

BMJ Open What is the role of primary care in the COVID-19 vaccine roll-out and the barriers and facilitators to an equitable vaccine roll-out? A rapid scoping review of nine jurisdictions

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ABSTRACT

Objectives This study aimed to: (1) examine the experience of nine global jurisdictions that engaged primary care providers (PCPs) to administer COVID-19 vaccines during the pandemic; (2) describe how vaccine hesitancy and principles of equity were incorporated in the COVID-19 vaccine roll-out strategies and (3) identify the barriers and facilitators to the vaccine roll-out.

Design Rapid scoping review.

Data sources Searches took place in MEDLINE, CINAHL, Embase, the Cochrane Library, SCOPUS and PsycINFO, Google, and the websites of national health departments. Searches and analyses took place from May 2021 to July 2021.

Results Sixty-two documents met the inclusion criteria (35=grey literature; 56% and 27=peer reviewed; 44%). This review found that the vaccine distribution approach started at hospitals in almost all jurisdictions. In some jurisdictions, PCPs were engaged at the beginning, and the majority included PCPs over time. In many jurisdictions, equity was considered in the prioritisation policies for various marginalised communities. However, vaccine hesitancy was not explicitly considered in the design of vaccine distribution approaches. The barriers to the roll-out of vaccines included personal, organisational and contextual factors. The vaccine roll-out strategy was facilitated by establishing policies and processes for pandemic preparedness, well-established and coordinated information systems, primary care interventions, adequate supply of providers, education and training of providers, and effective communications strategy.

Conclusions Empirical evidence is lacking on the impact of a primary care-led vaccine distribution approach on vaccine hesitancy, adoption and equity. Future vaccine distribution approaches need to be informed by further research evaluating vaccine distribution approaches and their impact on patient and population outcomes.

INTRODUCTION

On 30 January 2020, the WHO declared a Public Health Emergency of International Concern due to the spread of a novel

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ To the best of our knowledge, this is the first known review of international literature highlighting the role of primary care in vaccine roll-out strategies with a focus on hesitancy and equity.
- ⇒ This study followed a rigorous methodological approach and used a comprehensive search strategy according to the preferred reporting items for scoping reviews.
- ⇒ The exclusion of papers not published in English could have excluded relevant articles.
- ⇒ A limitation of the study was that most literature was grey literature that could not be systematically appraised.

coronavirus, COVID-19. Fortunately, Pfizer/BioNTech, Oxford and AstraZeneca reported the development of safe and effective COVID-19 vaccines by the end of December 2020.^{1,2}

There are significant concerns about vaccine hesitancy and the equitable distribution of the COVID-19 vaccine.³ It is estimated that approximately one-third of the global population is hesitant to receive one of the COVID-19 vaccines.^{4,5} Vaccine hesitancy is defined as a 'delay in acceptance or refusal of vaccines despite availability of vaccination services'.⁵ Lack of confidence in the safety and efficacy of vaccines is associated with low vaccine uptake.^{6,7} Several factors influence vaccine hesitancy, including the historical, political and sociocultural context of individuals (past experiences, risk perception and trust, subjective norms, religious and moral convictions), public health and vaccine policies (vaccination programmes, communication, safety evaluation and monitoring), recommendation of healthcare professionals, and media communications.⁶ Public

confidence in vaccine safety and effectiveness and the principles of equity should be considered in approaches for vaccine administration since it can result in poorer health outcomes, increased COVID burden and less vaccination in underserved communities.

The exclusion of primary care providers (PCPs) from vaccine distribution strategies could hinder the vaccination of many who trust and rely on these providers for healthcare advice and access to care.⁷ Primary care (PC) is the first point of contact with the health system, especially for vulnerable and medically underserved communities.⁸ Building vaccine confidence by addressing vaccine hesitancy is a foundational role of PC as patients trust their PCPs.⁸

In the context of the current pandemic, the experience of global jurisdictions that engaged their PC workforce in the administration of COVID-19 vaccines has not been studied. Since the delivery of immunisations is part of comprehensive PC, knowledge users are interested in learning if global jurisdictions that employed their PC workforce from the beginning of the pandemic were more successful in the roll-out of the vaccines and what lessons can be learnt from their experience.

Thus, the objective of this study was to synthesise available data on the experience of the vaccine roll-out strategy from nine jurisdictions. Jurisdictions were identified through the review of the literature⁹ and the global expertise of the study's senior author (REG). These jurisdictions included: Australia, Hong Kong, Germany, France, Israel, Singapore, Spain, the USA and the UK. This study occurred within a larger programme of research exploring vaccine distribution approaches. This specific report aimed to: (1) examine the experience of nine global jurisdictions that engaged PCPs to administer COVID-19 vaccines during the pandemic; (2) describe how vaccine hesitancy and principles of equity were incorporated into vaccine roll-out strategies and (3) identify the barriers and facilitators to the vaccine roll-out.

METHODS

Design

Rapid reviews are recommended by the WHO when policy makers urgently need evidence-based research.¹⁰ The rapid review process for this scoping review was guided by the National Institute for Clinical Health and Excellence methods manual to develop public health guidance¹⁰ and Arksey and O'Malley's guidelines for scoping reviews, including: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data and (5) collating, summarising and reporting the results.¹¹ In addition, we included the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).¹² A protocol was not registered. Online supplemental material 1 shows all PRISMA-ScR guidelines considered.

Step 1: research question and scope

The overarching question guiding this study was: What was the role of PC in the vaccine roll-out strategy? Two subquestions included: How was vaccine hesitancy and equity incorporated into the approach to the vaccine roll-out? What were the barriers and facilitators to the vaccine roll-out?

Steps 2 and 3: search strategy and publication selection

A literature search for peer-reviewed literature was conducted by an information specialist (JES-H) in MEDLINE, Embase, CINAHL, the Cochrane Library, SCOPUS and PsycINFO in June 2020. See online supplemental material 2 for the search strategy. To identify grey literature, a focused literature search was conducted on websites of all major international health agencies for nine jurisdictions by two research team members (JES-H and KMK) (see online supplemental material 3). Grey literature was defined as publicly available non-peer-reviewed literature. The search strategy comprised the National Library of Medicine's MeSH (Medical Subject Headings) and the keywords PC and COVID-19. Non-English language articles were excluded, as were articles published before the COVID-19 pandemic (before January 2020).

Documents were included if they included information on: (A) Australia, Hong Kong, Germany, France, Israel, Singapore, Spain, USA and the UK; (B) COVID-19 vaccines, including Pfizer/BioNTech, Moderna, Johnson, CoronaVac and AstraZeneca; and (C) role of PCPs in vaccine distribution.

Two reviewers (KMK and JES-H) independently screened titles and abstracts. Three reviewers (MA, KMK and JES-H) independently reviewed full-text articles against the inclusion criteria. Disagreements were resolved through discussion with the PI (MA). A hand-search of the reference list identified papers that might have been missed.

Step 4: data extraction

At stage 4, data from each abstract was extracted by KMK and reviewed by MA. A standardised Microsoft Excel form was used. Extracted data included publication details (author, date, journal, title, country, funding source), vaccine roll-out strategies, the role of PC in vaccine distribution, and barriers and facilitators to vaccination distribution. Based on the guidance of scoping review methodologies, an assessment of the quality of evidence of each article was not assessed.

Step 5: collating, summarising and reporting the results

We conducted a descriptive summary of the characteristics of included documents. We provide a narrative content analysis¹³ of the experience of selected jurisdictions in relation to the research questions. First, data from each article were sorted to the research questions through evidence tables. Next, two researchers (MA and KMK) explored relationships within each research question

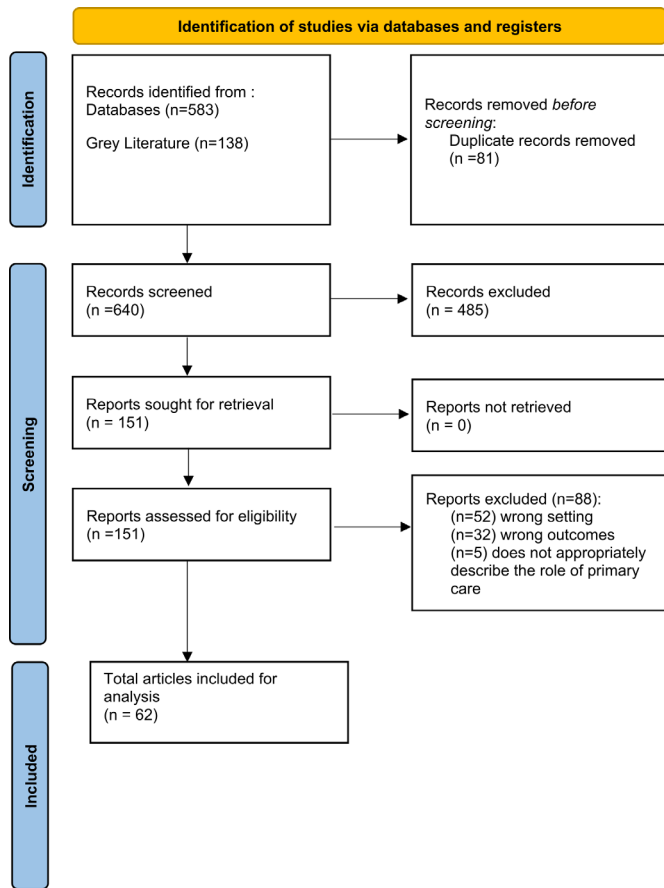


Figure 1 PRISMA-DIAGRAM. Adapted from: Page *et al.*⁸¹ PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

to consider differences within and between the data of included studies. Weekly meetings occurred where the researchers conducted a subgroup analysis by country, care providers involved and healthcare setting. Alternative analyses of the data were discussed. A synthesis of the relationships related to each question was provided to all members of the research team. Differences in opinions were resolved by discussion. The results of our synthesis are summarised below.

Patient and public involvement

No patient involved.

RESULTS

In total, 62 articles were included in this rapid review. See [figure 1](#) for an illustration of the search process.

Thirty-five articles were from the grey literature (56%), and 27 (44%) studies were peer-reviewed publications. Grey literature included government reports, committee reports, newsletters, technical specifications and standards, and newspaper articles. Of the peer-reviewed studies, two were qualitative (interviews), four were quantitative (three online surveys and one administrative data) and the rest (n=11) were commentaries (eg, opinion pieces). Most papers were from the USA

(n=18/62, 29%) and UK (n=14/62, 22.5%). Four papers focused on Europe more broadly. See online supplemental material 4 for an overview of the characteristics of the studies and online supplemental material 5 for an overview of the studies answering each question. Online supplemental material 6 provides an overview of the findings per region.

Role of PC in the vaccine roll-out strategy

In all jurisdictions, vaccines were purchased at the federal level,^{14–26} through agreements with manufacturers.^{19 22 23 27–29} Germany and Australia developed manufacturing plants per the federal government mandate.^{15 29–31} In all jurisdictions (except Singapore), vaccine distribution did not vary based on the type of vaccine. In Singapore, non-public healthcare providers were allowed to administer CoronaVac.

Due to a very limited supply of vaccines, only healthcare workers and those with high-risk conditions were initially eligible for the vaccine, which influenced the locations for initial vaccine distribution. Vaccine administration began at hospital sites and other mass clinics in all jurisdictions,^{14–29 32 33} except in Germany, which engaged general practitioners (GPs) in vaccine clinics outside of hospitals.^{27 29 31 34 35} As a result, many GPs who are not affiliated with hospitals had no role in vaccine distribution in other jurisdictions (USA and Hong Kong).³⁶

In Germany, vaccinations were being distributed by GPs, other physicians, medical assistants, retired health professionals, emergency medical services and others voluntarily.³⁷ The UK and Israel engaged GP-led practices in December 2020,^{18 20 22 24 35 38–40} and Australia implemented GP-led respiratory clinics.³⁷ Eventually, Australia, Spain, the USA, the UK, Singapore and Hong Kong shifted their strategy to distributing vaccines through PC clinics, offices and primary health centres.^{15 18–20 23 28 32 41–55} Australia, USA, Spain and France engaged physicians and nurses in administering vaccines.^{30 51} Israel, UK and France included paramedics.³⁵ In Australia, GP-led Aboriginal and Torres Strait Islander Community Controlled Health Services clinics and GP-led vaccination clinics were distributing the vaccines.³⁰ In Spain, the strategy included primary health centres and large vaccination centres.³⁵ In France, primary healthcare teams were mobilised to collaborate with secondary care and hospital-at-home patients to provide for housebound individuals.³⁷ Unlike in other countries, in Hong Kong and Singapore, privately funded clinics could participate in the vaccine administration. Mobile vaccine clinics and pharmacies were also administering vaccines.^{27 33 35}

This review did not find literature that delineates the impact of PC on the contribution to vaccination rates, except for one report from the UK, which stated that about 75% of vaccines had been delivered in PC-led clinics.¹⁸ One grey literature source reported that most unvaccinated individuals in the USA said they would prefer getting their COVID-19 vaccine from their family physicians (FPs).⁵⁶ This review found considerable consensus



(n=24) on the importance of including first-contact PCPs in vaccine distribution approaches, as failing to do so can lead to poor vaccination rates.^{3 17 18 20 21 27 36 37 43 44 50 54 56–66}

Governments have called for the increased use of PCPs,⁶⁷ including paediatricians,⁵² in offering door-to-door vaccinations, hosting workplace vaccination events and increasing the number of pharmacies administering vaccines.¹⁹

Role of vaccine hesitancy in vaccine roll-out strategy

Vaccine hesitancy was not explicitly (ie, defined or in the official strategy documents reviewed), considered in most jurisdictions' initial vaccine distribution approaches (except in Israel) who used public education to target hesitancy in the army.⁴⁰ The strategy appeared to be reaching as many of those in the priority groups as quickly as possible.^{15 19 63}

Various interventions were used to increase vaccine uptake in Hong Kong, UK and Australia later in the roll-out. In Hong Kong, massive government-led vaccination campaigns included virtual public education and resources on COVID-19 vaccines to encourage and promote vaccine uptake.⁴² In the UK, community pharmacists worked with their communities to address concerns around vaccine safety by sharing information about vaccines.⁵⁷ In Australia, the Federal Government recommended that Aboriginal and Torres Strait Islander peoples were engaged to inform culturally appropriate communication strategies to optimise vaccine acceptance and uptake.³⁰

This review also found that empirical evidence is lacking on the impact of a PC-led vaccine distribution approach on vaccine hesitancy. One study examined the role of PC in reducing vaccination hesitancy in soldiers.⁴⁰ The study found that dialogue-based interventions (group lectures, on-site consultations and PC visits) increased vaccine uptake.⁴⁰

Role of equity in vaccine roll-out strategy

In many jurisdictions, equity was considered in the prioritisation policies for various marginalised communities (see table 1). Guidance documents in most jurisdictions described allocating vaccines equitably by targeting racialised populations (ie, culturally and linguistically diverse groups^{30 48} (ie, Australia, Hong Kong, Spain, UK and the USA) and those with medical risk^{14–26 31 68–70} (all but Hong Kong and Singapore) during mass distribution efforts. In all jurisdictions, vaccinations were prioritised for the elderly. In the UK, Australia, France and Spain,^{27 71 72} the elderly, adults with comorbidity, healthcare workers, other risk groups (non-health workers of essential public services, immigrants, aged care residents), long-term care facilities and nursing homes were prioritised. France also prioritised public transport workers and teachers.³⁸ Similarly, specific zip codes were prioritised in Australia and the USA based on COVID-19 incidence rates to improve equitable allocation^{30 41 45} and high-risk neighbourhoods were prioritised in Hong Kong.³³

In Australia, funding was provided to Aboriginal organisations to target their communities.³⁰ Spain recommended administering the Janssen vaccine to vulnerable and homeless populations since only one shot was believed to be required for complete protection.⁵¹ In the USA, Australia, Hong Kong and Spain, guidance documents were produced for healthcare professionals, which recommended that communications material be tailored for culturally and linguistically diverse groups and at-risk populations.^{15 16 19 23 27 30 63}

In Australia, the Department of Health for the Victoria State Government recognised the vital role GPs would have in assuring equitable and easy access to vaccines.¹⁵ In Germany, UK and Israel, the approach included leveraging the PC workforce in settings beyond the GP clinic. This included the distribution of vaccines at large sites such as sports centres, entertainment venues and village

Table 1 Priority populations

Jurisdiction	Older adults	Indigenous populations	Medical risk	Racialised populations (ie, culturally and linguistically diverse groups, eg, black populations)	Front-line workers	Specific postal codes
Australia	✓	✓	✓	✓	✓	✓
Hong Kong	✓			✓		
Germany	✓		✓		✓	
France	✓		✓		✓	
Israel	✓		✓		✓	
Singapore	✓					
Spain	✓		✓	✓	✓	
USA	✓	✓	✓	✓	✓	✓
UK	✓		✓		✓	

halls.^{18 20 22 24 38–40} In Germany, PCPs were well positioned to vaccinate numerous individuals since they comprise a large proportion of providers.²⁹ PCPs made home visits in the UK to reach homebound individuals, and community pharmacists worked with their local communities to address cultural concerns around vaccine safety.⁵⁷ Practice managers, receptionists, care coordinators, link workers, nurses, volunteers and other support staff played a critical role in reaching the priority group (ie, those aged 80 and older) who were not technologically savvy to book appointments.¹⁸ By not explicitly having a targeted strategy to vaccinate priority racial populations, the UK was criticised within commentaries for not considering black, Asian and minority ethnic groups and migrant populations in their vaccine distribution approach.^{32 46 69} It was believed that PC could help vaccinate those individuals.

This review did not find any empirical evidence to suggest that jurisdictions that used their PC workforce resulted in a more equitable distribution of vaccines. However, it was noted that mass clinics in the USA allowed for increasing vaccination rates by addressing shortages of PCPs and patients who do not have a PCP.⁷³

Barriers to vaccination roll-out strategies

There were several personal (attitudes, individual proficiency with digital technology, language spoken, transportation), organisational (logistical) and contextual (supply of vaccines, shortage of health human resources, communications and culture) factors that served as barriers during the vaccine roll-out.

In Israel, Germany and Australia, the attitudes of patients and lack of public acceptance of different vaccines were reported in surveys as significant obstacles by healthcare professionals, the government and the overall healthcare system.^{34 40 63} In an empirical qualitative study from the UK, some migrants did not trust science, the health system, or the Government, believed COVID-19 was a hoax, a European infection, a condition that does not impact immigrant communities or could be alleviated through home remedies.⁴⁶ In addition, some migrants felt their communities were not represented in clinical trials and were used as guinea pigs.⁴⁶ Empirical studies (both qualitative and quantitative) reported that vaccine hesitancy was also an impediment among healthcare providers, including FPs in France,^{68 71 72} who were unsure of the new vaccines' safety and unforeseen side effects.^{34 40 63}

In the UK, booking appointments was an impediment for the elderly population (80 and over),¹⁸ since these populations were not proficient in email or text messages, which required them to use the phone to book appointments.¹⁸ Similarly, digitisation (registration, appointments, providing health information by text) reduced patient visits by migrant populations⁴⁶ since some did not own phones, did not know how to use them, or could not afford them. A study from the USA also identified web-based sign-up systems as a barrier to multilingual, low-income people.⁴⁵ In Spain, the lack of updated contact

information for people in the 60–79 age group served as an impediment to reaching this population. In England, language served as a barrier since healthcare providers could not address the questions or concerns of immigrant populations.⁴⁶

At the organisational level, the logistics of storing and handling different vaccines were identified as a significant barrier.^{18 44} The Pfizer-BioNTech vaccine had specific handling requirements, such as storing the vaccine in a cold environment (–70°C to –80°C).^{44 50} This was further complicated by the need to conduct 15 min observations of vaccines after being thawed.^{18 44} These logistical barriers prevented vaccine administration through GP clinics, community pharmacies and long-term care homes.^{18 44}

The UK and Australia had a limited number of vaccines from 2020 to 2021 to protect their citizens,^{15 18 44 63} with some areas having greater availability than others (ie, Israel).²⁴ In the UK, there was an inadequate health human workforce of GPs.⁴⁶ In Israel and the USA, PCPs reported high levels of frustration, burn-out and workloads during the pandemic.^{40 49} In Spain, lack of investment in human resources and inadequate compensation for primary healthcare centres contributed to physical and emotional exhaustion among PCPs.⁵⁴

Clear and reliable public communication in various languages is essential for facilitating the effective distribution of vaccines.^{21 24 30 32 39 46 57} PCPs did not receive adequate formal training in communication-related to vaccine hesitancy, making it difficult for them to effectively communicate the benefits of the vaccine.⁴³ In the UK, misinformation about COVID-19 vaccines among the public led to vaccine hesitancy and reduced uptake of vaccines among the immigrant population.⁴⁶

In the UK, the mutual aid policy (ie, the mutual sharing of resources across areas), which indicates that providers can only share vaccines in exceptional circumstances, created an individualised siloed approach that prevents collaboration among workers and organisations.²⁰

Facilitators to vaccination roll-out strategies

Contextual (eg, jurisdiction's pandemic preparedness, adequate vaccine supply) and organisational (eg, education and training of providers, effective communications strategy, incentives) factors were facilitators of the vaccine roll-out.

An effective vaccine distribution strategy is essential to the effective roll-out of vaccines.^{21 30 32 46 57} The high percentage of individuals in Israel receiving vaccines was attributed to having a national approach with structures, processes and information systems in place to enable vaccine distribution, as well as having a smaller country,^{22 39} including having a well-trained workforce that includes community nurses and the support of the armed forces.³⁸ Israel maintained an accurate register of the population considered, had an adequate number of trained staff to administer the vaccines, and mechanisms to identify differences in uptake within the population and respond to them.²²



In the UK, new workforce legislation was passed to allow a wider group of healthcare professionals to administer the vaccines^{26 69} including midwives, dentists, occupational therapists, paramedics, physiotherapists, radiographers, trainee doctors and nurses.³⁵ In addition, PC teams at mass vaccination sites were supported by including trained non-clinical staff and volunteers for administrative support.²⁶

Training clinicians and support staff to safely handle vaccines and cultural awareness³⁰ and establishing clear guidelines on vaccine storage and distribution for citizens and healthcare providers^{21 30 32 46 57} were identified as essential enablers of vaccine distribution. In Singapore, the professional medical associations supported FPs/GPs by educating them on enrolment criteria for vaccination, which vaccines to offer, the vaccination process and technical assistance with booking.⁶⁶ In Hong Kong, PCPs received information on vaccines for patients with chronic conditions,³³ free training courses¹⁶ and invitations to join vaccination programmes.^{16 55} Several guidance documents were available to providers in Australia, including information on vaccination site preparedness and a healthcare worker well-being centre to provide information on support for providers.¹⁵ In addition, immunisers were required to undertake training on using multidose vials, infection control, wastage, adverse reporting, each vaccine (storing and handling requirements) and reporting requirements.²⁸ Staff working with Aboriginal and Torres Strait Islander people were required to do cultural awareness training. PC staff were required to complete a 1.5-hour online training course in the UK and were reimbursed for vaccinating their own staff.⁴⁷

In Hong Kong and UK, financial incentives were provided to physicians for the administration of vaccines. In Hong Kong, a subsidy of US\$80.00 per dose was provided for the first vaccine and US\$40.00 for the second dose. GPs were reimbursed at £12.58 per dose in the UK and compensated for vaccinating their staff.⁴⁷ In Germany, compensation was provided for hygiene and safety equipment.³⁷

Supporting vaccine distribution approaches that permit healthcare professionals to administer vaccines in highly accessible settings for patients (ie, GP clinics) is essential for the successful distribution of vaccines.^{21 30 32 46 57} Israel, Germany, UK and the USA received logistical and leadership support from armed forces to help vaccinate individuals.^{19 25 26 38 40} In USA, the Centers for Disease Control and Prevention (CDC) indicated the intent to provide healthcare professionals with data analyses, administration and technical assistance to support implementing activities to increase vaccine distribution to medical offices and expand medical office enrolment.⁶⁷ Details of what type of analyses or technical assistance were not specified. However, it was mentioned that the CDC would facilitate partnerships with national professional medical associations and community-based organisations to support outreach to medical offices to encourage and facilitate enrolment.⁶⁷

DISCUSSION

This rapid review aimed to examine and synthesise available literature on the experience of nine global jurisdictions with the distribution of COVID-19 vaccines. A total of 62 articles were included in this review. Over time, all jurisdictions engaged their PCPs in the vaccine distribution strategy. In many jurisdictions, equity was considered in the prioritisation policies for various marginalised communities, by targeting them during mass distribution efforts. However, vaccine hesitancy was not explicitly considered in the design of vaccine distribution approaches.

At the time of our review, there was a paucity of empirical evidence on the impact of a PC-led vaccine distribution approach on vaccine uptake, vaccine confidence and equity. The existing empirical research highlighted that vaccine hesitancy was high among migrants, immigrants, GPs and soldiers.^{40 68 72} Vaccination rates as of March 2022 show that jurisdictions that engaged PCPs from the beginning do not have higher vaccination rates than those that did not. For example, full vaccination rates (ie, two doses) in Germany (75.55%) and the UK (73.11%) are lower compared with Singapore (92%) and Spain (82.6%).⁷⁴ This indicates that the vaccine distribution channel is not the only factor that impacts vaccination rates.⁷⁵ For instance, vaccine uptake in some countries may have been tied to behavioural incentives to get vaccinated, such as the inability to partake in activities in public settings without a vaccine status. Recent literature from Singapore suggests that high vaccine rates have been attributed to having small geography, adequate healthcare systems and a strong communications strategy.^{66 75–78} In Spain, public trust in public health institutions and a solidary culture have been attributed to its success—both of which are complex factors and difficult to change.⁷⁹

Several other factors may impact vaccine adoption, including having a sufficient vaccine supply, an adequate human resource workforce and the implementation of a multifaceted vaccine distribution strategy.³⁹ Information systems that capture accurate and reliable information on the uptake of vaccines, healthcare professionals administering the vaccine and permit ongoing surveillance can also be an enabler. At the provider level, investing in training and education (vaccine storage, handling, safe administration, cultural sensitivity, reporting, materials for vaccine recipients, tips on communicating confidently about vaccinations with diverse groups) may improve communication with patients and encourage vaccine uptake.⁶⁶ Other facilitators include the implementation of dialogue-based interventions and investments in inter-professional providers.³⁵ Ride-share programmes may help individuals without access to public transportation access vaccines. Future vaccine distribution approaches need to be informed by evaluating vaccine distribution approaches and their impact on patient and population outcomes.

This is a novel scoping review to understand how PC, equity and vaccine hesitancy were considered in the

global COVID-19 vaccination strategies. Some relevant articles may have been missed. Our search strategy was comprehensive and guided by an information science specialist to mitigate this risk.⁸⁰ This review relies on grey literature to capture national guidelines as there is a lack of academic literature on the role of PC in the COVID-19 vaccine roll-out strategy, however, vaccine distributors may not have published their vaccine distribution strategies. We did not assess the included studies' quality; thus, recommendations from the articles should be considered with caution.¹² Since this was a global study, the language of the documents was context-specific. At the time of this study, booster shots were not being distributed. Nonetheless, understanding early responses may have important implications for informing future vaccine distribution strategies.

CONCLUSION

A better understanding of vaccination efforts in response to COVID-19 is paramount with the possible future coronaviruses and other respiratory pathogens. This study found that all jurisdictions included first-contact PCPs in the vaccine distribution strategy at some point in the pandemic. Equity was considered in some vaccine roll-out strategies, but most did not consider vaccine hesitancy. The vaccine roll-out strategy was facilitated by establishing policies and processes for pandemic preparedness, well-established and coordinated information systems, PC interventions, adequate supply of providers, education and training of providers, incentives and effective communications strategy. However, no empirical evidence currently delineates the impact of a PC-focused vaccine roll-out strategy on vaccination rates, vaccine hesitancy and equity. Future vaccine distribution approaches need to be informed by evaluating vaccine distribution approaches and their impact on patient and population outcomes.

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study. MA and KMK led the screening of articles and the analysis and interpretation of data. All authors contributed to the interpretation of the results. MA and KMK led the development of the manuscript. Drafts of the manuscript were reviewed and revised by all authors. All the authors approved the final manuscript. MA is the guarantor of this review.

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REFERENCES

- Ramasamy MN, Minassian AM, Ewer KJ, *et al*. Safety and immunogenicity of chadox1 nCoV-19 vaccine administered in a prime-boost regimen in young and old adults (COV002): a single-blind, randomised, controlled, phase 2/3 trial. *Lancet* 2021;396:1979–93.
- Mills MC, Salisbury D. The challenges of distributing COVID-19 vaccinations. *EClinicalMedicine* 2021;31:100674.
- Ratzan S, Schneider EC, Hatch H, *et al*. Missing the point-how primary care can overcome covid-19 vaccine "hesitancy." *N Engl J Med* 2021;384:e100.
- Lazarus JV, Ratzan SC, Palayew A, *et al*. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021;27:225–8.
- SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. *Vaccine* 2015;33:4161–4.
- Dubé E, Laberge C, Guay M, *et al*. Vaccine hesitancy: an overview. *Hum Vaccin Immunother* 2013;9:1763–73.
- Shen SC, Dubey V. Addressing vaccine hesitancy: clinical guidance for primary care physicians working with parents. *Can Fam Physician* 2019;65:175–81.
- Fiscella K, Meldrum S, Franks P, *et al*. Patient trust: is it related to patient-centered behavior of primary care physicians? *Med Care* 2004;42:1049–55.
- McMaster Health Forum. COVID-19 living evidence profile #1: what is known about anticipated COVID-19 vaccine roll-out elements. 2020 Available: <https://www.mcmasterforum.org/find-evidence/products/project/covid-19-living-evidence-profile-1-what-is-known-about-anticipated-covid-19-vaccine-roll-out-elements>
- Tricco AC, Langlois E, Straus SE, *et al*. Rapid reviews to strengthen health policy and systems: a practical guide: world health organization. 2017.
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 2005;8:19–32.
- Tricco AC, Lillie E, Zarin W, *et al*. PRISMA extension for scoping reviews (PRISMA-scr): checklist and explanation. *Ann Intern Med* 2018;169:467–73.

- 13 Tamir P. Content analysis focusing on inquiry. *Journal of Curriculum Studies* 1985;17:87–94.
- 14 Ministry of Health Spain. COVID-19 vaccination strategy in Spain: key points. 2020.
- 15 Australia Government. COVID-19 vaccines 2021. 2021.
- 16 Hong Kong government COVID-19 vaccination programme healthcare services arrangements. 2020. Available: <https://www.info.gov.hk/gia/general/202102/23/P2021022300042.htm>
- 17 Warren S, Murray R. Assessing England's response to COVID-19 A framework. In: *Fund TKs*. 2021.
- 18 Hodes S, Majeed A. Building a sustainable infrastructure for COVID-19 vaccinations long term. *BMJ* 2021;373:1578.
- 19 U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. From the factory to the frontlines: the operation warp speed strategy for distributing a COVID-19 vaccine. 2020.
- 20 Sim F. Early COVID-19 vaccination rollout: A commentary from England. *Isr J Health Policy Res* 2021;10:18:18..
- 21 Majeed A, Molokhia M. Vaccinating the UK against COVID-19. *BMJ* 2020;371:m4654.
- 22 McKee M, Rajan S. What can we learn from Israel's rapid roll out of COVID-19 vaccination? *Isr J Health Policy Res* 2021;10:5:5..
- 23 Slaoui M, Hepburn M. Developing safe and effective COVID-19 vaccines—operation warp speed's strategy and approach. *N Engl J Med* 2020;383:1701–3.
- 24 Rosen B, Waitzberg R, Israeli A. Israel's rapid rollout of vaccinations for COVID-19. *Isr J Health Policy Res* 2021;10:6.
- 25 Government of England. Enhanced service specification COVID-19 vaccination programme. 2021. Available: <https://www.england.nhs.uk/coronavirus/publication/ess-vaccination-programme>
- 26 Government of the UK UK COVID-19 vaccines delivery. 2021. Available: <https://www.gov.uk/government/publications/uk-covid-19-vaccines-delivery-plan>
- 27 European Centre for Disease Prevention and Control. Overview of COVID-19 vaccination strategies and vaccine deployment plans in the EU/EEA and the UK: ECDC Stockholm. 2020.
- 28 Commonwealth of Australia. Victoria COVID-19 vaccination program: agreement between the Australian government and the Victorian government implementation plan. 2020. Available: https://www.federalfinancialrelations.gov.au/content/npa/health/national-partnership/VIC_vaccine_plan.PDF
- 29 Bundesgesundheitsminister. National COVID-19 vaccination strategy to introduce and evaluate a vaccine against SARS-CoV-2 in Germany 2020. 2020. Available: https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/C/Coronavirus/Impfstoff/German_National_COVID-19_Vaccination_Strategy_long_eng_061120.pdf
- 30 Government of Australia. COVID-19 vaccination program implementation plan: Aboriginal and Torres Strait Islander Peoples. 2021.
- 31 The Local. COMPARE: the different strategies used in Europe to vaccinate against COVID-19. 2021. Available: <https://www.thelocal.de/20210415/compared-how-countries-around-europe-are-organising-their-covid-vaccine-rollouts>
- 32 Osama T, Razai MS, Majeed A. COVID-19 vaccine allocation: addressing the United Kingdom's colour-blind strategy. *J R Soc Med* 2021;114:240–3.
- 33 Centre for Health Promotion. *Interim guidance notes on common medical diseases and COVID-19 vaccination in primary care settings*. 2021.
- 34 Nohl A, Afflerbach C, Lurz C, et al. Acceptance of COVID-19 vaccination among front-line health care workers: A nationwide survey of emergency medical services personnel from Germany. *Vaccines (Basel)* 2021;9:424.
- 35 Shuftan N. Who is tasked with administering COVID-19 vaccines in Europe?: World Health Organization. 2021. Available: <https://analysis.covid19healthsystem.org/index.php/2021/03/24/who-is-tasked-with-administering-covid-19-vaccines-in-europe>
- 36 Goldhill O. Still waiting for my turn': primary care doctors are being left behind in the vaccine rollout. *Stat News* 2021.
- 37 OECD. Strengthening the frontline: how primary health care helps health systems adapt during the COVID-19 pandemic. In: *OECD Policy Responses to Coronavirus (COVID-19)*. 2021: 19.
- 38 Marchildon GP. The rollout of the COVID-19 vaccination: what can Canada learn from Israel? *Isr J Health Policy Res* 2021;10:12:12..
- 39 Bassan S, Field RI. Israel owes its COVID-19 vaccination success to a system of universal coverage and community infrastructure: health affairs blog. 2021.
- 40 Talmy T, Cohen B, Nitzan I, et al. Primary care interventions to address COVID-19 vaccine hesitancy among Israel defense forces soldiers. *J Community Health* 2021;46:1155–60.
- 41 Schmidt H, Weintraub R, Williams MA, et al. Equitable allocation of COVID-19 vaccines in the United States. *Nat Med* 2021;27:1298–307.
- 42 Chan PKS, Wong MCS, Wong ELY. Vaccine hesitancy and COVID-19 vaccination in Hong Kong. *Hong Kong Med J* 2021;27:90–1.
- 43 Katzman JG, Katzman JW. Primary care clinicians as COVID-19 vaccine ambassadors. *J Prim Care Community Health* 2021;12.
- 44 Harnden A, Lim WS, Earnshaw A. COVID-19 vaccination programme: a central role for primary care. *Br J Gen Pract* 2021;71:52–3.
- 45 Stern RJ, Rafferty HF, Robert AC, et al. Concentrating vaccines in neighborhoods with high COVID-19 burden. *NEJM Catalyst Innovations in Care Delivery* 2021;2.
- 46 Knights F, Carter J, Deal A, et al. Impact of COVID-19 on migrants' access to primary care and implications for vaccine roll-out: a national qualitative study. *Br J Gen Pract* 2021;71:e583–95.
- 47 Davies C. COVID-19 vaccination programme: practice pointers for primary care. *Guidelines in Practice* 2021.
- 48 Hambling C, Patel D, Turner B. COVID-19 and diabetes: update for primary care in response to the ongoing coronavirus pandemic. *Diabetes Prim Care* 2021;23:9–12.
- 49 Greiner A. Survey shows more primary care practices are administering COVID-19 vaccines. 2021.
- 50 Jaspers B. All things considered. Demand for vaccines is dropping — so local doctors are working to convince patients. 2021.
- 51 Mouzo J. *COVID-19 vaccination drive in Spain: 45% of population has had at least one dose*. El País, 2021.
- 52 Pettypiece S, Egan L. Biden calls for more urgency for COVID-19 vaccinations as new variant spreads. *NBC News* 2021.
- 53 Hong Kong vaccination dashboard 2021. 2021. Available: <https://www.covidvaccine.gov.hk/en/dashboard>
- 54 Mouzo J. *Spain's primary healthcare centers buckling under pressure from pandemic*. El País, 2021.
- 55 Centre for Health Promotion. COVID-19 vaccination programme under the vaccination subsidy scheme (VSS) invitation to enrolment. In: *PROGRAMME MANAGEMENT & VACCINATION DIVISION*. 2021.
- 56 Firth S. Patients want COVID shot from their primary care docs — but both patients and physicians must still overcome several barriers to care delivery. *MedPage* 2021.
- 57 Ducker J. A "key clinical role" for community pharmacies in COVID-19 vaccination campaigns. *Medical News* 2021.
- 58 Shakory S, Eissa A, Kiran T, et al. Planning and implementing COVID-19 mass vaccination clinics. 2021.
- 59 McMorrow S, Thomas TW. *Historic vaccination patterns provide insights for COVID-19 vaccine rollout*. Washington, DC: Urban Institute, 2021.
- 60 Ableson R. Primary care doctors are left out of the vaccine rollout vaccine rollout was a total disaster — and what it means for the next few months. *New York Times* 2021.
- 61 Annals of Family Medicine. Annals of family medicine: primary care can play an important role in administering COVID-19 vaccines, providing patient information and support. *prnewswire*. 2021.
- 62 Wilkinson E, Jetty A, Petterson S, et al. Primary care's historic role in vaccination and potential role in COVID-19 immunization programs. *Ann Fam Med* 2021;19:351–5.
- 63 Danchin M, Biezen R, Manski-Nankervis J-A, et al. Preparing the public for COVID-19 vaccines: how can general practitioners build vaccine confidence and optimise uptake for themselves and their patients? *Aust J Gen Pract* 2020;49:625–9.
- 64 Skeldon LR, DeSoysa MN. COVID-19 vaccination programme: a central role for primary care. *British Journal of General Practice* 2021.
- 65 Padre S. Primary care is key to COVID-19 vaccine dissemination but is left out so far. 2021. Available: <https://www.pccp.org/2021/01/07/primary-care-key-covid-19-vaccine-dissemination-left-out-so-far>
- 66 Lim WH, Wong WM. COVID-19: notes from the front line, Singapore's primary health care perspective. *Ann Fam Med* 2020;18:259–61.
- 67 Centre for Disease Control, Prevention. Expanding COVID-19 vaccine distribution to primary care providers to address disparities in immunization: guide for jurisdictions. 2021.
- 68 Schwarzingler M, Watson V, Arwidson P, et al. COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics. *Lancet Public Health* 2021;6:e210–21.
- 69 Health Information and Quality Authority. Advice to the national public health emergency team an international review: policies relating to healthcare personnel who do not avail of COVID-19 vaccination. 2021.
- 70 Department of Haute Autorité de Santé. COVID-19 vaccination strategy anticipation of possible vaccination scenarios and preliminary guidelines for target populations. offering COVID-19 vaccinations 2020. 2020. Available: <https://www.has-sante.fr/upload/>

- docs/application/pdf/2020-12/rapport_strategie_vaccination_covid_19_anglais.pdf
- 71 Verger P, Scronias D, Fradier Y, *et al.* Online study of health professionals about their vaccination attitudes and behavior in the COVID-19 era: addressing participation bias. *Hum Vaccin Immunother* 2021;17:2934–9.
 - 72 Wilson RJI, Vergélys C, Ward J, *et al.* Vaccine hesitancy among general practitioners in southern France and their reluctant trust in the health authorities. *Int J Qual Stud Health Well-Being* 2020;15:1757336.
 - 73 Goralnick E, Kaufmann C, Gawande AA. Mass-vaccination sites-an essential innovation to curb the covid-19 pandemic. *N Engl J Med* 2021;384:e67:18..
 - 74 Our World in Data. Coronavirus (COVID-19) vaccinations. 2022. Available: <https://ourworldindata.org/covid-vaccinations>
 - 75 Corace K, Garber G. When knowledge is not enough: changing behavior to change vaccination results. *Hum Vaccin Immunother* 2014;10:2623–4.
 - 76 Huang S. Why is singapore leading in asia's COVID-19 vaccine effort? 2021. Available: <https://sg.finance.yahoo.com/news/why-singapore-leading-asias-covid-132839717.html>
 - 77 Wikipedia. COVID-19 vaccination in singapore. 2022. Available: https://en.wikipedia.org/wiki/COVID-19_vaccination_in_Singapore#cite_note-39
 - 78 Editorial Team. Sinovac COVID vaccine approved for use in singapore: MOH. *Yahoo News Singapore* 2021.
 - 79 S A. How struggling spain became one of europe's vaccination champions. 2021. Available: <https://www.euronews.com/2021/09/03/how-struggling-spain-became-one-of-europe-s-vaccination-champions>
 - 80 McGowan J, Sampson M, Salzwedel DM, *et al.* PRESS peer review of electronic search strategies: 2015 guideline statement. *Journal of Clinical Epidemiology* 2016;75:40–6.
 - 81 Page MJ, McKenzie JE, Bossuyt PM, *et al.* The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021.