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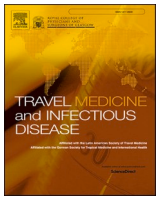

Infectious diseases prevention and vaccination in migrants in Latin America: The challenges of transit through the treacherous Darien gap, Panama

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Human migration is a dynamic, multifaceted and complex phenomenon shaped by economic, political, social, climatic and environmental factors [1–4]. Migration refers to the relocation of individuals from their habitual residence to a new location, while travel involves journeying between destinations for various purposes [5]. In recent years, migration trends have been shaped by globalisation, technological advancements, climate change, armed conflicts, social and economic disparities and political and religious persecution. Migration poses challenges for individual nations and represents a crucial humanitarian and global health issue requiring coordinated international efforts and long-term planning [6–8].

According to the International Organization for Migration (IOM), more than 280 million people —approximately 3.6% of the world's population— are international migrants (https://www.iom.int/fundamentals-migration). This figure includes individuals who move voluntarily to seek better living opportunities and those forcibly displaced due to conflict, persecution, and environmental disasters. In addition, internal migration—people moving within their own countries—affects hundreds of millions more, particularly in large nations like China, India, and the United States of America (USA) [9–11].

Migration occurs for diverse reasons, primarily economic prospects, conflict, violence associated with political conflicts and political instability, climate change, and demographic factors. Many migrants leave their home countries searching for better employment and living conditions, particularly from developing nations to wealthier regions. Wars, repression, and human rights violations force millions to displace globally, with, most recently, the Syrian, Afghan, Venezuelan (Fig. 1), and Ukrainian crises being among the most significant displacement events in recent history.

This unprecedented phenomenon, which is characterised by a complex relationship with the notion of disease, naturally varies among different groups of migrants and, depending on their characteristics, may even vary within the same group. Therefore, it is crucial to understand the mobility patterns and other inherent factors that affect the health and well-being of migrants, refugees, and travelers to develop measures to prevent the spread of diseases that may pose a threat to public health [2].

Climate change and environmental variables causing rising sea levels, droughts, hurricanes, and desertification have increasingly led to forced migration, particularly in vulnerable regions such as the Pacific Islands, the Sahel in Africa, and parts of South Asia. Meanwhile, demographical variables such as ageing populations in developed nations create labour shortages, leading to increased demand for migrant workers and consumers [12–16]. Climate-driven displacement increases exposure to vector-borne and water-related diseases, demanding integrated climate-health policies to protect vulnerable migrant populations in high-risk environments [17,18].

Migration can be considered a complex process and a recurring event from a historical perspective. It presents challenges and opportunities for host, transit, and origin countries. Challenges include social integration, cultural acceptance, strain on public services, labour market competition, and concerns over national security. In some cases, migration has fuelled political tensions and anti-immigration sentiments. On the other hand, migration also brings benefits. Migrants contribute to economic growth, cultural diversity, and demographic renewal. Remittances sent by migrants to their home countries represent

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Fig. 1. More than 7.1 million people have left Venezuela in one of Latin America's largest population movements in history; more than 2.48 million are in Colombia. (**A**) (2023), using diverse routes across the continent (**B**) (https://storyteller.iom.int/stories/venezuelans-brave-and-perilous-journey-through-ecuador).

a crucial source of income, often surpassing foreign aid in many cases [19–22].

In Latin America, migration has become one of the region's most pressing social and political issues. Driven by economic instability, political crises, violence, and climate change, migration patterns in Latin America are diverse, dynamic and complex, involving intraregional and international migratory movements [17,18,23–26].

One of the most significant migration flows is the Venezuelan exodus (since 2014, peak 2017–2019), with over 7.7 million Venezuelans leaving their country due to economic collapse, political repression, and humanitarian crises (Fig. 1). Neighbouring countries such as Colombia, Peru, Ecuador, Chile, and Brazil have received large numbers of Venezuelan migrants, creating both integration challenges and economic opportunities [27–29]. Migration between neighbouring countries, such as Haiti and the Dominican Republic, with substantial disparities in public health systems, has allowed diseases such as *Plasmodium falciparum* malaria to persist and cause cyclical outbreaks in communities with high concentrations of migrants. Because of the structural, social, economic and political consequences after the earthquake devastated Haiti, a large-scale migratory movement to the Dominican Republic was observed [30–32]. The Dominican Republic is the largest host country of Haitian migrants on the continent. The difficulty in accessing health services in the impoverished country leads thousands of Haitian citizens to cross the border between the two countries each year to seek medical care. Particularly noteworthy are pregnant Haitian women who frequently arrive at Dominican hospitals unattended and in poor general condition, contributing to the high maternal and infant mortality rates in the Dominican Republic [33,34].

Another major migration trend involves Central American migration toward the USA. Factors such as poverty, gang violence, and climate-related disasters force thousands of people, including entire families, to embark on dangerous journeys northward. Many migrants travel through Mexico, often facing human trafficking risks, abuse, and strict immigration policies [35]. A significant concern is the lack of understanding from the travelers about their destination. They are not concerned about what they can get, just about moving on from their origin. However, most of them are not really aware of what they will face on the route. For example, the Darién Gap (Fig. 3), a treacherous jungle route between Colombia and Panama, has become a key and perilous transit point for thousands of migrants seeking to reach North America, which implies multiple life-threating risks for the migrants [36–39].

A minor but still significant factor is Latin American migration to Europe, which surged in the late 1990s, with four million migrants living in Europe in 2008. This migration wave is distinguished by a high proportion of working-age adults and a notable predominance of women, underscoring the accelerating feminisation of migration flows to Europe. This trend not only highlights shifting gender dynamics within global mobility patterns but also serves as an emblematic case study of how migration intersects with evolving gender roles and women's integration into labour markets (https://ced.cat/wp-content/uploads/2019/03/InternationalMigration_2019_Bayona_Avila.pdf) [40]. European health systems face new challenges from Latin American migration, especially in screening for neglected diseases like Chagas, requiring enhanced preparedness and targeted health policies [40,41].

Latin America is also experiencing reverse migration and new migratory routes. Countries like Argentina and Chile, once major migrant-receiving nations, have seen increased emigration due to economic downturns [42]. At the same time, the region has become a transit corridor for people from Haiti, Africa, and Asia trying to reach the USA or Canada. Despite these challenges, migration remains a key driver of economic and social change in Latin America, requiring regional cooperation and sustainable policies to address its complexities [39,42–44]. Uncontrolled animal movement, improper carcass disposal, habitat invasion-destruction, and increased human-animal interaction drive zoonotic pathogen transmission. Human migration and food- and water-borne zoonotic diseases pose significant health risks [45]. Low and heterogeneous vaccination coverage rates among individuals who make up migratory groups, often in the context of crowds, can lead to outbreaks and the introduction of vaccine-preventable diseases (VPDs).

Internal displacement (including rural to urban and urban to urban) and international migration in Latin America have significant public health implications, particularly concerning infectious, tropical, emerging, parasitic and viral diseases [1,46–51]. The large-scale movement of people within and across borders and from areas with distinct epidemiological scenarios and endemicity patterns for different diseases can introduce and disseminate infectious agents, influence disease transmission, disrupt healthcare systems, and create challenges for disease surveillance and control that knows no borders. Migrant populations often face precarious living conditions, malnutrition, dehydration, unsanitized water consumption, limited access to healthcare, and higher exposure to endemic diseases, making them particularly vulnerable to infections. Understanding the impact of migration on health in Latin America is essential for developing effective public health policies and response strategies [52–62].

Migration facilitates the movement of infectious diseases across regions, particularly in areas where healthcare access is limited or overburdened [1,39,48,54,57]. Latin America has seen an increase in the transmission of tuberculosis (TB) [63–65], HIV/AIDS [3,66–69] and

VPDs such as measles due to migratory movements [48,70,71]. For example, Venezuelan migration has been linked to the resurgence of measles in South America, as outbreaks have been reported in Brazil, Colombia, Argentina, and other neighbouring countries. The collapse of Venezuela's healthcare system led to a drastic drop in vaccination coverage, allowing the virus to spread across borders through migrant populations [72–74].

Tuberculosis remains a significant concern [65], particularly among migrant groups living in overcrowded or unsanitary conditions [63,64]. Multidrug-resistant tuberculosis (MDR-TB) poses a growing threat, especially in regions with weak healthcare infrastructures with inappropriate treatment access and follow-up. The movement of people across different healthcare systems can delay diagnosis and treatment, further complicating disease control efforts. HIV/AIDS prevalence also remains a concern, particularly among migrants engaging in high-risk behaviours due to economic hardship, social isolation, or limited healthcare access.

Migration across borders increases vulnerability not only to HIV/AIDS but also to other sexually transmitted infections, probably through mechanisms that include sexual violence, sexual exploitation and new sexual partners. The impact of migration on the HIV epidemic in Latin America has not been considered in the implementation of HIV prevention programmes. Furthermore, the continuity of antiretroviral provision for individuals may be threatened during migration (https://www.sanidad.gob.es/ciudadanos/enfLesiones/enfTransmisibles/sida/INFORMES/DificultadesAccesoServiciosSanitarios_Final_2022.pdf). Migrant populations often face structural, cultural and social barriers to HIV prevention, testing, and treatment, increasing the likelihood of undiagnosed and untreated infections [75–78]. For example, in Spain in 2023, 49.8% of new HIV diagnoses occurred in the migrant population, primarily Latin American, with this percentage rising to 61.6% among new diagnoses in women (https://www.sanidad.gob.es/ciudadanos/enfLesiones/enfTransmisibles/sida/vigilancia/docs/Informe_VIH_SIDA_2023_Nov_2024_def.pdf). Among Venezuelan migrants, cases of sexual exploitation have been documented in host countries such as Colombia, Peru, and Ecuador, where many women and adolescents are coerced into sex work to survive. These conditions increase the risk of HIV transmission, as access to prevention methods, such as condoms and pre-exposure prophylaxis (PrEP), is limited, and early detection testing is often unavailable (https://www.r4v.info).

The Global Tuberculosis Report highlights COVID-19's impact on TB care, drug resistance, and HIV coinfection. Addressing these challenges requires international collaboration, prioritising transit migrants to ensure their inclusion in TB prevention and treatment efforts [79].

Like Argentina, Chile, and Colombia, Peru is one of the countries in the region that has temporarily expanded its healthcare coverage for migrants and refugees diagnosed with HIV and tuberculosis. Through Law No. 32154 (https://busquedas.elperuano.pe/dispositivo/NL/2340782-2), Peru ensures access to essential medical treatments and services without requiring proof of residency. However, the implementation of these policies varies in scope and effectiveness across countries, reflecting differences in regulations, healthcare infrastructure, and administrative challenges (https://www.ifrc.org/es/document/migracion-y-salud-en-las-americas-una-evaluacion-las-necesidades-y-servicios-2021-2023).

Latin America has several tropical and vector-borne diseases that disproportionately affect migrant populations due to increased exposure to vectors such as mosquitoes, sandflies, biting midges and triatomines. Dengue, Zika, Chikungunya and Oropouche are endemic in many Latin American countries, with seasonal outbreaks affecting millions and with an exponential growth in both cases and areas of endemicity, revealing a change in the global epidemiological scenario where Latin America currently accounts for 80% of the new cases in the world [80–86]. Migrants traveling through or settling in areas with high mosquito populations may be at greater risk of infection or eventually be a source of infection of emerging agents for potentially competent endemic vectors. Poor housing conditions, lack of vector control measures, and climate-related changes further exacerbate the spread of these diseases [87,88]. Non-vector-borne ectoparasitic diseases in Latin America, including scabies, tungiasis, pediculosis, and myiasis, cause itching, dermatitis, infections, and morbidity, particularly in vulnerable populations, requiring improved hygiene, surveillance, and control measures to mitigate their public health impact [89–92].

Although malaria transmission is localised in certain parts of Latin America, migration has contributed to outbreaks in areas previously considered malaria-free. Venezuelan migration, for example, has been linked to malaria resurgence in the border regions of Colombia and Brazil, where infected migrants unknowingly introduce the parasite into receptive environments [93,94]. For instance, in Colombia, with the need to enhance a malaria diagnostic network in municipalities, including the implementation of Voluntary Collaborators (ColVol) (https://www.ins.gov.co/buscador-eventos/Lineamientos/Pro_Malaria%202024.pdf), this program diagnosed 24,319 cases of malaria from 66,221 smears performed, resulting in a positivity rate of 36.72%. Among the cases, 9102 were due to *Plasmodium falciparum*, 14,545 to *Plasmodium vivax*, and 672 were mixed infections. As observed, borders with Venezuela and Panama were notably represented in the analyses (Fig. 2) (https://lookerstudio.google.com/reporting/9e7af8c8-6991-4930-8800-f990630f1224/page/kYQCE).

Similarly, Chagas disease, caused by *Trypanosoma cruzi* and transmitted by triatomine insects, is endemic to several Latin American countries. Migration has played a role in spreading Chagas disease beyond traditional endemic areas, particularly when infected individuals relocate to non-endemic regions where the healthcare system is unaware, without proper screening and treatment, as well as the risk of organ and blood donor transmission due to missing Chagas disease testing [52,54,57–59], resulting, including, in the risk of non-vector transmission, whether vertical or through transfusion procedures or organ and tissue donation [95]. Other parasitic diseases are common in migrant populations, including those causing leishmaniasis and helminth infections, which are highly prevalent in Latin America [96–99]. Some studies show that eosinophilia occurs in 12–31% of migrants, often due to helminth infections (19–80%) [100]. While usually benign, some, like *Strongyloides stercoralis*, could persist for life and cause fatal hyperinfection in immunosuppressed individuals [101].

The movement of people within Latin America also influences the emergence and re-emergence of infectious diseases. Environmental changes, urbanisation, and deforestation —often linked to migration and climate change— create new interfaces between humans and wildlife, increasing the risk of zoonotic spillovers [102]. The COVID-19 pandemic highlighted the vulnerability of migrant populations to emerging diseases. Migrants often had limited access to testing, vaccination, and healthcare services, leading to increased transmission risks in transit centres, refugee camps, and informal settlements (Fig. 3). Many Latin American countries struggled to include migrants in their national COVID-19 response strategies, further exacerbating disparities in healthcare access.

For example, in Venezuela, the drop in the percentage of coverage of the primary vaccines of the immunisation programme (DTP, measles, polio, BCG), was not only associated with the country's economic crisis (2017–2019), but was heightened by the COVID-19 pandemic (2020–2021), especially in the third dose of DTP and polio vaccine, causing a decrease of up to 25% and 26% respectively (http://saber.ucv.ve/ojs/index.php/rev_edsp/article/view/30094). Vaccination among migrant populations in Colombia, proceeding mainly from Venezuela, is concerning (Table 1). For 2024, it was estimated that 2.857.528 Venezuelans were living in Colombia, but probably just 13% were covered by vaccines (Table 1) (https://www.r4v.info/es/refugiadosymigrantes). In an assessment made by the Interagency Group on Mixed Migration Flows (GIFMM) (https://www.r4v.info/es/document/gifmm-colombia-evaluacion-conjunta-de-necesidades-para-poblacion-con-vocacion-de-0), on 1382 children below five years old who received at least one

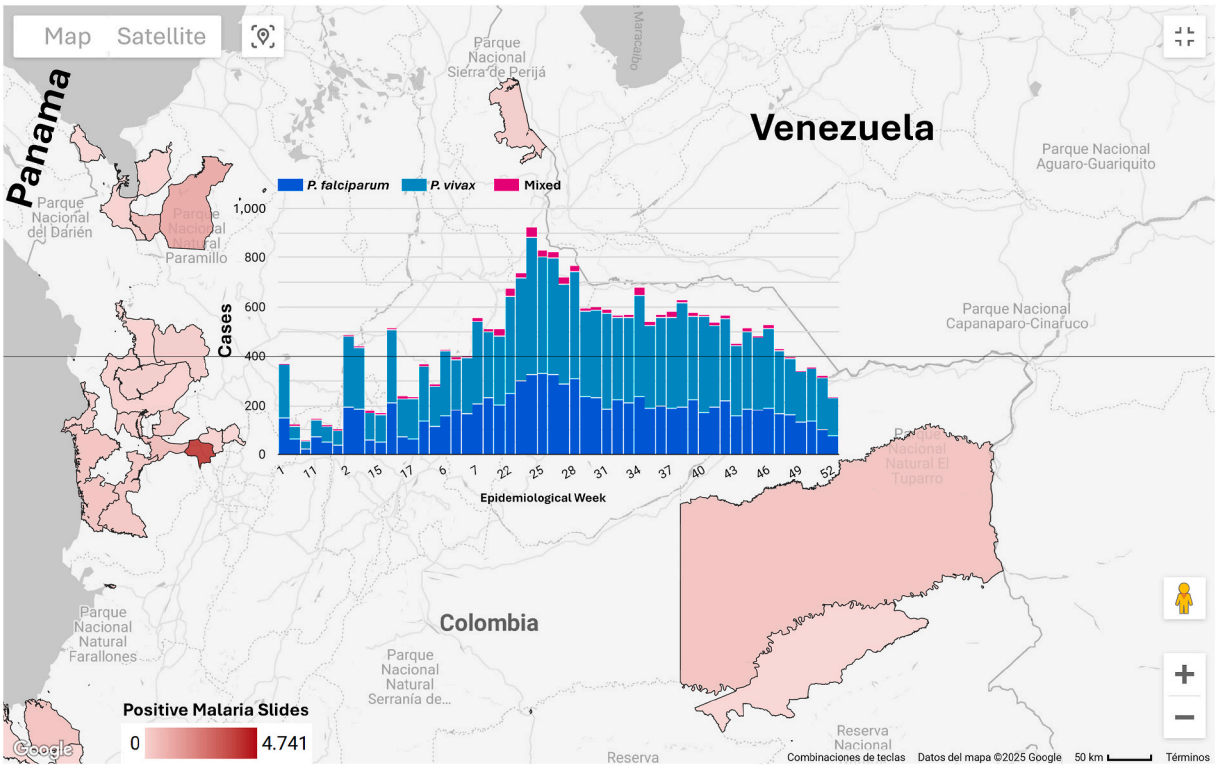

Fig. 2. Malaria diagnosed by the program ColVol in Colombia, 2024 (https://lookerstudio.google.com/reporting/9e7af8c8-6991-4930-8800-f990630f1224/page/kYQCE).

Fig. 3. Migrants camp in the Darien gap. Photos by Dr JA Suárez. The upper left corner image reads in Spanish, "Migrant children, we have rights; let's make them a reality!".

vaccine in their first five years of life, the pentavalent (DTwP-HepB-Hib) was applied to just 49% of them (Table 2). Even more, of 1483 assessed migrant children between 0 and 5 years of age who were in homes with a vocation to remain in Colombia, 7% (101) did not have vaccinations ("zero dose" children) (Table 3) (https://www.r4v.info/es/document/gifmm-colombia-evaluacion-conjunta-de-necesidades-para-poblacion-con-vocacion-de-0).

Flooding, poor sanitation, and crowded living conditions contribute to the spread of leptospirosis, transmitted through water contaminated by animal urine [103–105]. Migrant populations living in unsanitary environments are at higher risk of exposure, particularly in urban slums and informal settlements. Similarly, parasitic infections are a significant public health concern in Latin America, particularly among migrants from impoverished rural areas. These infections often go undiagnosed due to limited healthcare access and inadequate screening programs [60].

Migrants, particularly children, are at higher risk of intestinal parasitic infections due to poor sanitation, lack of clean water, and inadequate nutrition. These infections can cause malnutrition, anaemia, and developmental delays, further exacerbating health inequalities. While

Table 1
Vaccination among migrant populations in Colombia, proceeding mainly from Venezuela up to July 31, 2024 (https://www.r4v.info/es/refugiadosymigrantes), including 2023 vaccinations in Necocli, a nearby border area with Panama.

Year	Vaccinated population	Vaccinated at Necocli
2018	850	0
2019	8887	0
2020	14,487	0
2021	182,558	0
2022	125,818	0
2023	38,457	330
2024	2378	0
Total	373,435	330

Table 2
Vaccines received by a group of migrant children in Colombia in early childhood, below 5 years-old (https://www.r4v.info/es/document/gifmm-colombia-evaluacion-conjunta-de-necesidades-para-poblacion-con-vocacion-de-0).

Vaccine	n = 1382
	%
DTwP-HepB-Hib	49
Measles	47
Polio	45
Influenza	40
Hepatitis B	39
PCV13[a]	37
Hepatitis A	34
Rotavirus	32

[a] Between 2012 and 2022, Colombia used PCV10. Since 2022 is using PCV13.

Table 3
Migrant children below 5 years old in Colombia who have been vaccinated in their first years of life.

Current Age (years)	No vaccine	Age (years) of last vaccine						
		<1	1	2	3	4	5	Total
<1	8%	92%						199
1	7%	42%	51%					250
2	5%	9%	44%	42%				246
3	7%	6%	21%	40%	26%			272
4	7%	2%	13%	21%	31%	27%		264
5	7%	1%	6%	5%	12%	41%	29%	252
Total	7%	23%	23%	19%	12%	12%	5%	1483

not widespread across Latin America, schistosomiasis remains a localised concern in certain regions, particularly Brazil. Migration to endemic areas increases the risk of infection, especially for agricultural and construction workers exposed to contaminated freshwater [103].

Access to healthcare remains one of the most significant challenges for migrants in Latin America. Many migrants lack legal documentation, financial resources, or knowledge about available healthcare services, preventing them from seeking timely medical care. In some countries, restrictive immigration policies and language barriers further limit migrants' ability to access public health services. Additionally, overwhelmed healthcare systems in migrant-receiving countries struggle to meet the needs of both local and migrant populations. Border regions and urban centres with high migrant influxes often experience shortages of medical supplies –including vaccines and diagnostic tests– personnel, and infrastructure. This overburdening of healthcare services can lead to delays in disease diagnosis, inadequate treatment, and increased transmission of infectious diseases [28,68,76]. The recent announcement of restrictions and sanctions to countries that receive doctors from Cuban medical missions is just an added layer of burden to the hosting countries. Cuban doctors often serve in remote areas where local professionals are scarce (https://apnews.com/article/cuban-medical-missions-caribbean-50d1c8eefb14ceee1caf983e9a8e4edb). In many countries in the region, health system access among migrants and displaced populations is fragmented and often limited to some emergency, immunisation, and mother and child essential services (https://www.who.int/publications/i/item/9789240054462).

A multi-sectoral and regionally coordinated approach is essential to address the health challenges posed by migration in Latin America. Governments, international organisations, and healthcare systems should implement policies that improve healthcare access, disease surveillance, epidemiological information, and migrant health services. Key recommendations include expanding universal health coverage to ensure that migrants, regardless of legal status, have rapid access to essential healthcare services, including vaccinations, infectious disease screenings, maternal health care, and treatment and clinical follow-up of chronic non-transmissible diseases. Strengthening disease surveillance and cross-border collaboration is also necessary, as it allows for establishing regional cooperation mechanisms to monitor and respond to disease outbreaks in migrant-receiving and transit countries [7,8,24,49,53,56,57].

Improving living conditions for migrants by providing access to clean water, sanitation, and adequate housing can help reduce exposure to infectious diseases. Public health education should also be increased to raise awareness among migrant populations about disease prevention, hygiene practices, and available healthcare services. Integrating migrants into national health policies and incorporating their health needs into broader public health strategies are essential to ensuring a sustainable and inclusive healthcare response [25,53,54,72,73]. A 'whole-of-journey' approach to continuity of care considering migrants' health service access is urgently needed (Fig. 1) (https://www.health.vic.gov.au/publications/a-whole-of-journey-approach-for-health-services).

Migration in the region has profound implications for public health and impacts multiple dimensions, including social, economic, political, cultural, humanitarian and legal aspects impacting individuals, children, and families. The United Nations International Children's Emergency Fund (UNICEF) estimated that in the first four months of 2024, more than 30,000 children crossed the Darien Gap, a 40 percent increase compared to the same period in 2023 (https://www.unicef.org/lac/comunicados-prensa/migracion-ninos-ninas-adolescentes-darien-panama-registra-aumento-cuarenta-por-ciento). The movement of people across borders creates challenges for disease prevention, surveillance, and healthcare access, exacerbating existing health disparities. Addressing these issues requires a coordinated regional response prioritising healthcare access, disease control, and social integration of migrant populations. By implementing inclusive and sustainable public health policies, Latin American countries can mitigate the health risks associated with migration while ensuring the well-being of both migrants and host communities [14,39,42]. Integrative, cross-border strategies to promote and facilitate vaccination, mass drug administration for parasitic diseases, and access to timely diagnosis and treatment are essential to mitigating the public health impact of migration in Latin America. Additionally, incorporating measures for animals and pets traveling with migrants should be considered, as they can serve both as hosts and vectors for diseases relevant to human, animal, and agricultural health. Migrant populations often travel with animals, which may act as disease vectors or reservoirs, underscoring the need for integrated One Health surveillance and response strategies [45].

The vaccination of migrant populations in Latin America is a crucial public health issue, as mass human mobility increases the risk of outbreaks of VPDs. Migrants often face barriers to vaccination, including possible unavailability of vaccines in the place of origin, lack of access to healthcare, logistical difficulties, and misinformation in the destination country (e.g. Venezuela). The Venezuelan migration case, one of the

largest mass displacements in the region's history, highlights the challenges of vaccinating migrants and the importance of coordinated public health efforts. The re-emergence of diseases such as measles, diphtheria, and pertussis in Venezuela has significantly impacted migrant populations and host countries, underscoring the need for comprehensive vaccination strategies [28,54,70,106,107]. In countries such as Venezuela, the lack of public data is also a significant problem; there are no statistics and epidemiological weekly reports for any disease [108,109].

Migrant populations in Central and South America are particularly vulnerable to VPDs due to low and heterogeneous immunisation coverage in their home countries, crowded living conditions, and inadequate access to healthcare services. Among the most significant VPDs affecting migrants in the region are measles, diphtheria, polio, pertussis, and hepatitis B. The collapse of Venezuela's healthcare system led to a drastic decline in vaccination coverage, contributing to a measles outbreak that spread to neighbouring countries. Since 2017, thousands of measles cases have been reported in Colombia, Brazil, Ecuador, and Peru, primarily among Venezuelan migrants and their host communities. The movement of unvaccinated individuals has fuelled the transmission of the virus in areas where measles had been previously eliminated [28,54,70,106,107].

Another concerning outbreak among Venezuelan migrants has been diphtheria, a potentially deadly bacterial infection preventable through vaccination. Due to shortages of the diphtheria-tetanus-pertussis (DTP) vaccine in Venezuela, many migrants have travelled without adequate immunisation, leading to new cases in receiving countries. Imported cases and diphtheria outbreaks have been reported in Brazil, Colombia, Peru, and the Dominican Republic, highlighting the urgent need for catch-up vaccination campaigns [48,110–113]. Poliomyelitis, while eliminated in Latin America since 1994, remains a concern due to declining immunisation rates in some countries [114]. The risk of polio reintroduction is exceptionally high among migrant populations from Venezuela, where vaccination rates have dropped significantly in recent years [48,110–113].

The vaccination of migrants in Latin America faces multiple barriers that hinder efforts to protect both migrants and host communities from VPDs. Limited access to healthcare services remains a significant obstacle, as many migrants, especially those in irregular situations, struggle to access vaccination programs. Vaccine hesitancy and misinformation also pose significant challenges to vaccination efforts among migrant populations [115,116]. Some migrants fear that seeking vaccination may expose them to immigration authorities, resulting in deportation. In contrast, others may not prioritise immunisation due to more immediate concerns, such as employment and housing. Language and cultural barriers hinder vaccine uptake, as migrants often lack health information in their native language or trusted sources. Poor documentation of previous vaccinations and unfamiliarity with the host country's immunisation programmes further complicate access. Addressing these challenges requires targeted health education campaigns tailored to migrant communities [117].

While some countries have adopted inclusive health policies offering free vaccinations to migrants, including in border areas [118], implementation remains inconsistent, impacting herd immunity [119–121]. On the other hand, migrants in Latin America, particularly Venezuelans, face a heightened risk of acquiring sexually transmitted infections (STIs) due to multiple factors, including precarious living conditions, limited access to healthcare, and social vulnerability. The lack of universal vaccination coverage further exacerbates this risk, especially for infections preventable by vaccines, such as mpox and hepatitis B. Without adequate immunisation and with increased exposure risks, the potential for outbreaks and long-term health complications rises significantly within these populations. Strengthening vaccination programs and ensuring equitable access to healthcare services are critical steps to mitigate these risks [122]. In addition to hepatitis B vaccination, hepatitis A is essential among migrants (Table 2) [123].

Overburdened healthcare systems in receiving countries further complicate vaccination efforts. Countries such as Colombia, Peru, Brazil, and Ecuador have struggled to integrate vaccination services into their strained healthcare systems. Increased demand for vaccines and logistical challenges in distribution can lead to shortages and delays in immunisation. Additionally, interrupted vaccination schedules are common among migrant children, as families traveling long distances or through multiple countries may miss key doses of essential vaccines. These gaps leave children vulnerable to infectious disease outbreaks [124,125]. The absence of a printed vaccination record or book is common as many parents leave their countries urgently, or this document gets lost, stolen, or damaged due to weather conditions or flooding during the migration process.

Cross-border coordination remains a key issue in ensuring continuous immunisation coverage for migrants. Since many migrants transit through multiple countries, harmonising vaccination policies and exchanging immunisation records are necessary to protect against VPDs. Differences in national immunisation schedules, vaccine availability, and healthcare policies create inconsistencies that complicate migrant vaccination efforts. Strengthening regional collaboration is essential for addressing these gaps [126]. The role of NGOs is essential, although it should be clear that they cannot (and should not) replace national and international authorities. It is important to highlight an organisation such as *Salud Entre Culturas* in Spain, which provides interpretation services and intercultural mediation, among other activities, to improve migrants' access to healthcare services (https://www.saludentreculturas.es/).

Latin American countries and international organisations must implement targeted strategies to improve vaccination coverage among migrants. Community-level impact will be achieved only if preventive strategies encompass citizens, travelers, and migrants alike, recognising that public health safety can only be achieved through a holistic, integrative, and non-discriminatory approach. Universal access to vaccination should be prioritised, ensuring that all migrants receive essential vaccines regardless of legal status. Mobile vaccination units and outreach programs can help reach migrant populations in transit areas, border crossings, and informal settlements. Deploying healthcare teams to provide on-the-spot immunisation and raise awareness about the importance of vaccines is a practical approach [28,68,76,125]. Vaccination strategies should also address migrant adolescents, a frequently overlooked group with low immunisation rates and high exposure to vaccine-preventable infections [127].

Catch-up vaccination campaigns are also crucial for closing immunisation gaps among migrant populations. National immunisation programmes should prioritise measles, diphtheria, polio, and other essential vaccines, ensuring unvaccinated individuals receive necessary doses. While the full schedule remains important, the focus should be on diseases linked to recent outbreaks. Strengthening public health education and communication efforts is another essential component. Providing culturally sensitive and language-appropriate health information can help reduce vaccine hesitancy and increase immunisation rates [28,68,76,125].

Cross-border health collaboration should be reinforced to facilitate immunisation data exchange and ensure continuous vaccination coverage for migrants. Initiatives such as the Pan American Health Organization's (PAHO) regional vaccination strategies should be expanded to improve coordination among countries. Integrating migrants into national immunisation programs and ensuring they receive vaccinations as part of routine healthcare services can reduce the risk of disease morbidity and mortality and the occurrence of outbreaks [126].

In the Special Issue "Migration in Latin America: Implications in Health and Infectious Diseases" (https://www.sciencedirect.com/special-issue/10L4D5W0Q3G), these and other aspects of the challenging impacts of migration and health in the region are analysed, studied, and covered, including COVID-19 [106,107,128], migration to USA [129–131] and Europe [132], intraregional migration [133], impacts on

specific populations, e.g. migrant pregnant women [134,135], Hondurans [136], vaccinations [106,107], among others.

Vaccinating migrant populations in Latin America is a critical public health priority that requires coordinated efforts at national and regional levels. The re-emergence of VPDs, particularly among Venezuelan migrants, underscores the importance of ensuring immunisation access for all. Overcoming barriers such as healthcare access, vaccine hesitancy, and cross-border coordination is essential to protecting migrants and host communities from infectious diseases.

By implementing inclusive vaccination policies, strengthening health systems and epidemiological surveillance, enhancing regional integration, and promoting public health education, Latin America can mitigate the risks associated with migration and safeguard the region's immunisation achievements.

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AJRM: conceptualisation, writing–original draft, investigation; Rest of authors: writing, reviewing, investigation, final document.

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