

Factors affecting COVID-19 vaccination acceptance and uptake among the general public: a living behavioural science evidence synthesis (v2, May 31st, 2021)

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Research Question: How can behavioural science help inform messaging to and broader supports for the general public to encourage vaccination for COVID-19? How can behavioural science help address vaccine-related concerns from equity-seeking groups?

Table of contents	Page
Summary of key findings	3
Introduction	5
Objectives	6
Methods	7
Results	
Study characteristics	9
Objective 1: Rates of COVID-19 vaccination acceptance among the general public	22
Objective 2: Rates of COVID-19 vaccination uptake among the general public	22
Objective 3: Factors associated with higher and lower COVID-19 vaccination acceptance and uptake in the general public	22
Objective 4: Factors associated with higher and lower COVID-19 vaccination acceptance and uptake among equity-seeking groups	43
Discussion	52
References	56
Appendices	63

What is new in this update (version 2, 31st May, 2021)

- 26 studies were added to version 2 of this report, although no new Canadian studies were included. All studies measured COVID-19 vaccination acceptance; 1/26 also measured actual COVID-19 vaccination uptake.
- Based on the Capability, Opportunity, and Motivation-Behaviour (COM-B) model, factors associated with vaccine acceptance and uptake continue to focus predominantly on Opportunity and Motivation. The domain 'Goals' was identified for the first time in 2 studies including an experimental study that found that COVID-19 vaccination preference (i.e., matching one's preferences for a particular COVID-19 vaccine) was associated with higher intention to vaccinate.
- 6 studies conducted in the USA explored COVID-19 vaccine acceptance within certain equity-seeking groups, including incarcerated/detained residents, people experiencing homelessness, and people from sexual and gender minority backgrounds. All 6 studies found that that racialized (Black and Latinx in particular) respondents are less likely to express vaccine acceptance vs. White respondents. However, none of these studies examined determinants (based on the Theoretical Domains Framework) of vaccine acceptance according to equity-seeking groups.

Key Findings

- Overall, we identified 66 studies ($k=40$ from v1; $k=26$ from v2) that assessed factors associated with vaccination acceptance and/or uptake in the general public in the period since COVID-19 vaccines have been approved (spanning Nov, 2020 - May, 2021); only 1 study was conducted in Canada.
- The overall percentage of individuals willing to accept a COVID-19 vaccine was 62% ($k=58$; IQR=46-79%). In studies conducted in North America, 61% of respondents were willing to accept a COVID-19 vaccine ($k=19$; IQR=50-75%). In the 1 Canadian study (conducted in Jan/Feb, 2021) identified to date, 62% of respondents were willing to accept vaccination. 3/66 studies measured actual COVID-19 vaccination uptake (ranging 14-63%); although none of these studies were conducted in Canada.
- Based on the Capability, Opportunity, and Motivation-Behaviour (COM-B) model, factors associated with vaccine acceptance and uptake focused predominantly on Opportunity and Motivation. Capability factors identified focused on 'Knowledge'; Opportunity factors identified included 'Environmental context and

resources' and 'Social influences', and Motivation factors identified included 'Beliefs about consequences', 'Goals', 'Social/professional role and identity', 'Reinforcement', and 'Emotion'. These cover 8 of 14 domains of the Theoretical Domains Framework.

- These domains are almost identical to those identified in our latest report focusing on COVID-19 vaccination acceptance/uptake among healthcare workers ([version 2, 18th May, 2021](#)).
- Domains that continue to not emerge to date as factors associated with COVID-19 vaccine acceptance among the general public include: 'Skills'; 'Behavioural regulation'; 'Memory/attention'; 'Beliefs about capabilities', and 'Optimism'. Future research should aim to explore whether these potential determinants are important in this context.
- Across studies, concerns and misunderstandings about COVID-19 vaccine safety, efficacy, and necessity were common and associated with lower vaccination acceptance.
- Mistrust of governments and public health agencies was related to lower vaccination acceptance, whereas more proximal social influences such as peer-to-peer/group norms may help encourage vaccination.
- Overall, 16/66 studies assessed whether vaccine acceptance was associated with race and ethnicity among equity-seeking groups. Of these, 15/16 studies found that that racialized (Black and Latinx in particular) respondents are less likely to express vaccine acceptance vs. White respondents.
- Based on data from 4/16 studies, 4 of 14 domains from the Theoretical Domains Framework were associated with COVID-19 vaccine acceptance among racialized groups: 'Knowledge'; 'Environmental context and resources'; 'Social influences'; and 'Beliefs about consequences'.
- Respondents from some racialized groups (e.g., Black, Latinx) expressed more mistrust than other groups (e.g., White, Asian).
- Concerns about vaccine development were more common among Black, Latinx, and Asian vs. White respondents while concerns over safety were identified across groups.
- With this updated review, we continue to observe the paucity of published research with Canadian samples looking at COVID-19 vaccination acceptance and uptake since the approval of COVID-19 vaccines. Now that vaccines are steadily being rolled out and 2nd doses being administered, there is a clear need for more Canadian research to help understand the factors associated with vaccination

acceptance and uptake in the general public and in particular those from equity-seeking groups to help better inform how best to support greater vaccination.

Introduction: Leveraging behavioural science to provide a new lens on COVID-19 vaccination

Since Dec 2020, COVID-19 vaccines have steadily been rolled out across Canada to help curb the spread of COVID-19 which has accounted for an estimated 3.5 million deaths globally, including over 25,000 Canadians (as of May 28th, 2021, cf. Johns Hopkins [COVID tracker](#)). High uptake of COVID-19 vaccines is needed to achieve maximum effectiveness within the population and new data is showing the benefit of vaccine uptake to substantially reduce hospitalisations for COVID-19 [1]. However, hesitancy to receive a COVID-19 vaccine remains a major public health concern that may undermine efforts to reduce the continued impact of COVID-19. As such, it is crucial to identify and understand the key factors associated with vaccination acceptance within the general public and in particular individuals among equity-seeking groups (e.g., those experiencing racial, ethnic, and socioeconomic disparities/marginalization). This is especially important given the [disproportionate health, economic, and emotional impact](#) COVID-19 has had on equity-seeking groups in Canada.

A behavioural science approach does not imply an individual-focus, nor does it put the onus of responsibility on individuals. Rather, framing COVID-19 vaccination uptake as a behaviour allows us to draw upon decades of research aimed at understanding factors that affect what people think, feel, decide, and ultimately do. Such an approach fully recognizes that what individuals, groups, communities, and populations do is shaped by the past and present experiences, resources, and constraints afforded or not by the social and physical contexts in which they live and work. These experiences and affordances (or lack thereof) ultimately serve to shape the Capability, Opportunity, and Motivation that drive the behaviour of individuals and groups (cf. COM-B model [2]).

Capability-, Opportunity- and Motivation-related factors of individuals are shaped by the multiple social, cultural, historical, community, governmental, clinical, and environmental levels that influence acceptance and uptake of COVID-19 vaccination. We drew upon the overarching COM-B model to situate 14 key behavioural factors that can drive vaccination intention and uptake (**Figure 1**). These 14 factors are reflected in the Theoretical Domains Framework (TDF), a synthesis of decades of research and evidence of the key, modifiable factors that influence behaviour [3–5]. TDF factors are linked to specific behaviour change techniques that can be used to address particular barriers and enablers to vaccination, thus linking barriers to

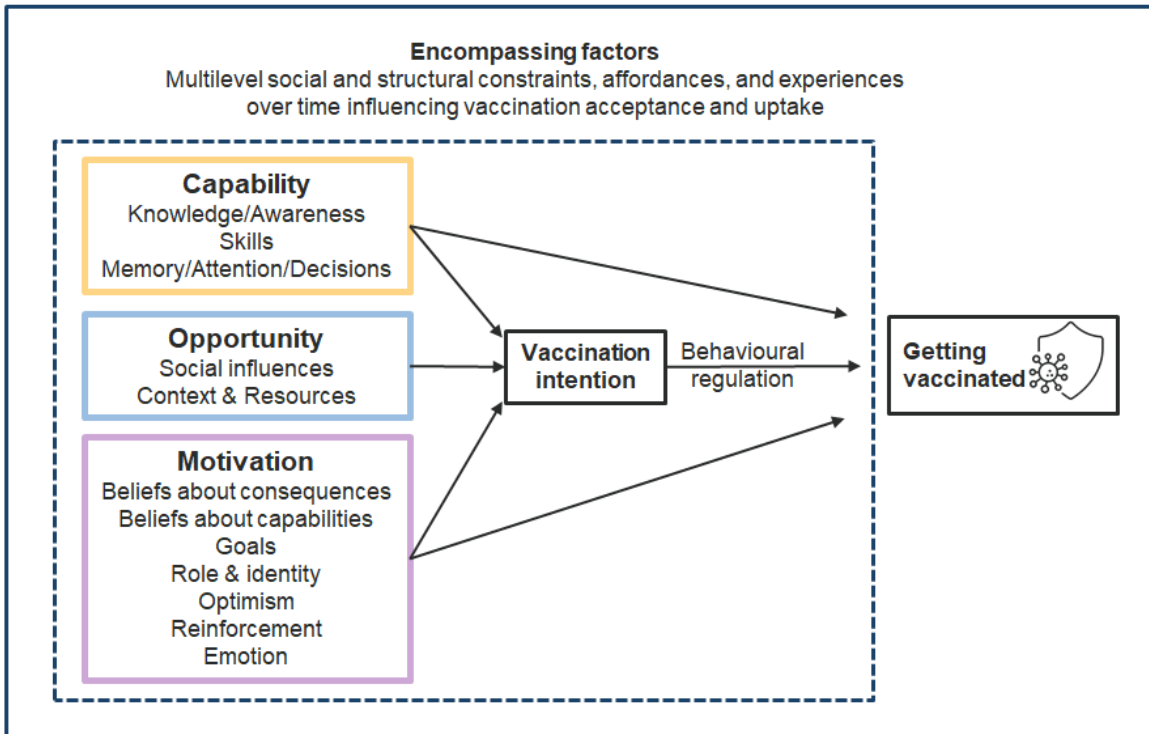
solutions. Using these approaches can enable exploration of whether different factors influence vaccine acceptance in different equity-seeking groups which may point to strategies and programs that address the needs and concerns of these groups. Such approaches have been used extensively to understand and address behaviour change in other health-related contexts but have yet to be fully leveraged to address COVID-19 vaccination acceptance and uptake [6].

As part of a living behavioural science evidence synthesis (LBSSES), we will use perspectives from the COM-B model and TDF to help identify factors affecting vaccination acceptance and uptake among the general public both globally and in Canada, and in particular those serving equity-seeking groups. We have already conducted version 2 (published May 18th, 2021) of our LBSSES focusing on COVID-19 vaccination acceptance/uptake among healthcare workers (HCWs) which can be found [here](#).

Living Behavioural Science Evidence Synthesis Objectives

1. Identify rates of COVID-19 vaccination acceptance in the general public globally and in Canada (p22).
2. Identify rates of COVID-19 vaccination uptake in Canada in the general public globally and in Canada (p22).
3. Identify factors associated with COVID-19 vaccination acceptance and uptake among the general public globally and in Canada (p22).
4. Identify factors associated with COVID-19 vaccination acceptance and uptake among equity-seeking groups (p43).

Figure 1. Potential drivers of vaccination acceptance and uptake based on the COM-B model and Theoretical Domains Framework



Methods

Data sources

We identified two databases that have been capturing published peer-reviewed papers, preprints, published reports, and unpublished datasets relating to our research questions. The first database is run by the McMaster Health Forum who produces a monthly Living Evidence Profile looking at COVID-19 vaccine rollout which includes acceptance/uptake. This Profile is searched manually for relevant papers. The second database is run by Kristin Konnyu (Brown University, USA) who is co-author on this report. This database includes weekly searches of MEDLINE (via PubMed) and the Cochrane Register of Clinical Trials (PROSPERO registration: CRD42021253533). Two researchers have been independently undertaking level 1 (title and abstract) and level 2 (full-text) screening (screening team includes co-authors Crawshaw, Konnyu, Castillo, and van Allen). Discrepancies during screening are being resolved via consensus meetings. Data extraction is being undertaken by Crawshaw, Konnyu, Castillo, and van Allen. The following links represent the most recent publically-available reports based on the databases detailed above:

- [COVID-19 Living Evidence Profile #1: What is known about anticipated COVID-19 vaccine roll-out elements?](#) [7] (Most recent search: Apr 20, 2021).
- [Rapid Evidence Review: What are the barriers and facilitators to individuals' willingness to be vaccinated for COVID-19?](#) [8]; [Understanding and promoting COVID-19 vaccine uptake among marginalized communities in RI](#) [9] (Most recent data extraction from database: Apr 19, 2021).

Inclusion criteria

- *Population:* General public and particularly those from equity-seeking groups. Includes patient and student samples, among others.
- *Outcome:* Studies that include a measure (self-report and/or objective) of COVID-19 vaccination willingness/intention/hesitancy/acceptance (referred to as **vaccination acceptance** hereafter), and/or uptake.
- *Time:* Studies that collected data in the period since COVID-19 vaccine approval (spanning Nov, 2020 - Apr, 2021). Studies that had data collection periods that bridged this timeframe (e.g., Sep 1 – Dec 31, 2020) were included.
- *Design:* Qualitative and survey (observational) data; cross-sectional, experimental, prospective, and cohort designs.

Exclusion criteria

- *Outcome:* Studies that only included a measure of vaccination knowledge.
- *Time:* Studies that collected data collection exclusively between Jan - Oct 2020 (i.e., before COVID-19 vaccines were being authorised for emergency use). See **Appendix 1** for a list of relevant studies ($k=131$) which collected data in the months prior to COVID-19 vaccine approvals (Jan - Oct 2020) which were excluded from this report.

Data extraction

The two data sources were manually searched and cross-referenced for relevant studies. A standardised data extraction form (**Appendix 2**) was used to extract relevant data relating to study characteristics, behavioural specification, factors affecting vaccination acceptance based on the COM-B model and TDF, and equity-related data. The equity-related factors identified in our [first review focusing on HCWs](#) suggested that racialized groups may differ in their level of vaccine acceptance. Though the studies reviewed provided limited data, the SafeCare-BC report

(an ongoing Canadian dataset) [10] suggests that some racialized groups may have specific concerns regarding COVID-19 vaccines. We, therefore, focused our analysis of equity-related factors to race and ethnicity for this review. 'k' refers to the number of studies. Where available, we have captured key statistical analyses (odds ratios (OR); adjusted odds ratios (ORa)) on the factors associated with higher or lower vaccination acceptance.

Results

Study characteristics

A total of 66 studies met inclusion criteria and were included ($k=26$ added to v2 of this report) [11–76]. **Table 1** provides an overview of the 66 studies. 45 were published peer-reviewed papers and 21 were preprints. 58/66 used cross-sectional survey designs; 3 longitudinal studies [23,49,73], 4 experimental studies [14,37,66,76], and 1 qualitative study [39]. 63/66 studies measured COVID-19 vaccine acceptance; 3 studies also reported actual vaccination uptake [35,44,45].

20/66 studies collected data on specific groups from the general public: patients with inflammatory bowel disease [22]; patients with chronic respiratory or autoimmune disease [55]; patients with multiple sclerosis [62]; patients with HIV [72]; outpatients [41]; patients with psoriasis [65]; patients with a rheumatologic condition [15,18]; patients with cancer [18]; people experiencing homelessness [40]; people from sexual and gender minority backgrounds [69]; incarcerated or detained residents [67]; international travelers [54]; people with development disabilities [35]; workers supporting people with intellectual disabilities [42]; and pregnant people/non-pregnant mothers [19,46,63]. Two studies recruited migrant samples [34,39] and another study recruited individuals from underserved rural and urban communities [26].

23/66 studies were conducted exclusively in North America [16,21–23,26,27,32,33,35,37,40,42,48,50,51,53,55,59,61,65,67–69], one of which was conducted in Canada [42]. One large study collected data in both the USA and UK [49]. 33/66 studies were conducted outside of North America: Qatar [11,38]; Italy [17–19,24,46]; UK [25,39,56]; Spain [28]; Jordan [29,58]; China [30,34,47,73]; India [31]; Nigeria [36]; Poland [44]; Turkey [75]; Greece [76]; Germany [45,66]; Japan [43]; Portugal [62,64]; France [72]; Taiwan [41]; Slovenia [52]; Saudi Arabia [12]; Malta [20]; and Russia [70]. 9 studies collected data from multiple countries in different regions/classifications: Latin America [14]; Europe [15]; Arab states [57]; Africa [60]; Global [54,63,71,74]; and low-middle income countries [13].

Table 1. Evidence of COVID-19 vaccination acceptance among the general public

Study author	Publication status	Country	Design	Sample	Sample size	Data collection period	Mean % vaccine acceptance [actual uptake, if assessed]	COM-B model factors (<i>TDF domains</i>)
North American studies ($k=24$), listed in order of recency of data collection								
Nguyen H et al.* [49]	Preprint	USA data only	Cohort	General public	87,388	Mar 24, 2020 - Feb 16, 2021	91%	See Tables 5-8 for equity-related breakdown
Iadarola et al. [35]	Preprint	USA	CS	People with intellectual and developmental disabilities	825	Jan 19 - Feb 9, 2021	62% [14%]	See Tables 5-8 for equity-related breakdown
Lunsky et al. [42]	Published	Canada	CS	Workers supporting adults with intellectual disabilities	3,371	Jan 21 - Feb 3, 2021	62%	Opportunity (<i>Environmental context and resources; Social influences</i>) Motivation (<i>Social/professional role and identity; Beliefs about consequences</i>)

Ricotta et al. [55]	Preprint	USA	CS	Patients with chronic respiratory or autoimmune disease, and health control sample	2,535	Feb, 2021	NR	Motivation (<i>Beliefs about consequences</i>)
Daly et al. [23]	Preprint	USA	LT	General public	7,840	Oct, 2020 - Feb, 2021	61%	See Tables 5-8 for equity-related breakdown
Dalal et al. [22]	Published	USA	CS	Inflammatory bowel disease patients	906	Dec 22, 2020 - Jan 26, 2021	81%	Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Grumbach et al. [33]	Published	USA	CS	General public	3,161	Nov 27, 2020 - Jan 15, 2021	66%	See Tables 5-8 for equity-related breakdown
Kuhn et al. [40]	Preprint	USA	CS	People experiencing homelessness	90	Dec, 2020 - Jan, 2021	52%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Benis et al. [16]	Published	USA	CS	General public (social media users)	1,644	Dec 10-24, 2020	NR	Opportunity (<i>Social influences</i>) Motivation (<i>Social/professional role and identity; Beliefs about consequences</i>)

Piltch-Loeb et al. [53]	Preprint	USA	CS	People from vaccine priority group (inc. HCWs)	2,650	Dec 13-23, 2020	40%	Opportunity (<i>Environmental context and resources; Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Savoia et al. [61]	Preprint	USA	CS	General public	2,650	Dec 13-23, 2020	40%	Opportunity (<i>Environmental context and resources; Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Teixeira da Silva et al. [69]	Published	USA	CS	People from sexual and gender minority backgrounds	1,350	Oct 19 - Dec 16, 2020	NR (1-10 scale, mean=7, SD=3.1)	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Kaplan & Milstein [37]	Published	USA	Exp	General public	1,000 (Aug) & 1,000 (Dec)	Aug 20-27 & Dec 16-22, 2020	NR	Opportunity (<i>Social influences</i>) Motivation (<i>Social/professional role and identity; Beliefs about consequences</i>)
Doherty et al. [26]	Preprint	USA	CS	General public (underserved rural and urban communities)	948	Aug 27 - Dec 15, 2020	69%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>) See Tables 5-8 for equity-related breakdown

Stern et al. [67]	Published	USA	CS	Incarcerated or detained residents	5,110	Sep 22 - Dec 12, 2020	45%	Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Park et al. [51]	Published	USA	CS	General public (Asian Americans and Pacific Islanders specifically)	1,646	Oct 24 - Dec 11, 2020	44%	Motivation (<i>Beliefs about consequences</i>)
Szilagyi et al. [68]	Published	USA	CS	General public	8,167 total (5,660 from Nov-Dec 2020 sample)	Apr 1 - Dec 8, 2020	Apr: 74% & Dec: 56%	N/A
Salmon et al. [59]	Published	USA	CS	General public	2,525	Nov 25 - Dec 7, 2020	50% classified as 'intenders'	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Nguyen I et al. [48]	Published	USA	CS	General public	3,541 (Sep) & 2,033 (Dec)	Sep & Dec, 2020	Sep: 39% & Dec: 49%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)

Sotiriou et al. [65]	Published	USA	CS	Patients with psoriasis and immunosuppressed patients with other skin conditions	941	Nov 10-25, 2020	Psoriasis group: 80% & other skin condition group: 51%	Motivation (<i>Beliefs about consequences</i>)
Nikolovski et al. [50]	Preprint	USA	CS	Clinical trial cohort (age: 65+)	7,621	Nov 6-20, 2020	91%	Motivation (<i>Beliefs about consequences</i>)
Graupensperger et al. [32]	Published	USA	CS	General public (university students)	647	Nov 2-13, 2020	92%	Opportunity (<i>Social influences</i>)
Craig [21]	Published	USA	CS	General public	1,153	Nov 9-11, 2020	61%	Motivation (<i>Reinforcement</i>)
Dorman et al. [27]	Published	USA	CS	General public	26,324	Oct - Nov, 2020	NR (most of the groups had mean scores between 4 (neutral) and 5 (slightly agree))	Motivation (<i>Beliefs about consequences</i>)

Study author	Publication status	Country	Design	Sample	Sample size	Data collection period	Mean % vaccine acceptance [actual uptake, if assessed]	COM-B model factors (<i>TDF domains</i>)
International studies ($k=43$), listed in order of recency of data collection								
Sprengholz et al. [66]	Published	Germany	Exp	General public	1,012	Feb 23-24, 2021	72%	Motivation (<i>Goals</i>)
Nguyen II et al.* [49]	Preprint	UK data only	Cohort	General public	1,254,294	Mar 24, 2020 - Feb 16, 2021	95%	See Tables 5-8 for equity-related breakdown
Urrunaga-Pastor et al. [71]	Published	Multiple (200+ countries)	CS	General public (Latin American and Caribbean respondents)	472,521	Jan 15 - Feb 1, 2021	80%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Emotion; Goals</i>)
Malesza & Bozym [44]	Preprint	Poland	CS	General public (age: 70+)	1,427	Jan - Feb, 2021	[63%]	Opportunity (<i>Social influences</i>)
Argote et al. [14]	Preprint	Multiple (Latin America)	Exp	General public	13,189	11-29 Jan, 2021	59%	N/A
Machida et al. [43]	Published	Japan	SC	General public	2,956	Jan 14-28, 2021	62%	Motivation (<i>Beliefs about consequences</i>)

Khaled et al. [38]	Preprint	Qatar	CS	General public	1,038	Dec 15, 2020 - Jan 25, 2021	43%	Motivation (<i>Beliefs about consequences</i>)
Sallam et al. [58]	Published	Jordan	CS	General public (university students)	1,106	Jan 19-23, 2021	35%	Opportunity (<i>Environmental context and resources; Social influences</i>)
Malesza & Wittmann [45]	Published	Germany	CS	General public (age: 75+)	1,084	Jan 4-17, 2021	57% [21%]	Opportunity (<i>Environmental context and resources</i>) Motivation (<i>Beliefs about consequences</i>)
Yurttas et al. [75]	Published	Turkey	CS	General public (inc. rheumatology patients & HCWs)	732	Jan 4-13, 2021	29% - 53% (median=39%)	Motivation (<i>Emotions</i>)
Soares et al. [64]	Published	Portugal	CS	Gen pub	1,943	Sep 29, 2020 - Jan 8, 2021	35%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement; Emotion</i>)
Serrazina et al. [62]	Published	Portugal	CS	Patients with multiple sclerosis	256	Dec 21, 2020 - Jan 3, 2021	81%	Capability (<i>Knowledge</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Carbone et al. [19]	Preprint	Italy	CS	Pregnant people	142	Jan, 2021	28%	N/A

Radic et al. [54]	Published	Global	CS	International travelers	1,221	Dec, 2020 - Jan, 2021	NR	Opportunity (<i>Environmental context and resources</i>) Motivation (<i>Social/professional role and identity</i>)
Arce et al. [13]	Preprint	Multiple (mainly LMICs)	CS	General public	45,928	Jun, 2020 – Jan, 2021	30% - 97% (median=78%)	Motivation (<i>Beliefs about consequences</i>)
Vallée et al. [72]	Published	France	CS	Patients with HIV	237	Jan, 2021	71%	Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Biasio et al. [17]	Published	Italy	CS	General public	885 (Jun, 2020); 160 (Jan, 2021)	Jun, 2020 & Jan, 2021	91%	Motivation (<i>Beliefs about consequences</i>)
Kukreti et al. [41]	Published	Taiwan	CS	HCW & outpatient samples	500 (HCWs); 238 (patients)	Sep 24 - Dec 31, 2020	31%	Motivation (<i>Reinforcement</i>)
Iheanacho et al. [36]	Preprint	Nigeria	CS	General public	410	Nov 20 - Dec 28, 2020	57%	Motivation (<i>Beliefs about consequences</i>)
Mappa et al. [46]	Published	Italy	CS	Pregnant people	161	Dec 27, 2020	53%	Motivation (<i>Beliefs about consequences</i>)
Petravić et al. [52]	Published	Slovenia	CS	Gen public (inc. HCWs)	12,042	Dec 17-27, 2020	59%	Opportunity (<i>Social influences</i>)
Sallam et al. [57]	Published	Multiple (Arab states)	CS	General public	3,414	Dec 14-18, 2020	29%	Motivation (<i>Beliefs about consequences</i>)

Wouters et al. [74]	Published	Multiple (Global)	CS	General public	26,758	Oct 21 - Dec 16, 2020	38% - 98% (median=73%)	N/A
Alfageeh et al. [12]	Published	Saudi Arabia	CS	General public	2,137	Dec 8-14, 2020	48%	Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Campochiaro et al. [18]	Published	Italy	CS	Rheumatology and oncology patients	202 rheum & 68 oncology	Nov 23 - Dec 10, 2020	82%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Dickerson et al. [25]	Preprint	UK	CS (inc. Qual data)	General public	535	Oct 9 - Dec 9, 2020	29%	[Based on Qual data] Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Robertson et al. [56]	Preprint	UK	CS	General public (part of an ongoing study)	12,035	Nov 24 - Dec 1, 2020	82%	Motivation (<i>Beliefs about consequences</i>)
Beesley et al. [15]	Published	Multiple (Europe)	CS (inc. Qual data)	Rheumatology patients	1,505 adult & 140 paediatric	Dec, 2020	Adult: 87% & paediatric: 66%	[Based on Qualitative data] Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)

Samarasekera et al. [60]	Published	Multiple (Africa)	CS	General public	>15,000	Aug - Dec, 2020	59% - 94% (median=79%)	Motivation (<i>Beliefs about consequences</i>)
Wang et al. [73]	Published	China	Cohort	General public	2,058 in Mar; 2,013 in Dec; 791 longitudinal	Mar & Dec, 2020	23%	Opportunity (<i>Environmental context and resources; Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Di Giuseppe et al. [24]	Published	Italy	CS	General public (university students)	1,518	Sep 14 - Nov 30, 2020	84%	Motivation (<i>Beliefs about consequences</i>)
Knights et al. [39]	Published	UK	Qual	General public (migrants, inc. HCWs)	81	Jun 18 - Nov 30, 2020	NR	[Based on Qual data] Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Mo et al. [47]	Published	China	CS	General public (university students)	6,922	Nov 1-28, 2020	79%	Opportunity (<i>Environmental context and resources</i>) Motivation (<i>Beliefs about consequences</i>)
Cordina et al. [20]	Published	Malta	CS	General public	3,363	Oct 26 - Nov 26, 2020	50%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)

Eguia et al. [28]	Published	Spain	CS	General public (inc. HCWs)	731	Sep 10 - Nov 23, 2020	78%	Motivation (<i>Beliefs about consequences</i>)
Han et al. [34]	Preprint	China	CS	General public (migrants)	2,126	Nov 1-20, 2020	89%	Motivation (<i>Beliefs about consequences</i>)
Skjefte et al. [63]	Published	Multiple (Global)	CS	Pregnant people & non-pregnant mothers	17,871	Oct 28 - Nov 18, 2020	69%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Alabdulla et al. [11]	Published	Qatar	CS	General public (inc. HCWs)	7,821	Oct 15 - Nov 15, 2020	60%	Capability (<i>Knowledge</i>) Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Gan et al. [30]	Published	China	CS	General public	1,009	Oct 23 - Nov 10, 2020	60%	Capability (<i>Knowledge</i>) Motivation (<i>Beliefs about consequences; Reinforcement</i>)
Tran et al. [70]	Published	Russia	CS	General public	876	Sep 26 - Nov 9, 2020	42%	Opportunity (<i>Social influences</i>) Motivation (<i>Beliefs about consequences</i>)
Zampetakis & Melas [76]	Published	Greece	Exp	General public	1,006	Oct 1 - Nov, 5 2020	NR	Motivation (<i>Beliefs about consequences</i>)
El-Elimat et al. [29]	Preprint	Jordan	CS	General public	3,100	Nov, 2020	37%	Motivation (<i>Beliefs about consequences; Reinforcement</i>)

Gautam et al. [31]	Preprint	India	CS	General public	1,078	Oct – Nov, 2020	77%	N/A
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Table 1 notes: COM-B model = Capability, Opportunity, and Motivation-Behaviour model; CS = cross-sectional survey; Exp = Experimental study design; HCW = healthcare worker, LT = longitudinal study; N/A = studies that did not capture these factors; NR = not reported; Qual = qualitative; TDF = Theoretical Domains Framework; * = Nguyen II et al. collected both USA and UK data so included in both North America and International sections.

Objective 1: COVID-19 vaccination acceptance rates in the general public

58/66 studies included a mean % for COVID-19 vaccination acceptance. Across 58 studies, almost two thirds of respondents from the general public were willing to accept a COVID-19 vaccine (median=62%, IQR=46-79%). These data are comparable to the mean % vaccine acceptance rates found among HCWs ($k=58$, median=64%, IQR=46-79%) reported elsewhere ([v2, May 18th, 2021](#)). Among North American studies ($k=19$), 61% of respondents from the general public were willing to accept a COVID-19 vaccine (median=61%, IQR=50-75%). In studies conducted outside of North America ($k=39$), 62% of respondents from the general public were willing to accept a COVID-19 vaccine (median=62%, IQR=43-79%). For future versions of this report, we will investigate trends in vaccination acceptance over time (e.g., box-and-whisker plots).

Objective 2: COVID-19 vaccination uptake rates

3 studies included self-reported vaccination uptake rates [35,44,45], although none were conducted in Canada. Iadarola et al. reported that 14% of respondents (USA) had already had a COVID-19 vaccine [35] whilst Malesza and Bozym reported 63% of respondents (Poland) had received a COVID-19 vaccine [44]. Additionally, Malesza and Wittmann reported that 21% of respondents (Germany) aged 75+ years had received a COVID-19 vaccine. Data from the [Government of Canada website](#) reports that as of May 22nd, 2021, 51% of the Canadian population had received at least one dose of a COVID-19 vaccine. Future versions of this LBSES report will continue to capture recently conducted studies that will likely measure actual vaccination uptake and factors (based on COM-B model and TDF) associated with uptake. Moreover, we will investigate trends in vaccination uptake over time (e.g., box-and-whisker plots).

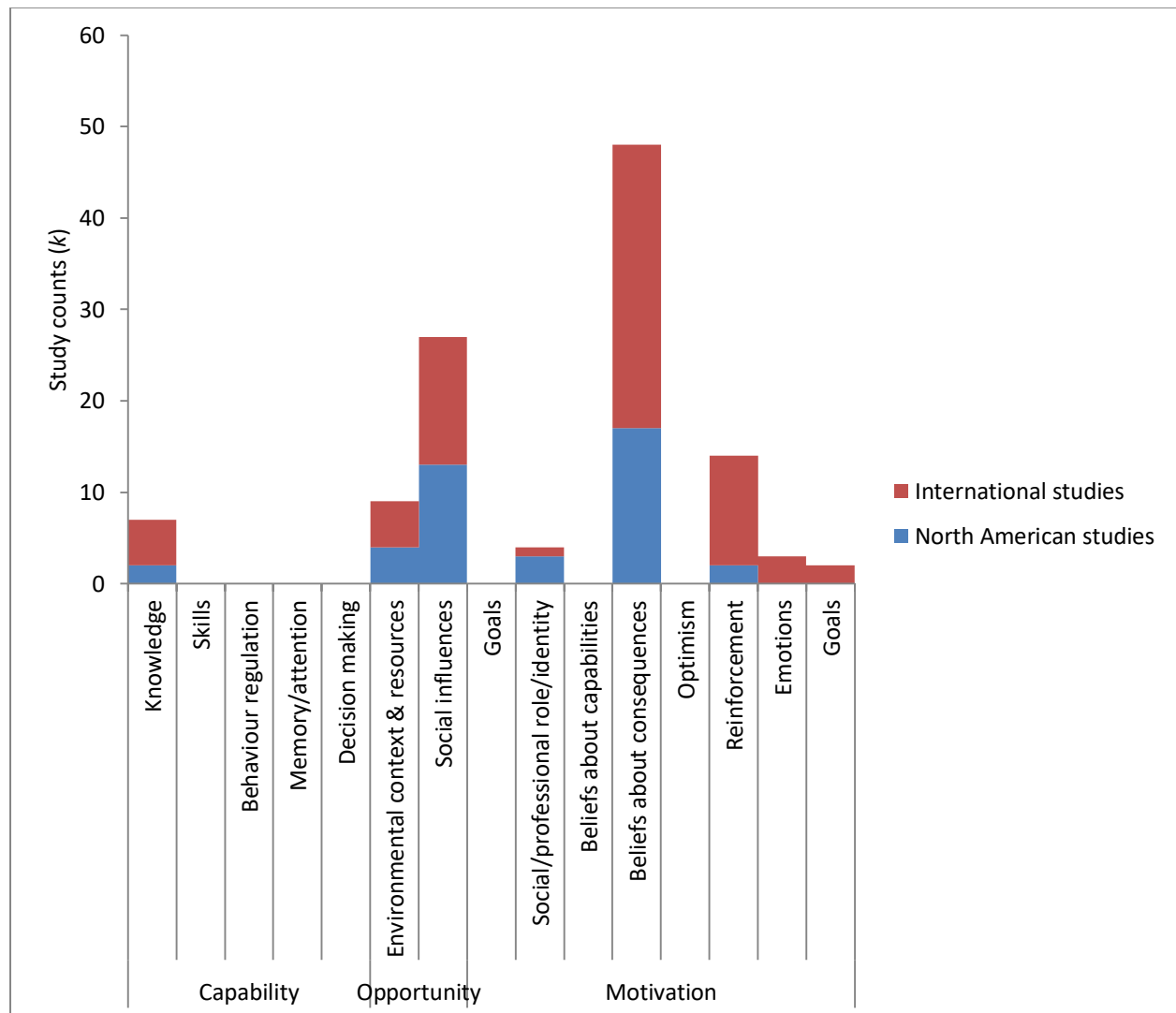
Objective 3: Factors associated with higher and lower COVID-19 vaccination acceptance

56/66 studies provided evidence of the potential factors underlying COVID-19 vaccine acceptance which were mapped using the COM-B model and TDF. 5 studies either reported rates of vaccination acceptance only or reported data that we were unable to be map onto the COM-B model and TDF [14,19,31,68,74]. Moreover, 5 studies assessed potential factors predicting vaccination acceptance among equity-seeking groups [23,26,33,35,49] (see **Objective 4**).

To date, 8 (of a possible 14) TDF domains appear to be important determinants of COVID-19 vaccine acceptance in the general public (based on recent data since vaccines have been approved for use) (see **Figure 2**):

- **Capability** (Knowledge [$k=8$]) (see **Table 2**).
- **Opportunity** (Environmental context and resources [$k=8$]; Social influences [$k=27$]) (see **Table 3**).
- **Motivation** (Beliefs about consequences [$k=48$]; Social/professional role and identity [$k=4$]; Reinforcement [$k=16$]; Emotion [$k=3$]; Goals [$k=2$]) (see **Table 4**).

Figure 2. Frequency of Capability, Opportunity and Motivation factors associated with COVID-19 vaccination acceptance in the general public across $k=66$ studies



These domains are similar to those found in a recent review [8] and our LBSES focusing on COVID-19 vaccination acceptance/uptake among HCWs ([v2, May 18th, 2021](#)), although these reviews included studies reporting data since the start of the pandemic which were excluded in this report. As such, our findings indicate that drivers of vaccination acceptance appear to remain consistent to date, even in light of authorised vaccines (since Nov/Dec, 2020). Domains that did not emerge to date as important determinants of COVID-19 vaccine acceptance among the general public included: Skills; Behavioural regulation; Memory/attention; Beliefs about capability; and Optimism.

Capability-related factors associated with higher and lower COVID-19 vaccination acceptance

Knowledge is the key Capability-related domain identified within this literature (Table 2). A general lack of knowledge about COVID-19 vaccines was cited as a barrier in 4 studies [11,15,25,39], including one qualitative study [39]. One study of rheumatology patients found a desire for additional disease-specific guidance on COVID-19 vaccination given there may be additional risks for comorbid conditions. This highlights the importance of tailoring advice for specific clinical populations which may be at a higher risk of developing COVID-19 and have worse outcomes upon infection.

Table 2. Capability-related factors associated with COVID-19 vaccination acceptance

TDF Domain (Definition)	
Knowledge (What do people know & how does that influence what they do? Do they have the procedural knowledge (know how to do it)?)	
Knowledge factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=4 \rightarrow$ Having generally poor understanding of COVID-19 and vaccines <ul style="list-style-type: none"> ○ Of those who were unsure and showed vaccine hesitancy, 36% and 43% respectively reported that supplementing their own understanding of the disease was needed increase vaccine acceptance [11] ○ A lack of information (e.g., safety, efficacy, how vaccines work) was preventing rheumatology patients from currently accepting the vaccine (51% adults, 22% paediatric) [15]

	<ul style="list-style-type: none"> ○ Some hesitant individuals were unaware that effective vaccines had been developed and authorised [25] ○ Qual data: A number of migrants reported contradiction of information between different information sources, confusion or indecision with regards to whether to take the vaccine [39]
<p>Knowledge factors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● $k=1$ → Desire for disease-specific guidance on vaccination safety would encourage acceptance <ul style="list-style-type: none"> ○ Approximately 70% desired specific data regarding vaccine safety/efficacy among patients with inflammatory bowel disease [22] ● $k=2$ → Keeping well-informed about vaccine-related news <ul style="list-style-type: none"> ○ Those who pay close attention to the latest news of the vaccine were more willing to be vaccinated (OR=1.60, 95% CI: 1.05–2.45) [30] ○ Vaccine acceptability was associated with COVID-19 information-seeking behaviour ($p=0.01$) [62]

Opportunity-related factors associated with higher and lower COVID-19 vaccination acceptance

Evidence indicating the importance of opportunity related-factors was strong (**Table 3**). In particular, Social influence was an important factor associated with vaccination acceptance. Government and health agency mistrust was a frequently cited barrier to vaccine acceptance which is likely exacerbated by misinformation and conspiracy beliefs among the general public ($k=10$). The ongoing nature of the pandemic may have contributed to the erosion of trust among governing bodies. 5 studies identified the role of HCWs in influencing the likelihood of being vaccinated people, in particular among certain patient groups (e.g., patients with a rheumatic condition) [15,18,44,50,73]. 2 studies reported that hesitancy was linked to individuals waiting for others being vaccinated first, although it is unclear whether this was driven by altruistic tendencies or safety concerns. 3 studies reported the importance of social norms and in particular descriptive norms (i.e., being aware of what others like you are doing) which relates to comparing the likely uptake of peers ('proximal' influences) [32,42,47]. This could be particularly important to encourage young people to get vaccinated once able to, and also potentially among racialized groups (discussed further in **Objective 4**). 2 studies cited potential access issues in terms of time, convenience, and cost which were associated with

lower vaccination acceptance [42,73]. Such practical barriers could be addressed at a system and/or policy level to minimise barriers to access.

Table 3. Opportunity-related factors associated with COVID-19 vaccination acceptance

TDF Domain (Definition)	
Environmental context and resources (What are the things in people’s environment that influence what they do and how do they influence?)	
Environmental context and resource factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=2 \rightarrow$ Access issues in terms of time, convenience, and cost <ul style="list-style-type: none"> ○ Finding time to get vaccinated was overwhelming (OR=0.60, 95% CI 0.36-0.98) [42] ○ Vaccination convenience (OR=0.64, 95% CI: 0.46–0.91) or vaccine price (OR=0.54, 95% CI: 0.40–0.74) (Environ) associated with delayed vaccination acceptance [73]
Environmental context and resource factors associated with higher acceptance	<ul style="list-style-type: none"> • $k=5 \rightarrow$ Information-seeking using traditional news sources/social media – role of mass media <ul style="list-style-type: none"> ○ A higher proportion of individuals who had received information from a national TV (47%), local TV (45%), national newspaper (55%), and radio (51%) were vaccine acceptant compared to those who had not [53] ○ Use of social media for COVID-19 vaccine-related information was positively associated with the intention to receive a COVID-19 vaccination [47] ○ The overall intention to get COVID-19 vaccines was the highest among students who reported dependence on medical doctors, scientists, and scientific journals for knowledge regarding the vaccine (47%), while the lowest rate of intention to get the vaccine was among those who depended on social media platforms (20%; $p<0.01$) [58] ○ The media’s reporting of the side-effects was associated with the intention to get vaccinated (OR=1.54, 95% CI: 1.08-2.00) [45]

	<ul style="list-style-type: none"> ○ Mass media coverage positively influenced intention to vaccinate for COVID-19 (beta=0.06, p<0.01) [54]
TDF Domain (Definition)	
Social influences (What do others do? What do others think of what people do or what they should do? Who are they and how does that influence what they do?)	
<p>Social influence factors associated with lower acceptance</p>	<ul style="list-style-type: none"> ● $k=10 \rightarrow$ State/government/public health agency mistrust/conspiracy <ul style="list-style-type: none"> ○ Vaccine hesitancy associated with view that authorities are motivated by financial gain rather than health of people (OR=1.14, $p=0.03$) [11] ○ UK participants who trusted the national health service (NHS) a great deal were most likely to have decided they want a vaccine (44%) vs. those that distrusted NHS (7%) [25] ○ Government mistrust was a predictor of hesitancy (OR=3.57, 95% CI: 2.26-5.63) [26] ○ Participants who believed that there was a conspiracy behind COVID-19 (OR=0.50, 95 CI: 0.36-0.71) and those who do not trust any source of information on COVID-19 vaccines (OR=0.27, 95% CI: 0.18-0.40), were less likely to have acceptance towards them [29] ○ Common reason for hesitancy - don't trust the government (13%) [48] ○ Qual data: Migrants also reported a range of beliefs that COVID-19 is a 'Western disease', fear of discrimination or being used as 'guinea pigs',". Also mistrust of doctors, government, and vaccines, believing conspiracies from friends [39] ○ The vaccine conspiracy belief score and its association with higher COVID-19 vaccine hesitancy ($p<0.01$) [58] ○ Vaccine concerns were prevalent, including mistrust about government and drug companies "experiment on people like me" (53%) [59] ○ Recommendations by politicians (RPa=0.93; 95% CI: 0.92-0.94), was associated with a lower probability of

	<p>vaccination intention [71]</p> <ul style="list-style-type: none"> ○ Those who trust alternative sources and/or state a distrust in government were more vaccine hesitant [52] ○ Perceived inadequate response by government response associated with increased odds of refusal (ORa=8.49, 95% CI: 5.44-13.25); Perceived inadequate information by health authorities associated with increased odds of refusal (ORa=8.61, 95% CI: 4.73-15.68) [64] ● <i>k</i>=2 → Advice from medical professionals to abstain from receiving a COVID-19 vaccine <ul style="list-style-type: none"> ○ Advised by doctor to abstain from vaccination among rheumatic patients [15,18] ● <i>k</i>=2 → Intention to allow others to receive the vaccine first (this could be judged altruistically or related to safety concerns) <ul style="list-style-type: none"> ○ Between 24-26% of participants, independent of their vaccine hesitancy (or lack of) wanted others to get the vaccine first [26] ○ The hesitant participants most commonly selected 'prefer to see how others tolerate vaccine first' [22]
<p>Social influence factors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● <i>k</i>=6 → Trust in state/government/public health agency handling of the pandemic; 'trusted sources' <ul style="list-style-type: none"> ○ Those with high trust in COVID-19 vaccine information vs. low trust were more likely to get vaccinated (OR=15.04, 95% CI: 11.26-20.09) [53] ○ Non-pregnant mothers: Trust in public health agencies (vs. no trust in public health agencies) (ORa=1.62, 95% CI: 1.38-1.89) [63] ○ Confidence in healthcare providers (ORa=2.81, 95% CI: 1.50-5.29) and the pharmaceutical industry (ORa=6.83, 95% CI: 4.23-11.13) associated with vaccination acceptance [16] ○ Those with positive trust in the healthcare system (ORa=2.73, 95% CI 1.76-4.24) were more likely to be

	<p>willing to receive the COVID-19 vaccine [70]</p> <ul style="list-style-type: none"> ○ Those who trusted official sources were more ready to get vaccinated [52] ○ Recommendations from World Health Organization (RPa=1.44; 95% CI: 1.41-1.47) and government health officials (RPa=1.10; 95% CI: 1.09-1.11) were associated with a higher probability of vaccination intention [71] ● <i>k</i>=5 → Advice from medical professionals encouraging vaccination <ul style="list-style-type: none"> ○ Significant independent predictors of vaccine acceptance were being given an explanation by a medical professional as to why they should be vaccinated (OR=4.23, 95% CI: 2.90-5.75) [44] ○ The vast majority of those who would be willing to vaccinate indicated they would talk to their healthcare provide or staff before deciding whether or not to receive the vaccine (91% of women and 89% of men) [50] ○ Valuing doctor's recommendation (OR=3.13, 95% CI: 1.96-5.01) associated with delayed vaccination acceptance [73] ○ Valuing the advice of healthcare professionals regarding effectiveness of COVID-19 vaccine (beta=0.24 p<0.01) associated with higher acceptance [20] ○ Recommendations from local doctors (RPa=1.29; 95% CI: 1.26-1.31) was associated with a higher probability of vaccination intention [71] ● <i>k</i>=1 → Endorsement from a prominent public figure <ul style="list-style-type: none"> ○ When asked how likely they would be to take a vaccine if endorsed by (former) President Trump (USA), 18% chose very likely. Swapping in a Dr. Fauci endorsement for a Trump endorsement more than doubled (38%) [37] ● <i>k</i>=4 → Influence of family member/peer/co-worker
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	<p>vaccination intentions (social norms)</p> <ul style="list-style-type: none"> ○ Likelihood of getting the vaccine if their co-workers did (OR=0.16, 95% CI 0.08-0.29) [42] ○ Descriptive norms (i.e., being aware of what others like you are doing) predicted COVID-19 vaccination intention ORa=1.05, 95% CI: 1.03-1.07). Those who thought a greater proportion of typical young adults would get vaccinated were more likely to report intentions to get COVID-19 and influenza vaccines [32] ○ Descriptive norm was positively associated with the intention to receive COVID-19 free and self-paid vaccination [47] ○ Recommendations from family and friends (RPa=1.08; 95% CI: 1.07-1.09) was associated with a higher probability of vaccination intention [71]
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Motivation-related factors associated with higher and lower COVID-19 vaccination acceptance

The most frequently identified factor associated with individuals' willingness to receive a COVID-19 vaccine were Beliefs about consequences, specifically beliefs about vaccine safety, efficacy, and necessity (**Table 4**). Common concerns and erroneous beliefs focused on the beliefs that COVID-19 vaccine development was rushed ($k=4$) which aligns closely with common safety and efficacy concerns ($k=14$). Although many such concerns related to general vaccine safety, 3 studies found specific patient groups citing concerns about possible contraindications. 4 studies found that vaccine hesitance was related to a lack of perceived necessity with respondents citing natural resistance/protection and feeling in good health as reasons not to get vaccinated. Conversely, the two main beliefs driving higher acceptance were positive beliefs about vaccine safety and efficacy ($k=13$), along with an understanding that vaccines were necessary to help prevent risk of infection, reduce severity if infected, reduce the risk of spreading to others, and to ultimately help overcome the pandemic ($k=15$). 1 study added to version 2 of this report found that positive beliefs about the effectiveness of COVID-19 vaccines was associated with actual vaccination uptake [45].

In line with our previous [HCW-focused report](#), Reinforcement was a prominent Motivation-related factor associated with vaccination acceptance. 10 studies found historical influenza vaccine behaviour predicted current intentions towards COVID-19 vaccination. Personal

experience of COVID-19, either being severely infected themselves or having a close family member/friend die, was associated with higher and lower rates of acceptance, respectively, although these were only shown in singular studies. The Social/professional role and identity domain was less represented in this general public dataset compared with our HCW-focused report which found some differences between HCW professions/specialties. That being said, 2 studies added to version 2 of this report [16,54] found that respondents who perceived vaccination as a personal responsibility/role were more likely to accept vaccination. In line with most COVID-19 mitigation strategies (e.g., staying home where possible, face coverings, physical distancing), framing vaccination as a community role/responsibility may help increase motivation to be vaccinated.

Emotion was an infrequently coded domain (k=3). One study found that higher scores on COVID-19 related anxiety was related to vaccine acceptance [75] whilst another study found that depressive symptoms was associated with high vaccination acceptance [71]. 1 study also found that individuals who felt agitated, sad, or anxious due to the physical distancing measures on some days had lower odds of vaccine refusal than individuals who never had those feelings [64]. Interestingly, an experimental study [66] found that COVID-19 vaccination preference (i.e., matching one's preferences for a particular COVID-19 vaccine) was associated with higher intention to vaccinate (captured under the Goals domain). Such experiments help to clarify the role of preferences in the changing landscape of approved and available vaccines.

Table 4. Motivation-related factors associated with COVID-19 vaccination acceptance

TDF Domain (Definition)	
Beliefs about consequence (What are the good and bad things that can happen from what people do and how does that influence whether they'll do it in the future?)	
Beliefs about consequences factors associated with lower acceptance	<ul style="list-style-type: none"> • k=4 → Beliefs about rushed vaccine development/insufficient data on development <ul style="list-style-type: none"> ○ Vaccine hesitancy was significantly associated with the belief that there has been insufficient testing of COVID-19 vaccines (OR=1.70, $p<0.01$) [11] ○ Qual data: Data on vaccination hesitancy (343/535 open text responses) cited perceived lack of evidence/research/speed of development on vaccines [25] ○ Did not trust the vaccine because of its fast

	<p>development (OR=5.72, 95% CI: 3.84–8.53) had a higher odds of reporting vaccination non-intent compared with those who did not have those beliefs (Lunsky et al., 2021)</p> <ul style="list-style-type: none"> ○ Individuals who have little to no trust in the COVID-19 vaccines being developed was strongly associated with higher odds of refusal (ORa=109.69, 95% CI: 57.38-206.69) [64] ● <i>k</i>=4 → Perceived necessity (beliefs about natural resistance/already protected/already in good health) <ul style="list-style-type: none"> ○ Vaccine hesitancy was significantly associated with the belief that natural exposure to germs and viruses gives the safest protection (OR=1.22, <i>p</i><0.01) [11] ○ Qual data re vaccination hesitancy (343/535 open text responses) cited already adopting other healthy behaviours so no need for vaccination [25] ○ Those that believed the vaccine is unnecessary because of good health (OR=4.22, 95% CI: 2.66-6.68) had a higher odds of reporting vaccination non-intent compared with those who did not have those beliefs [42] ○ The 'Wait and Learn' group (i.e., hesitant), compared to the 'Intender's, were less likely to perceive COVID-19 as severe, and were less likely to judge a COVID-19 vaccine as important to stop the spread of infection [59] ● <i>k</i>=14 → Concern about vaccine safety/risk of adverse reactions/efficacy <ul style="list-style-type: none"> ○ The most common reason expressed for reluctance to take the vaccine in LMIC studies was concern about side effects [13] ○ The hesitant participants most commonly selected 'concern that long term safety of vaccines is unknown' [22] ○ Concerns about side effects of COVID vaccines associated with increased hesitancy (Risk Ratio=8.28;
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	<p>95% CI: 4.32-15.90) [38]</p> <ul style="list-style-type: none"> ○ Overall, vaccine safety was the leading concern; 25% of respondents believed that a COVID-19 vaccine would be unsafe and 18% believed that vaccines generally were not safe [60] ○ Psoriasis patients citing concerns mainly about its safety and efficacy (94%) [65] ○ Reasons for not getting vaccinated include safety/efficacy, adverse events, beliefs that vaccines are harmful, beliefs that COVID doesn't exist, belief already have immunity, chronic disease for which vaccine is not recommended [28] ○ Were scared of the vaccine's potential side effects (OR=2.30, 95% CI: 1.56-3.39) had a higher odds of reporting vaccination non-intent compared with those who did not have those beliefs (Lunsky et al., 2021) ○ Concern about the side effects and safety of the vaccine (30%); Plan to wait and see if it is safe and may get it later (15%); Concern that the vaccine is being developed too quickly (10%) [48] ○ The main reasons for vaccine hesitancy were concerns over future unknown effects of a vaccine (43%) [56] ○ Range of concerns associated with vaccination hesitancy: COVID-19 origin (natural vs. man-made) (OR=0.47, 95% CI: 0.38-0.57); COVID-19 is man-made to force people to get the vaccine? (yes vs. no) (OR=1.89, 95% CI: 1.46-2.43); COVID-19 vaccine will be used to implant microchips to humans? (yes vs. no) (OR=2.39, 95% CI: 1.72-3.30); COVID-19 vaccine causes infertility? (yes vs. no) (OR=2.73, 95% CI: 1.90-3.93); Are you against vaccination in general? (yes vs. no) (OR=9.26, 95% CI: 6.60-12.99) [57] ○ Less likely to take vaccine if benefit was lower (50% vs. 70% vs. 90% efficacy). Less likely to take vaccine if
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	<p>risk of adverse event was higher (1/100 million or 1/million in comparison to 1 per 100,000 ($p < 0.05$)) [37]</p> <ul style="list-style-type: none"> ○ Qual data: Reliance on 'home remedies' was also thought to present challenges"; vaccines not safe/won't work; anticipating discrimination [39] ○ Among those who said they definitely would not get the vaccine, 7% were concerned only about side effects, 15% were concerned that only that the vaccine was unsafe, and 71% had multiple concerns [51] ○ Concerns about the serious side effects of COVID-19 vaccines ($p < 0.01$) was significantly associated with COVID-19 vaccination hesitancy [72] ● $k=3$ → Concern about adverse reactions (specifically contraindications among patients) <ul style="list-style-type: none"> ○ This lack of information/concerns about possible medication contraindications, safety and efficacy for patients with autoimmune conditions, and side effects [15] ○ Reasons for declining COVID-19 vaccination among rheumatologic patients were fear of adverse reactions ($n=14$) and of rheumatic disease worsening ($n=3$), safety concerns related to the rapidity of vaccine production ($n=6$), doubt on its usefulness ($n=1$) [18] ○ Respondents with an autoimmune disease were more likely to report concern of a bad vaccine reaction as the reason for unwillingness to be vaccinated (OR=1.22, 95% CI: 1.06-1.41) [55] ● $k=3$ → High/low risk perception about contracting COVID-19 <ul style="list-style-type: none"> ○ Association between COVID-19 risk perception and vaccine acceptance showed that persons who had high risk perception of COVID-19 may not necessarily accept the vaccine (OR=0.45; 95% CI: 0.30-0.68) [36] ○ Those with higher perceived risk of contracting
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	<p>COVID-19 were more hesitant [53]</p> <ul style="list-style-type: none"> ○ Those with a high-risk perception of contracting COVID-19 or of infecting a family member or friend had 1.30 times the odds of being at a higher level of hesitancy compared to those not having such concerns (OR=1.30, 95% CI: 1.06-1.60) [61]
<p>Beliefs about consequences factors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● $k=13 \rightarrow$ =Positive beliefs about vaccine safety/risk of adverse reactions/efficacy <ul style="list-style-type: none"> ○ Participants who believed that vaccines are generally safe (OR=9.26, 95% CI: 6.02-14.24) nine times more likely to accept vaccines [29] ○ Participants who trust the effectiveness of the vaccine were more willing to be vaccinated (OR=6.42, 95% CI: 3.72-11.07) [30] ○ Those who perceived a COVID-19 vaccination as important (OR=8.71, 95% CI: 5.89-12.89), safe (OR=1.80, 95% CI: 1.24-2.61), and effective (OR=2.66, 95% CI: 1.83-3.87) were significantly more likely to accept COVID-19 vaccination [34] ○ Perceived efficacy of the COVID-19 vaccination was positively associated with the intention to receive COVID-19 free and self-paid vaccination [47] ○ Pregnant people: Confident in safety of COVID-19 vaccine post-approval by country's health agencies (vs. not confident) (ORa=3.68, 95% CI: 3.02-4.50). Non-pregnant mothers: Confident in safety of COVID-19 vaccine post-approval by country's health agencies (vs. not confident) (ORa=5.12, 95% CI: 4.06-6.46). Pregnant people: Confident in COVID-19 vaccine efficacy post approval by country's health agencies (ref: not confident) (ORa=1.26, 95% CI: 1.02-1.55). Non-pregnant mothers: Confident in COVID-19 vaccine efficacy post approval by country's health agencies (vss. not confident) (ORa=2.35, 95% CI: 1.93-2.87) [63] ○ Believing that COVID-19 vaccination was effective

	<p>(OR=2.07, 95% CI: 1.07–3.99) associated with immediate vaccination acceptance [73]</p> <ul style="list-style-type: none"> ○ Confidence in the safety of the vaccine was the strongest predictor of willingness to be vaccinated, followed by concern for protecting others and whether or not one believed that COVID-19 was serious enough to warrant vaccination [27] ○ The majority of respondents reported they were confident in the safety of vaccines (69%), believed the benefits of vaccines are much bigger than the risks (80%), and that CDC vaccination recommendations are a good fit for them (73%) [59] ○ Positive opinions about COVID-19 vaccine safety and necessity were significantly associated with likelihood to accept COVID-19 vaccine ($p < 0.01$) [17] ○ 'Lack of concern about side-effects' (ORa=1.65, 95% CI 1.03-2.65) were more likely to be willing to receive the vaccine; 'Lack of concern about the effectiveness, safety of vaccination' (ORa=2.55, 95% CI 1.60-4.08) were more likely to be willing to receive the vaccine [70] ○ Perceived effectiveness of a COVID-19 vaccine (OR=9.15, 95% CI: 6.69-12.51) associated with higher acceptance [43] ○ Trusting in the effectiveness of the COVID-19 vaccine was associated with higher acceptance (OR=4.17, 95% CI: 2.85-5.49) [45] ○ Respondents considered the effectiveness (29%) of the vaccine and the severity of COVID-19 (26%) the most important reasons to receive this vaccination, whilst the safety (21%) of the vaccine was the third [24] ○ Vaccination uptake: I trust in the effectiveness of the COVID-19 vaccine (OR=5.03, 95% CI: 3.36-6.70) [45] ● $k=15 \rightarrow$ Perceived necessity (to prevent risk of infection, reduce severity if infected, and reduce risk of spreading to
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	<p>others, to overcome the pandemic and return to normal)</p> <ul style="list-style-type: none"> ○ Lower risk of non-intent: Perceived risk of becoming ill with COVID-19 (OR=0.51, 95% CI 0.34-0.76); Perception that vaccination would protect their family (OR=0.19, 95% CI 0.13-0.28); Perception that getting vaccinated would protect their clients (0.36, 95% CI 0.24–0.54); Those with vaccination non-intent had lower odds of being concerned about their clients becoming ill (OR=0.57, 95% CI 0.34-0.97) [42] ○ Regarding COVID-19, the most strongly associated beliefs included that the COVID-19 vaccine will help protect “myself and others” (OR=38.60, 95% CI: 32.40-46.10), the COVID-19 vaccine would be safe and effective (OR=21.60, 95% CI: 18.90-24.70), and being comfortable with short term side effects such as prolonged injection site pain (OR10.90, 95% CI: 9.10-13.10) [50] ○ The main reasons for being willing to take up a vaccine were to avoid catching COVID-19 or becoming ill from the disease (55%) [56] ○ Concerns about getting seriously ill or being afraid that a family member would get seriously sick from COVID-19 (RPa=1.28; 95% CI: 1.26-1.30) was associated with a higher prevalence of vaccination intention [71] ○ Concerns about contracting COVID-19 and its effects (ORa=1.90, 95% CI: 1.01-3.50) was associated with vaccine acceptance [16] ○ Individuals who perceived their health status as reasonable compared to good or very good had lower odds of refusal (ORa=0.59, 95% CI: 0.40-0.87) [64] ○ Stronger vaccination intentions associated with high concerns about contracting COVID-19 (OR=1.91, 95% CI: 1.29-2.81) [12] ○ Perceiving a high or very high risk of infection (OR=1.59, 95% CI: 1.06–2.40) associated with
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	<p>immediate vaccination acceptance [73]</p> <ul style="list-style-type: none"> ○ Based on the Health Beliefs Model: Intention to vaccinate against COVID-19 is greater when perceived severity of the disease is high, perceived benefits from the vaccination are high, perceived susceptibility after having the new vaccine is low, and perceived barriers for the vaccination procedure are low (model explained 59% of the variance in vaccination intentions) [76]. ○ 'The vaccine will help to provide long-term immunity' (ORa=2.73, 95% CI 1.72-4.35) were more likely to be willing to receive the vaccine [70] ○ Pregnant people: Among the vaccine positive group (i.e. felt vaccination a breakthrough in resolving the pandemic), 72 women (53%) were favourable to obtain the vaccine during pregnancy, a percentage significantly higher (p=0.02) when compared to the vaccine negative group (i.e. considered the vaccine not useful) (28%) [46] ○ Willingness to protect others by getting oneself vaccinated (OR=3.51, 95% CI: 2.75-4.48) associated with higher acceptance [43] ○ Belief that vaccines will help protect the health of the people who take it (beta=0.23, p<0.01) associated with higher acceptance [20] ○ Patients who wanted to be vaccinated had a higher desire of acquiring self-protection from the vaccine (p<0.01), as well as protection of family (p<0.01) and community (p<0.01) and the belief that population COVID-19 vaccination will bring life to normal (p=0.01) [62]
<p>TDF Domain (Definition)</p>	
<p>Social/professional role and identity (How does their role/responsibility (in various settings) influence whether they do or not? How does who they are influence whether they do something or not? Is the behaviour something they are supposed to do or is someone else responsible?)</p>	

<p>Role and identity factors associated with lower acceptance</p>	<ul style="list-style-type: none"> • No specific role/identity factors identified to date
<p>Role and identity factors associated with higher acceptance</p>	<ul style="list-style-type: none"> • $k=1 \rightarrow$ Political preference/identity <ul style="list-style-type: none"> ○ Of those likely to take a vaccine, 64% favoured (now President) Biden (vs. 27% Trump, vs. 9% undecided). Even for vaccines that were described as 90% effective, more Biden voters reported they would be very likely to be inoculated in comparison to Trump voters (38.3 vs. 26.5%, $p<0.05$) [37] • $k=1 \rightarrow$ Role responsibility at work <ul style="list-style-type: none"> ○ Getting vaccinated was part of their job (OR=0.43, 95% CI 0.28-0.66) (workers supporting adults with intellectual disabilities) [42] • $k=2 \rightarrow$ Personal norms/responsibility/duty <ul style="list-style-type: none"> ○ Personal norm (awareness of consequences and ascription of responsibilities are conditions for the activation of personal norms) positively influenced intention to vaccinate for COVID-19 (beta=0.94, $p<0.01$) [54] ○ Feeling that getting the vaccine is a civic responsibility associated with vaccination acceptance (ORa=32.39, 95% CI: 17.63-61.86) [16]
<p>TDF Domain (Definition)</p>	
<p>Reinforcement (How have their experiences (good and bad) of doing it in the past influence whether or not they do it? Are there incentives/rewards?)</p>	
<p>Reinforcement factors associated with lower acceptance</p>	<ul style="list-style-type: none"> • $k=1 \rightarrow$ Past experience with severe COVID-19 infection <ul style="list-style-type: none"> ○ Respondents who had COVID-19 with severe symptoms were more hesitant about taking the vaccine with 1.42 times the odds of being at a higher level of hesitancy compared to those who did not experience the disease at all (OR=1.42, 95% CI: 1.01-1.99) (Savoia et al., 2021) • $k=3 \rightarrow$ Historical influenza vaccination <ul style="list-style-type: none"> ○ Individuals who would not take the flu vaccine this

	<p>year associated with higher odds of refusal (ORa=19.81, 95% CI: 9.74-40.30) [64]</p> <ul style="list-style-type: none"> ○ Previous vaccine refusal ($p < 0.01$) was significantly associated with COVID-19 vaccination hesitancy [72] ○ The 'Wait and Learn' group (i.e., hesitant), compared to the 'Intenders', were less likely to report receiving an influenza vaccine in the past 12 months [59] ● $k=2 \rightarrow$ Past experience with vaccine-related allergic reactions and refusal <ul style="list-style-type: none"> ○ Allergies to past vaccines among rheumatic patients [15] ○ History of refusing a certain type of vaccination (OR=0.57, 95% CI: 0.40–0.82) associated with delayed vaccination acceptance (Wang et al., 2021)
<p>Reinforcement actors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● $k=10 \rightarrow$ Historical influenza vaccination <ul style="list-style-type: none"> ○ Those who had a flu vaccine in the last 3 years, took regular medication were significantly less likely to be vaccine hesitators [11] ○ Rheumatic and oncology patients who joined 2020 influenza vaccine campaign were keener to get COVID-19 vaccination (90% vs. 36%, $p < 0.01$) [18] ○ Those that had already had a flu vaccine this year were more likely to want a COVID-19 vaccine (51% vs. 21%) [25] ○ Seasonal influenza vaccine (OR=2.04, 95% CI: 1.31–3.17) were more likely to accept Covid-19 vaccines [29] ○ Participants who had been vaccinated against influenza in the past were more willing to receive the SARS-CoV-2 vaccine (OR=2.18, 95% CI: 1.47-3.21) [30] ○ Pregnant people: Did receive flu vaccination last year (vs. did not receive) (ORa=1.40, 95% CI: 1.18-1.67). Non-pregnant mothers: Did receive flu vaccination last year (vs. did not receive) (ORa=1.58, 95% CI: 1.36-1.82) [63] ○ Adding proof of vaccination (e.g., vaccination card)

	<p>associated with greater likelihood of vaccination acceptance (given its potential privileges, its use as a status symbol, or as a ticket to normalcy) [21]</p> <ul style="list-style-type: none"> ○ Having flu vaccine last year (beta=0.28, p<0.01) associated with higher acceptance [20] ○ Patients up to date on their vaccination schedule (according to the Portuguese National Vaccination Programme) reported more willingness to get a COVID-19 vaccine (p<0.01) [62] ○ Stronger intentions if they received the seasonal influenza vaccination in the past (OR=1.52, 95% CI: 1.17-1.97) [12] ● <i>k</i>=2 → Personal experience with COVID-19/COVID-19-related death <ul style="list-style-type: none"> ○ Stronger intentions to vaccinate if respondents had previously contracted or currently had COVID-19 (OR=1.48, 95% CI: 0.97-2.27) [12] ○ Having a close family member or friend who had died of COVID-19, respondents were 47% more acceptant of the vaccine (OR=1.47, 95% CI: 1.08-1.99) [53] ● <i>k</i>=1 → Engagement with COVID-19 personal protective behaviours/mitigation strategies <ul style="list-style-type: none"> ○ Engaging in preventive COVID-19 infection behaviours (OR=1.69; 95% CI 1.09-2.60) associated with vaccine willingness [41]
TDF Domain (Definition)	
Emotion How do they feel (affect) about what they do and do those feelings influence what they do?	
Emotion factors associated with lower acceptance	<ul style="list-style-type: none"> ● No emotion factors identified in literature to date
Emotion factors associated with higher acceptance	<ul style="list-style-type: none"> ● <i>k</i>=1 → Higher scores on COVID-19 related anxiety was related to vaccine acceptance (OR=1.09, 95% CI: 1.03-1.16) [75] ● <i>k</i>=1 → Displaying depressive symptoms (RPa=1.03; 95% CI: 1.03-1.04) associated with higher prevalence of vaccination

	<p>intention [71]</p> <ul style="list-style-type: none"> • $k=1 \rightarrow$ Individuals who felt agitated, sad, or anxious due to the physical distancing measures on some days had lower odds of refusal than individuals who never had those feelings (ORa=0.49, 95% CI: 0.31-0.78) [64]
TDF Domain (Definition)	
Goals	
How important is what they do & does that influence whether or not they do it?	
Goals factors associated with lower acceptance	<ul style="list-style-type: none"> • No goals factors identified in literature to date
Goals factors associated with higher acceptance	<ul style="list-style-type: none"> • $k=1 \rightarrow$ Matching vaccine preference <ul style="list-style-type: none"> ○ Vaccination intention differed between the two groups (experimental study); when assigned their preferred vaccine, only 6% of participants intended to decline vaccination, as compared to 42% in the non-preferred vaccine group. So willingness to be vaccinated increased when the preferred vaccine was assigned and decreased for the non-preferred vaccine [66] • $k=1 \rightarrow$ Engagement with COVID-19 personal protective behaviours/mitigation strategies <ul style="list-style-type: none"> ○ Compliance with community mitigation strategies (RPa=0.99; 95% CI: 0.98–0.99) was associated with a lower prevalence of vaccination intention [71]

Objective 4: Equity-related factors associated with higher and lower COVID-19 vaccination acceptance

We focused our assessment of equity-related factors on studies that assessed race and ethnicity in relation to vaccine acceptance. Overall, 16/66 studies assessed whether vaccine acceptance was associated with race and ethnicity. Of these, 15/16 found differences in vaccine acceptance and uptake based on racial/ethnic identity. The main findings from these studies are reported in **Table 5**. 3 studies added to version 2 of this report were conducted with people experiencing homelessness [40], people from sexual and gender minority backgrounds [69], and incarcerated/detained residents [67].

Table 5. Differences in vaccine acceptance among equity-seeking groups

Study authors (Country)	Vaccine acceptance/hesitancy rates among equity-seeking groups
Dalal et al. (USA)	<ul style="list-style-type: none"> • Respondents who identified as White were associated with vaccination intent (ORa=2.10, 95% CI: 1.20-3.90).
Dickerson et al. (UK)	<ul style="list-style-type: none"> • 43% (95% CI: 37-54%) of White British and 60% (35-81%) in the least deprived areas do want a vaccine, compared to 13% (9-19%) of Pakistani heritage and 20% (15-26%) in the most disadvantaged areas.
Doherty et al. (USA)	<ul style="list-style-type: none"> • Black respondents were 1.68 (95% CI: 1.16, 2.45) times more likely to report vaccine hesitancy than White respondents.
Grumbach et al. (USA)	<ul style="list-style-type: none"> • Vaccine uptake in racialized groups vs. White respondents: <ul style="list-style-type: none"> ○ Black (ORa=0.29, 95% CI: 0.20-0.43) ○ Latinx (ORa=0.55, 95% CI: 0.43-0.71) ○ Asian (ORa=0.57, 95% CI: 0.47-0.70) ○ Multiple races (ORa=0.65, 95% CI: 0.46-0.92)
Iadarola et al. (USA)	<ul style="list-style-type: none"> • Black respondents >50 years old were more likely accept a vaccine than younger respondents (OR=3.72, 95% CI: 1.73-8.00).
Nguyen II et al. (USA and UK)	<ul style="list-style-type: none"> • Vaccine hesitancy in racialized groups vs. White UK respondents: <ul style="list-style-type: none"> ○ Black (OR=2.84, 95% CI: 2.69-2.99) ○ South Asian (OR=1.66, 95% CI: 1.57-1.76) ○ Middle East/East Asian (OR=1.84, 95% CI: 1.70-1.98)

Study authors (Country)	Vaccine acceptance/hesitancy rates among equity-seeking groups
	<ul style="list-style-type: none"> ○ Multiple races/other (OR=1.48, 95% CI: (1.39-1.57)) ● Vaccine hesitancy in racialized groups vs. White USA respondents: <ul style="list-style-type: none"> ○ Black (OR=3.15, 95% CI: 2.86-3.47) ○ Latinx (OR=1.42, 95% CI: 1.28-1.58) ○ Asian (OR=1.34, 95% CI: 1.18-1.52) ○ Multiple races/other (OR=2.02, 95% CI: 1.70-2.39)
Robertson et al. (UK)	<ul style="list-style-type: none"> ● Vaccine hesitancy in racialized groups vs. White British/Irish UK respondents: <ul style="list-style-type: none"> ○ Black/Black British (OR=12.96, 95% CI: 7.34-22.89) ○ Pakistani/Bangladeshi (OR=2.31, 95% CI: 1.55-3.44)
Savoia et al. (USA)	<ul style="list-style-type: none"> ● Vaccine hesitancy was predicted by the experience of racial discrimination (OR=1.21, 95% CI: 1.01-1.45).
Szilagy et al. (USA)	<ul style="list-style-type: none"> ● Black (vs. White) respondents were less likely to get a vaccine (38% vs. 59%; ORa=0.70, 95% CI: 0.60-0.80).
Dorman et al. (USA)	<ul style="list-style-type: none"> ● Race/ethnicity also showed a significant effect on willingness to be vaccinated ($p < 0.01$). Asian respondents were most likely to want to be vaccinated, followed by non-Hispanic White, Hispanic, and non-Hispanic Black respondents. All racial/ethnic groups differed significantly from one another ($p < 0.01$).
Stern et al. (USA)	<ul style="list-style-type: none"> ● Willingness to receive a vaccination (among incarcerated or detained residents) was lowest among Black participants (37%) and highest among Hispanic/Latino (Hispanic) (53%) and American Indian/Alaska Native (48%) participants ($p < 0.01$ for group).
Daly et al. (USA)	<ul style="list-style-type: none"> ● Regression analyses showed statistically significant increases in intentions to vaccinate between October 2020 and February 2021 for all demographic groups examined. Over this period the largest increases in willingness to vaccinate were found among Black (16% increase, 95% CI: 10-22, $p < 0.01$) and Hispanic participants (12% increase, 95% CI: 6-18, $p < 0.01$).
Salmon et al. (USA)	<ul style="list-style-type: none"> ● Intent to get vaccinated was substantially lower among

Study authors (Country)	Vaccine acceptance/hesitancy rates among equity-seeking groups
	African Americans (32%) and comparable among White non-Hispanics (55%), Hispanics (52%) and Other non-Hispanics (53%). Compared to the Intenders, the 'Wait and Lear' group (i.e., hesitant) were more likely to be African American (OR=2.51, 95% CI: 1.98-3.18).
Teixeira da Silva et al. (USA)	<ul style="list-style-type: none"> White participants (among people from sexual and gender minority) were more willing to accept a COVID-19 vaccine than Black, American Indian/Alaskan Native participants, and participants identifying with another race. Asian participants reported greater vaccine acceptance than White participants.
Benis et al. (USA)	<ul style="list-style-type: none"> A higher vaccination hesitancy was noted among minorities than among the White population (22% vs. 15%, p<0.01).

The studies listed in **Table 5** provide evidence to suggest that respondents from racialized communities are less likely to express vaccine acceptance than White respondents. For example, one survey study conducted in the USA [61] found that participants who reported past experiences with discrimination also reported greater vaccine hesitancy when compared to those who did not report past racial discrimination (OR=1.21, 95% CI: 1.01-1.45). Another survey study in the USA [49] found that Black respondents reported lower vaccine uptake even when controlling for other factors. The authors note that this disparity persisted even among individuals who endorsed a willingness to obtain a vaccine. Though one study [26] reported that vaccine hesitancy declined over time (OR=0.76, 95% CI: 0.63-0.92) across racialized groups. Among new studies added to version 2 of this report, 6 studies conducted in the USA found that COVID-19 vaccination acceptance rates were generally lower among individuals identifying as Black [27,59,67,69] or an ethnic minority [16] compared to White respondents. However, a longitudinal study by Daly et al. found that between October 2020 and February 2021, there was a large increase in COVID-19 vaccination acceptance among Black (16% increase) and Hispanic (12% increase) participants. Understanding why such racial and ethnic differences exist is critical to the success of any vaccination campaign. Assessing barriers and enablers to vaccine acceptance that racialized groups experience may provide valuable insights into factors driving observed disparities, and suggest ways to better support specific groups based on their specific concerns and experienced barriers.

Version 1 of this review further identified four studies [26,33,35,49] that examined factors associated with vaccine acceptance among different racialized groups. Based on USA data, the authors of these studies examined factors associated with vaccine acceptance among Black, Latinx, Asian, and White-identified respondents. 3 studies added to version 2 of this review examined determinants of vaccine acceptance among marginalized groups, namely: people experiencing homelessness [40], people from sexual and gender minority backgrounds [69], and incarcerated/detained residents [67]. Based on these data, 4 (of a possible 14) TDF domains - Knowledge (see **Table 6**); Environmental context and resources, Social influences (see **Table 7**), Beliefs about consequences (see **Table 8**) – were identified as potential determinants of COVID-19 vaccine acceptance among equity-seeking groups.

Capability-related factors associated with higher and lower COVID-19 vaccination acceptance among equity-seeking groups

Only 1 from 4 studies presented evidence suggesting that capability-related factors were associated with vaccine acceptance among Black, Latinx, Asian, and White-identified respondents (**Table 6**). Nguyen II et al. found that among those who reported lower vaccine acceptance in the US, Black and Latinx individuals cited a lack of knowledge about the vaccine (51% and 51%, respectively) at a higher rate than White individuals (42%). In the UK, Black (45%) and South Asian (42%) respondents cited not knowing enough about the vaccine at a higher rate than White respondents (37%). However, these differences are based on reported frequencies only [49]. A new study added to version 2 of this report found that incarcerated or detained residents reported a desire for further information about COVID-19 vaccines in order to increase vaccination acceptance [67].

Table 6. Capability-related factors associated with COVID-19 vaccination acceptance among equity-seeking groups

TDF Domain (Definition)	
Knowledge (What do people know & how does that influence what they do? Do they have the procedural knowledge (know how to do it)?)	
Knowledge factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=3 \rightarrow$ not knowing enough about COVID-19 vaccines was cited as a common reason for lower vaccine acceptance [49] <ul style="list-style-type: none"> ○ Frequency comparisons suggest Black, Latinx, and South Asian respondents cited lack of knowledge at

	<p>higher rates than White respondents [49]</p> <ul style="list-style-type: none"> ○ Among incarcerated/detained residents, common reasons reported for COVID-19 vaccine hesitancy were waiting for more information (55%) [67]
<p>Knowledge factors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● No Knowledge factors identified in literature to date

Opportunity-related factors associated with higher and lower COVID-19 vaccination acceptance among equity-seeking groups

One study that sought to examine vaccine acceptance among underserved communities in the USA found that owning a mobile phone or computer was associated with lower vaccine acceptance across racialized groups [26] (Table 7). Three studies reported data suggesting that distrust in institutions was associated with lower vaccine acceptance [26,33,35]. While Doherty et al. found that lack of trust in the government predicted lower vaccine acceptance across all groups surveyed, Iadarola found that Black respondents reported more distrust in government at a significantly higher rate (96%) than other groups (80% Latinx, 78% White, 0% Asian; $p < 0.01$). Iadarola et al. also found that Black (96%) and Latinx (91%) participants were more concerned about being used as an experiment than other groups (76% White, 67% Asian; $p < 0.05$). Grumach et al. also found evidence of greater mistrust among Black respondents who were three times more likely to express distrust in companies making vaccines than White respondents (ORa=3.08, 95% CI: 2.00-4.73). Similar findings were found among samples of incarcerated/detained residents [67] and people from sexual and gender minority backgrounds [69]. Taken together, these studies suggest that distrust plays an important role in determining how willing different equity-seeking groups are to COVID-19 vaccination and that some groups may experience greater trust-related hesitancy. One study [26] found that wanting others to receive the vaccine first was marginally predictive of lower vaccine acceptance (OR=1.44, 95% CI: 0.98-2.11). The authors note between 24-26% of participants, independent of their vaccine hesitancy or acceptance wanted others to get the vaccine first ($p = 0.77$). It is unclear what may motivate this preference. 1 study added to version 2 of this report found that altruistic motivation was associated with higher vaccination acceptance in a sample of people from sexual and gender minority backgrounds [69].

Table 7. Opportunity-related factors associated with COVID-19 vaccination acceptance among equity-seeking groups

TDF Domain (Definition)	
Environmental Context and Resources	
(What are the things in people’s environment that influence what they do and how do they influence?)	
Environmental Context and Resource factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=1 \rightarrow$ Ownership of mobile phones and computers was associated with lower vaccine acceptance [26] <ul style="list-style-type: none"> ○ Mobile phones (OR=2.12, 95%CI 1.31-3.43) ○ Computers (OR=1.46, 95%CI: 1.00-2.13)
Environmental context and resource factors associated with higher acceptance	<ul style="list-style-type: none"> • No Environmental context and resource factors identified in literature to date
TDF Domain (Definition)	
Social influences	
(What do others do? What do others think of what people do or what they should do? Who are they and how does that influence what they do?)	
Social influence factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=3 \rightarrow$ Distrust in government and companies making vaccines was associated with lower vaccine acceptance <ul style="list-style-type: none"> ○ Distrust predicted lower vaccine acceptance (OR=3.57, 95% CI: 2.26-5.63) across all groups [26] ○ Black-identified respondents expressed more distrust in companies making vaccines than White respondents (ORa=3.08, 95% CI: 2.00-4.73) [33] ○ Black-identified respondents reported higher rates (96%) of distrust in government than Latinx (80%), White (78%), and Asian (0%) respondents ($p<0.01$) [35] ○ Latinx and Black respondents reported concerns over being used as an experiment more often (96% and 91%, respectively) than White or Asian respondents (76% and 67%, respectively) ($p=0.05$) [35] ○ Among incarcerated/detained residents who would refuse a COVID-19 vaccination, 20% cited distrust of health care, correctional, or governmental personnel or institutions [67]

	<ul style="list-style-type: none"> ○ Among individuals from sexual and gender minority backgrounds, medical mistrust was associated with lower COVID-19 vaccination acceptance (beta -0.06, $p < 0.05$) [69] ○ $k=1 \rightarrow$ Wanting others to receive vaccine first was marginally associated with lower vaccine acceptance (OR=1.44, 95% CI: 0.98-2.11) [26] ● $k=1 \rightarrow$ Influence of social networks as information sources (although association was marginally statistically non-significant) <ul style="list-style-type: none"> ○ Among people experiencing homelessness, those who trusted COVID-19 information from official sources and news media were less hesitant, while those solely trusting personal sources (i.e., friends/family and social media) were relatively more hesitant (ORa=2.70, 95% CI: 0.93-7.81, $p=0.07$, n.s.) [40]
<p>Social influence factors associated with higher acceptance</p>	<ul style="list-style-type: none"> ● $k=1 \rightarrow$ Role of altruistic motivation <ul style="list-style-type: none"> ○ Among people from sexual and gender minority backgrounds, acceptance of a COVID-19 vaccine was positively associated with altruistic motivations (beta=0.60, $p < 0.01$) [69] ● $k=1 \rightarrow$ Trust in 'official sources' associated with higher acceptance (although association was marginally statistically non-significant) <ul style="list-style-type: none"> ○ Among, people experiencing homelessness: those who trusted official sources were less hesitant (ORa=0.37, 95% CI: 0.12-1.11, $p=0.08$, n.s.) [40]

Motivation-related factors associated with higher and lower COVID-19 vaccination acceptance among equity-seeking groups

Three studies [26,33,49] reported Beliefs about consequences as a factor associated with vaccine acceptance among racialized groups (**Table 8**). Two studies found that safety concerns were associated with lower vaccine acceptance. Doherty et al. found that participants with safety concerns were 4 times more likely express vaccine hesitancy (OR=4.28, 95% CI: 3.06-5.97) across all groups [26]. However, they also found that Latinx respondents (32%) were less

likely to cite safety concerns as a reason for delaying or not wishing to get the COVID-19 vaccine than were White (54%) and Black (53%) respondents. Another study reporting frequencies of reasons for refusing a vaccine found that concerns over safety was the most common reason cited across all participants [49]. Black respondents in the USA reported higher rates of safety concerns based on reported frequencies. Two studies found that concerns over vaccine efficacy were associated with lower vaccine acceptance [26,33]. While Doherty et al. found that efficacy concerns predicted lower vaccine acceptance across all groups, Grumbach et al. found that Black, Latinx, and Asian respondents were about twice as likely to express efficacy concerns than were White respondents. Finally, one study found that Black, Latinx and Asian respondents were more likely to express concerns over a rushed approval process [33].

Table 8. Motivation-related factors associated with COVID-19 vaccination acceptance among equity-seeking groups

TDF Domain (Definition)	
Beliefs about consequence (What are the good and bad things that can happen from what people do and how does that influence whether they'll do it in the future?)	
Beliefs about consequences factors associated with lower acceptance	<ul style="list-style-type: none"> • $k=2 \rightarrow$ Safety concerns (i.e., side effects and adverse reactions) were associated with lower vaccine acceptance <ul style="list-style-type: none"> ○ Safety concerns predicted lower vaccine acceptance across all groups (OR=4.28, 95% CI: 3.06-5.97) [26] ○ Safety concerns were the most commonly cited reason for lower acceptance among White (54%), Black (53%) and Latinx (32%) participants ($p<0.01$) [26] ○ Black respondents in the USA cited side effects as the most common reason for vaccine hesitancy (57% vs. 52% White, 55% Latinx, 50% Asian respondents) [49] • $k=2 \rightarrow$ Concerns over vaccine efficacy was associated with lower vaccine acceptance <ul style="list-style-type: none"> ○ Efficacy concerns were associated with lower acceptance across all groups (OR= 3.50, 95% CI: 1.57-7.82) [26] ○ Black (ORa=2.39, 95% CI: 1.58-3.61), Latinx

	<p>(ORa=2.04, 95% CI: 1.58-2.64) and Asian (ORa=1.85, 95% CI: 1.51-2.27) respondents twice as likely to express doubts in vaccine efficacy than White respondents [33]</p> <ul style="list-style-type: none"> • <i>k</i>=1 → Concerns over a rushed approval process <ul style="list-style-type: none"> ○ Black (ORa=2.10, 95% CI: 1.44-3.05), Latinx (ORa=1.68, 95% CI: 1.34-2.10) and Asian (ORa=1.81, 95% CI: 1.53-2.15) respondents reported greater concern than White respondents [33] • <i>k</i>=1 → Social concerns related to COVID-19 vaccination <ul style="list-style-type: none"> ○ Among people from sexual and gender minority backgrounds, social concerns regarding the vaccine associated with lower COVID-19 vaccination acceptance (beta=0.10, p<0.01) [69]
<p>Beliefs about consequences factors associated with higher acceptance</p>	<ul style="list-style-type: none"> • <i>k</i>=1 → Concern about contracting COVID-19 <ul style="list-style-type: none"> ○ Among people experiencing homelessness, those with a higher perceived threat of contracting COVID-19 were less likely to be hesitant (ORa=0.25, 95% CI: 0.08-0.80, p=0.02) [67]

Discussion

Overview

This report details version 2 of our LBSES looking at factors affecting COVID-19 vaccination acceptance and uptake among the general public. A total of 66 studies (including 26 studies added for version 2 of this report) were identified spanning Nov, 2020 - Apr, 2021, thus representing research conducted since the approval of COVID-19 vaccines in late-2020. Only 1 study identified to date was conducted in Canada which highlights an urgent need for more Canadian research in this area.

The overall percentage of individuals willing to accept a COVID-19 vaccine was 62% ($k=58$; IQR=46-79%). In studies conducted in North America, 61% of respondents were willing to accept a COVID-19 vaccine ($k=19$; IQR=50-75%). In the 1 Canadian study identified to date, 62% of respondents were willing to accept a vaccine for COVID-19. These vaccine acceptance rates are comparable to data focusing on HCW vaccination reported elsewhere ([v2, May 18th, 2021](#)).

Based on the Capability, Opportunity, and Motivation-Behaviour (COM-B) model [2], a number of important factors were identified that focused primarily on Opportunity and Motivation. Capability factors (i.e., the individuals capacity to engage in the behaviour) focused on the role of Knowledge; Opportunity factors (i.e., all the factors that lie outside the individual that make the behaviour possible or prompt it) identified included Environmental context and resources and Social influences, and Motivation factors (i.e., the thought processes within the individual that energize and direct the behaviour) included Beliefs about consequences, Social/professional role and identity, Reinforcement, Emotion, and Goals. These cover 8 of 14 domains of the Theoretical Domains Framework (TDF) and are almost identical to the key domains identified in our [previous report](#) focusing on COVID-19 vaccination acceptance among HCWs (which included data since start of the pandemic). As such, our findings indicate that drivers of vaccination acceptance appear to remain consistent to date, even in light of authorised vaccines (since Dec 2020).

Across studies, concerns and erroneous beliefs about COVID-19 vaccine safety, efficacy, and necessity (captured under Beliefs about consequences) were common and associated with lower vaccination acceptance. Mistrust of governments and public health agencies (captured under Social influences) was frequently associated with lower vaccination acceptance. As seen in our HCW-focused report, previous vaccination behaviour (captured under Reinforcement) consistently predicted intention to receive a vaccine for COVID-19. As such, there may be opportunities to adapt previous campaign strategies and programs encouraging routine

vaccination to the COVID-19 context, although addressing system-level mistrust will be crucial going forward to encourage vaccination uptake. There may also be opportunities to leverage social norms and in particular descriptive norms (i.e., being aware of what others like you are doing; captured under Social influence) which were shown to be associated with higher vaccination acceptance in 3 studies. This could be particularly important to encourage young people to get vaccinated once able to.

In terms of racialized groups, 15 studies conducted in North America provided evidence suggesting that racialized (e.g., Black, Latinx, Asian) respondents are less likely to express vaccine acceptance than White respondents. We identified 4 of 14 domains of the TDF associated with vaccination acceptance among racialized groups, namely, Knowledge, Environmental context and resources; Social influences, and Beliefs about consequences. Government and public health agency mistrust was again cited as an important barrier to vaccination and concerns about vaccine development were more common among Black, Latinx, and Asian vs. White respondents while concerns about vaccine safety were common across all groups. Such findings may help inform strategies and programs addressing the specific needs and concerns of such equity-seeking groups, although additional field work needs to be conducted in Canada with a particular focus on indigenous communities in which perspectives and data are currently lacking.

Future directions for research in this area

Although some behavioural domains did not yet emerge as factors associated with COVID-19 vaccine acceptance in the general public, there may be opportunity for considering a greater breadth of possible barriers and enablers which could be guided by frameworks such as the TDF. Domains from the TDF that did not emerge to date as factors associated with COVID-19 vaccine acceptance among the general public include: Skills; Behavioural regulation; Memory/attention; Beliefs about capabilities; and Optimism. It may be that other methods of data collection (e.g., qualitative methods) may be better suited to elucidate the range of potential barriers and enablers to vaccination acceptance and uptake. To date, we have only identified 1 qualitative study exploring drivers of COVID-19 vaccination acceptance and uptake in the general public [39], therefore, further qualitative research is needed.

Now that COVID-19 vaccines continue to be steadily rolled out, there is a clear need for more Canadian research to help understand the factors associated with vaccination acceptance and uptake in the general public and in particular those from equity-seeking groups to help better inform how best to support greater vaccination. Assessing barriers and enablers to vaccine

acceptance that racialized groups experience may provide valuable insights into factors driving observed disparities, especially when considered alongside the COM-B related barriers/enablers that each racialized group experience to better support each group.

There was some evidence indicating that knowledge was associated with vaccination acceptance among the general public. Knowledge, or lack thereof, is often seen as a key barrier to behaviour change which is reflected in the abundance of strategies and programs that focus solely on education and providing information. Whilst knowledge is undoubtedly important, it is usually insufficient as a stand-alone strategy, therefore, additional evidence-based, modifiable barriers must also be considered (cf. [recent brief](#) from the Ontario COVID-19 Science Advisory Table [78]). This point is further highlighted by the fact that Opportunity factors – which are deemed to lie outside the individual – have been shown to be important determinants of vaccination acceptance/uptake. As such, key infrastructure, supports, and resources need to be in place to support individuals to enact their intentions now that vaccines continue to be steadily rolled out across Canada.

Future directions for this LBSES

Given that COVID-19 vaccines have been rolling out since Dec 2020, we expect to see more research to investigate drivers of actual uptake, in addition to vaccination acceptance. From a behavioural science perspective, this will provide an opportunity to assess whether the same factors associated with vaccine acceptance (intention) are also associated with actual vaccination uptake (behaviour) and whether vaccine intention predicts behaviour. Evidence from other behavioural literatures suggests a gap between intention and action and measures for bridging this gap offer opportunities for ensuring individuals who do develop strong intentions and acceptance for the COVID-19 vaccine translate their strong intention into vaccination [78]. From an equity-seeking group perspective, future versions of this LBSES will continue to assess what is driving observed differences in vaccination acceptance and uptake. In particular, we will attempt to identify additional Canadian studies from the grey literature, as per the recent [rapid review](#) from National Collaborating Centre for Methods and Tools. Moreover, we will connect with Canadian researchers who are spearheading the important work of nuancing observed differences to vaccine acceptance to better account for how the lived experiences of equity-seeking groups may impact barriers and enablers to vaccine acceptance.

Future planned LBSES

- Identify which **strategies/techniques** are effective in supporting COVID-19 vaccination acceptance and uptake in the general public.
- Identify **alignment and gaps** between experienced barriers/enablers and currently tested strategies, and any lack of data for certain equity-seeking groups.
- Summarize **actionable implications** in general and in particular among those serving equity-seeking groups.

Funding statement

To help health- and social-system leaders as they respond to unprecedented challenges related to the COVID-19 pandemic, the Ottawa Hospital Research Institute is preparing living evidence profiles like this one. This living review is funded by the Public Health Agency of Canada. The opinions, results, and conclusions are those of the Ottawa Hospital Research Institute and are independent of the funder. No endorsement by the Public Health Agency of Canada is intended or should be inferred.

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Citation

Crawshaw, J., Konnyu, K., Castillo, G., van Allen, Z., Grimshaw, JM., Presseau, J. Factors affecting COVID-19 vaccination acceptance and uptake among the general public: a living behavioural science evidence synthesis (v2, May 31st, 2021). Ottawa: Ottawa Hospital Research Institute, May 31, 2021.

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Appendices

Appendix 1. List of additional studies (k=131) looking at COVID-19 vaccination acceptance since start of the pandemic (Jan - Oct, 2020), excluded for the purposes of this report

First Author	Study Title	Journal	Year	Country	Study Design	Data Collection Period
Akarsu	While studies on COVID-19 vaccine is ongoing, the public's thoughts and attitudes to the future COVID-19 vaccine	International Journal of Clinical Practice	2021	Turkey	Survey	June 10 – July 10, 2020
Akel	Modification of a vaccine hesitancy scale for use in adult vaccinations in the United States and China	Human Vaccines & Immunotherapeutics	2021	United States and China	Survey	Mar-Jun 2020
Alali	Perception and awareness of COVID-19 among health science students and staff of Kuwait University: An online cross-sectional study	Preprint	2021	Kuwait	Survey	June – July, 2020
AlHajri	Willingness of parents to vaccinate their children against influenza and the novel coronavirus disease-2019	The Journal of Pediatrics	2021	Kuwait	Survey	Aug 26 – Sept 1, 200
Allen	Factors associated with the intention to obtain a COVID-19 vaccine among a racially/ethnically diverse sample of women in the USA	Translational Behavioral Medicine	2021	United States	Survey	Apr 13 – Jun 8 2020
Alley	As the pandemic progresses, how does willingness to vaccinate against COVID-19 evolve?	Journal of Environmental Research and Public Health	2021	Australia	Survey	April - Aug, 2020
Allington	Media usage predicts intention to be vaccinated against SARS-CoV-2 in the US and the UK	Vaccine	2021	United States and United Kingdom	Survey	Jun-20
Al-Mohaithef	Determinants of COVID-19 vaccine acceptance in Saudi Arabia: A web-based national survey	Journal of Multidisciplinary Healthcare	2020	Saudi Arabia	Survey	NA

Al-Qerem	COVID-19 vaccination acceptance and its associated factors among a Middle Eastern population	Frontiers in Public Health	2021	Jordan	Survey	Oct-20
Alqudeimat	Acceptance of a COVID-19 vaccine and its related determinants among the general adult population in Kuwait	Medical Principles and Practice	2021	Kuwait	Survey	Aug 26 - Sept 1, 2020
Attwell	Converting the maybes: Crucial for a successful COVID-19 vaccination strategy	PloS One	2021	Australian	Survey	May-20
Barello	Vaccine hesitancy' among university students in Italy during the COVID-19 pandemic	European Journal of Epidemiology	2020	Italy	Survey	NA
Bell	Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: A multi-methods study in England	Vaccine	2020	England	Mixed Methods	April 19 – May 11, 2020
Benham	Attitudes, current behaviours and barriers to public health measures that reduce COVID-19 transmission: A qualitative study to inform public health messaging	PloS One	2021	Canada	Qualitative	Aug – Sept, 2020
Bogart	COVID-19 related medical mistrust, health impacts, and potential vaccine hesitancy among Black Americans living with HIV	Journal of Acquired Immune Deficiency Syndromes	2021	United States	Survey	May – July, 2020
Bokemper	Timing of COVID-19 vaccine approval and endorsement by public figures	Vaccine	2021	United States	Experimental	Sept 9 – 22, 2020
Borriello	Preferences for a COVID-19 vaccine in Australia	Vaccine	2021	Australia	Survey	March 27 – 31, 2020.
Brandt	National Study of Youth Opinions on Vaccination for COVID-19 in the U.S	Journal of Adolescent Health	2021	United States	Survey	Oct-20
Callaghan	Correlates and disparities of intention to vaccinate against COVID-19	Social Science & Medicine	2020	United States	Survey	May 28 – June 8, 2020
Caserotti	Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents	Social Science & Medicine	2021	Italy	Survey	Feb – Jun, 2020

Ceulemans	Vaccine Willingness and Impact of the COVID-19 Pandemic on Women's Perinatal Experiences and Practices-A Multinational, Cross-Sectional Study Covering the First Wave of the Pandemic	International journal of environmental research and public health	2021	Belgium	Survey	Apr-Jul 2020
Chen	An online survey of the attitude and willingness of Chinese adults to receive COVID-19 vaccination	Human Vaccines & Immunotherapeutics	2021	China	Survey	May – June, 2020
Chu	Integrating health behavior theories to predict American's intention to receive a COVID-19 vaccine	Patient Education and Counseling	2021	United States	Survey	Sep-20
COVID Collaborative	COVID Collaborative survey: Coronavirus vaccination hesitancy in the Black and Latinx communities	NA	2020	United States	Survey	Aug 27-30
Daly	Willingness to vaccinate against COVID-19 in the US: longitudinal evidence from a nationally representative sample of adults from April-October 2020	Preprint	2021	United States	Survey	April-Oct, 2020
Ditekemena	COVID-19 vaccine acceptance in the Democratic Republic of Congo: A cross-sectional survey	Vaccines	2021	Democratic Republic of Congo	Survey	Aug-Sept 2020
Dodd	Willingness to vaccinate against COVID-19 in Australia	The Lancet Infectious Diseases	2021	Australia	Survey	April 17-21
Dodd	Concerns and motivations about COVID-19 vaccination	The Lancet Infectious Diseases	2021	Australia	Survey	June – July, 2020
Dong	Public preference for COVID-19 vaccines in China: A discrete choice experiment	Health Expectations	2020	China	Experiment	June – July, 2020
Dror	Vaccine hesitancy: the next challenge in the fight against COVID-19	European Journal of Epidemiology	2020	Israeli	Survey	Mar-20
Edwards	COVID-19 vaccine hesitancy and resistance: Correlates in a nationally representative longitudinal survey of the Australian population	PloS One	2021	Australia	Survey	Aug-20
Ehde	Willingness to obtain COVID-19 vaccination in adults with multiple sclerosis in the United States	Multiple Sclerosis and Related Disorders	2021	United States	Survey	April 10 - May 6, 2020

Faasse	Public perceptions of COVID-19 in Australia: perceived risk, knowledge, health-protective behaviors, and vaccine intentions	Frontiers in Psychology	2020	Australia	Survey	March 2 – 9, 2020
Feleszko	Flattening the curve of COVID-19 vaccine rejection-an international overview	Vaccines	2021	Multicounty	Survey	June 2 – 9, 2020
Freeman	COVID-19 vaccine hesitancy in the UK: The Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II	Psychological Medicine	2020	United Kingdom	Survey	Sept 24 – Oct 17, 2020
Fridman	COVID-19 and vaccine hesitancy: A longitudinal study	PloS One	2021	United States	Survey	Mar 16 – Aug 16 2020
Gatwood	Factors influencing likelihood of COVID-19 vaccination: A survey of Tennessee adults	American Journal of Health-System Pharmacy	2021	United States	Survey	Jun-20
Gbashi	Systematic delineation of media polarity on COVID-19 vaccines in Africa using computational linguistic models	JMIR Medical Informatics	2020	Multi-Country (Africa)	Qualitative	Feb-May 2020
Gerussi	Vaccine hesitancy among Italian patients recovered from COVID-19 infection towards Influenza and Sars-Cov-2 vaccination	Vaccines	2021	Italy	Survey	March– May 2020
Gheorghe	Knowledge, attitudes and practices related to the COVID-19 outbreak among Romanian adults with cancer: A cross-sectional national survey	ESMO Open	2021	Romania	Survey	April-May 2020
Goldman	Caregiver willingness to vaccinate their children against COVID-19: Cross sectional survey	Vaccine	2020	Multi-Country	Survey	March 26 – May 31
Graffigna	Relationship between citizens' health engagement and intention to take the COVID-19 vaccine in Italy: A mediation Analysis	Vaccines	2020	Italy	Survey	NA
Gramacho	When politics collides with public health: COVID-19 vaccine country of origin and vaccination acceptance in Brazil	Vaccine	2021	Brazil	Survey	Sep-Oct 2020

Green	A study of ethnic, gender and educational differences in attitudes toward COVID-19 vaccines in Israel - implications for vaccination implementation policies	Israel Journal of Health Policy Research	2021	Israel	Survey	Oct-20
Guidry	Willingness to get the COVID-19 vaccine with and without emergency use authorization	American Journal of Infection Control	2021	United States	Survey	Jul-20
Guzoglu	General attitudes toward and awareness of vaccines among students at a university in Northern Cyprus	Human Vaccines & Immunotherapeutics	2021	Cyprus	Survey	Mar 2019 – Jun 2020
Harapan	Acceptance of a COVID-19 vaccine in Southeast Asia: A cross-sectional study in Indonesia	Frontiers in Public Health	2020	Indonesia	Survey	March 25 – April 6, 2020
Head	A national survey assessing SARS-CoV-2 vaccination intentions: Implications for future public health communication efforts	Science Communication	2020	United States	Survey	May-20
Hetherington	Covid-19 vaccination intentions among Canadian parents of 9-12 year old children: Results from the All Our Families longitudinal cohort	Preprint	2021	Canada	Survey	May-June 2020
Hursh	Quantifying the impact of public perceptions on vaccine acceptance using behavioral economics	Frontiers in Public Health	2020	United States	Survey	Jun-20
Huynh	A little shot of humility: Intellectual humility predicts vaccination attitudes and intention to vaccinate against COVID-19	Journal of Applied Social Psychology	2021	United States	Survey	Before Sep 2020
Jackson	Negative vaccine attitudes and intentions to vaccinate against Covid-19 in relation to smoking status: a population survey of UK adults	Nicotine & Tobacco Research	2021	United Kingdom	Survey	Sep-Oct 2020
Jaspal	Social support, perceived risk and the likelihood of COVID-19 testing and vaccination: cross-sectional data from the United Kingdom	Current Psychology	2021	United Kingdom	Survey	Aug-Sep 2020
Jiang	Knowledge, attitudes and mental health of university students during the COVID-19 pandemic in China	Children and Youth Services Review	2020	China	Survey	10-Feb-20

Jung	Concerns for others increases the likelihood of vaccination against influenza and COVID-19 more in sparsely rather than densely populated areas	Proceedings of the National Academy of Sciences	2021	United States	Survey + Experimental	Sept 2018 - 2020 pre vaccine approval
Karlsson	Fearing the disease or the vaccine: The case of COVID-19	Personality and individual differences	2021	Finland	Survey	Mar - Apr 2020
Kelly	Predictors of willingness to get a COVID-19 vaccine in the U.S	BMC Infectious Diseases	2021	United States	Survey	Apr-20
Kerr	Predictors of COVID-19 vaccine acceptance across time and countries	Preprint	2020	Multi-Country (12 Countries)	Survey	March – Oct, 2020
Khubchandani	COVID-19 vaccination hesitancy in the United States: A rapid national assessment	Journal of Community Health	2021	United States	Survey	Jun-20
Kourlaba	Willingness of Greek general population to get a COVID-19 vaccine	Global Health Research and Policy	2021	Greece	Survey	April 28 – May 3, 2020
Kreps	Factors associated with US adults' likelihood of accepting COVID-19 vaccination	JAMA Network Open	2020	United States	Survey	9-Jul-20
La Vecchia	Attitudes towards influenza vaccine and a potential COVID-19 vaccine in Italy and differences across occupational groups, September 2020	Medicina Del Lavoro	2020	Italy	Survey	Sep-20
Lackner	Demographic, psychological, and experiential correlates of SARS-CoV-2 vaccination intentions in a sample of Canadian families	Vaccine: X	2021	Canada	Survey	May-Jun 2020
Latkin	Mask usage, social distancing, racial, and gender correlates of COVID-19 vaccine intentions among adults in the US	PLoS One	2021	United States	Survey	May 14 – 18, 2020
Latkin	COVID-19 vaccine intentions in the United States, a social-ecological framework	Vaccine	2021	United States	Survey	Jul-20
Lazarus	Hesitant or Not? The Association of Age, Gender, and Education with Potential Acceptance of a COVID-19 Vaccine: a Country-level Analysis	Journal of Health Communication	2021	International	Survey	Jun-20
Leng	Individual preferences for COVID-19 vaccination in China	Vaccine	2021	China	Experiment	NA

Lennon	Unique predictors of intended uptake of a COVID-19 vaccine	Preprint	2020	United States	Survey	Aug-Oct, 2020
Lin	Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China	PLoS Neglected Tropical Diseases	2020	China	Survey	May 1 – 19, 2020
Liu	COVID-19 Vaccination Willingness among Chinese Adults under the Free Vaccination Policy	Vaccines	2021	China	Survey	May 30 – Jun 10 2020
Liu	Factors associated with the willingness and acceptance of SARS-CoV-2 vaccine from adult subjects in China	Human Vaccines and Immunotherapeutics	2021	China	Survey	Sep 8-15, 2020
Lockyer	Understanding Covid-19 misinformation and vaccine hesitancy in context: Findings from a qualitative study involving citizens in Bradford, UK	Preprint	2020	United Kingdom	Qualitative	“Autumn” 2020
Loomba	Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA	Nature Human Behaviour	2021	United Kingdom & United States	Experiment	Sep 7 – Sep 14, 2020
Lucia	COVID-19 vaccine hesitancy among medical students	Journal of Public Health	2020	United States	Survey	NA
Lueck	Which Beliefs Predict Intention to Get Vaccinated against COVID-19? A Mixed-Methods Reasoned Action Approach Applied to Health Communication	Journal of Health Communication	2021	United States	Survey	Sep-Oct 2020
Ma	Predicting intentions to vaccinate against COVID-19 and seasonal flu: The role of consideration of future and immediate consequences	Health Communications	2021	United States (unclear, MTurk sample)	Survey	April 7 – May 32, 2020
Manning	COVID-19 vaccination readiness among nurse faculty and student nurses	Nursing Outlook	2021	United States	Survey	Aug 10 – Sept 14, 2020
McPhedran	Efficacy or delivery? An online Discrete Choice Experiment to explore preferences for COVID-19 vaccines in the UK	Economics Letters	2021	United Kingdom	Experiment	Aug 27 – Sept 3, 2020
Meier	Predictors of the intention to receive a SARS-CoV-2 vaccine	Journal of Public Health	2021	United States	Survey	Oct 28 – 30, 2020

Mercadante	Will they, or Won't they? Examining patients' vaccine intention for flu and COVID-19 using the Health Belief Model	Research in Social and Administrative Pharmacy	2020	United States	Survey	Oct 2 – 29, 2020
Momplaisir	Understanding drivers of COVID-19 vaccine hesitancy among Blacks	Clinical Infectious Diseases	2021	United States	Qualitative	Jul – Aug, 2020
Montagni	Acceptance of a Covid-19 vaccine is associated with ability to detect fake news and health literacy	Journal of Public Health	2021	France	Survey	Apr 8 – May 11, 2020
Motta	Can a COVID-19 vaccine live up to Americans' expectations? A conjoint analysis of how vaccine characteristics influence vaccination intentions	Social Science & Medicine	2021	United States	Experiment	Aug-20
Muqattash	Survey data for COVID-19 vaccine preference analysis in the United Arab Emirates	Data in Brief	2020	United Arab Emirates	Survey	July 4 – Aug 4, 2020
Murphy	Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom	Nature Communications	2021	Ireland & United Kingdom	Survey	March - April 2020
Olagoke	Intention to vaccinate against the novel 2019 Coronavirus disease: The role of health locus of control and religiosity	Journal of Religion and Health	2021	United States	Survey	22-Mar-20
Olomofe	Predictors of uptake of a potential Covid-19 vaccine among Nigerian adults	Preprint	2021	Nigeria	Survey	June – July, 2020
Palamenghi	Mistrust in biomedical research and vaccine hesitancy: the forefront challenge in the battle against COVID-19 in Italy	European Journal of Epidemiology	2020	Italy	Survey	NA
Pastorino	Impact of COVID-19 pandemic on Flu and COVID-19 vaccination intentions among university students	Vaccines	2021	Italy	Survey	June 8 – July 12, 2020
Pogue	Influences on attitudes regarding potential COVID-19 vaccination in the United States	Vaccines	2020	United States	Survey	NA
Prati	Intention to receive a vaccine against SARS-CoV-2 in Italy and its association with trust, worry and beliefs about the origin of the virus	Health Education Research	2020	Italy	Survey	Apr-20

Qattan	Acceptability of a COVID-19 Vaccine Among Healthcare Workers in the Kingdom of Saudi Arabia	Frontiers in Medicine	2021	Kingdom of Saudi Arabia	Survey	Dec 8-14 2020
Qiao	Risk exposures, risk perceptions, negative attitudes toward general vaccination, and COVID-19 vaccine acceptance among college students in South Carolina	Preprint	2020	United States	Survey	Sept - Oct 2020
Qiao	Vaccine acceptance among college students in South Carolina: Do information sources and trust in information make a difference?	Preprint	2020	United States	Survey	Sep-20
Reiter	Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated?	Vaccine	2020	United States	Survey	May-20
Rhodes	Preparing for A COVID-19 Vaccine: a Mixed Methods Study of Vaccine Hesitant Parents	Journal of Health Communication	2021	United States	Survey	Jul 15 – Aug 2 2020
Rhodes	Intention to vaccinate against COVID-19 in Australia	The Lancet Infectious Diseases	2020	Australia	Survey	June 15 – 23, 2020
Romer	Patterns of Media Use, Strength of Belief in COVID-19 Conspiracy Theories, and the Prevention of COVID-19 from March to July 2020 in the US	Journal of Medical Internet Research	2021	United States	Survey	Mar-Jul 2020
Romer	Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S	Social Science & Medicine	2020	United States	Survey	Mar-20
Ruiz	Predictors of intention to vaccinate against COVID-19: results of a nationwide survey	Vaccine	2021	United States	Survey	June 15–16, 2020
Salali	COVID-19 vaccine hesitancy is associated with beliefs on the origin of the novel coronavirus in the UK and Turkey	Psychological medicine	2020	United Kingdom & Turkey	Survey	May-20
Schwarzinger	COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics	The Lancet. Public Health	2021	France	Experiment	Jul-20
Scott	Vaccination patterns of the northeast Ohio Amish revisited	Vaccine	2021	United States	Survey	Apr-20
Seale	Examining Australian public perceptions and behaviors towards a future COVID-19 vaccine	BMC Infectious Diseases	2021	Australia	Survey	March 18 – 24, 2020

Sherman	COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey	Human Vaccines & Immunotherapeutics	2020	United Kingdom	Survey	July 14 – 17, 2020
Soveri	Unwillingness to engage in behaviors that protect against COVID-19: the role of conspiracy beliefs, trust, and endorsement of complementary and alternative medicine	BMC Public Health	2021	Finland	Survey	Apr-20
Strickland	Integrating operant and cognitive behavioral economics to inform infectious disease response: Prevention, testing, and vaccination in the COVID-19 pandemic	Preprint	2021	United States	Experiment	March 2020 & May 2020 & Jul 2020 & Sep 2020
Tam	Factors associated with decision making on COVID-19 vaccine acceptance among college students in South Carolina	Preprint	2020	United States	Survey	Sept-Oct 2020
Teovanovic	Irrational beliefs differentially predict adherence to guidelines and pseudoscientific practices during the COVID-19 pandemic	Applied Cognitive Psychology	2021	Siberia	Survey	April 10 – 22, 2020
Tervonen	Willingness to wait for a vaccine against COVID-19: Results of a preference survey	The Patient-Patient-Centered Outcomes Research	2020	Multi-Country	Survey	May 5 – 29, 2020
Thacker	The Persistence of Vaccine Hesitancy: COVID-19 Vaccination Intention in New Zealand	Journal of Health Communication	2021	New Zealand	Survey	Jul-20
The COCONEL Group	A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation	The Lancet Infectious Diseases	2020	France	Survey	March 27 – 29, 2020
Turcu-Stiolica	Influence of COVID-19 on health-related quality of life and the perception of being vaccinated to prevent COVID-19: An approach for community pharmacists from Romania and Bulgaria	Journal of Clinical Medicine	2021	Romania & Bulgaria	Survey	July 15 – Aug 15, 2020
Vallis	Protecting Individuals Living with Overweight and Obesity: Attitudes and Concerns Towards COVID-19 Vaccination in Canada	Obesity	2021	Canada	Survey	Jun-Oct 2020

Wang	Change of willingness to accept COVID-19 vaccine and reasons of vaccine hesitancy of working people at different waves of local epidemic in Hong Kong, China: Repeated cross-sectional surveys	Vaccines	2021	China	Survey	Feb 2020 & Aug-Sep 2020
Wang	Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China	Vaccines	2020	China	Survey	Mar-20
Wang	Intention of nurses to accept coronavirus disease 2019 vaccination and change of intention to accept seasonal influenza vaccination during the coronavirus disease 2019 pandemic: A cross-sectional survey	Vaccine	2020	China	Survey	Feb 31 – March 31, 2020
Ward	The French public's attitudes to a future COVID-19 vaccine: The politicization of a public health issue	Social Science & Medicine	2020	France	Survey	Apr-20
Whitebridge	Perceptions, knowledge, and behaviors related to COVID-19 among social media users: Cross-sectional study	Journal of Medical Internet Research	2020	Multi-Country (Arabian Gulf countries)	Survey	March 28 – April 4, 2020
Williams	Social patterning and stability of intention to accept a COVID-19 vaccine in Scotland: Will those most at risk accept a vaccine?	Vaccines	2021	Scotland	Survey	May – Aug, 2020
Williams	Towards intervention development to increase the uptake of COVID-19 vaccination among those at high risk: Outlining evidence-based and theoretically informed future intervention content	British Journal of Health Psychology	2020	United Kingdom	Survey	Apr-20
Woko	An Investigation of Low COVID-19 Vaccination Intentions among Black Americans: The Role of Behavioral Beliefs and Trust in COVID-19 Information Sources	Journal of Health Communication	2021	United States	Survey	May-Jul 2020
Wong	Acceptance of the COVID-19 vaccine based on the health belief model: a population-based survey in Hong Kong	Vaccine	2021	China	Survey	July 27 – Aug 18, 2020
Wong	The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay	Human Vaccines & Immunotherapeutics	2020	Malaysia	Survey	April 3 – 12, 2020

Yin	Unfolding the determinants of COVID-19 vaccine acceptance in China	Journal of medical Internet research	2021	China	Survey	Jan – Oct, 2020
Yoda	Willingness to receive COVID-19 vaccination in Japan	Vaccines	2021	Japan	Survey	Sep-20
Yu	Understanding the prevalence and associated factors of behavioral intention of COVID-19 vaccination under specific scenarios combining effectiveness, safety, and cost in the Hong Kong Chinese general population	International Journal of Health Policy and Management	2021	China	Survey	Sept 16-30, 2020
Zeballos	Social media exposure, risk perception, preventive behaviors and attitudes during the COVID-19 epidemic in La Paz, Bolivia: A cross sectional study	PloS One	2021	Bolivia	Survey	April – May, 2020
Zhang	Behavioral intention to receive self-financed and free COVID-19 vaccination among Chinese factory workers who resumed work during the pandemic: Cross-sectional online survey	Journal of Medical Internet Research	2021	China	Survey	Sept 1-7, 2020
Zhang	Willingness of the general population to accept and pay for COVID-19 vaccination during the early stages of COVID-19 pandemic: A nationally representative survey in mainland China	Human Vaccines & Immunotherapeutics	2021	China	Survey	March – May, 2020
Zhang	Parental acceptability of COVID-19 vaccination for children under the age of 18 Years: Cross-sectional online survey	JMIR Pediatrics and Parenting	2020	China	Survey	Sept 1 – 7, 2020

Appendix 2. Data abstraction form templates

Study characteristics	Behaviour specs	Key findings/themes by COM-B and TDF do
Author:	Action(s):	Capability
Year:	Actor(s):	Knowledge:
URL:	Context(s):	Skills:
Design:	Target:	Behaviour regulation:
Publication status:	Time:	Memory/attention:
Countries/provinces:		Decision making:
Data collection date range:		Opportunity
		Environmental context & resources:
		Social influences:
		Motivation
		Intention (capture % intention/hesitant/confident where available)
		Goals:
		Social/professional role/identity:
		Beliefs about capabilities:
		Beliefs about consequences:
		Optimism:
		Reinforcement:
		Emotions:
		Other Specify:
		%/Mean vaccine intention and/or hesitancy

Equity seeking groups	TDF/COM-B Key findings/themes					
Race/ethnicity/indigeneity groups included:	Group A:		Group B:		Group C:	
	Capability		Capability		Capability	
		Knowledge:		Knowledge:		Knowledge:
		Skills:		Skills:		Skills:
		Behaviour regulation:		Behaviour regulation:		Behaviour regulation:
		Memory/attention:		Memory/attention:		Memory/attention:
		Decision making:		Decision making:		Decision making:
	Opportunity		Opportunity		Opportunity	
		Environmental context & resources:		Environmental context & resources:		Environmental context & resources:
		Social influences:		Social influences:		Social influences:
	Motivation		Motivation		Motivation	
		Intention (capture % intention/hesitant/confident where available)		Intention (capture % intention/hesitant/confident where available)		Intention (capture % intention/hesitant/confident where available)
Other notes:		Goals:		Goals:		Goals:
		Social/professional role/identity:		Social/professional role/identity:		Social/professional role/identity:
		Beliefs about capabilities:		Beliefs about capabilities:		Beliefs about capabilities:
		Beliefs about consequences:		Beliefs about consequences:		Beliefs about consequences:
		Optimism:		Optimism:		Optimism:
		Reinforcement:		Reinforcement:		Reinforcement:
		Emotions:		Emotions:		Emotions:
	Other	Specify:	Other	Specify:	Other	Specify:
	% Mean vaccine intention and/or hesitancy		% Mean vaccine intention and/or hesitancy		% Mean vaccine intention and/or hesitancy	