes of TPB constructs on vaccination intention varied across geographic regions and study populations. Attitude had large effect sizes in Asia, Europe, and Oceania, especially among the adult general population, parents, and patients. Subjective norms had large effect sizes in Asia and Oceania, especially among parents and patients. Perceived behavioral control was the most dominant predictor of vaccination acceptance in Africa among patients. These findings suggest that TPB provides a useful framework for predicting intention to receive a COVID-19 vaccine. Hence, public awareness and educational programs aimed at promoting COVID-19 vaccination intention should consider using TPB as a framework to achieve the goal.

Keywords: vaccination intention; COVID-19; theory of planned behavior; attitude; subjective norms; perceived behavioral control; systematic review; meta-analysis

1. Introduction

The recent COVID-19 pandemic has posed global challenges and a threat to humanity. Hence, in March 2020, the World Health Organization (WHO) declared it a pandemic [1]. Nevertheless, the impact of the pandemic was very distressing; as of 19 September 2022, there were over 609 million confirmed cases of COVID-19 globally, with over 6 million deaths. However, over 12 billion vaccine doses have been administered [2]. Usually, vaccine development takes an average of 10 years; however, in the case of COVID-19, several vaccine candidates entered into clinical trials within 6 months and were conditionally approved in 10 months [3]. More than 287 potential vaccines are being developed, and over 102 clinical trials were recently released [4,5]. According to the WHO, on 22 October 2021, there were 322 vaccine candidates in development. Around 40% were in clinical development (128 vaccine candidates), while 194 were in preclinical development [6]. Despite this success in the development of vaccines, almost one billion people in lower-income countries remain unvaccinated; only 57 countries have vaccinated 70% of their population, and almost all of them are high-income countries [7]. The WHO has a target to reach 70% vaccination coverage as soon as possible, including 100% for those aged over 60 years, health workers, and those with underlying conditions [7]; however, convincing individuals to accept vaccination against COVID-19 remains a major challenge. Similarly,

improving vaccination rates, especially booster vaccination among specific groups such as children, is an immense obstacle in some countries such as China [8].

Vaccine hesitancy, which refers to a delay in the acceptance or a refusal of safe vaccines despite the availability of vaccination services [9], has been the major barrier to COVID-19 vaccine acceptance. Previous studies showed that many people were hesitant to get vaccinated across the world, such as 37.3% in Uganda [10], 64% in Egypt [11], and 23% in the United States [12]. Limbu et al. [13] also reported an overall vaccination hesitancy rate for COVID-19 of 33.23%, with the highest rate in France (60.6%), followed by China (56.4%), South Korea (53.3%), Bangladesh (46.2%), and the United States (43.5%). They also found that vaccine hesitancy was more prevalent among diabetes patients (56.4%), while the lowest vaccine hesitancy was reported among healthcare workers (15%). Vaccine hesitancy is considered one of the greatest threats to the ongoing COVID-19 vaccination programs and to the progress in tackling the disease [9,14]. In order to achieve a higher coverage of the vaccines, it is essential to elicit a positive attitude toward the vaccine amongst individuals and populations [15]. Therefore, it is imperative to identify the causes of refusal/hesitancy and accordingly make suitable interventions [15]; on the other hand, it is essential to identify the factors helping in fostering positive intentions toward the uptake of vaccines. Since vaccination intention, which refers to the intention to take a vaccine when offered [16], is pivotal to the success of vaccination campaigns to attain herd immunity, it is essential to understand the factors influencing COVID-19 vaccination intention.

Prior studies showed that COVID-19 vaccination intention ranged from 67% to 91% across countries such as India, Saudi Arabia, Canada, the United States, and China [17–22]. Various factors are related to willingness to accept the COVID-19 vaccine, including socioeconomic factors [23,24], psychological determinants [25,26], and informational aspects such as the role of availability of information and misinformation on vaccination intention [23–25,27]. Several demographic factors and perception of the disease's risk have been found to be associated with COVID-19 vaccination intention [21,22,28]. People's perceptions of health risk, that they are more susceptible to infection of the disease, that it is a serious threat to their health, and that the vaccine will successfully protect them are more likely to get vaccinated [29]. Similarly, a health provider's recommendation, which is a type of subjective norm, may also impact vaccine uptake [30].

Several theories have been used to predict COVID-19 vaccination intention, including the theory of planned behavior (TPB) [31]. The TPB, proposed by Icek Ajzen as a successor of the theory of reasoned action [32], is one of the best-supported social psychological theories in relation to predicting human behavior in different populations and contexts [33–35]. The TPB holds that behavioral intentions are the outcome of a combination of three factors: attitudes about the behavior, subjective norms (i.e., social influence/pressure on people to perform or not to perform the particular behavior), and perceived behavioral control (i.e., an individual's perception of their ability to perform the behavior). It has been proposed as a theoretical guideline to explain the factors influencing various health behaviors in public health research [36,37]. The basis of the TPB is that we make systematic use of available information and consider the consequences of our actions before engaging in a behavior [38]. With a strong intention to carry out a behavior, a person tends to perform that behavior [38]. According to Ajzen [37], the complexities of the health behaviors can be successfully dealt with by TPB. Hence, the objective of this systematic review and meta-analysis was to analyze the literature using the TPB as a theoretical framework to investigate the role of its constructs in determining the intention to get vaccinated against COVID-19.

2. Previous Systematic Reviews and Meta-Analyses

Several systematic reviews have already been conducted on vaccination intention against COVID-19. These reviews analyzed COVID-19 vaccination intentions across genders [39] and healthcare workers [40], as well as between healthcare workers and the general population [41]. Two studies conducted rapid reviews, a simplified approach to

systematic reviews [42,43]. Some studies performed scoping reviews to explore broad factors such as demographic, social, and contextual factors that influenced the intention to use COVID-19 vaccines [44]. Patwary et al. [45] performed a rapid systematic review and meta-analysis to summarize the COVID-19 vaccine acceptance rates and factors associated with acceptance in low- and lower-middle-income countries. In a scoping review, Willems et al. [46] provided some insight into the factors influencing COVID-19 vaccine hesitancy and the willingness of healthcare workers, including those who care for people with intellectual disabilities. Wang et al. [47] and Chen et al. [48] estimated the COVID-19 vaccine acceptance rate and identified predictors associated with COVID-19 vaccine acceptance. Shakeel et al. [49] conducted a systematic review to examine how and why the rates of COVID-19 vaccine acceptance and hesitancy differ across countries and continents. Sallam et al. [50] conducted a concise narrative review and provided an updated perspective on the status of COVID-19 vaccine acceptance rates worldwide. Roy et al. [51] conducted a systematic review to identify factors influencing COVID-19 vaccine acceptance and refusal intention. Renzi et al. [52] conducted a meta-analysis to explore the prevalence of COVID-19 vaccine acceptance with a specific focus on worldwide geographical differences. Terry et al. [53] conducted a systematic review and meta-analysis of cross-sectional studies to identify factors associated with public intention to receive COVID-19 vaccines until February 2021. Alarcón-Braga et al. [54] performed a systematic review to estimate the prevalence of the intention to vaccinate against COVID-19 in Latin America and the Caribbean and to explore how it varies across different age groups. In conclusion, prior systematic reviews mainly focused on narrow topics and rapid, scoping, or narrative reviews. However, to the best of our knowledge, no systematic review and meta-analysis has reviewed the literature using TPB as a theoretical framework and addressed TPB's utility in predicting vaccination intention against COVID-19.

The current study contributes to the literature in several ways. Firstly, to our knowledge, this study represents the first systematic review and meta-analysis of quantitative studies examining the association between TPB constructs and COVID-19 vaccination intention. Secondly, this review and meta-analysis identifies the occurrence of the TPB constructs that are positively associated with behavioral intention to vaccinate against COVID-19. Furthermore, these results are broken down by year of study, geographical region, and population type. The subgroup meta-analyses are performed to examine the impacts of TPB constructs on vaccination intention across geographic regions and study populations. Thirdly, this study provides an up-to-date and comprehensive review of the latest studies, including articles published in 2022, and those articles covering booster/third-dose vaccination intention. Fourthly, this review and meta-analysis also includes the studies that examined parents' or caregivers' intention to vaccinate their young children against COVID-19. Lastly, we report on the overall vaccination intention rate by types of vaccines (original shots vs. boosters), country and continent, year, and population type.

3. Methodology

For this systematic review and meta-analysis, we followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [55,56]. We searched four databases for articles using the theory of planned behavior to examine COVID-19 vaccination intentions using key terms such as "theory of planned behavior" or "TPB", "COVID-19", "corona virus", "booster shot or dose", "SARS-CoV-2", and "vaccination intention". The search was conducted from 3 January 2022 to 15 August 2022. Full-length papers published during December 2019 and August 2022 were retrieved for analysis.

3.1. Inclusion and Exclusion Criteria

The main inclusion criteria were quantitative studies published in peer-reviewed journals, written in English, that used the TPB as a theoretical basis to examine the associations

between TPB constructs and COVID-19 vaccination intention. We excluded qualitative studies, non-peer-reviewed studies, conference proceedings, and case reports.

3.2. Search Strategy

We conducted a comprehensive search of the published literature using each of the four selected databases: PubMed (National Library of Medicine), Web of Science (Clarivate), CINAHL, and Google Scholar. The combinations of key terms and Boolean operators (AND, OR) that were used to locate studies in each database are presented in Table 1.

Table 1. Search Strategy.

Search	Search Terms (Boolean Operators)
#1	"theory of planned behav*" AND "vaccination intent*" OR vaccine accept*" AND "COVID-19"
#2	"theory of planned behav*" AND "vaccination intent*" OR vaccine accept*" AND "coronavirus"
#3	"theory of planned behav*" AND "vaccination intent*" OR vaccine accept*"AND "SARS-CoV-2"
#4	"theory of planned behav*" AND "vaccin* intent*" OR "vaccin* accept*" AND "COVID-19" OR "coronavirus" OR "SARS-CoV-2"

Two researchers independently screened the titles and abstracts of the identified articles. Non-quantitative studies, and the studies not applying the TPB framework for predicting vaccination intention, were excluded. Full-text articles were obtained for studies whose titles and abstracts met the inclusion criteria. Then these full-text articles were evaluated to confirm if they reported the necessary statistics of TPB constructs with respect to vaccination intention.

PRISMA flow diagram demonstrates the study selection process, the number of records identified, screened, and excluded, and the reasons for exclusion (see Figure 1). A total of 1147 records were retrieved from the electronic databases. Of them, 948 records were removed as duplicates, conference proceedings, qualitative studies, and non-peer-reviewed articles. A total of 104 articles were excluded after screening the abstracts for being irrelevant or not examining the relationships between TPB constructs and vaccination intention. The remaining 95 full-text articles were further assessed for eligibility, and only 43 studies were found eligible for this systematic review and meta-analysis.

3.3. Data Extraction and Analysis

The same two researchers extracted data independently of one another. The following information was extracted from each study: author's name, data collection year, publication year, study objective, study design, participants, sample size, sampling method, measures, statistical analysis techniques, analytical tools, country where the study was conducted, statistics (e.g., effect size, odd ratio, means, and standard deviations), and vaccination rate. We also extracted information on TPB constructs associated with vaccination intention.

Data were analyzed using IBM SPSS Statistics 27 and Comprehensive Meta-Analysis 4.0. First, characteristics of studies included in the review were summarized using frequencies and percentages. Average vaccination intention rates were reported by country, sample, and year of data collection. The prevalence and strengths of TPB constructs that were significantly related to vaccination intention were presented by year, geographical region, and population. The effect size metric reported in this meta-analysis was the sample-weighted average correlation (r_+). The included studies used different types of effect sizes, such as correlation coefficients, multiple regression coefficients, and odds ratios. Odds ratios were converted into correlation coefficients [57]. When a study neither reported the odds ratios nor the correlation coefficients, the reported standardized regression coefficients were used to calculate the effect size [58]. A random effect model was used for the meta-

analyses as the samples in the included studies were heterogeneous [59]. The within-study variation was estimated with a 95% confidence interval (CI) and the between-study variation was estimated with the maximum likelihood estimator for tau (the standard deviation of true effect sizes). The Higgins and Thompsons' [60] I^2 was used to assess heterogeneity. Subgroup analyses on the geographic location (continent) of the study and sample population were conducted to explore the sources of heterogeneity.

Identification

Articles identified through database searching (n=1147)
PubMed ($n = 466$)
Web of Science ($n = 120$)
CINAHL ($n = 111$)
Google Scholar ($n = 450$)

Studies excluded ($n = 948$)
- *Duplicates*
- *Not a quantitative study*
- *Not peer-reviewed studies*
- *Conference proceedings*

Screening

Studies after removal and screening ($n = 199$)

Studies excluded after screening abstracts ($n = 104$)
- *Not relevant studies*
- *Full text not available*
- *Did not examine association between TPB constructs and vaccination intention*

Eligibility

Full text articles accessed for eligibility ($n = 95$)

Papers excluded ($n = 52$)
- *Did not report necessary statistics*
- *Measurement issues*

Selection

Studies included in this systematic review ($n = 43$)

Figure 1. PRISMA flow diagram showing search strategy and study selection process.

4. Results

4.1. Study Characteristics

Forty-three studies were included in this systematic review and meta-analysis. Twenty-six of them were published in 2021, sixteen were published in 2022, and one was published in 2020 (see Table 2). However, most studies (24/43) collected data in 2021, sixteen collected data in 2020, and one collected data in 2022. Nearly half of the studies (21/43) were conducted in Asia, in contrast to nine in North America, nine in Europe, three in Africa, and one in Oceania. However, astonishingly, no study was carried out in South America. This review and meta-analysis included studies from twenty countries, including nine from the United States, nine from China, and three from India. Forty-one studies were cross-sectional

in design. The studies included in this review and meta-analysis consisted of 64,359 respondents, with an average sample size of 1496 respondents (standard deviation = 2380.71), ranging from 69 [61] to 11,141 [62]. The majority of the studies focused on the general adult population (69.8%), followed by patients (9.2%), students (7%), healthcare workers (4.6%), parents (4.7%), and factory workers (4.7%).

4.2. Vaccination Intention Rate

The average rate of COVID-19 vaccination intention was 73.19% (SD = 11.63), ranging from 31% [62] to 88.86% [31]. However, vaccination acceptance for a booster shot was much higher (85.51%, SD = 2.54) than that for the original shot(s) (72.48%, SD = 11.56). The vaccination intention appeared slightly higher in Western countries (74.49%) than in non-Western countries (72.2%). There was no significant difference between US and Chinese adults in vaccination intention (74.28% versus 75.81%). Vaccination acceptance rate slightly increased in 2021 (75.89%) from 2020 (72.61%). Vaccine acceptance was higher among patients (80.4%), followed by students (78.37%), healthcare workers (75.33%), and the general adult population (72.74%). Vaccine acceptance was lower among parents for their children (59.15%).

4.3. TPB Constructs Associated with Vaccine Intention

Table 2 presents the frequency of significant relationships between TPB constructs and COVID-19 vaccination intention. Although all studies included in this systematic review and meta-analysis used the TPB as the theoretical basis, eight studies focused on only one or two of its constructs. Thirty-five studies (81.4%) used the TPB in its entirety. Our results show that people's attitude toward COVID-19 vaccination was the most frequently demonstrated TPB construct influencing vaccination intention in thirty-eight studies (92.68%); however, three studies [63–65] showed an insignificant effect. Two studies did not include it as a predictor. Subjective norms were significantly associated with vaccination intention in thirty studies (78.57%), but the association was not statistically significant in nine studies (21.43%). In one study [66], it was not examined as a determinant. Perceived behavioral control was found to be directly associated with vaccination intention in twenty studies (55.56%); however, surprisingly, the association was not statistically significant in sixteen studies (44.44%). Seven studies did not include it as a model construct. Eight studies tested an extended TPB by incorporating self-efficacy, which was found to be a significant predictor of COVID-19 vaccination intention.

A few studies examined the role of moderators and mediators in the relationships between TPB constructs and vaccination intention. For example, Dou et al. [63] found that the association between attitude and vaccination intention was significantly stronger for Chinese males, whereas the association between subjective norms and vaccination intention was significantly stronger for Chinese females. However, gender difference was not evident in the relationship between perceived behavioral control and vaccination intention. One study [67] surveyed Italians and concluded that the effect of subjective norms on vaccination intention is fully mediated by trust in science. Ekinci et al. [68] showed that the effect of subjective norms on COVID-19 vaccination intention was partially mediated by attitude toward COVID-19 vaccines.

Table 2. Study Characteristics and TPB Constructs Influencing COVID-19 Vaccination Intention.

Author(s)	Year of Publication	Country	Vaccine Intention %	Population	Sample Size	Survey Year	TPB Construct—Vaccination Intention Association		
							ATT	SN	PBC
Almoayad et al. [69]	2022	Saudi Arabia	47.43	adult general population	487	2021	YES	YES	NS
An et al. [70]	2021	Vietnam	77.10	student	854	2021	YES	NS	YES
An et al. [71]	2021	Vietnam	80.50	patient	462	2021	YES	YES	YES
Asmare et al. [72]	2021	Ethiopia	64.90	adult general population	1080	2021	YES	YES	YES
Barattucci et al. [67]	2022	Italy	83.71	adult general population	1095	2021	YES	YES	RNR
Berg and Lin [73]	2021	USA	70.60	adult general population	350	2020	YES	YES	NS
Breslin et al. [74]	2021	Ireland	66.70	adult general population	439	2021	YES	NS	YES
Callow and Callow [31]	2021	USA	88.86	adult general population	583	2020	YES	YES	NS
Chu and Liu [75]	2021	USA	82.10	adult general population	934	2020	YES	YES	NS
Dou et al. [63]	2022	China	73.00	adult general population	405	2021	NS	YES	YES
Drążkowski and Trepanowski [76]	2021	Poland	61.14	adult general population	551	2020	YES	YES	YES
Ekinci et al. [68]	2022	USA	69.90	adult general population	1008	-	YES	YES	RNR
Fan et al. [77]	2021	China	75.86	Student	3145	2021	YES	NS	NS
Goffe et al. [78]	2021	England	62.20	adult general population	1660	2020	YES	YES	NS
Guidry et al. [79]	2021	USA	59.90	adult general population	788	2020	YES	YES	NS
Hagger and Hamilton [80]	2022	USA	-	adult general population	479	2021	YES	YES	YES
Hayashi et al. [81]	2022	USA	-	adult general population	172	2021	YES	NS	YES
Husain et al. [82]	2021	India	71.50	adult general population	400	2021	YES	YES	YES
Irfan et al. [66]	2021	Pakistan	-	adult general population	754	2020	YES	RNR	RNR
Kaida et al. [61]	2022	Canada	79.70	patient	69	2021	YES	YES	RNR
Khayyam et al. [83]	2022	Pakistan	-	healthcare worker	680	2021	YES	YES	YES
Li et al. [62]	2022	Hong Kong	31.00	parent	11141	2022	YES	YES	NS
Mir et al. [84]	2021	India	-	adult general population	254	-	YES	YES	RNR
Ogilvie et al. [85]	2021	Canada	79.80	adult general population	4948	2020	YES	YES	NS
Okai and Abekah-Nkrumah [86]	2022	Ghana	62.70	adult general population	362	2021	YES	NS	RNR
Patwary et al. [64]	2021	Bangladesh	85.00	adult general population	639	2021	NS	NS	NS
Prakash et al. [87]	2022	India	83.54	adult general population	228	2021	YES	YES	NS
Qi et al. [88]	2021	China	80.00	patient	350	2021	RNR	YES	NS
Rosental and Shmueli [89]	2021	Israel	82.15	student	628	2020	YES	NS	NS
Rountree and Prentice [90]	2021	Ireland	70.04	adult general population	1995	2020	YES	YES	RNR
Seddig et al. [91]	2022	Germany	-	adult general population	5044	2021	YES	YES	NS
Servidio et al. [92]	2022	Italy	81.40	patient	276	2021	YES	YES	YES

Table 2. *Cont.*

Author(s)	Year of Publication	Country	Vaccine Intention %	Population	Sample Size	Survey Year	TPB Construct—Vaccination Intention Association		
							ATT	SN	PBC
Shmueli [65]	2021	Israel	80.00	adult general population	398	2020	NS	YES	NS
Sieverding et al. [93]	2022	Germany	76.70	adult general population	1428	2020	YES	YES	YES
Thaker and Ganchoudhuri [94]	2021	New Zealand	82.40	adult general population	650	2021	YES	NS	NS
Twum et al. [95]	2021	Ghana	83.00	adult general population	478	2021	YES	YES	YES
Ullah et al. [96]	2021	Pakistan	59.80	adult general population	1034	2020	YES	YES	YES
Wolff [97]	2021	Norway	76.71	adult general population	1003	2020	YES	YES	YES
Yahaghi et al. [98]	2021	Iran	76.80	adult general population	10843	2021	YES	YES	YES
Zhang et al. [99]	2021	China	66.60	factory worker	2053	2020	YES	YES	YES
Zhang et al. [100]	2020	China	72.60	factory worker	2053	2020	YES	YES	YES
Zhong et al. [101]	2022	China	75.33	nurse	547	2021	YES	YES	YES
Zhou et al. [8]	2022	China	87.30	parent	1602	2021	YES	NS	YES

ATT: attitude; SN: subjective norms; PBC: perceived behavioral control; YES: significant; NS: not significant; RNR: result not reported.

Figures 2–5 display the meta-analytic results and forest plots on the correlations between TPB constructs (including self-efficacy) and vaccination intention, respectively. Attitude had the strongest association with vaccination intention, yielding an average correlation of 0.487 (95% CI: 0.368–0.590). Subject norms had an effect size of 0.409 (95% CI: 0.300–0.507) on vaccination intention. Perceived behavioral control had the smallest effect size of 0.286 (95% CI: 0.198–0.369). Self-efficacy had an overall effect size of 0.301 (95% CI: 0.025–0.534).
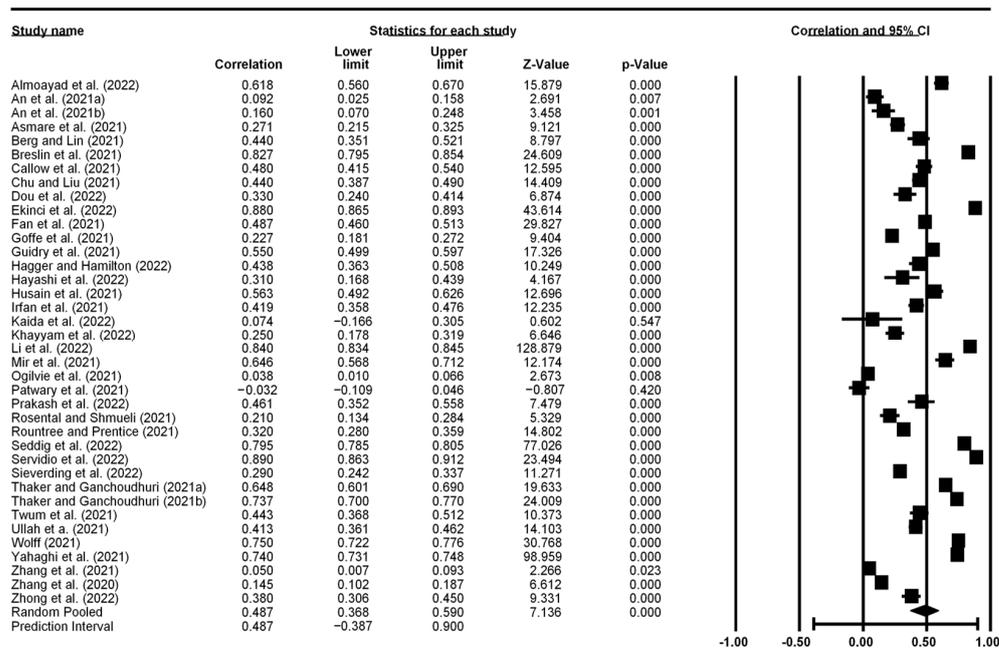

Figure 2. Forest plot showing attitude and vaccination intention correlation.
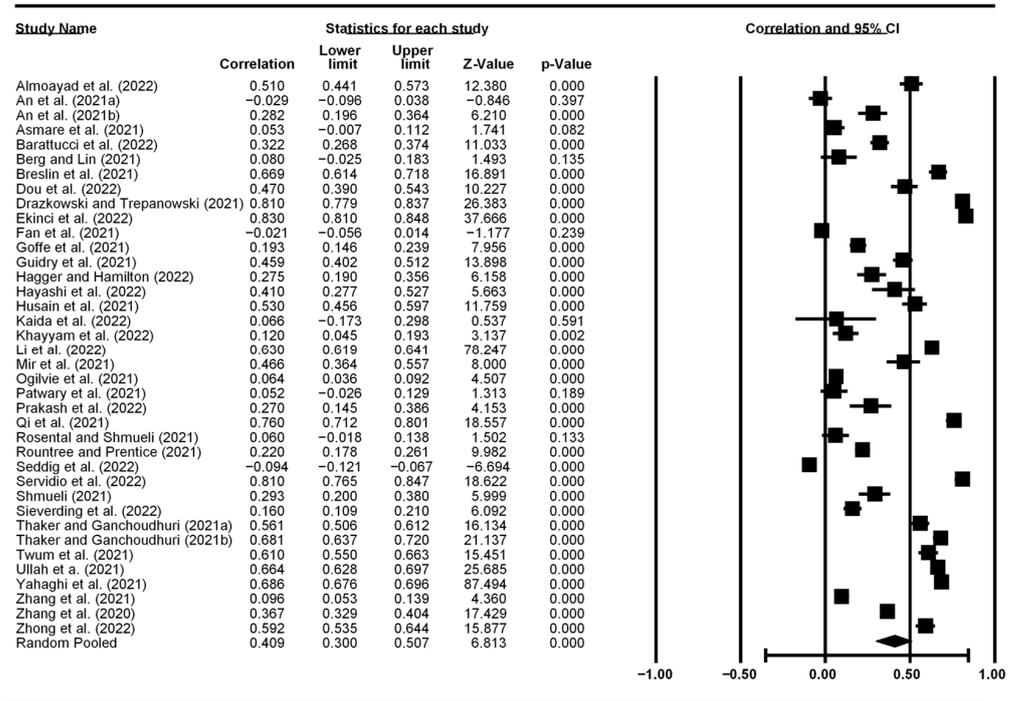
Study Name	Statistics for each study					Correlation and 95% CI
	Correlation	Lower limit	Upper limit	Z-Value	p-Value	
Almoayad et al. (2022)	0.510	0.441	0.573	12.380	0.000	
An et al. (2021a)	−0.029	−0.096	0.038	−0.846	0.397	
An et al. (2021b)	0.282	0.196	0.364	6.210	0.000	
Asmare et al. (2021)	0.053	−0.007	0.112	1.741	0.082	
Barattucci et al. (2022)	0.322	0.268	0.374	11.033	0.000	
Berg and Lin (2021)	0.080	−0.025	0.183	1.493	0.135	
Breslin et al. (2021)	0.669	0.614	0.718	16.891	0.000	
Dou et al. (2022)	0.470	0.390	0.543	10.227	0.000	
Drazkowski and Trepanowski (2021)	0.810	0.779	0.837	26.383	0.000	
Ekinci et al. (2022)	0.830	0.810	0.848	37.666	0.000	
Fan et al. (2021)	−0.021	−0.056	0.014	−1.177	0.239	
Goffe et al. (2021)	0.193	0.146	0.239	7.956	0.000	
Guidry et al. (2021)	0.459	0.402	0.512	13.898	0.000	
Hagger and Hamilton (2022)	0.275	0.190	0.356	6.158	0.000	
Hayashi et al. (2022)	0.410	0.277	0.527	5.663	0.000	
Husain et al. (2021)	0.530	0.456	0.597	11.759	0.000	
Kaida et al. (2022)	0.066	−0.173	0.298	0.537	0.591	
Khayyam et al. (2022)	0.120	0.045	0.193	3.137	0.002	
Li et al. (2022)	0.630	0.619	0.641	78.247	0.000	
Mir et al. (2021)	0.466	0.364	0.557	8.000	0.000	
Ogilvie et al. (2021)	0.064	0.036	0.092	4.507	0.000	
Patwary et al. (2021)	0.052	−0.026	0.129	1.313	0.189	
Prakash et al. (2022)	0.270	0.145	0.386	4.153	0.000	
Qi et al. (2021)	0.760	0.712	0.801	18.557	0.000	
Rosental and Shmueli (2021)	0.060	−0.018	0.138	1.502	0.133	
Rountree and Prentice (2021)	0.220	0.178	0.261	9.982	0.000	
Seddig et al. (2022)	−0.094	−0.121	−0.067	−6.694	0.000	
Servidio et al. (2022)	0.810	0.765	0.847	18.622	0.000	
Shmueli (2021)	0.293	0.200	0.380	5.999	0.000	
Sieverding et al. (2022)	0.160	0.109	0.210	6.092	0.000	
Thaker and Ganchoudhuri (2021a)	0.561	0.506	0.612	16.134	0.000	
Thaker and Ganchoudhuri (2021b)	0.681	0.637	0.720	21.137	0.000	
Twum et al. (2021)	0.610	0.550	0.663	15.451	0.000	
Ullah et a. (2021)	0.664	0.628	0.697	25.685	0.000	
Yahaghi et al. (2021)	0.686	0.676	0.696	87.494	0.000	
Zhang et al. (2021)	0.096	0.053	0.139	4.360	0.000	
Zhang et al. (2020)	0.367	0.329	0.404	17.429	0.000	
Zhong et al. (2022)	0.592	0.535	0.644	15.877	0.000	
Random Pooled	0.409	0.300	0.507	6.813	0.000	

Figure 3. Forest plot showing subjective norms and vaccination intention correlation.

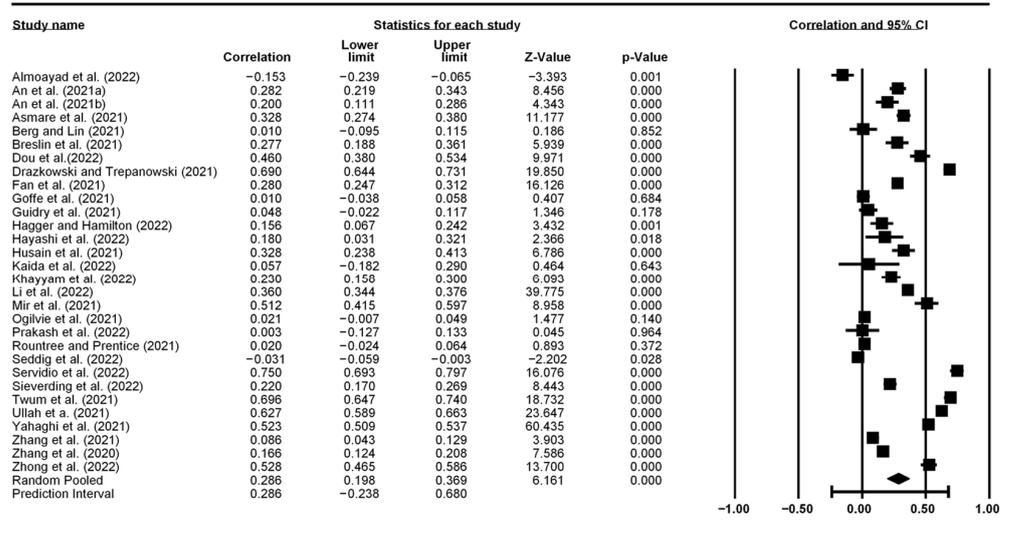| Study name	Statistics for each study					Correlation and 95% CI
	Correlation	Lower limit	Upper limit	Z-Value	p-Value	
Almoayad et al. (2022)	−0.153	−0.239	−0.065	−3.393	0.001	
An et al. (2021a)	0.282	0.219	0.343	8.456	0.000	
An et al. (2021b)	0.200	0.111	0.286	4.343	0.000	
Asmare et al. (2021)	0.328	0.274	0.380	11.177	0.000	
Berg and Lin (2021)	0.010	−0.095	0.115	0.186	0.852	
Breslin et al. (2021)	0.277	0.188	0.361	5.939	0.000	
Dou et al.(2022)	0.460	0.380	0.534	9.971	0.000	
Drazkowski and Trepanowski (2021)	0.690	0.644	0.731	19.850	0.000	
Fan et al. (2021)	0.280	0.247	0.312	16.126	0.000	
Goffe et al. (2021)	0.010	−0.038	0.058	0.407	0.684	
Guidry et al. (2021)	0.048	−0.022	0.117	1.346	0.178	
Hagger and Hamilton (2022)	0.156	0.067	0.242	3.432	0.001	
Hayashi et al. (2022)	0.180	0.031	0.321	2.366	0.018	
Husain et al. (2021)	0.328	0.238	0.413	6.786	0.000	
Kaida et al. (2022)	0.057	−0.182	0.290	0.464	0.643	
Khayyam et al. (2022)	0.230	0.158	0.300	6.093	0.000	
Li et al. (2022)	0.360	0.344	0.376	39.775	0.000	
Mir et al. (2021)	0.512	0.415	0.597	8.958	0.000	
Ogilvie et al. (2021)	0.021	−0.007	0.049	1.477	0.140	
Prakash et al. (2022)	0.003	−0.127	0.133	0.045	0.964	
Rountree and Prentice (2021)	0.020	−0.024	0.064	0.893	0.372	
Seddig et al. (2022)	−0.031	−0.059	−0.003	−2.202	0.028	
Servidio et al. (2022)	0.750	0.693	0.797	16.076	0.000	
Sieverding et al. (2022)	0.220	0.170	0.269	8.443	0.000	
Twum et al. (2021)	0.696	0.647	0.740	18.732	0.000	
Ullah et a. (2021)	0.627	0.589	0.663	23.647	0.000	
Yahaghi et al. (2021)	0.523	0.509	0.537	60.435	0.000	
Zhang et al. (2021)	0.086	0.043	0.129	3.903	0.000	
Zhang et al. (2020)	0.166	0.124	0.208	7.586	0.000	
Zhong et al. (2022)	0.528	0.465	0.586	13.700	0.000	
Random Pooled	0.286	0.198	0.369	6.161	0.000	
Prediction Interval	0.286	−0.238	0.680			

Figure 4. Forest plot showing perceived behavioral control and vaccination intention correlation.

We also performed subgroup analyses to explore the sources of high heterogeneity in the main analyses, in which I^2 exceeded 75% for each effect size, indicating that the subgroups were very heterogeneous [102]. The breakdown of average effect sizes by moderators (geographic region and study population) are presented in Tables 3–5. The pooled effect sizes of TPB constructs on vaccination intention varied across geographic regions and study populations.
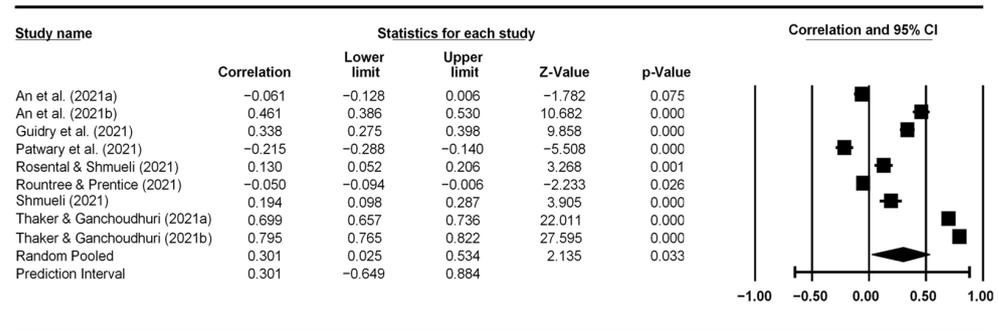
Study name	Statistics for each study					Correlation and 95% CI
	Correlation	Lower limit	Upper limit	Z-Value	p-Value	
An et al. (2021a)	−0.061	−0.128	0.006	−1.782	0.075	
An et al. (2021b)	0.461	0.386	0.530	10.682	0.000	
Guidry et al. (2021)	0.338	0.275	0.398	9.858	0.000	
Patwary et al. (2021)	−0.215	−0.288	−0.140	−5.508	0.000	
Rosental & Shmueli (2021)	0.130	0.052	0.206	3.268	0.001	
Rountree & Prentice (2021)	−0.050	−0.094	−0.006	−2.233	0.026	
Shmueli (2021)	0.194	0.098	0.287	3.905	0.000	
Thaker & Ganchoudhuri (2021a)	0.699	0.657	0.736	22.011	0.000	
Thaker & Ganchoudhuri (2021b)	0.795	0.765	0.822	27.595	0.000	
Random Pooled	0.301	0.025	0.534	2.135	0.033	
Prediction Interval	0.301	−0.649	0.884			

Figure 5. Forest plot showing self-efficacy and vaccination intention correlation.

Table 3. The Meta-analysis Results of Subgroup Analyses (Attitude–Intention).

Group	# of Studies	Effect Size (95% CI)	Z-Value	*p*-Value	Q-Value	*p*-Value	I²
Continent							
Africa	2	0.33 [0.28, 0.37]	13.34	0.00	12.92	0.00	92.26
Asia	18	0.65 [0.64, 0.66]	148.90	0.00	6362.99	0.00	99.73
Europe	7	0.63 [0.62, 0.63]	81.05	0.00	1903.42	0.00	99.68
North America	9	0.34 [0.32, 0.35]	33.65	0.00	1643.74	0.00	99.51
Oceania	2	0.70 [0.67, 0.72]	30.86	0.00	9.57	0.00	89.56
Total within					9932.65	0.00	
Total between					1632.95	0.00	
Population							
Adult general	27	0.58 [0.57, 0.58]	129.28	0.00	5941.28	0.00	99.56
Factory worker	2	0.10 [0.07, 0.13]	6.28	0.00	9.44	0.00	89.41
Healthcare worker	2	0.30 [0.26, 0.36]	11.18	0.00	6.31	0.01	84.15
Parent	1	0.84 [0.83, 0.85]	128.88	0.00	0.00	1.00	0.00
Patient	3	0.53 [0.47, 0.57]	16.54	0.00	290.81	0.00	99.31
Student	3	0.39 [0.36, 0.41]	27.72	0.00	156.97	0.00	98.73
Total within					6404.81	0.00	
Total between					5160.79	0.00	

Table 4. The Meta-analysis Results of Subgroup Analyses (Subjective Norms–Intention).

Group	# of Studies	Effect Size (95% CI)	Z-Value	*p*-Value	Q-Value	*p*-Value	I²
Continent							
Africa	2	0.25 [0.20, 0.29]	10.00	0.00	141.79	0.00	99.29
Asia	19	0.52 [0.51, 0.53]	110.42	0.00	3731.04	0.00	99.52
Europe	8	0.17 [0.16, 0.19]	19.41	0.00	1318.08	0.00	99.47
North America	7	0.27 [0.25, 0.29]	24.25	0.00	1116.75	0.00	99.46
Oceania	2	0.62 [0.59, 0.66]	26.35	0.00	12.51	0.00	92.01
Total within					6320.19	0.00	
Total between					1948.53	0.00	
Population							
Adult general	26	0.41 [0.40, 0.42]	84.38	0.00	5710.76	0.00	99.56
Factory worker	2	0.24 [0.21, 0.26]	15.41	0.00	85.40	0.00	98.83
Healthcare worker	2	0.35 [0.30, 0.40]	12.93	0.00	94.64	0.00	98.94
Parent	1	0.63 [0.62, 0.64]	78.25	0.00	0.00	1.00	0.00
Patient	4	0.59 [0.56, 0.63]	23.37	0.00	183.86	0.00	98.37
Student	3	−0.01 [−0.04, 0.02]	−0.78	0.43	3.75	0.15	46.61
Total within					6078.42	0.00	
Total between					2190.30	0.00	

Table 5. The Meta-analysis Results of Subgroup Analyses (PBC–Intention).

Group	# of Studies	Effect Size (95% CI)	Z-Value	*p*-Value	Q-Value	*p*-Value	I²
Continent							
Africa	2	0.46 [0.42, 0.50]	19.67	0.00	88.76	0.00	98.87
Asia	15	0.38 [0.37, 0.39]	74.76	0.00	1089.85	0.00	98.72
Europe	7	0.09 [0.08, 0.11]	10.06	0.00	663.56	0.00	99.10
North America	6	0.04 [0.01, 0.06]	3.09	0.00	12.08	0.03	58.60
Total within					1854.25	0.00	
Total between					1370.10	0.00	
Population							
Adult general	20	0.27 [0.26, 0.28]	51.13	0.00	2838.61	0.00	99.33
Factory worker	2	0.13 [0.10, 0.16]	8.12	0.00	6.78	0.01	85.25
Healthcare worker	2	0.37 [0.32, 0.42]	13.68	0.00	37.62	0.00	97.34
Parent	1	0.36 [0.34, 0.38]	39.78	0.00	0.00	1.00	0.00
Patient	3	0.43 [0.37, 0.48]	12.83	0.00	112.90	0.00	98.23
Student	2	0.28 [0.25, 0.31]	18.21	0.00	0.00	0.96	0.00
Total within					2995.92	0.00	
Total between					228.44	0.00	

In terms of geographic representation, attitude toward COVID-19 vaccine was a statistically significant predictor of vaccine acceptance in all eighteen studies in a Western context, but only 87% of the studies reported attitude as a significant determinant in a non-Western context. Furthermore, 85% of the Asian studies found a significant positive relationship between attitude and vaccine acceptance, but the association was significant in all studies conducted in North America, Europe, Africa, and Oceania. In sixteen out of nineteen studies (84.2%), subjective norms significantly predicted vaccination intention in Western countries, whereas only 73.9% of the studies (17/23) predicted vaccination intention in non-Western countries. Only 46.7% (7/15) of the studies in a Western setting and 61.9% (13/21) in a non-Western setting found a significant influence of perceived behavioral control on vaccination intention. Perceived behavioral control was found to be a key factor influencing vaccination intention in Africa. Subgroup analyses also revealed that effects of TPB constructs on vaccination intention differed by geographic region. Attitude had large and significant effect sizes on vaccination intention in Asia 0.65 [95% CI: 0.64, 0.66], Europe 0.63 [95% CI: 0.62, 0.63], and Oceania 0.70 [95% CI: 0.67, 0.72]. Subjective norms had large and significant effect sizes on vaccination intention in Asia 0.52 [95% CI: 0.51, 0.53] and Oceania 0.62 [95% CI: 0.59, 0.66]. While perceived behavioral control did not have a large impact in other subgroups, it was a significant predictor of vaccination intention in Africa, with an effect size of 0.46 [95% CI: 0.42, 0.50].

With regard to the study population, attitude predicted intention in all studies, except three studies that surveyed the general adult population [63–65]. Subjective norms were a more frequently demonstrated predictor of vaccination intention among patients (100%), healthcare workers (100%), and factory workers (100%) compared with the general adult population (82.8%). Interestingly, all three studies that surveyed students revealed an insignificant effect [70,77,89]. All studies that surveyed healthcare workers [83,101] and factory workers [99] showed a significant effect of perceived behavioral control on vaccination intention. Subgroup analyses also showed that the pooled effect sizes of TPB constructs on vaccination intention varied across different sample populations (see Tables 3–5). Attitude had large and significant effect sizes on vaccination intention in the adult general population 0.41 [95% CI: 0.40, 0.42], parents 0.84 [95% CI: 0.83, 0.85], and patients 0.53 [95% CI: 0.47, 0.57]. Subjective norms had large and significant effect sizes on vaccination intention in parents 0.63 [95% CI: 0.62, 0.64] and patients 0.59 [95% CI: 0.56, 0.63]. While perceived behavioral control did not have a large impact in other subgroups, it was a significant predictor of vaccination intention in the patient subgroup, with an effect size of 0.43 [95% CI: 0.37, 0.48].

In terms of the study year, attitude was a significant predictor of vaccination intention more frequently in 2021 (93.8%) than in 2020 (90.9%). On the contrary, subjective norms were a dominant predictor of vaccine acceptance in fourteen studies (93.3%) in 2020, but only 66.7% of the studies reported the same in 2021. Similarly, perceived behavioral control was found to influence vaccination intention more frequently in 2021 (66.7%) than in 2020

(42.9%). We also performed meta-regressions for data collection date and vaccination intention; however, none of the results were significant.

Only two studies examined the effects of TPB constructs on vaccination intention for booster shots. All core TPB constructs were statistically significant, positive predictors of booster vaccine intentions among Americans [81]. Zhou et al. [8] examined the predictors of parents' intentions regarding the COVID-19 booster vaccination for their children. Attitude and perceived behavioral control were positively associated with parents' intentions.

Two studies focused on parents' intention to vaccinate their children. Parent's intention was stronger if they had higher levels of positive attitudes toward vaccinating their children and if they reported stronger subjective norms [62]. However, perceived behavioral control was not a significant predictor of vaccination intention. Zhang et al. [99] found that positive attitudes toward COVID-19 vaccination, perceived subjective norm (i.e., the perception that a family member would support them in having their children take up COVID-19 vaccination), and perceived behavioral control to have the children take up COVID-19 vaccination were associated with higher parental acceptability of COVID-19 vaccination.

5. Discussion

Vaccination is recognized as the most successful and cost-effective public health intervention to combat the ongoing COVID-19 pandemic. Furthermore, it has made a significant contribution to improving global health by reducing the incidence and deaths of many infectious diseases [103,104]. Incidentally, despite the availability of vaccines and mass global drive for vaccination, many people remain hesitant to be vaccinated, are less inclined to receive booster shots, or are even less likely to vaccinate their offspring [13]. As a result, several countries, including some African countries, have not yet achieved herd immunity [103]. The World Health Organization also identified vaccine hesitancy as one of the most critical health threats to the successful implementation of any future COVID-19-like vaccination program [105].

Several studies employed the TPB to study behavioral intentions to vaccinate against COVID-19 [65,77,98,106]. From a theoretical perspective, this study was the first systematic review and meta-analysis of quantitative studies that used the TPB as the theoretical framework to examine its constructs contributing to the intention to vaccinate against COVID-19. Our findings suggest that the TPB provides a useful framework for explaining and predicting COVID-19 vaccination intention. Thus, public awareness and educational programs aimed at promoting vaccine acceptance should consider using TPB as a framework with the focus on attitude, subjective norms, perceived behavioral control, and self-efficacy.

Our findings revealed that the COVID-19 vaccination intention rate was relatively high (73.19%). This finding corroborates the previous reviews of Wang et al. [47] and Terry et al. [53], who reported overall vaccine acceptance rates of 73.31% and 73.3%, respectively. Renzi et al. [52] reported a relatively smaller pooled prevalence of COVID-19 vaccination acceptance rate (66%). Alarcón-Braga et al. [54] found a very high vaccination acceptance (78.0%) among the general population in Latin America and the Caribbean. These findings indicate that overall vaccination intention rate remained stable and did not increase from 2020 to 2021. Vaccine acceptance was lower among parents for their children (59.15%). Thus, information campaigns targeted at parents should focus on communicating the safety and efficacy of COVID-19 vaccines.

Our findings demonstrate that attitude was the strongest and most frequently demonstrated TPB construct influencing vaccination intention, followed by subjective norms, and perceived behavioral control. This finding supports previous research [76,80,97]. However, our finding also contradicts other studies [72,95,96,99], in which, among the TPB constructs, perceived behavioral control was the strongest predictor of behavioral intention to vaccinate against COVID-19. However, a few studies reported that subjective norms had a smaller [83,92,96,107] or a larger [98,100,101] effect than other TPB constructs. Interestingly, attitude was the weakest predictor of vaccination intention in four studies [95,99–101]. Future research should further clarify these mixed findings.

Possible explanations for these inconsistent findings are that the strength of associations between TPB constructs and behavioral intention to vaccinate against COVDI-19 may vary across different contexts. For example, our results show that the effects of TPB constructs on vaccination intention vary across geographic regions and study populations. While attitude had large effect sizes in Asia, Europe, and Oceania, especially among the adult general population, parents, and patients, subjective norms had large effect sizes in Asia and Oceania, especially among parents and patients. Perceived behavioral control was found to be a key factor influencing vaccination intention in Africa. Our results also confirm that the association between TPB constructs and vaccination intention varied according to study population. While attitude predicted intention among the general population, subjective norms were a stronger predictor of vaccine acceptance among patients and healthcare workers than the general adult population. Perceived behavioral control was an influential predictor of behavioral intention to vaccinate against COVID-19 among healthcare workers. These findings support a need to create messages tailored to specific target populations. More targeted communication strategies can be developed for the vaccine-hesitant populations.

Another explanation for the conflicting results may be presented in terms of data collection year. Our review revealed that subjective norms were a more dominant predictor of vaccine acceptance in 2020 than in 2021. On the contrary, attitude was a significant predictor of vaccine acceptance more frequently in 2021 than in 2020. Similarly, perceived behavioral control was found to influence vaccination intention more frequently in 2021 than in 2020. Therefore, to increase COVID-19 vaccination, people's belief about the outcomes of vaccination and their perceptions of ability to control factors that hinder vaccination intention should be focused on.

Over half of the studies that examined the association between perceived behavioral control and vaccination intention reported insignificant associations [69,73,91], threatening the TPB's utility in predicting vaccination intention. A possible reason for the insignificant result could be the types of samples used by the studies. For example, perceived behavioral control had no effect among patients [62] and students [70,77]. Another possible explanation might be the geographical differences. Our study shows that the influence of perceived behavioral control was weaker in non-African countries. This warrants further investigation into the effect of perceived behavioral control on vaccination intention.

To sum up, findings from this investigation provide important insights for public health interventions on how to increase the coverage of vaccination, which is essential to reduce the load of DALYs (disability-adjusted life years) due to COVID-19, and to decrease the mortality rate. As a result of the mass vaccination drive, gradually, the world is overcoming the hazardous effect of the recent pandemic of COVID-19; but, the recurrence of similar and even worse pandemic cannot be denied. Hence, this systematic review and meta-analysis will be helpful to the agencies involved in vaccination, as well as prevention and control of pandemics.

Vaccination intention is a complicated and multifaceted phenomenon, as well as a dynamic social process. This entails the existence of cognitive, psychological, sociodemographic, and cultural factors. Our results suggest that all TPB constructs are useful tools in promoting vaccination. However, several studies reported statistically insignificant effects of perceived behavior control and subjective norms on COVID-19 vaccination intention. This indicates that the predictive utility of the TPB may be different depending on various factors, including culture, country, target population, and study context. Our results also show that the impacts of TPB constructs on vaccination intention are determined by geographical differences, study population, and study year. Therefore, governments, policymakers, NGOs, and other stakeholders should consider these factors in developing interventions aimed at enhancing people's positive attitudes toward vaccines, their perceptions of social pressure from their significant others to get vaccinated, and their perceived ability to get vaccines. Effective communication strategies may include encouragement from loved ones and trusted figures such as physicians and religious leaders,

sharing personal stories, and peer pressure. Minority, lower-income, and less-educated individuals are disproportionately more susceptible to COVID-19 [107,108]. They also have lower acceptance, which requires special attention, addressing the effect of their chronic distrust of health authorities in order to confront the vicious cycle of skepticism. In policy planning to combat the pandemic, caution should be taken in interpreting and using the results, since intention or survey responses may not directly predict future behavior [109]. Moreover, opinions may change, especially amid the raging pandemic. Reported clinical trials incidents or outcomes and subsequent introductions of vaccines or new treatments would further change people's minds about getting vaccinated. Hence, policymakers must review their strategy in definite intervals. Since several factors affect individuals' decision to accept a COVID-19 vaccine, a holistic educational approach to improve confidence in the COVID-19 vaccine should be implemented. Moreover, policymakers should develop and implement targeted education for people with a low level of knowledge that are designed to increase their self-efficacy (i.e., confidence in their ability to receive the vaccines or to overcome vaccination barriers). This study reveals that there exist noticeable psychological, demographic, and geographical disparities in vaccine acceptance. Hence, a country- and population-specific strategy is required for successful mass vaccination drive and to attain herd immunity.

This systematic review and meta-analysis identified several important areas for future research. First, nearly one-fifth of the studies (18.6%) included in this study focused on only one or two of the TPB constructs. Moreover, only three studies [63,73,78] examined the role of moderators and mediators in the relationships between TPB constructs and COVID-19 vaccination intention. Thus, future studies should consider extending the TPB model by incorporating various factors such as mediators, moderators, covariates, and confounders. Second, the studies included in this systematic review and meta-analysis were conducted only in twenty countries, mostly in developed or emerging nations, which focused on the general adult population, patients, students, healthcare workers, parents, and factory workers. Hence, future studies should examine the applicability of the TPB model in predicting vaccine acceptance using diverse samples from understudied countries. Third, our systematic review and meta-analysis also showed that only two studies investigated parental acceptance of COVID-19 vaccination for their children. Hence, more research is needed to understand the applicability of the TPB model for understanding parental vaccine acceptance. Fourth, a vast majority of the studies included in our study were cross-sectional in design. In addition, only two studies [8,80] investigated the associations between TPB constructs and COVID-19 vaccine acceptance for booster shots. Therefore, more longitudinal studies are needed to gain a better understanding of how TPB predicts vaccination intention over time. Finally, the subgroup meta-analytic results of the current study need to be interpreted with caution as the percentage of variability attributed to heterogeneity for most subgroups remained high, indicating that the samples in the included studies were heterogeneous. Therefore, future studies should consider performing subgroup analyses or meta-regression analyses by incorporating other moderating variables.

6. Conclusions

This systematic and meta-analytic review represents an initial attempt to analyze the literature using the TPB as a theoretical model to examine the influence of TPB constructs on vaccination intention against COVID-19. Attitude was the strongest predictor of vaccination intention, followed by subjective norms and perceived behavioral control. However, the effects of these TPB constructs on behavioral intention to vaccinate against COVID-19 were moderated by geographic region and study population. These findings provide important insights for developing health education messages to promote acceptance of vaccination against COVID-19.

References

1. World Health Organization. WHO Director-General's Opening Remarks at the Media Briefing on COVID-19. 11 March 2020. Available online: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020 (accessed on 30 December 2021).
2. World Health Organization. WHO Coronavirus (COVID-19) Dashboard. Available online: https://covid19.who.int/ (accessed on 25 September 2022).
3. Li, Y.; Tenchov, R.; Smoot, J.; Liu, C.; Watkins, S.; Zhou, Q. A comprehensive review of the global efforts on COVID-19 vaccine development. *ACS Cent. Sci.* **2021**, *7*, 512–533. [CrossRef] [PubMed]
4. Lurie, N.; Saville, M.; Hatchett, R.; Halton, J. Developing Covid-19 vaccines at pandemic speed. *N. Engl. J. Med.* **2020**, *382*, 1969–1973. [CrossRef]
5. World Health Organization. DRAFT Landscape of COVID-19 Candidate Vaccine. 22 January. 2021. Available online: https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines (accessed on 22 January 2021).
6. Hadj Hassine, I. Covid-19 vaccines and variants of concern: A review. *Rev. Med. Virol.* **2022**, *32*, e2313. [CrossRef] [PubMed]
7. World Health Organization. WHO Coronavirus (COVID-19) Dashboard. Available online: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines (accessed on 25 September 2022).
8. Zhou, M.; Liu, L.; Gu, S.Y.; Peng, X.Q.; Zhang, C.; Wu, Q.F.; Xu, X.P.; You, H. Behavioral Intention and Its Predictors toward COVID-19 Booster Vaccination among Chinese Parents: Applying Two Behavioral Theories. *Int. J. Environ. Res. Public Health* **2022**, *19*, 7520. [CrossRef] [PubMed]
9. MacDonald, N.E. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* **2015**, *33*, 4161–4164. [CrossRef]
10. Kanyike, A.M.; Olum, R.; Kajjimu, J.; Ojilong, D.; Akech, G.M.; Nassozi, D.R.; Agira, D.; Wamala, N.K.; Asiimwe, A.; Matovu, D.; et al. Acceptance of the coronavirus disease-2019 vaccine among medical students in Uganda. *Trop. Med. Health* **2021**, *49*, 37. [CrossRef]
11. Saied, S.M.; Saied, E.M.; Kabbash, I.A.; Abdo, S.A.E. Vaccine hesitancy: Beliefs and barriers associated with COVID-19 vaccination among Egyptian medical students. *J. Med. Virol.* **2021**, *25*, 19. [CrossRef]
12. Lucia, V.C.; Kelekar, A.; Afonso, N.M. COVID-19 vaccine hesitancy among medical students. *J. Public Health* **2021**, *43*, 445–449. [CrossRef]
13. Limbu, Y.B.; Gautam, R.K.; Pham, L. The Health Belief Model Applied to COVID-19 Vaccine Hesitancy: A Systematic Review. *Vaccines* **2022**, *10*, 973. [CrossRef]
14. Khiri, N.M. Vaccine hesitancy among communities in ten countries in Asia, Africa, and South America during the COVID-19 pandemic. *Pathog. Glob. Health* **2022**, *116*, 236–243. [CrossRef]
15. Alam, M.M.; Melhim, L.K.; Ahmad, M.T.; Jemmali, M. Public Attitude towards COVID-19 Vaccination: Validation of COVID-Vaccination Attitude Scale (C-VAS). *J. Multidiscip. Healthc.* **2022**, *15*, 941. [CrossRef] [PubMed]
16. Gates, A.; Gates, M.; Rahman, S.; Guitard, S.; MacGregor, T.; Pillay, J.; Ismail, S.J.; Tunis, M.C.; Young, K.; Hardy, K.; et al. A systematic review of factors that influence the acceptability of vaccines among Canadians. *Vaccine* **2021**, *39*, 222–236. [CrossRef]
17. Sharun, K.; Rahman, C.F.; Haritha, C.V.; Jose, B.; Tiwari, R.; Dhama, K. Covid-19 vaccine acceptance: Beliefs and barriers associated with vaccination among the general population in India. *J. Exp. Biol. Agric. Sci.* **2020**, *8*, 210–218. [CrossRef]
18. Reiter, P.L.; Pennell, M.L.; Katz, M.L. Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? *Vaccine* **2020**, *38*, 6500–6507. [CrossRef]
19. Taylor, S.; Landry, C.A.; Paluszek, M.M.; Groenewoud, R.; Rachor, G.S.; Asmundson, G.J. A proactive approach for managing COVID-19: The importance of understanding the motivational roots of vaccination hesitancy for SARS-CoV2. *Front. Psychol.* **2020**, *11*, 575950. [CrossRef]
20. Harapan, H.; Wagner, A.L.; Yufika, A.; Winardi, W.; Sofyan, H.; Mudatsir, M. Acceptance of a COVID-19 vaccine in Southeast Asia: A cross-sectional study in Indonesia. *Front. Public Health* **2020**, *8*, 381. [CrossRef] [PubMed]

21. Al-mohaithef, M.; Padhi, B.K. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: A web-based National Survey. *J. Multidiscip. Healthc.* **2020**, *13*, 1657–1663. [CrossRef]

22. Wang, J.; Jing, R.; Lai, X.; Zhang, H.; Lyu, Y.; Knoll, M.D.; Fang, H. Acceptance of COVID-19 vaccination during the COVID-19 pandemic in China. *Vaccines* **2020**, *8*, 482. [CrossRef]

23. Chadwick, A.; Kaiser, J.; Vaccari, C.; Freeman, D.; Lambe, S.; Loe, B.S.; Vanderslott, S.; Lewandowsky, S.; Conroy, M.; Ross, A.R.; et al. Online social endorsement and Covid-19 vaccine hesitancy in the United Kingdom. *Soc. Media+ Soc.* **2021**, *7*, 20563051211008817. [CrossRef]

24. Allington, D.; McAndrew, S.; Moxham-Hall, V.; Duffy, B. Coronavirus conspiracy suspicions, general vaccine attitudes, trust and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic. *Psychol. Med.* **2021**, *12*, 1–2. [CrossRef]

25. Murphy, J.; Vallières, F.; Bentall, R.P.; Shevlin, M.; McBride, O.; Hartman, T.K.; McKay, R.; Bennett, K.; Mason, L.; Gibson-Miller, J.; et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat. Commun.* **2021**, *12*, 29. [CrossRef] [PubMed]

26. Barello, S.; Palamenghi, L.; Graffigna, G. Looking inside the "black box" of vaccine hesitancy: Unlocking the effect of psychological attitudes and beliefs on COVID-19 vaccine acceptance and implications for public health communication. *Psychol. Med.* **2021**, 1–2. [CrossRef]

27. Mannan, D.K.; Farhana, K.M. Knowledge, attitude and acceptance of a COVID-19 vaccine: A global cross-sectional study. *Int. Res. J. Bus. Soc. Sci.* **2020**, *7*, 4. [CrossRef]

28. Fisher, K.A.; Bloomstone, S.J.; Walder, J.; Crawford, S.; Fouayzi, H.; Mazor, K.M. Attitudes toward a potential SARS-CoV-2 vaccine: A survey of US adults. *Ann. Intern. Med.* **2020**, *173*, 964–973. [CrossRef]

29. Corace, K.M.; Srigley, J.A.; Hargadon, D.P.; Yu, D.; MacDonald, T.K.; Fabrigar, L.R.; Garber, G.E. Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review. *Vaccine* **2016**, *34*, 3235–3242. [CrossRef]

30. Rosenthal, S.L.; Weiss, T.W.; Zimet, G.D.; Ma, L.; Good, M.B.; Vichnin, M.D. Predictors of HPV vaccine uptake among women aged 19–26: Importance of a physician's recommendation. *Vaccine* **2011**, *29*, 890–895. [CrossRef]

31. Callow, M.A.; Callow, D.D. Older adults' behavior intentions once a COVID-19 vaccine becomes available. *J. Appl. Gerontol.* **2021**, *40*, 943–952. [CrossRef] [PubMed]

32. Ajzen, I.; Fishbein, M. Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychol. Bull.* **1977**, *84*, 888–918. [CrossRef]

33. Lutz, S. The theory of planned behaviour and the impact of past behavior. *Int. Bus. Econ. Res. J.* **2011**, *10*, 91–110.

34. Lu, W.; Yuan, L.; Xu, J.; Xue, F.; Zhao, B.; Webster, C. The psychological effects of quarantine during COVID-19 outbreak: Sentiment analysis of social media data. *medRxiv* **2020**. [CrossRef]

35. Adiyoso, W.; Wilopo, W. Social distancing intentions to reduce the spread of COVID-19: The extended theory of planned behavior. *Res. Sq.* **2020**. [CrossRef]

36. Rosenstock, I.M.; Strecher, V.J.; Becker, M.H. Social learning theory and the health belief model. *Health Educ. Q.* **1988**, *15*, 175–183. [CrossRef] [PubMed]

37. Ajzen, I. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* **1991**, *50*, 179–211. [CrossRef]

38. Ko, N.Y.; Feng, M.C.; Chiu, D.Y.; Wu, M.H.; Feng, J.Y.; Pan, S.M. Applying theory of planned behavior to predict nurses' intention and volunteering to care for SARS patients in southern Taiwan. *Kaohsiung J. Med. Sci.* **2004**, *20*, 389–398. [CrossRef] [PubMed]

39. Zintel, S.; Flock, C.; Arbogast, A.L.; Forster, A.; von Wagner, C.; Sieverding, M. Gender differences in the intention to get vaccinated against COVID-19: A systematic review and meta-analysis. *Z. Gesundh. Wiss.* **2022**, *7*, 1–25. [CrossRef] [PubMed]

40. Galanis, P.A.; Vraka, I.; Fragkou, D.; Bilali, A.; Kaitelidou, D. Intention of health care workers to accept COVID-19 vaccination and related factors: A systematic review and meta-analysis. *medRxiv* **2020**. [CrossRef]

41. Al-Amer, R.; Maneze, D.; Everett, B.; Montayre, J.; Villarosa, A.R.; Dwekat, E.; Salamonson, Y. COVID-19 vaccination intention in the first year of the pandemic: A systematic review. *J. Clin. Nurs.* **2022**, *31*, 62–86. [CrossRef]

42. Lin, C.; Tu, P.; Beitsch, L.M. Confidence and receptivity for COVID-19 vaccines: A rapid systematic review. *Vaccines* **2021**, *9*, 16. [CrossRef]

43. Wang, Y.; Liu, Y. Multilevel determinants of COVID-19 vaccination hesitancy in the United States: A rapid systematic review. *Prev. Med. Rep.* **2021**, *16*, 101673. [CrossRef]

44. AlShurman, B.A.; Khan, A.F.; Mac, C.; Majeed, M.; Butt, Z.A. What demographic, social, and contextual factors influence the intention to use COVID-19 vaccines: A scoping review. *Int. J. Environ. Res. Public Health* **2021**, *18*, 9342. [CrossRef]

45. Patwary, M.M.; Alam, M.A.; Bardhan, M.; Disha, A.S.; Haque, M.Z.; Billah, S.M.; Kabir, M.P.; Browning, M.H.; Rahman, M.M.; Parsa, A.D.; et al. COVID-19 Vaccine Acceptance among Low-and Lower-Middle-Income Countries: A Rapid Systematic Review and Meta-Analysis. *Vaccines* **2022**, *11*, 427. [CrossRef] [PubMed]

46. Willems, L.D.; Dyzel, V.; Sterkenburg, P.S. COVID-19 Vaccination Intentions amongst Healthcare Workers: A Scoping Review. *Int. J. Environ. Res. Public Health* **2022**, *19*, 10192. [CrossRef] [PubMed]

47. Wang, Q.; Yang, L.; Jin, H.; Lin, L. Vaccination against COVID-19: A systematic review and meta-analysis of acceptability and its predictors. *Prev. Med.* **2021**, *150*, 106694. [CrossRef] [PubMed]

48. Chen, F.; He, Y.; Shi, Y. Parents' and guardians' willingness to vaccinate their children against COVID-19: A systematic review and meta-analysis. *Vaccines* **2022**, *10*, 179. [CrossRef] [PubMed]

49. Shakeel, C.S.; Mujeeb, A.A.; Mirza, M.S.; Chaudhry, B.; Khan, S.J. Global COVID-19 vaccine acceptance: A systematic review of associated social and behavioral factors. *Vaccines* **2022**, *10*, 110. [CrossRef]

50. Sallam, M.; Al-Sanafi, M.; Sallam, M. A global map of COVID-19 vaccine acceptance rates per country: An updated concise narrative review. *J. Multidiscip. Healthc.* **2022**, *15*, 21. [CrossRef]

51. Roy, D.N.; Biswas, M.; Islam, E.; Azam, M.S. Potential factors influencing COVID-19 vaccine acceptance and hesitancy: A systematic review. *PLoS ONE* **2022**, *17*, e0265496. [CrossRef]

52. Renzi, E.; Baccolini, V.; Migliara, G.; Bellotta, C.; Ceparano, M.; Donia, P.; Marzuillo, C.; De Vito, C.; Villari, P.; Massimi, A. Mapping the Prevalence of COVID-19 Vaccine Acceptance at the Global and Regional Level: A Systematic Review and Meta-Analysis. *Vaccines* **2022**, *10*, 1488. [CrossRef]

53. Terry, E.; Cartledge, S.; Damery, S.; Greenfield, S. Factors associated with COVID-19 vaccine intentions during the COVID-19 pandemic; a systematic review and meta-analysis of cross-sectional studies. *BMC Public Health* **2022**, *22*, 1667. [CrossRef]

54. Alarcón-Braga, E.A.; Hernandez-Bustamante, E.A.; Salazar-Valdivia, F.E.; Valdez-Cornejo, V.A.; Mosquera-Rojas, M.D.; Ulloque-Badaracco, J.R.; Rondon-Saldaña, J.C.; Zafra-Tanaka, J.H. Acceptance towards Covid-19 vaccination in Latin America and the Caribbean: A systematic review and meta-analysis. *Travel Med. Infect. Dis.* **2022**, *49*, 102369. [CrossRef]

55. Liberati, A.; Altman, D.G.; Tetzlaff, J.; Mulrow, C.; Gøtzsche, P.C.; Ioannidis, J.P.; Clarke, M.; Devereaux, P.J.; Kleijnen, J.; Moher, D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *J. Clin. Epidemiol.* **2009**, *62*, e1–e34. [CrossRef] [PubMed]

56. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Moher, D. Updating guidance for reporting systematic reviews: Development of the PRISMA 2020 statement. *J. Clin. Epidemiol.* **2021**, *1*, 103–112. [CrossRef] [PubMed]

57. Borenstein, M.; Hedges, L.V.; Higgins, J.P.T.; Rothstein, H.R. *Introduction to Meta-Analysis*; Wiley: Chichester, UK, 2009.

58. Peterson, R.A.; Brown, S.P. On the use of beta coefficients in meta-analysis. *J. Appl. Psychol.* **2005**, *90*, 175–181. [CrossRef]

59. Field, A.P.; Gillett, R. How to do a meta-analysis. *Br. J. Math. Stat. Psychol.* **2010**, *63*, 665–694. [CrossRef]

60. Higgins, J.P.; Thompson, S.G. Quantifying heterogeneity in a meta-analysis. *Stat. Med.* **2002**, *21*, 1539–1558. [CrossRef] [PubMed]

61. Kaida, A.; Brotto, L.A.; Murray, M.; Côté, H.C.; Albert, A.Y.; Nicholson, V.; Gormley, R.; Gordon, S.; Booth, A.; Smith, L.W.; et al. Intention to receive a COVID-19 vaccine by HIV status among a population-based sample of women and gender diverse individuals in British Columbia, Canada. *AIDS Behav.* **2022**, *26*, 2242–2255. [CrossRef] [PubMed]

62. Li, J.B.; Lau, E.Y.H.; Chan, D.K.C. Why do Hong Kong parents have low intention to vaccinate their children against COVID-19? Testing health belief model and theory of planned behavior in a large-scale survey. *Vaccine* **2022**, *40*, 2772–2780. [CrossRef] [PubMed]

63. Dou, K.; Yang, J.; Wang, L.X.; Li, J.B. Theory of planned behavior explains males' and females' intention to receive COVID-19 vaccines differently. *Hum. Vaccines Immunother.* **2022**, *18*, 2086393. [CrossRef]

64. Patwary, M.M.; Bardhan, M.; Disha, A.S.; Hasan, M.; Haque, M.Z.; Sultana, R.; Hossain, M.R.; Browning, M.H.; Alam, M.A.; Sallam, M. Determinants of COVID-19 vaccine acceptance among the adult population of Bangladesh using the health belief model and the theory of planned behavior model. *Vaccines* **2021**, *9*, 1393. [CrossRef]

65. Shmueli, L. Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health* **2021**, *21*, 804. [CrossRef]

66. Irfan, M.; Shahid, A.L.; Ahmad, M.; Iqbal, W.; Elavarasan, R.M.; Ren, S.; Hussain, A. Assessment of public intention to get vaccination against COVID-19: Evidence from a developing country. *J. Eval. Clin. Pract.* **2022**, *28*, 63–73. [CrossRef] [PubMed]

67. Barattucci, M.; Pagliaro, S.; Ballone, C.; Teresi, M.; Consoli, C.; Garofalo, A.; De Giorgio, A.; Ramaci, T. Trust in Science as a Possible Mediator between Different Antecedents and COVID-19 Booster Vaccination Intention: An Integration of Health Belief Model (HBM) and Theory of Planned Behavior (TPB). *Vaccines* **2022**, *10*, 1099. [CrossRef] [PubMed]

68. Ekinci, Y.; Gursoy, D.; Can, A.S.; Williams, N.L. Does travel desire influence COVID-19 vaccination intentions? *J. Hosp. Mark. Manag.* **2022**, *31*, 413–430. [CrossRef]

69. Almoayad, F.; Bin-Amer, L.A.; Althubyani, N.T.; Alajmi, S.M.; Alshammari, A.A.; Alsuwayal, R.A. The general public's intent to receive a COVID-19 vaccine in Saudi Arabia. *Int. J. Health Promot. Educ.* **2022**, 1–16. [CrossRef]

70. An, P.L.; Nguyen, H.; Nguyen, D.D.; Vo, L.Y.; Huynh, G. The intention to get a COVID-19 vaccine among the students of health science in Vietnam. *Hum. Vaccines Immunother.* **2021**, *17*, 4823–4828. [CrossRef]

71. An, P.L.; Nguyen, H.T.N.; Dang, H.T.B.; Huynh, Q.N.H.; Pham, B.D.U.; Huynh, G. Integrating Health Behavior Theories to Predict Intention to Get a COVID-19 Vaccine. *Health Serv. Insights* **2021**, *14*, 11786329211060130. [CrossRef]

72. Asmare, G.; Abebe, K.; Atnafu, N.; Asnake, G.; Yeshambel, A.; Alem, E.; Chekol, E.; Asmamaw, T. Behavioral intention and its predictors toward COVID-19 vaccination among people most at risk of exposure in Ethiopia: Applying the theory of planned behavior model. *Hum. Vaccines Immunother.* **2021**, *17*, 4838–4845. [CrossRef]

73. Berg, M.B.; Lin, L. Predictors of COVID-19 vaccine intentions in the United States: The role of psychosocial health constructs and demographic factors. *Transl. Behav. Med.* **2021**, *11*, 1782–1788. [CrossRef]

74. Breslin, G.; Dempster, M.; Berry, E.; Cavanagh, M.; Armstrong, N.C. COVID-19 vaccine uptake and hesitancy survey in Northern Ireland and Republic of Ireland: Applying the theory of planned behaviour. *PLoS ONE* **2021**, *16*, e0259381. [CrossRef]

75.　Chu, H.; Liu, S. Integrating health behavior theories to predict American's intention to receive a COVID-19 vaccine. *Patient Educ. Couns.* **2021**, *104*, 1878–1886. [CrossRef]

76.　Drążkowski, D.; Trepanowski, R. Reactance and perceived disease severity as determinants of COVID-19 vaccination intention: An application of the theory of planned behavior. *Psychol. Health Med.* **2022**, *27*, 2171–2178. [CrossRef] [PubMed]

77.　Fan, C.W.; Chen, I.H.; Ko, N.Y.; Yen, C.F.; Lin, C.Y.; Griffiths, M.D.; Pakpour, A.H. Extended theory of planned behavior in explaining the intention to COVID-19 vaccination uptake among mainland Chinese university students: An online survey study. *Hum. Vaccines Immunother.* **2021**, *17*, 3413–3420. [CrossRef]

78.　Goffe, L.; Antonopoulou, V.; Meyer, C.J.; Graham, F.; Tang, M.Y.; Lecouturier, J.; Grimani, A.; Bambra, C.; Kelly, M.P.; Sniehotta, F.F. Factors associated with vaccine intention in adults living in England who either did not want or had not yet decided to be vaccinated against COVID-19. *Hum. Vaccines Immunother.* **2021**, *17*, 5242–5254. [CrossRef] [PubMed]

79.　Guidry, J.P.; Laestadius, L.I.; Vraga, E.K.; Miller, C.A.; Perrin, P.B.; Burton, C.W.; Ryan, M.; Fuemmeler, B.F.; Carlyle, K.E. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am. J. Infect. Control* **2021**, *49*, 137–142. [CrossRef] [PubMed]

80.　Hagger, M.S.; Hamilton, K. Predicting COVID-19 booster vaccine intentions. *Appl. Psychol. Health Well-Being* **2022**, *14*, 819–841. [CrossRef]

81.　Hayashi, Y.; Romanowich, P.; Hantula, D.A. Predicting Intention to Take a COVID-19 Vaccine in the United States: Application and Extension of Theory of Planned Behavior. *Am. J. Health Promot.* **2022**, *36*, 710–713. [CrossRef]

82.　Husain, F.; Shahnawaz, M.G.; Khan, N.H.; Parveen, H.; Savani, K. Intention to get COVID-19 vaccines: Exploring the role of attitudes, subjective norms, perceived behavioral control, belief in COVID-19 misinformation, and vaccine confidence in Northern India. *Hum. Vaccines Immunother.* **2021**, *17*, 3941–3953. [CrossRef]

83.　Khayyam, M.; Chuanmin, S.; Salim, M.A.; Nizami, A.; Ali, J.; Ali, H.; Khan, N.; Ihtisham, M.; Anjum, R. COVID-19 Vaccination Behavior Among Frontline Healthcare Workers in Pakistan: The Theory of Planned Behavior, Perceived Susceptibility, and Anticipated Regret. *Front. Psychol.* **2022**, *13*, 808338. [CrossRef]

84.　Mir, H.H.; Parveen, S.; Mullick, N.H.; Nabi, S. Using structural equation modeling to predict Indian people's attitudes and intentions towards COVID-19 vaccination. *Diabetes Metab. Syndr. Clin. Res. Rev.* **2021**, *15*, 1017–1022. [CrossRef]

85.　Ogilvie, G.S.; Gordon, S.; Smith, L.W.; Albert, A.; Racey, C.S.; Booth, A.; Gottschlich, A.; Goldfarb, D.; Murray, M.; Galea, L.A.; et al. Intention to receive a COVID-19 vaccine: Results from a population-based survey in Canada. *BMC Public Health* **2021**, *21*, 1017. [CrossRef]

86.　Okai, G.A.; Abekah-Nkrumah, G. The level and determinants of COVID-19 vaccine acceptance in Ghana. *PLoS ONE* **2022**, *17*, e0270768. [CrossRef] [PubMed]

87.　Prakash, A.; Jeyakumar Nathan, R.; Kini, S.; Victor, V. Message framing and COVID-19 vaccine acceptance among millennials in South India. *PLoS ONE* **2022**, *17*, e0269487. [CrossRef] [PubMed]

88.　Qi, L.; Yang, L.; Ge, J.; Yu, L.; Li, X. COVID-19 Vaccination Behavior of People Living with HIV: The Mediating Role of Perceived Risk and Vaccination Intention. *Vaccines* **2021**, *9*, 1288. [CrossRef]

89.　Rosental, H.; Shmueli, L. Integrating health behavior theories to predict COVID-19 vaccine acceptance: Differences between medical students and nursing students. *Vaccines* **2021**, *9*, 783. [CrossRef] [PubMed]

90.　Rountree, C.; Prentice, G. Segmentation of intentions towards COVID-19 vaccine acceptance through political and health behaviour explanatory models. *Ir. J. Med. Sci.* **2022**, *191*, 2369–2383. [CrossRef]

91.　Seddig, D.; Maskileyson, D.; Davidov, E.; Ajzen, I.; Schmidt, P. Correlates of COVID-19 vaccination intentions: Attitudes, institutional trust, fear, conspiracy beliefs, and vaccine skepticism. *Soc. Sci. Med.* **2022**, *302*, 114981. [CrossRef]

92.　Servidio, R.; Malvaso, A.; Vizza, D.; Valente, M.; Campagna, M.R.; Iacono, M.L.; Martin, L.R.; Bruno, F. The intention to get COVID-19 vaccine and vaccine uptake among cancer patients: An extension of the theory of planned behaviour (TPB). *Support. Care Cancer* **2022**, *30*, 7973–7982. [CrossRef]

93.　Sieverding, M.; Zintel, S.; Schmidt, L.; Arbogast, A.L.; von Wagner, C. Explaining the intention to get vaccinated against COVID-19: General attitudes towards vaccination and predictors from health behavior theories. *Psychol. Health Med.* **2022**, 1–10. [CrossRef]

94.　Thaker, J.; Ganchoudhuri, S. The role of attitudes, norms, and efficacy on shifting COVID-19 vaccine Intentions: A longitudinal study of COVID-19 vaccination intentions in New Zealand. *Vaccines* **2021**, *9*, 1132. [CrossRef]

95.　Twum, K.K.; Ofori, D.; Agyapong, G.K.Q.; Yalley, A.A. Intention to vaccinate against COVID-19: A social marketing perspective using the theory of planned behaviour and health belief model. *J. Soc. Mark.* **2021**, *11*, 549–574. [CrossRef]

96.　Ullah, I.; Lin, C.Y.; Malik, N.I.; Wu, T.Y.; Araban, M.; Griffiths, M.D.; Pakpour, A.H. Factors affecting Pakistani young adults' intentions to uptake COVID-19 vaccination: An extension of the theory of planned behavior. *Brain Behav.* **2021**, *11*, e2370. [CrossRef] [PubMed]

97.　Wolff, K. COVID-19 vaccination intentions: The theory of planned behavior, optimistic bias, and anticipated regret. *Front. Psychol.* **2021**, 2404. [CrossRef] [PubMed]

98.　Yahaghi, R.; Ahmadizade, S.; Fotuhi, R.; Taherkhani, E.; Ranjbaran, M.; Buchali, Z.; Jafari, R.; Zamani, N.; Shahbazkhania, A.; Simiari, H.; et al. Fear of COVID-19 and perceived COVID-19 infectability supplement theory of planned behavior to explain Iranians' intention to get COVID-19 vaccinated. *Vaccines* **2021**, *9*, 684. [CrossRef] [PubMed]

99. Zhang, K.C.; Fang, Y.; Cao, H.; Chen, H.; Hu, T.; Chen, Y.; Zhou, X.; Wang, Z. Behavioral intention to receive a COVID-19 vaccination among Chinese factory workers: Cross-sectional online survey. *J. Med. Internet Res.* **2021**, *23*, e24673. [CrossRef] [PubMed]

100. Zhang, K.C.; Fang, Y.; Cao, H.; Chen, H.; Hu, T.; Chen, Y.Q.; Zhou, X.; Wang, Z. Parental acceptability of COVID-19 vaccination for children under the age of 18 years: Cross-sectional online survey. *JMIR Pediatr. Parent.* **2020**, *3*, e24827. [CrossRef]

101. Zhong, Y.; Zhao, H.; Wang, X.; Ji, J. Using the theory of planned behaviour to explain junior nurses' and final-year student nurses' intention to care for COVID-19 patients in China: A multisite cross-sectional study. *J. Nurs. Manag.* **2022**, 1–9. [CrossRef]

102. Higgins, J.P.; Thompson, S.G.; Deeks, J.J.; Altman, D.G. Measuring inconsistency in meta-analyses. *BMJ* **2003**, *327*, 557–560. [CrossRef]

103. Idris, I.O.; Ayeni, G.O.; Adebisi, Y.A. Why many African countries may not achieve the 2022 COVID-19 vaccination coverage target. *Trop. Med. Health* **2022**, *50*, 15. [CrossRef]

104. Centers for Disease Control and Prevention (CDC). *COVID Data Tracker*; US Department of Health and Human Services: Atlanta, GA, USA, 2022. Available online: https://covid.cdc.gov/covid-data-tracker (accessed on 10 February 2022).

105. Verger, P.; Dubé, E. Restoring confidence in vaccines in the COVID-19 era. *Expert Rev. Vaccines* **2020**, *19*, 991–993. [CrossRef]

106. Wong, L.P.; Alias, H.; Wong, P.F.; Lee, H.Y.; AbuBakar, S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Hum. Vaccines Immunother.* **2020**, *16*, 2204–2214. [CrossRef]

107. CDC. COVID-19 hospitalization and death by race/ethnicity. In *Centers for Disease Control and Prevention*; CDC: Atlanta, GA, USA, 2020.

108. Hawkins, R.B.; Charles, E.J.; Mehaffey, J.H. Socioeconomic Status and Coronavirus Disease 2019 (COVID-19) Related Cases and Fatalities. *Public Health* **2020**, *189*, 129–134. [CrossRef] [PubMed]

109. Wieber, F.; Thürmer, J.L.; Gollwitzer, P.M. Promoting the translation of intentions into action by implementation intentions: Behavioral effects and physiological correlates. *Front. Hum. Neurosci.* **2015**, *9*, 395. [CrossRef] [PubMed]