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Defining the determinants of vaccine uptake and undervaccination in migrant populations in Europe to improve routine and COVID-19 vaccine uptake: a systematic review

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Understanding why some migrants in Europe are at risk of underimmunisation and show lower vaccination uptake for routine and COVID-19 vaccines is critical if we are to address vaccination inequities and meet the goals of WHO's new Immunisation Agenda 2030. We did a systematic review (PROSPERO: CRD42020219214) exploring barriers and facilitators of vaccine uptake (categorised using the 5As taxonomy: access, awareness, affordability, acceptance, activation) and sociodemographic determinants of undervaccination among migrants in the EU and European Economic Area, the UK, and Switzerland. We searched MEDLINE, CINAHL, and PsycINFO from 2000 to 2021 for primary research, with no restrictions on language. 5259 data sources were screened, with 67 studies included from 16 countries, representing 366 529 migrants. We identified multiple access barriers—including language, literacy, and communication barriers, practical and legal barriers to accessing and delivering vaccination services, and service barriers such as lack of specific guidelines and knowledge of health-care professionals—for key vaccines including measles-mumps-rubella, diphtheria-pertussis-tetanus, human papillomavirus, influenza, polio, and COVID-19 vaccines. Acceptance barriers were mostly reported in eastern European and Muslim migrants for human papillomavirus, measles, and influenza vaccines. We identified 23 significant determinants of undervaccination in migrants ($p < 0.05$), including African origin, recent migration, and being a refugee or asylum seeker. We did not identify a strong overall association with gender or age. Tailored vaccination messaging, community outreach, and behavioural nudges facilitated uptake. Migrants' barriers to accessing health care are already well documented, and this Review confirms their role in limiting vaccine uptake. These findings hold immediate relevance to strengthening vaccination programmes in high-income countries, including for COVID-19, and suggest that tailored, culturally sensitive, and evidence-informed strategies, unambiguous public health messaging, and health system strengthening are needed to address access and acceptance barriers to vaccination in migrants and create opportunities and pathways for offering catch-up vaccinations to migrants.

Introduction

Some migrant populations (defined as foreign-born individuals) are known to be at risk of underimmunisation¹⁻⁴ and have been involved in recent outbreaks of vaccine-preventable diseases in the EU and European Economic Area (EEA).⁵ The severe health inequities exposed by the COVID-19 pandemic,⁶⁻⁹ including barriers to accessing vaccination services,¹⁰ have highlighted the need for novel strategies to improve engagement with underimmunised groups, address barriers to COVID-19 vaccine uptake, and facilitate countries in meeting their vaccination targets, relieving their health systems, and reopening their economies.^{10,11} Emerging evidence shows lower COVID-19 vaccine uptake in some migrant and ethnic minority populations, groups which have been disproportionately affected by the disease.^{6,12,13} Adolescent and adult migrants might be particularly at risk of underimmunisation for routine vaccinations and excluded from initiatives to promote catch-up vaccination on arrival in some European countries.¹⁴ Migrants also face well documented barriers to accessing health care,^{2,15} but it is unclear to what extent this impacts on their ability to access vaccination services or how cultural, personal, and

language barriers also influence vaccine uptake.¹⁰ Despite known gaps in uptake, there is limited research exploring these factors and how levels of vaccination coverage and uptake vary within and between migrant subpopulations.

International migrants are a diverse group, including refugees, asylum seekers, irregular migrants, international students, and labour migrants, with varying social determinants of health and reasons for migration. Understanding the factors that influence low vaccination coverage and uptake in some migrants and identifying which subpopulations specifically are affected are critical to driving improvements in vaccination programmes and national vaccination strategies, including in the immediate term for COVID-19. It also supports key objectives of WHO's new Immunisation Agenda 2030 (IA2030)¹⁶ to improve vaccine coverage for vaccine-preventable diseases, achieve equitable access for vulnerable populations, and integrate vaccination throughout the life-course, including a focus on catching-up older migrants with missed vaccines or doses.¹⁷ At present, inconsistent use of terminology complicates the discourse around vaccination (and migrant health more generally) and might contribute to the design of interventions that fail to account for the full range of reasons for suboptimal vaccination.^{18,19} Several

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Key messages

- Migrants in Europe are one of several underimmunised groups and might be excluded from initiatives to promote catch-up vaccination for missed vaccines and doses on arrival in some European countries. Emerging data show low intent to vaccinate and low uptake in some migrant groups for COVID-19.
- The COVID-19 pandemic has exposed severe health and vaccination inequities and presented opportunities for innovations in vaccine service delivery and policy to better include refugees and migrants, including novel strategies to improve engagement with underimmunised groups.
- Our review confirms that migrants' barriers to accessing health care limit vaccine uptake and shows that a range of access barriers exist for key vaccines, including language, literacy, communication, practical, legal, and service barriers.
- Vaccine acceptance barriers were mostly reported in eastern European and Muslim migrants, for human papillomavirus, measles, and influenza vaccines. African migrants, recent migrants, refugees, and asylum seekers might be at higher risk of being undervaccinated.
- A shift towards migrant-sensitive and adaptable vaccination services, systems, and policies, with coproduction of tailored interventions and clear, consistent public health messaging, is needed to address specific vaccine access and acceptance barriers in migrants and strengthen vaccination programmes in high-income countries.
- Health-system strengthening is needed to provide opportunities and care pathways to offer child, adolescent, and adult migrants catch-up vaccinations along the entire migration trajectory for missed vaccines and doses.

models and theoretical frameworks exist to help define vaccination behaviour; the evidence-informed 5As taxonomy²⁰ is considered to capture most determinants of vaccine uptake and is most relevant to the aims of this Review, and includes a focus on access, affordability, awareness, acceptance, and activation (panel 1). There is an urgent need to investigate the relative contributions of these various factors to suboptimal vaccine uptake in migrant populations to inform the development of evidence-based interventions to improve vaccine equity. We therefore did a systematic review to identify (1) barriers and facilitators to vaccine uptake in migrants (categorised using the 5As) and (2) determinants of undervaccination, to improve uptake and coverage of routine and COVID-19 vaccination in diverse migrant populations in the EU and EEA.

Methods

We did a systematic review according to PRISMA guidelines²¹ and registered with the International Prospective Register of Systematic Reviews (PROSPERO: CRD42020219214).

Inclusion and exclusion criteria

We included primary research studies that included data on barriers to or facilitators of vaccine uptake (primary outcome) or determinants of undervaccination (secondary outcome) in migrant populations living in one of 30 EU or EEA countries, the UK, or Switzerland, published between 2000 and 2021 in any language. Key terms are defined in

Panel 1: Definitions of key terms

Access

The ability of individuals to be reached by, or to reach, recommended vaccines*

Affordability

The ability of individuals to afford vaccination, both in terms of financial and non-financial costs (eg, time)*

Awareness

The degree to which individuals have knowledge of the need for, and availability of, recommended vaccines and their objective benefits and risks*

Acceptance

The degree to which individuals accept, question, or refuse vaccination*

Activation

The degree to which individuals are nudged towards vaccination uptake*

Barrier

A factor that hindered vaccine uptake—ie, anything that an individual said that indicated why they did not, would not, or found it difficult to get vaccinated

Facilitator

A factor that supported or promoted uptake—ie, anything that an individual said that indicated why they did or would get vaccinated, or found it easier to get vaccinated

Determinant of undervaccination

A factor statistically associated with incomplete coverage or uptake of recommended vaccines ($p < 0.05$), or where uptake or coverage was statistically significantly lower compared with the reference population

Migrant

A person who is foreign-born (ie, born outside of the country in which the research study is conducted), or, in the case of children, having at least one foreign-born parent

*As defined by the 5As taxonomy for the determinants of vaccination.²⁰

panel 1. Studies involving health-care professionals (HCPs) working with migrant populations were included to capture provider-level and system-level perspectives pertaining to our primary outcome. We included all vaccines in this analysis. The inclusion and exclusion criteria, developed using a PICOS framework,²² are outlined in full in table 1. Studies were excluded if they did not contain data from one of the listed countries, were published outside the specified date range, contained non-disaggregated migrant population data, did not meet the key definitions, or were non-primary research articles. Regarding the date range, studies published before 2000 were excluded to keep findings relevant to recent migrant population flows, policy, and events; literature on COVID-19 was included.

Search strategy

MEDLINE, CINAHL, and PsycINFO databases were searched for primary research articles in any language published between Jan 1, 2000, and Sept 14, 2021, combining free-text terms and subject headings relating to (migration) AND (vaccination) AND (determinants) (appendix p 22). Grey literature sources and bibliographies of included studies were also hand-searched. Records were imported into EndNote, and duplicates deleted. Title and abstract screening and full-text screening were independently carried out by two reviewers (AFC and JC, KR, or AD) using Rayyan QCRI.²³ A minority of papers (11 [4%] of 272) not written in English, Spanish, or French (languages of the research team) were translated using Google Translate to assess full-text inclusion. The selection process is shown in the figure.

Data extraction

Data were independently extracted by two reviewers (AFC and YF) using a customised form (developed and piloted for the Review), including location and year of study, study design, vaccine(s), vaccination type (eg, childhood immunisations), and determinants and rates of undervaccination. Discrepancies at any stage were resolved by consensus.

Quality assessment

The quality of all included studies was independently assessed by two reviewers (AFC and YF) using JBI Critical Appraisal Tools,²⁴ with parameters of low (<49%), medium (50–79%), and high (80–100%) study quality. Data were not excluded based on study quality, but this information informed the narrative synthesis and discussion.

Data synthesis and analysis

Extracted data were tabulated and results presented as reported in the studies. All data were synthesised narratively. Qualitative data were first analysed thematically to identify factors influencing uptake, then categorised using the 5As taxonomy²⁰ (panel 1), and further classified by emergent subthemes. Quantitative data addressing the secondary outcome were tabulated by theme. Data synthesis and analysis were carried out by two reviewers (AFC and YF) in consultation.

Results

5259 data sources were screened (title or abstract, n=4362; full text, n=1149), of which 67 studies were included in the systematic review (primary outcome, n=43; secondary outcome, n=37); 42 focused on “foreign-born” migrants (not otherwise defined) or children of migrants, while the remainder focused on asylum seekers and refugees (n=10), undocumented migrants (n=3), homeless migrant children (n=1), European Roma (n=2), and HCPs who had worked with migrants (n=8); papers containing multiple population

	Inclusion criteria	Exclusion criteria
Population	Adult, adolescent, and child migrants (foreign-born) and children of migrants (under 16 years of age, with at least one migrant parent) residing in the UK, Switzerland, or one of 30 EU or EEA countries*; HCPs (doctors, nurses, health-care assistants, etc) who work with or have worked with the above populations	Migrant status not defined by country or region of birth or not defined; data not disaggregated between migrants and non-migrants; data not collected from one of the listed countries*
Intervention	Vaccination	NA
Control	No comparator or control was selected for this Review	NA
Outcome	Barriers and facilitators to vaccine uptake in migrant populations (primary outcome); determinants of undervaccination in migrant populations (secondary outcome)	NA
Study design	Primary research	Non-original research articles (eg, reviews, commentaries, editorials, case reports, and guidelines on vaccination)
Other	Published in any language	Did not meet definitions for primary or secondary outcomes; papers reporting immunity gained through natural disease (as opposed to vaccination)

EEA=European Economic Area. HCP=health-care professional. NA=not applicable. *Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden.

Table 1: Inclusion and exclusion criteria, using PICOS framework

groups were counted more than once. The included studies had a combined sample size of 366 529 migrants and 641 HCPs. Most studies reported on measles-containing vaccines (n=18), human papillomavirus (HPV) vaccine (n=17), or diphtheria, tetanus, or pertussis-containing vaccines (n=16); two studies looked at COVID-19 vaccination in migrants. Studies were conducted in 16 countries, and were cross-sectional (n=36), cohort (n=12), case-control (1), qualitative (n=16), or other (n=2) in design. 64 of 67 papers were quality-appraised (three study designs did not have an appropriate checklist), with a mean score of 82% (range 22–100%). Detailed characteristics of included studies are shown in the appendix (pp 2–16).

See Online for appendix

Barriers to and facilitators of vaccine uptake in migrant populations

43 studies^{8,25–66} addressed barriers to or facilitators of vaccine uptake. Access and acceptance were the most common themes, with awareness, affordability, and activation reported to a lesser extent. Unique subthemes relating to barriers (n=20) and facilitators (n=18) to uptake were defined and are summarised in panel 2 (further details are shown in the appendix, pp 23–26).

Access to vaccination

Low literacy,^{39,53,58} language barriers, and lack of interpreting services^{26,28,36,37,39,43,44,46,53,55,58,65,67,69} were common barriers to uptake. Specific barriers for European Roma were highlighted (lack of access to Romani-speaking interpreters; HCPs unaware of the difference between

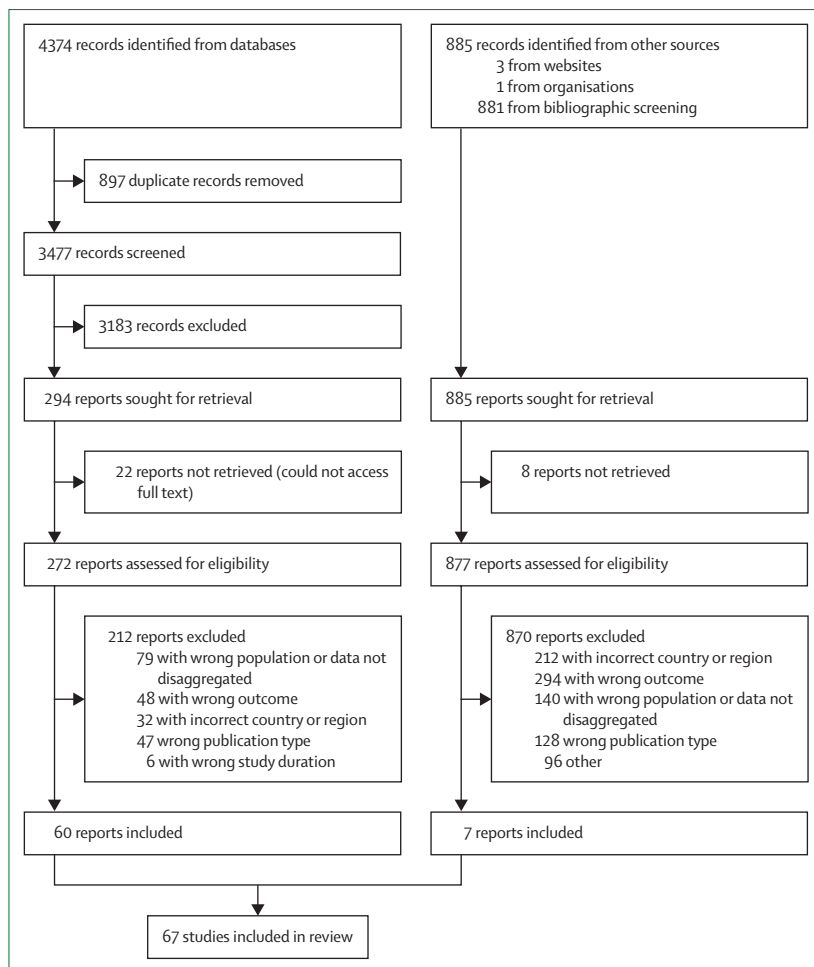


Figure: Study selection process

Shown by PRISMA 2020 flow diagram for new systematic reviews including searches of databases, registers, and other sources.

Roma and Romanian).^{39,58} HCPs reported that vaccination appointment times (10–15 min) were unrealistic when faced with communication barriers.⁵⁸ System-level barriers included lack of accessible, tailored, or translated information about vaccination for migrant populations.^{26,28,36,38,44,46,53,55,58–60,64,69} For example, some Moroccan, Turkish, and Somali populations said they preferred oral information, and written formats were not appropriate.^{38,55} In the absence of translated or accessible information, migrants also turned to alternative and unregulated sources, such as Google, social media, friends, and family.^{25,36,56,59,60}

Practical and legal barriers to accessing health care (whether perceived or real), including insecure housing, frequent change of address or no fixed address,^{34,41,44} digital exclusion,³⁹ and fears and uncertainty around legal entitlement,^{8,34,39,58–60,69} presented challenges to accessing vaccination services. Vaccines delivered through mainstream channels (eg schools) were not accessible for certain subpopulations—eg, European

Roma.^{34,39,69} Barriers related to legal entitlement included fear of being charged for care or asked about immigration status when accessing care, distrust of HCPs and authorities based on rumours or experiences of discrimination, difficulties registering with a general practitioner (GP), and being refused care.^{8,34,39,58–60,69} Asylum seekers, refugees, and migrants with precarious immigration status in two UK studies expressed concern that they would be deprioritised or excluded from the COVID-19 vaccine roll-out because of their status,^{8,59} and undocumented migrants (n=10 participants) remained unaware that they could access COVID-19 vaccination free of charge and without immigration checks after the government widened access.⁵⁹

Poor HCP knowledge of migrants' entitlements to health care and vaccination guidelines (eg, vaccination of individuals with incomplete or uncertain immunisation status) resulted in patients being wrongly refused access to primary care or not offered recommended catch-up vaccinations.^{34,48,60,65} A French study of GPs found wide variation in vaccination practices for newly arrived migrants with no vaccination record, while a Portuguese study suggested there had been missed opportunities to vaccinate migrants for tetanus when they had been in contact with the health-care system.^{48,61}

There was an absence of policies promoting vaccination and catch-up vaccination of migrants in some settings. A European network survey found most surveyed European countries lacked guidelines on offering BCG vaccinations to migrants,⁶⁸ while two studies reported no or limited checking of immunisation status in refugees and asylum seekers on arrival in Hungary, Greece, and the Netherlands.^{42,45}

Local variability in approach and coordination was another barrier to vaccination uptake. Introduction of the PHILOS vaccination programme improved coordination, planning, and monitoring of vaccinations for refugee children in Greece. Prior to PHILOS, vaccination activities in camps were mostly carried out by non-governmental organisations and determined by camp population size and site resources. Higher vaccination coverage at larger camps was possibly due to more organised, frequent, and effective vaccination campaigns.⁴⁷ A Welsh study reported variability in local procedures and resource allocation between asylum dispersal sites, including differences in accepting verbal history as proof of vaccination status, staff allocation, and follow-up procedures.⁵²

Staff shortages, including of bilingual HCPs, interpreters,³⁹ and cultural mediators,⁴⁷ were barriers, particularly in camps⁴⁷ and reception settings.^{52,65} In two studies, the mode of determining vaccination status and need for catch-up vaccination through mapping activities in the absence of a record was deemed too resource-intensive.^{41,65}

Timing and engagement with services were barriers in some studies. Included studies suggested there might be no good time to vaccinate during the migration

journey. Low participation in a vaccination programme in Hungary was attributed to it being a transit, rather than a destination, country.⁴⁵ Another study found asylum seekers had lower uptake in a destination country (the Netherlands) compared with a transit country (Greece), possibly reflecting a change in their priorities upon reaching their destination.⁴² Lower

coverage in Syrian refugees in Greek camps might have been due to their higher turnover relative to other populations, due to a more straightforward asylum process.⁴⁷

There were several facilitators of vaccine uptake, including cultural competence, integration, and engagement, and alternative access points. Cultural competence

Panel 2: What are the barriers to and facilitators of vaccine uptake in migrants?

Access

Barriers

- Language, literacy, and communication barriers^{26,28,36–39,43,44,46,53,55,58–60,64,65,67}
- Resource and capacity constraints^{39,41,47,52,58,61,65}
- Practical barriers^{34,39,41,42,44,45,47,59}
- Legal barriers^{42,45,68}
- Distrust of health system or authorities; sense of alienation and disempowerment^{8,34,39,58–60}
- Specific provider-level barriers^{34,42,46,48,58,60–62}—eg, health professionals lacking specific knowledge of migrant entitlements or catch-up vaccination guidelines, missed opportunities to vaccinate

Facilitators

- Social integration^{34,39,44,48,64}—eg, engaging with health or vaccination system, having citizenship
- Service coordination, organisation, and infrastructure^{27,47,58}
- Culturally competent and migrant-sensitive care^{29,34,38,41,53,59,60,63}—eg, inclusive services and policies, alternative access points
- Tailored information sources^{8,53,59}
- Vaccination policy⁶³—eg, policy to vaccinate in absence of vaccination card
- Trust in the provider, system, or State^{34,60}

Affordability

Barriers

- Direct costs^{28,32,42,58}
- Indirect costs⁵⁹—eg, cost of travelling to vaccination appointment
- Competing priorities^{34,58,59}

Facilitators

- Cost offsetting^{32,36,39,44,48,59}—eg, free vaccination, insurance cover
- Convenience^{38,58}—eg, walk-in clinics rather than pre-booked appointments, flexible appointments

Awareness

Barriers

- Lack of knowledge about disease or need for vaccination^{8,28,30,35,37,39,42,43,45,46,51,54,55,58,60,64}
- Lack of knowledge about entitlement to vaccination^{39,45}
- Personal health stewardship^{45,66}—eg, knowing own medical and vaccination history
- Misinformation or lack of information^{8,51,58–60}—eg, about the vaccine or its availability

Facilitators

- Health promotion and awareness^{35,45}—eg, health educational programmes, being aware of benefits of vaccination

Acceptance

Barriers

- Worries about vaccine safety and side-effects^{30,34–39,54,56,58,59,64}
- Cultural, religious, and social barriers^{36,37,49,54–56,64}—eg, stigma around specific vaccines, vaccination unfashionable in home country
- Distrust of health system or authorities, sense of alienation and disempowerment^{8,34,55,58,59}
- Misinformation or lack of information^{8,30,36,56,59,60}
- Low perception of risk of disease or importance of vaccination^{8,30,37,42,58–60,64}
- Vaccination not physician-recommended³⁰

Facilitators

- Positive perceptions of vaccination^{34,35,37,38,67}
- Positive social norms^{34,36,38,39,60}—eg, normalisation of vaccination
- Tailored approaches, information, and messaging^{38,55}—eg, emphasising that human papillomavirus vaccine prevents cervical cancer, rather than a sexually transmitted infection
- Access to credible information sources^{37,51,56}

Activation

Barriers

- Lack of information or practical support from health-care professionals when desired⁶⁴
- Blanket approaches⁵⁸—eg, vaccination reminders sent via letter or text message not suitable for transient Roma populations

Facilitators

- Catch-up vaccination initiatives^{47,50}—eg, on-arrival health screening and vaccination for asylum seekers, mass vaccination campaigns
- Mandates⁵⁴—eg, mandatory workplace vaccination
- Provider recommendation⁵⁴
- Health promotion and education⁴²
- Culturally tailored and community-based interventions^{39,47,57,58}—eg, face-to-face communication, personalised reminders, community advocates

Other

Barriers

- Lack of vaccination documentation or record^{41,45,65,66}

Facilitators

- Not applicable

of HCPs and migrant-sensitive services and policies facilitated uptake.^{29,34,41,53,63} In Sweden, all newly arrived migrant children are invited to meet with the school nurse to determine health and vaccination needs, helping to establish trust early.⁴¹ A UK study increased immunisation uptake in unaccompanied asylum-seeking children by training support staff and promoting the importance of vaccination and regular monitoring.²⁹ Social integration and engagement with the health-care system also had a positive association with uptake. Two studies found that migrants (adults and homeless children) who had been in contact with the health-care system or a GP in the previous year had a significantly lower risk of being insufficiently immunised.^{44,48} Regular contact with local health services,³⁴ closer geographical proximity to a GP,³⁹ and integration with the local community and health services⁶⁴ were associated with greater engagement and vaccination uptake. A UK study found that migrants preferred familiar and local settings for vaccination, requiring minimal travel, such as walk-in clinics at food banks, community centres, and charities, and requested support in registering with primary care to access vaccinations.⁵⁹

Acceptance of vaccination

Social norms, cultural acceptability, and stigma were noted to be barriers to vaccination uptake in several studies. Four studies reported barriers stemming from cultural acceptability and stigma around specific vaccines such as HPV.^{36,54–56} For example, Somali Muslim communities felt HPV vaccination promoted promiscuous sexual behaviour and was unnecessary as Somali women are expected to not engage in premarital sex. In an Italy-based study, religious and personal reasons were also more often cited as a reason for refusing tetanus vaccination among foreign-born construction workers compared with Italian-born construction workers.⁵⁴ Two studies suggested that negative social norms and different recommendations around vaccination in migrants' countries of origin were a barrier, with vaccination considered "unfashionable" in Poland, and not recommended in pregnancy.^{36,56}

Concerns about safety and side-effects were also noted in some studies. Worries about "overloading" the immune system with multiple or combined childhood vaccines, and side-effects including death, paralysis, or the potential effects on an unborn child, specifically in the case of HPV and measles-mumps-rubella (MMR) vaccines, were highlighted by several migrant groups.^{30,34–37,39,54,56,59,64} Studies also suggested that migrants' vaccination perceptions (including anti-vaccination sentiment) were influenced by a reliance on information and messages from their home countries, including friends, family, (social) media, and other online resources.^{36,56} Vaccine anxiety around the MMR–autism controversy was also a reported barrier to the uptake of other vaccines.⁵⁶ Three-quarters of migrants interviewed (23 [72%] of 32) in a UK study were reluctant

to accept a COVID-19 vaccination and said they would need more information before making a decision, citing concerns about ingredients and side-effects.⁵⁹ Undocumented migrants raised concerns that vaccine side-effects might require medical attention and thus contact with the health system, which they were keen to avoid.³⁴

Another barrier to acceptance of vaccines was low perceived importance and effectiveness of vaccination and low perceived risk of vaccine-preventable diseases. In nine studies,^{8,30,36,37,42,56,59,60,64} uptake was hindered by a belief that vaccination was unimportant or not fully protective, or because patients felt they lacked credible information about the need for vaccination. Some Romanian and Romanian Roma parents considered contracting measles a rite of passage for their child and a way to build natural immunity against the disease, or considered vaccines unnecessary or ineffective (particularly influenza and MMR vaccines).⁵⁸ Five studies highlighted how a lack of information could lead to exposure to misinformation from unofficial sources, presenting further barriers to uptake.^{8,36,56,59,60} Some migrants felt a COVID-19 vaccine was not needed, and preferred to rely on natural remedies, their immune system, or self-isolation to prevent infection.^{8,59}

Alienation and disempowerment were themes that arose in some studies. Distrust of the health-care system and fear of being questioned about one's legal status was reported as a barrier both to accessing, and accepting, routine and COVID-19 vaccination.^{8,34,55,58,59,69} Ukrainian migrants in Poland specifically expressed distrust of the Ukrainian system and were more accepting of vaccination in Poland, where they felt the quality of vaccines and the health-care system were higher.⁶⁰

There were multiple facilitators relating to acceptance. Holding a positive attitude towards vaccination and its benefits, confidence in the advice of HCPs, positive religious beliefs about vaccination, and normalisation of vaccination were identified as facilitators.^{30,34,35,37–39,67} Reframing the language and messaging around vaccination helped address cultural barriers; for example, emphasising that HPV vaccination prevents cervical cancer, rather than a sexually transmitted infection,⁵⁵ and linking the benefits of vaccination to religious teachings (eg, that vaccination can help maintain good health).³⁸ Having access to a trusted information source, often medical, and HCP recommendations were also important.^{30,35,51,54,56,64}

Awareness of need for, and availability of, vaccination

Knowledge barriers in migrants included low health literacy or lacking knowledge of: the need for vaccination or boosters;^{28,30,35,39,42,43,45,51,54,64} the disease, or its relationship to the vaccine (eg, cervical cancer and HPV vaccine);^{8,28,37,51,55,59,60} the immunisation schedule or need for boosters, and where to access them;^{46,51,54,58,66} and knowledge or evidence of one's own vaccination

history,^{41,45,65,66} although few studies measured the effect of knowledge on vaccine uptake. Many migrants said they struggled to find credible and trustworthy information about vaccination in their own language. Two studies found that migrant adolescents had limited knowledge about the existence of common vaccines, including measles and polio,³⁰ and were unlikely to actively seek out vaccine-related information.⁶⁴

Affordability of vaccination (financial and non-financial)

Few studies investigated financial barriers; however, cost was found to be prohibitive when assessed hypothetically^{28,42} or where self-payment was required.³² Romanian and Polish participants in two UK studies reported that high cost of vaccines in their country of origin was a barrier.^{36,39} Newly arrived migrants also highlighted indirect costs associated with getting a vaccine, such as travel costs,⁵⁹ and lack of clarity around payment for health services.⁵⁸

Free-of-charge vaccination, or having private health insurance, facilitated uptake in four studies.^{32,36,39,48} Migrants with precarious immigration status said that if they could be confident there would be no associated costs, more of their community would present for COVID-19 vaccination.⁵⁹

Competing priorities and rigidity of scheduling were non-financial barriers to vaccination, including among parents who were positive about vaccination or intended to vaccinate their children.³⁴ Where prebooked appointments were poorly attended by Romanian and Romanian Roma migrants, health professionals found that offering walk-in vaccination clinics improved attendance.⁵⁸

Activation and nudging towards vaccination

Face-to-face communication and outreach (eg, during community visits) were generally effective and well received by Romanian and Roma communities,^{39,58} and helped to increase trust. Personalised vaccination reminders had a larger positive effect on the uptake of childhood vaccines in non-Western mothers compared with Danish mothers.⁵⁷ Initiatives that built trust and shared responsibility through local partnerships and collaboration were also effective.^{27,47,58} Health professionals suggested that, although costly, involving community members as vaccine advocates could help promote vaccination in communities that had experienced measles outbreaks.⁵⁸

Determinants of undervaccination in migrant populations

37 studies^{26,27,31–33,44,45,47,48,50,52,54,62,70–93} addressed determinants of undervaccination in migrant populations. We identified 23 specific determinants of undervaccination in migrant populations: geographical origin; recent migration; lower acculturation; gender or sex; age; being a refugee or asylum seeker; income; health-care contact; health insurance; housing insecurity; region of residence;

dispersal site; smaller refugee camp; not having citizenship; comorbidity; being in an influenza risk group; and seven parental characteristics, including: younger maternal age, education level, language difficulties, unemployment, one or both parents born overseas, first-generation children, and larger family size. Geographical origin and recent migration were the factors most associated with undervaccination. Determinants of undervaccination are summarised in table 2 (for further details, see appendix pp 17–21). Only adjusted analyses (where available) and determinants where a statistical association was found were reported. Where studies were conducted with a mixed population (migrant and non-migrant), only variables that could be attributed with certainty to the migrant population (eg, geographical origin) were extracted.

25 of 26 studies found a statistically significant ($p < 0.05$) association between geographical origin and undervaccination.^{26,31–33,45,47,50,54,62,70,71,73–77,81,84,86,87,89–93} Of these, 13 studies found an association specifically with African origin (Africa,^{45,73,76,92} sub-Saharan Africa,^{31,71,75,77,84} north Africa,^{75,77} Morocco,^{62,74,86} Eritrea,⁵⁰ Suriname,⁶² Somalia⁸⁴). Five studies found a specific association with eastern or central European origin,^{26,71,73,77,84} three studies with Turkish origin;^{62,74,86} six studies with eastern Mediterranean or Middle Eastern origin (eastern Mediterranean,⁵⁴ Middle East,^{73,84} Syria,^{33,47} Iraq,^{47,50,84} Afghanistan,^{50,84} Iran⁵⁰); six studies with Asian origin;^{31,73,75,77,89,92} and two studies with central or South American origin^{76,77} (table 2).

Six out of eight studies^{31,32,78,82–84} found that undervaccination was significantly associated with more recent migration to^{31,32,78,82,84} or lower acculturation with⁸³ the host society. Other predictors of undervaccination included higher income (three of four studies^{44,48,88}), being a refugee or asylum seeker (two of three studies^{52,84}), having not accessed health care in more than a year (two of two studies^{44,48}), having no private health insurance (two of two studies^{44,48}), and region of residence (two of two studies^{31,48}). Specific familial characteristics, such as parental education level, difficulties speaking the host country language, or larger family size, were also associated with undervaccination. Two studies^{44,88} found that higher income and higher parental education level were associated with HPV undervaccination in children. We did not identify a strong overall association with gender or sex^{27,44,45,47,48,82,83} or age^{31,32,45,78,82,84,88} in the data.

Discussion

We have reported data on barriers to and facilitators of vaccine uptake and defined key determinants of under-immunisation in migrant populations, summarising data on 366 529 migrants living in EU or EEA countries, the UK, and Switzerland. These data hold immediate relevance to strengthening vaccination programmes in high-income countries, including for COVID-19, where better consideration is now needed to promote vaccination for migrants across the life-course, to ensure catch-up for

	Significant association with undervaccination?	Number of studies finding a significant association/number of studies investigating the determinant
Individual characteristics		
Geographical origin: ^{26,31-33,45,47,50,54,62,70,71,73-77,81,84,85,86,87,89-93} African region (Africa, ^{45,73,76,92} sub-Saharan Africa, ^{31,71,75,77,84} north Africa, ^{75,77} Morocco, ^{62,74,86} Eritrea, ⁵⁰ Suriname, ⁶² Somalia ⁸⁴); European region (eastern Europe, ^{26,73,77,84} central and eastern Europe, ⁷¹ Europe, ⁹¹ western Europe, ⁷¹ Turkey ^{62,74,86}); eastern Mediterranean and Middle Eastern region (eastern Mediterranean, ⁵⁴ Middle East, ⁷³ Syria, ^{33,47} Iraq, ^{47,50,84} Afghanistan, ^{50,84} Iran ⁵⁰); Asian region (Asia, ^{31,73,75,89,92} mid or eastern Asia, ⁷⁷ western Asia, ⁷⁷); Americas (central or South America, ^{76,77} Americas ^{71,91}); other* ^{50,71,76,77,81,84,87,90,91,93}	Studies finding a significant association; ^{26,31-33,45,47,50,54,62,70,71,73-77,81,84,86,87,89-93} studies not finding a significant association ⁸⁵	25/26
Having recently migrated to the host country ^{31,32,45,48,78,82,84}	Studies finding a significant association; ^{31,32,78,82,84} studies not finding a significant association ^{45,48}	5/7
Being less acculturated to the host country ⁸³	Studies finding a significant association ⁸³	1/1
Gender or sex: ^{27,44,45,47,48,50,78,82,83,94} being female, ^{50,94} being male ^{78,94}	Studies finding a significant association; ^{50,78,94} studies not finding a significant association ^{27,44,45,47,48,82,83}	3/10
Age (or birth year or birth cohort) ^{27,31-33,44,45,48,50,77,80,82,84,88,91,94}	Studies finding a significant association; ^{27,33,44,48,50,77,80,91,94} studies not finding a significant association ^{31,32,45,78,82,84,88}	9/16
Being a refugee or asylum seeker ^{45,52,84}	Studies finding a significant association; ^{52,84} studies not finding a significant association ⁴⁵	2/3
Income (household or disposable): ^{44,48,84,88} having higher income; ^{44,48,88} having lower income ⁸⁴	Studies finding a significant association ^{44,48,84,88}	4/4
Not having accessed health care/GP in past 12 months ^{44,48}	Studies finding a significant association ^{44,48}	2/2
Not having private health insurance ^{44,48}	Studies finding a significant association ^{44,48}	2/2
Having frequent residence changes ⁴⁴	Studies finding a significant association ⁴⁴	1/1
Specific region of residence (eg, capital city) ^{31,48}	Studies finding a significant association ^{31,48}	2/2
Specific asylum dispersal site (as local procedures might vary) ⁵²	Studies finding a significant association ⁵²	1/1
Living in a smaller refugee camp ⁴⁷	Studies finding a significant association ⁴⁷	1/1
Not having host country citizenship ⁴⁸	Studies finding a significant association ⁴⁸	1/1
Having a comorbidity ⁹⁴	Studies finding a significant association ⁹⁴	1/1
Being in an influenza risk group (<65 years plus comorbidity) ⁹⁴	Studies finding a significant association ⁹⁴	1/1
Familial characteristics (where parents were decision maker for childhood immunisations)		
Younger maternal age ⁷²	Studies finding a significant association ⁷²	1/1
Parental education level: ^{33,44,71,72,83,88} higher; ^{44,71,88} lower or none ^{33,72}	Studies finding a significant association; ^{33,44,71,72,88} studies not finding a significant association ⁸³	5/6
Parents have difficulties speaking host country language ^{26,44}	Studies finding a significant association ^{26,44}	2/2
Parents unemployed ^{31,33,48}	Studies finding a significant association; ³³ studies not finding a significant association ^{31,48}	1/3
One or both parents born overseas ^{85,90}	Studies finding a significant association ^{85,90}	2/2
Children are first-generation migrants ^{85,88}	Studies finding a significant association ^{85,88}	2/2
Larger family size ^{33,72}	Studies finding a significant association; ⁷² studies not finding a significant association ³³	1/2
Lists are shown where relevant to illustrate the direction of the association and related citations (geographical origin; gender; income; education level). Table only reports factors where a statistically significant association was found in at least one study. Associations were based on adjusted rates, where data were provided. GP=general practitioner. *Other category included: old EU countries (joined EU before 2004) or other Western countries; Western countries; non-European; former Yugoslavian; Russian; other Western; other non-Western; non-European; Oceania; Middle East and north Africa.		
Table 2: Determinants of undervaccination in migrants		

missed vaccines and doses, and to align them with the host country schedule. Access barriers were of key importance and included language, literacy, and communication barriers, practical and legal barriers to vaccination services and systems, and service barriers (eg, lack of dedicated resourcing, specific guidelines, and training or knowledge of HCPs) for key vaccines,

including MMR, diphtheria-pertussis-tetanus, HPV, influenza, polio, and COVID-19 vaccines. Acceptance barriers were mostly reported in eastern European and Muslim migrants, for HPV, measles, and influenza vaccines, suggesting these barriers might be unique to certain populations, vaccines, and contexts. We identified 23 specific determinants of undervaccination

in migrant populations, including that those from Africa, eastern Europe, the eastern Mediterranean, and Asia, and recently arrived migrants, refugees, or asylum seekers were most likely to be undervaccinated, a finding which has immediate policy and planning implications. Although these findings should be interpreted with caution, one hypothesis is that they reflect diminishing trust in authorities and vaccine confidence in eastern Europe,^{95,96} and access barriers and interrupted childhood immunisation campaigns in remote and conflict settings. The association with geographical origin more broadly, and recent arrival, could indicate some interacting factor such as language barrier, which is experienced almost universally by newly arrived migrants. A range of other possible determinants were also identified, suggesting that the reasons for under-vaccination of migrants are highly variable and influenced by context. Robust research is now needed to study associations at the subregional level and to control for potential confounders, alongside exploring innovative approaches to engaging marginalised migrant populations in vaccination and to ensure equitable access. Future research must also use clear migrant definitions to define subpopulations, study generational effects, and explore how migrants' vaccination views and behaviours might change over time in the host society. Opportunities to conduct subanalyses on migrants in general population studies, where data are disaggregated, should also be explored.

The breadth of vaccine access barriers—practical, legal, and administrative—experienced by migrants and identified in this Review was substantial. Migrants' barriers to accessing health care are already well documented,^{97–100} and this Review confirms their role in limiting vaccine uptake. Our findings align with a recent rapid review of vaccine hesitancy in migrants,¹⁰¹ which suggested that hesitancy in these populations might be an expression of cultural alienation resulting from experiences of marginalisation or discrimination, while a systematic review¹⁰² of mostly US studies concluded that vaccination campaigns might need special consideration among this population due to the specific cultural and knowledge barriers identified. We noted barriers from gaps in health-care provider knowledge around catch-up vaccination, an area where experts have called for more guidelines.^{11,14} At the policy level, national vaccination strategies and guidelines vary considerably across Europe and many countries do not specifically include or target refugees and migrants in their vaccination plans (including for COVID-19) or fail to implement them correctly.^{15,103} Recent steps have been taken in Europe to widen access to COVID-19 vaccination for undocumented migrants and marginalised populations following recommendations by international and EU bodies,^{104–107} including through more accessible distribution points and reducing entitlement and charging barriers, although migrants' awareness of these policies or

willingness to come forward might be limited.^{59,108} Similar steps should be taken to reduce legal barriers to, and increase opportunities for, migrants to access routine and catch-up vaccination. In the short term, strengthening the capacity of host country health systems to enable more opportunities and novel access points for catch-up vaccination of migrants, particularly older adolescents and adults, is vital if we are to meet ambitious new WHO targets¹⁶ and ensure high COVID-19 vaccine coverage. Longer-term measures should focus on improving coordination of policies, guidelines, and vaccination delivery for migrants and mobile populations across European borders.¹⁰⁹

In addition to improving intraregional capacity to monitor and deliver vaccination services to migrants, measures must tackle the systemic barriers to accessing vaccination by creating more culturally competent health systems. Migrants described lacking trust in the health system, and struggling to communicate with HCPs and access or understand vaccination information, which led them to avoid care, delay vaccination, or turn to alternative sources, including social media. HCPs highlighted the additional burden that communication barriers and lack of interpreters imposed on their limited consultation time. Wider research shows that such patient–provider obstacles can result in delayed engagement with, and difficulty navigating, health services, and patients being less able to communicate concerns, advocate for themselves, and obtain better care.^{110–112} This might partly explain why more recently arrived and less acculturated migrants were at greater risk of undervaccination. The Council of Europe urges that “access to vaccination services should be tailored to the needs of persons in vulnerable situations having difficulties in accessing health services”,¹¹³ and our findings demonstrate that migrants need more linguistically, socially, religiously, and culturally tailored information, in a variety of formats, to make informed decisions about their health, including vaccination, particularly those who might already be reluctant or hesitant to vaccinate.¹¹⁴ Producing these types of resources should be prioritised by public health bodies.

Among the limited number of studies reporting facilitators to vaccine uptake, tailored vaccination messaging (based on specific perceptions, beliefs, or barriers), community outreach, and interventions to nudge behaviour (eg, personalised reminders) were shown to be effective. COVID-19 has presented new opportunities to engage more effectively with migrants and other marginalised groups around vaccination,^{10,115} and future research must focus on identifying novel and participatory approaches that facilitate uptake in specific migrant groups and can be embedded in vaccination programmes. We noted the importance of clear public health messaging around vaccination, with examples of misinformation and lack of official information influencing vaccination perceptions and decision making. A particular challenge during

the COVID-19 pandemic has been the need for quick and clear communication during a rapidly evolving situation, much of which has been conducted by politicians rather than public health professionals. Recent evidence shows that “vague, reassuring communication” which is more typical of politicians, who are motivated by short-term goals, does not increase vaccine acceptance and leads to both lower trust and higher endorsement of conspiracy theories.¹¹⁶ It is possible that for migrant populations facing language barriers, these negative trade-offs are even more pronounced. Therefore, governments should recognise the importance of clear and transparent communication in any vaccination campaign, and after vaccine development continue to invest funds in developing strong communication and vaccine roll-out strategies to gain and maintain the trust of—and reach—their entire population. Existing research evidence around effective vaccine communication, and new toolkits to combat vaccine misinformation produced during the pandemic, provide useful guidance.^{117–119}

This Review has some limitations. Included studies came from only 16 of the 32 review countries; therefore, this Review is not fully representative of the European region and largely focuses on western Europe, highlighting the urgent need for more data on vaccination uptake disaggregating by migrant status in all European countries, which is rarely collected by national data systems. The lack of uptake data for COVID-19 vaccines in diverse migrant populations has been previously highlighted and has undoubtedly hindered evidence-based service delivery.^{105,120} Certain subpopulations and nationalities of migrants were not well reported (eg, undocumented migrants), with an urgent need now for vaccine uptake datasets (including for COVID-19) in Europe that disaggregate by migrant status to inform service delivery. Due to scope, we only reported determinants of undervaccination where at least one statistically significant association was found; therefore, other determinants might warrant exploration, with studies needed to explore links between factors.

This Review has shown that access to and acceptance of vaccination are key factors influencing vaccine uptake in migrant populations in the EU and EEA, requiring multilevel action. Vaccination services should be designed to better meet patients’ social, cultural, and linguistic needs, through the translation and tailoring of information, provision of interpreters, training of HCPs in migrant health and vaccination guidelines, and implementation of interventions that facilitate access to vaccination. Migration policies must support a life-course approach to vaccination, which is a priority of IA2030, and implement novel strategies to ensure all migrants are included in catch-up initiatives and supported in accessing health and social care on arrival to host countries, drawing on innovations and models of good practice in vaccine delivery employed during the COVID-19 pandemic.¹²¹ Tailored and evidence-informed

strategies should be codesigned with migrant populations to address specific barriers and perceptions towards vaccines and vaccination in context. Effective and unambiguous communication of public health messages, delivered by trusted messengers, will be vitally important to reach and gain the trust of migrant populations, and to combat the spread of misinformation, as highlighted by the COVID-19 vaccine roll-out. The findings of this Review have immediate implications for strengthening national and regional routine immunisation programmes and public health responses to the COVID-19 pandemic.

Contributors

AFC and SH had the idea for this Review and designed the protocol. ASF, HB, KR, JC, AD, SEH, and YF reviewed and commented on the protocol. AFC and YF independently conducted and verified the searches, screening, data extraction, and analysis, with validation and support from KR, JC, AD, and SEH. AFC and YF wrote a first draft of the paper with input from SH and ASF. All authors discussed the findings and contributed to the review and editing of the final manuscript. All authors had full access to the full data in the study and accept responsibility for the decision to submit for publication.

Declaration of interests

HB is a member of the National Institute for Health and Care Excellence committee developing guidance on vaccine uptake in the general population. SH is a freelance senior editor for *The Lancet Infectious Diseases* and other *Lancet* journals. FW is a member of the Vulnerable Migrants Wellbeing Project Advisory Board, led by the University of Birmingham and Doctors of the World and funded by the Nuffield Foundation. All other authors declare no competing interests.

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