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Current evidence on improving influenza vaccine uptake in low- and middle-income countries: A scoping review of determinants and interventions

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ABSTRACT

Influenza is a vaccine-preventable disease affecting three to five million individuals across the globe annually. Low- and middle-income countries (LMICs) bear substantial health and economic consequences of influenza-related mortality. Despite this disproportionate burden, influenza vaccinations are seldom used across LMICs. In this article, we reviewed current evidence on improving influenza vaccine uptake within LMICs by examining key determinants and interventions. We conducted a scoping review of peer-reviewed studies pertaining to influenza vaccine uptake in LMICs. We searched five electronic databases for articles published 2014–2024, using terms relating to influenza vaccines, interventions, and context. Twenty-four articles met the inclusion criteria with sample sizes ranging from 38 to 9420. The authors followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines and synthesized the included articles using thematic analysis.

All studies included in this review were cross-sectional and primarily used quantitative surveys. Most of the included studies were conducted in Sub-Saharan Africa (South Africa, Kenya, Malawi, and Sierra Leone) and the Middle East and North Africa (Tunisia, Jordan, Lebanon, and Egypt). Articles predominantly targeted vulnerable populations including elderly, pregnant women, and young children as well as healthcare workers. Participants across the included studies reported high levels of willingness to receive the influenza vaccination but lower levels of uptake. Having positive perceptions and attitudes towards the efficacy and safety of the vaccine, greater belief in disease susceptibility, physician recommendations, and a history of being vaccinated were associated with greater willingness to receive the influenza vaccine. Six articles explored national campaigns or researcher-led interventions to improve influenza vaccine uptake with educational campaigns positively changing attitudes towards influenza vaccination and integration of year-round vaccination campaigns with routine services as an effective vaccine delivery method.

1. Introduction

Seasonal influenza – a vaccine-preventable acute respiratory infection caused by influenza viruses – affects millions of individuals across the globe annually; resulting in approximately 290,000 to 650,000 deaths annually [1]. Low- and middle-income countries (LMICs) in particular bear substantial health and economic consequences with Sub-Saharan Africa representing 17 % of total influenza-associated mortality [2,3]. Despite this disproportionate respiratory infection burden, influenza (flu) vaccinations are seldom used across LMICs [4,5]. Moreover, reliable data on influenza in Sub-Saharan Africa and other LMICs are scarce [6,7]. For example, less than of African countries surveyed in a study systematically collected data on severe acute respiratory infection caused by influenza [3,8]. The lack of comprehensive and up-to-date

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data outside of the United States and Europe obscures the true extent of the impact of influenza-related illness.

Evidence suggests that promoting health-seeking behaviors can increase vaccine uptake, even among those who may not fully understand the benefits of vaccination [9,10]. For instance, a recent study in Sub-Saharan Africa shows that community involvement in vaccination programs can enhance vaccine confidence and uptake [11]. Vaccination campaigns tend to focus on high-risk groups such as young children, the elderly, and immunocompromised individuals as they are more susceptible to severe complications [1,12–14].

Interventions to improve influenza vaccine uptake – such as increasing community demand and enhancing vaccination access – have had varying degrees of success [15–18]. While studies in this field have predominantly focused on high-income settings, a systematic review conducted in LMICs also shows that effects of digital interventions for vaccination in current research are inconclusive [19]. Studies differ regarding the people the intervention is targeted for, the type of intervention and the purpose of the digital intervention and how the outcomes are measured making it difficult to get clear evidence on the effect. It is therefore challenging to obtain an overall picture of the available evidence. We also identified a lack of up to date, well-conducted systematic reviews for interventions targeting adults. In this article, we review current evidence on influenza vaccine uptake within low- and middle-income countries by examining key determinants and interventions.

Research objectives.

The objectives for this scoping review are threefold:

1. To review current evidence on influenza vaccine uptake – including willingness to receive influenza vaccines.
2. To identify health intervention and campaign recommendations to improve influenza vaccine uptake.
3. To highlight gaps in research.

2. Material and methods

We designed and implemented this review based on the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews checklist. The framework consisted of the following steps: needs assessment, topic selection and refinement, protocol development, literature search, screening and study selection, knowledge synthesis, and reporting the findings [20]. This review was not registered.

2.1. Search strategy

We searched five relevant electronic databases – Global Health, Google Scholar, PubMed, PyscInfo, and Scopus – for peer-reviewed articles using search terms relating to influenza vaccines (e.g. 'influenza vaccin*', 'influenza immunization', 'flu jab'), interventions (e.g. 'campaign', 'program', 'communication'), and context (e.g. sub-Saharan Africa, low- and middle-income countries). Additionally, we searched citations of identified articles. The authors conducted the search in English and included all articles from 2014 to 2024. PA and LT ran the original search on 17 April 2024 as well as an additional search on 14 November 2024.

The first author (PA) screened titles and abstracts of the identified records to determine their eligibility based on the predefined inclusion and exclusion criteria. Full-text articles were obtained and assessed for all potentially eligible studies. A second reviewer (LT) screened a random subset of search results ($n = 300$, >15 %) to test the reliability of the screening process. Any discrepancies between the reviewers were resolved through discussion and consensus, with the involvement of a third reviewer (JD) where necessary. The full search strategy for each database is presented in Appendix B.

2.2. Inclusion and exclusion criteria

Studies were considered eligible for inclusion if they met the following criteria:

- Peer-reviewed articles including data on influenza vaccines or health communication, marketing, or social media campaigns around influenza vaccination
- Studies conducted within/including data from Sub-Saharan Africa or low- and middle-income countries
- Published between 2014 and 2024
- Available in English

We excluded systematic reviews, epidemiological studies only measuring influenza infection rates without data around influenza vaccination or behavior, studies conducted in high-income countries, articles not available in English, and articles published before 2014.

2.3. Data extraction and synthesis

Data extraction was performed by two reviewers using a standardized data extraction form. From each article, we documented the following: author name, year of publication, country of origin, sample size, study design (e.g. qualitative or quantitative, cross-sectional or longitudinal), data collection methods (e.g. survey, interview), study population, main findings (including factors affecting vaccination uptake or effectiveness of interventions). Appendix C provides the coding framework designed by the authors for data extraction.

The authors employed a descriptive and narrative approach to analyze and present the findings from the included studies. This approach involved identifying common themes and patterns across the studies related to interventions around influenza vaccination. We synthesized the findings and discussed these in relation to the research objectives, considering the perspectives of marginalized young people and the global context of influenza vaccination uptake. We identified the enablers and impediments to influenza vaccination by charting the key issues reported from each study. As part of data extraction, the results section of each study was reviewed to identify vaccination interventions as well as various perspectives and attitudes towards influenza vaccines.

3. Results

3.1. Search outcome

We ran the original search on 17 April 2024 as well as an additional search on 14 November 2024 and identified 1840 citations after removing duplicates. Following title and abstract screening of all citations, PA retrieved 121 articles and included these in the full-text screen. Of these, 24 met the inclusion criteria and were considered in our final analysis (Fig. 1).

Page, McKenzie [21].

3.2. Study characteristics

All the 24 studies included in this review were published across nine years between 2014 and 2022. No articles published in 2023 and 2024 met our inclusion criteria. Fig. 2 shows the distribution of published articles by year.

All study designs were cross-sectional with the majority using quantitative surveys ($n = 20$) while one study incorporated open-ended questions within their survey design. Two mixed-methods studies collected data through focus groups and interviews in addition to surveys while the only qualitative study included in this review utilized interviews. Sample sizes ranged from 38 to 9420 with mean age of respondents between 6 and 69.5 years.

Several of the included studies explored influenza vaccination

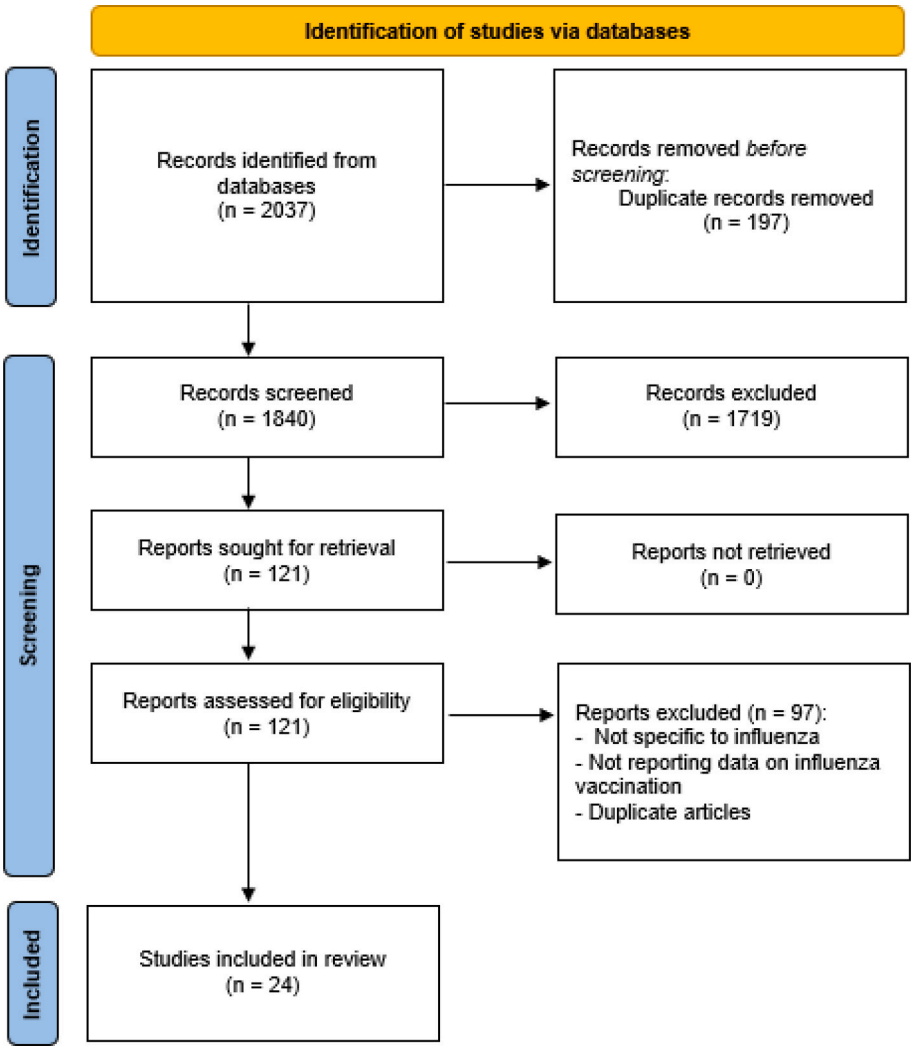

Fig. 1. Flow diagram of study selection process.

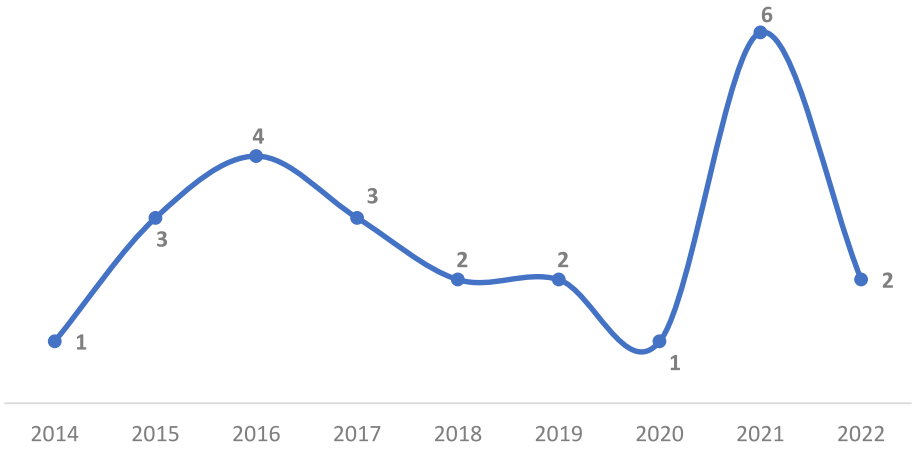

Fig. 2. Publication distribution by year (2014–2022*). No publications meeting inclusion criteria in 2023 and 2024.

perceptions and experiences of vulnerable populations – such as pregnant women (n = 6), individuals over the age of 65 years (n = 2) or individuals with underlying medical conditions like diabetes or chronic diseases (n = 3). Some studies also specifically surveyed healthcare professionals (n = 8) while only one Jordan-based study examined the general population.

Primary outcomes across the studies included: knowledge, attitudes, practices, and perceptions around influenza vaccination (n = 14); willingness/intention to receive or acceptance of influenza vaccine (n = 5); influenza vaccine uptake (n = 5). Three articles also incorporated cost/cost effectiveness and estimated or actual effectiveness of influenza vaccine. Six of the 24 included articles mentioned national or

researcher-led seasonal influenza interventions.

Nine of the included studies were based in Sub-Saharan Africa, including South Africa ($n = 4$), Kenya ($n = 3$), Malawi ($n = 1$), and Sierra Leone (n = 1). Eight studies were based in the Middle East and North Africa region – such as Tunisia (n = 3), Jordan ($n = 2$), and Egypt (n = 1) – and five in Asia – Pakistan (n = 3), Malaysia (n = 1) and Thailand (n = 1). The remaining two articles were from Latin America – including one study in El Salvador and a five-country study covering Brazil, Chile, Paraguay, Peru, and Uruguay. Fig. 3 illustrates the geographical distribution of the included studies. (See Fig. 4 for word cloud of findings.)

Table 1 provides a summary of the study characteristics of all the articles included in this review.

3.3. Factors associated with willingness to receive influenza vaccination

Twenty-one articles incorporated factors associated with willingness to receive the influenza vaccine (Table 2). Overall, participants across studies reported relatively high levels of willingness to receive influenza vaccination (60 %–93 %) but lower levels of uptake (<1 %–51 %). The main factors associated with willingness to receive the influenza vaccination included: a) positive perceptions and attitudes towards the efficacy and safety of the vaccine, b) greater belief in disease susceptibility, c) recommendations from physicians, and d) history of receiving vaccinations. On the other hand, a) concerns with vaccine safety and side effects, b) lack of belief in vaccine efficacy, c) limited awareness of influenza illness and vaccine, and d) having to pay for vaccines were identified as key barriers. Additionally, two studies reported that individuals with higher levels of education – primary caregivers and healthcare workers – were less likely to get vaccinated [24,33].

3.4. Perceptions about vaccines efficacy, safety, and side effects

Several studies described positive beliefs and attitudes as factors associated with greater willingness to get vaccinated while concerns about vaccine efficacy, safety, and side effects were described as key barriers [32,34,36,37,39–41]. For example, participants – including pregnant women, elderly with chronic illness, and healthcare workers (HCWs) – with a belief in the vaccine's effectiveness were more likely to be vaccinated [23,34,37,44]. A South African study where willingness to vaccinate among primary caregivers was high observed lower levels of concerns about vaccine efficacy and safety [24]. Additionally,

Fig. 4. Word cloud representing findings.

confidence in the vaccine was cited as an important aspect of vaccine demand among immunization program officers in South America [35].

3.5. Beliefs regarding disease susceptibility and severity of illness

Knowledge of the seriousness of influenza illness was present among vaccinated elderly participants as well as HCWs and associated with willingness to vaccinate [34,44]. Perceived susceptibility to influenza was significantly associated with willingness to get vaccinated among slum-based pregnant women in Karachi, Pakistan. [28]. Additionally, willingness to vaccinate was motivated by the view that children's health is important. However, there were studies that highlighted negative beliefs about the value of vaccinating with participants perceiving the vaccine to be unbeneficial or unnecessary [27,38].

3.6. Recommendations from physicians

Several studies highlighted the role of healthcare providers on vaccination decision-making. Healthcare providers were described as a highly reliable source of information in a group of pregnant women [28]. Additionally, one study reporting high vaccine acceptance among pregnant women and new mothers also reported a high level of trust between the community and healthcare providers [26]. In Malawi, positive healthcare worker attitudes when introducing new vaccines was cited alongside strong maternal vaccine acceptance [30]. Studies

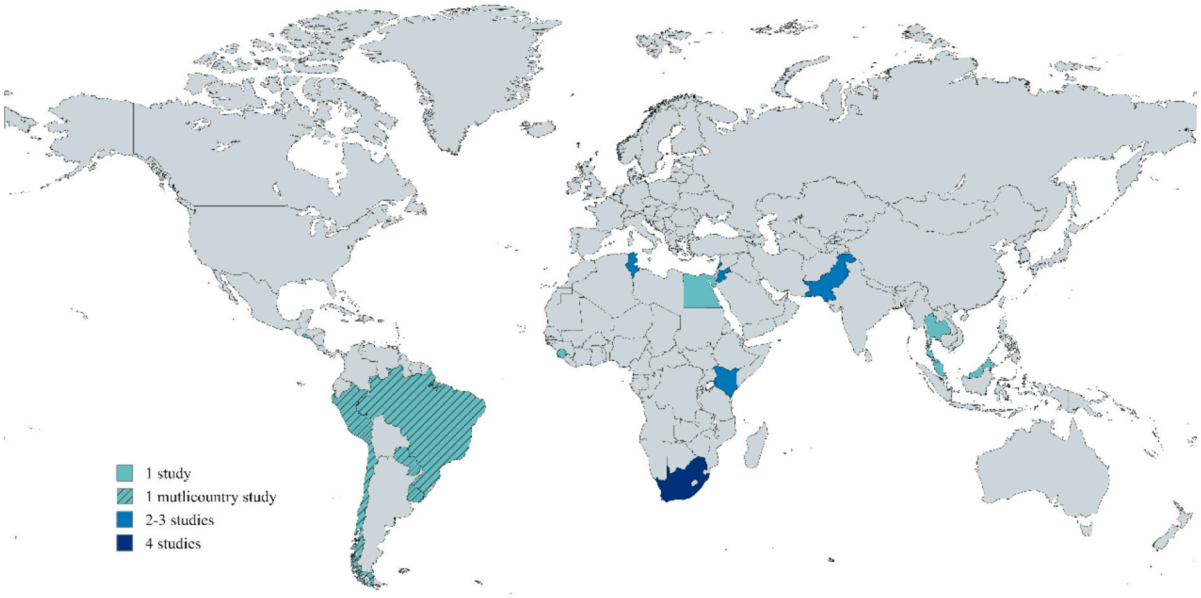

Fig. 3. Geographical distribution of studies. Created using MapChart: www.mapchart.net/world.

Table 1
Summary of study characteristics for included articles.

Study details				Data collection and approach			Sample			Findings	
First author, year	Country	Setting	Topic	Study design	Method	Date	Key study population	Age (years)	Sample size	Primary outcome(s)	Reporting intervention
Edoka [22]	South Africa	National	Cost effectiveness of influenza vaccination program	- Quantitative - Cross-sectional	Survey [a]	2018	Vulnerable populations [b]	Not reported	Not reported	Cost effectiveness of influenza vaccination program	Yes
Otieno [23]	Kenya	- Nairobi - Mombasa - Marsabit - Siaya	Knowledge & attitudes of influenza & influenza vaccination among pregnant women	- Quantitative - Cross-sectional	Survey	2017–18	Pregnant women	Mean: 26 (15–43)	507	Knowledge, attitude, & willingness to receive influenza vaccine	No
Wong [24]	South Africa	- Soweto - Klerksdorp	Knowledge, attitudes, & practices (KAP) about influenza illness and vaccination	- Quantitative - Cross-sectional	Survey	Aug-Sep 2012	Primary caregiver	Median: 40 & 38	2415	Knowledge of & intention to receive influenza vaccine	No
Otieno [25]	Kenya	Rural western Kenya	Demographic, socioeconomic, & geographic determinants of influenza vaccine uptake	- Quantitative - Cross-sectional	Survey [a]	Apr-Jun 2011	Children	Mean: 6 (0.6–11)	7249	Influenza vaccine uptake	Yes
Fleming [26]	El Salvador	- San Salvador - La Libertad - Santa Ana - Ahuachapán - San Miguel - La Unión	Experiences & lessons learned from maternal influenza immunization	- Mixed methods - Cross-sectional	- Focus group discussion - Interview	2015–16	Pregnant and recently pregnant women [c]	Median: 23 (18–38)	326	Influenza immunization delivery & acceptance	Yes
Olatunbosun [27]	South Africa	Tertiary hospitals, Pretoria	KAP about influenza & influenza vaccination among diabetics	- Quantitative - Cross-sectional	Survey	Oct-Dec 2015	Diabetic patients	Mean: 49	292	Influenza vaccine uptake	No
Khan [28]	Pakistan	Healthcare centres in slums, Karachi	Influenza vaccine acceptance among pregnant women in slums	- Quantitative - Cross-sectional	Survey	May-Aug 2013	Low-income pregnant women	Median: 25 (18–43)	283	Influenza vaccine acceptance	No
McMorrow [29]	Kenya	National	Impact of maternal influenza vaccine strategies on disease burden in pregnant women & infants	- Quantitative - Cross-sectional	Survey [a]	2010–14	- Pregnant women - Young infants	Not reported	Not reported	Estimated outcomes/ those averted with vaccination of pregnant women	Yes
Fleming [30]	Malawi	-Rumphi - Dowa - Zomba	Community perceptions, programmatic considerations, & recommendations on maternal immunization	- Mixed methods - Cross-sectional	- Focus group discussion - Interview	2015	Pregnant and recently pregnant women [c]	Not reported	274	Perceptions of maternal immunization	No
McAnerney [31]	South Africa	Primary healthcare settings	KAP & effectiveness of influenza vaccine	- Quantitative - Cross-sectional	Survey	Jan 2010-Dec 2013 [d]	- Clinicians - Patients	Not reported	9420 [d]	KAP and effectiveness of influenza vaccine	No
Dhaouadi [32]	Tunisia	Health facilities	KAP of influenza vaccine among pregnant women	- Quantitative - Cross-sectional	Survey	Mar-May 2019	Pregnant women	25–34 (62.4 %)	1157	KAP about influenza vaccine	No
Cherif [33]	Tunisia	Health facilities	Knowledge, attitudes, & uptake of influenza vaccine among healthcare workers	- Quantitative - Cross-sectional	Survey	Mar-May 2019	Healthcare workers (HCWs)	Mean: 44.5	1231	Knowledge, attitudes, & uptake of influenza vaccine	No

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Table 1 (*continued*)

Study details				Data collection and approach			Sample			Findings	
First author, year	Country	Setting	Topic	Study design	Method	Date	Key study population	Age (years)	Sample size	Primary outcome(s)	Reporting intervention
Kharroubi [34]	Tunisia	Health facilities	KAP of influenza vaccination among elderly with chronic diseases	- Quantitative - Cross-sectional	Survey	Mar-Jun 2019	Elderly with chronic diseases	60–99	1191	KAP about influenza and influenza vaccine	No
Gonzalez-Block [35]	- Brazil - Chile - Paraguay - Peru - Uruguay		Barriers & facilitators to influenza vaccination	- Qualitative - Cross-sectional	Interview	Not reported	Immunization program officers	Not reported	38	Barriers & facilitators to influenza vaccine	No
Hakim [36]	Egypt	National health facilities	HCW attitudes, beliefs, & practice towards influenza vaccination	- Quantitative - Cross-sectional	Survey	Jun-Oct 2019	HCWs	<40 (71.5 %)	3534	Attitudes, beliefs, & practices towards influenza vaccine	No
Alame [37]	Lebanon	Health institutions	HCWs' uptake & KAP about influenza vaccination	- Mixed design - Cross-sectional	Survey	Jan-Jun 2019	HCWs	25–34 (41.5 %)	429	KAP & uptake of influenza vaccine	No
Awad [38]	Jordan		KAP of influenza illness & vaccination in children	- Quantitative - Cross-sectional	Survey	Nov 2016	Parents	Mean: 38.2	1241	KAP of influenza & influenza vaccine	Yes
Bukhsh [39]	Pakistan		Parents' KAP of influenza vaccination	- Quantitative - Cross-sectional	Survey	Not reported	Parents with 1 child <6 months	25–34 (47.2 %)	532	KAP of influenza vaccine	No
Abu-Rish [40]	Jordan	Amman	KAP and implications around influenza & vaccination	- Quantitative - Cross-sectional	Survey	Dec 2015-Apr 2016	General adult population	Mean: 36.63	941	KAP of influenza & influenza vaccine	No
Worasathit [41]	Thailand	Health centers in Bangkok	Factors influencing acceptance of & willingness to pay for influenza vaccination among older adults	- Quantitative - Cross-sectional	Survey	Jun-Jul 2013	Older adults	Mean: 69.5	2693	Acceptance of & willingness to pay for influenza vaccine	Yes
James [42]	Sierra Leone	Health facilities in Freetown	Healthcare professionals' knowledge about & attitude towards influenza vaccination	- Quantitative - Cross-sectional	Survey	Feb-Apr 2016	Healthcare professionals	20–39 (85.3 %)	706	Knowledge, attitude, & uptake of influenza vaccine	No
Khan [43]	Pakistan	Hospital in Peshawar	Healthcare professionals' knowledge, attitudes, & awareness about influenza vaccination	- Quantitative - Cross-sectional	Survey	Apr 2015	Healthcare professionals	Median: 30	165	Knowledge, attitude, & awareness of influenza vaccine	No
Hudu [44]	Malaysia	Hospitals in Klang Valley	Coverage & attitudes about influenza vaccination among HCWs	- Quantitative - Cross-sectional	Survey	Not reported	HCWs	Median: 30	527	Uptake, knowledge, & attitude of influenza vaccine	No
Zakhour [45]	Lebanon	Schools in Beirut	Parents KAP of influenza vaccination	- Quantitative - Cross-sectional	Survey	Nov-Dec 2017	Parents of school-aged children	30–50 (88 %)	306	KAP of influenza vaccine	No

[a] Secondary analysis of survey data; [b] Persons aged >65 years, pregnant women, persons living with HIV/AIDS, persons of any age with underlying medical conditions, and children aged 6–59 months; [c] Also interviewed family members, community leaders, health personnel, public health managers and partners, and policymakers; [d] 96 KAP survey participants (program clinicians) interviewed in 2013 considered for this review.

Table 2
Factors associated with willingness to receive influenza vaccination reported across 21 studies.

First author, year	Country	Key study population	Willingness to receive influenza vaccination	Factors associated with willingness to receive influenza vaccination
Otieno [23]	Kenya	Pregnant women	84 % willing to receive vaccine	Mothers' belief in protective effect (OR 3.87, 95 % CI 1.56–9.59) & safety (OR 5.32, 95 % CI 2.35–12.01) of influenza vaccines during pregnancy more willing to receive vaccine - Concerns about efficacy (19 %) & safety (Soweto:17 %; Klerksdorp: 10 %)
Wong [24]	South Africa	Primary caregiver	Willingness to get vaccine: Klerksdorp 92 %, Soweto 79 % ($p < 0.001$)	- Soweto: women (aRR 2.0, 95 % CI 1.3–3.2) & those with higher household income (aRR 1.8, 95 % CI 1.2–2.7) less willing to receive vaccine - Klerksdorp: more educated (aRR 1.6, 95 % CI 1.1–2.4) less willing to receive vaccine; households with HIV-positive member were more willing to receive vaccine (aRR 0.3, 95 % CI 0.1–0.8) - Households located >5 km radius from vaccination facilities significantly less likely to be vaccinated (aOR 0.70, 95 % CI 0.54–0.91, $p = 0.007$)
Otieno [25]	Kenya	Children	N/A	- Children with mothers aged 25–34 and 35–44 years more likely to be vaccinated than children with mothers less than 25 years of age (aOR 1.36, 95 % CI 1.15–1.62, $p < 0.001$; aOR 1.35, 95 % CI 1.10–1.64, $p = 0.003$, respectively) - Children aged 2–5 years and > 5 years of age (aOR 1.38, 95 % CI 1.20–1.59, p < 0.001; aOR 1.41, 95 % CI1.23–1.63, p < 0.001, respectively) more likely to be vaccinated - Children who had a sibling hospitalized within past year (aOR 1.73, 95 % CI 1.40–2.14, p < 0.001) more likely to be vaccinated
Fleming [26]	El Salvador	Pregnant & recently pregnant women	High vaccine acceptance	- Use of multiple vaccine delivery strategies, targeted education & community engagement efforts, & a high degree of trust between the community and health care providers associated with high vaccine acceptance - Improvement in acceptance attributed to education targeting health care advisors - Perceived challenges to pregnant women receiving healthcare & vaccination include need for permission to attend services & limited access to health services in insecure areas related to the presence of criminal gang activity
Olatunbosun [27]	South Africa	Diabetic patients	28.8 % previously vaccinated	- Participants with good attitude score for influenza vaccination were 18.4 times more likely to be vaccinated compared with those with poor attitude score (OR 18.4, 95 % CI 5.28–64.10, $p = 0.001$) - Previously vaccinated participants, advice from their doctors (98 %) main factor encouraging vaccination - Unvaccinated participants included use of alternative protection (51 %) & that vaccination is not necessary because flu is just a minor illness (45 %)
Khan [28]	Pakistan	Low-income pregnant women	87 % willing to accept vaccine	- Perceived vaccine safety, efficacy, & disease susceptibility were significantly associated with intention to accept influenza vaccine ($p < 0.05$) - 96 % rated healthcare providers as highly reliable source of vaccine information
Fleming [30]	Malawi	Pregnant & recently pregnant women	N/A	- Strong maternal vaccine acceptance in the community, an existing strategy for maternal tetanus vaccine delivery, & positive health workers' views about introduction of additional maternal vaccines - Challenges for influenza vaccine included limited awareness of influenza disease & its low prioritization among health needs
Dhaouadi [32]	Tunisia	Pregnant women	36.8 % willing to receive influenza vaccine during next pregnancy	Intention to accept vaccine significantly associated with recommendation by healthcare providers and perceived safety and effectiveness of vaccine
Cherif [33]	Tunisia	Healthcare workers (HCWs)	- 15.3 % vaccinated during last season - 27.6 % vaccinated at least once in last 4 years - 36.6 % vaccinated at least once in their lives	- High confidence regarding efficacy, belief about the mandatory character of influenza vaccination for HCWs, and vaccine uptake in the 4 years independently associated with higher influenza vaccine uptake - Participants with high educational level were less likely to receive the vaccine than those with lowest education level
Kharroubi [34]	Tunisia	Elderly with chronic diseases	- 19.4 % vaccinated during last season - 64.7 % willing to receive vaccine	- Knowledge of influenza severity & having chronic diseases associated with willingness to be vaccinated ($p < 0.01$) - Perceived belief in flu vaccine effectiveness and lack of concerns about vaccine side effects were more likely to be vaccinated ($p < 0.001$) - Main reason for vaccine acceptance was a doctor's recommendation (41.1 %) - Main reasons for refusal were concerns about side effects (71.5 %) and a belief that vaccine was ineffective in averting influenza illness (33.9 %)
Gonzalez-Block [35]	- Brazil - Chile - Paraguay - Peru - Uruguay	Immunization program officers	- High-coverage for risk groups: Brazil 81–95 %, Chile 65–90 % - Low-coverage for risk groups: Paraguay 24–54 %, Peru 38–55 %, Uruguay 24–57 %	- Supply-side components: legal & financial bases; programming, purchase and distribution; personnel; access; collaboration arrangements; & monitoring, research, & evaluation - Demand-side components: vaccine promotion and communication; confidence on the vaccine; complacency with influenza
Hakim [36]	Egypt	HCWs	- 30.7 % uptake during last season - 46.8 % ever vaccinated	- Significant positive association between attitude score and influenza vaccine uptake - Key barriers: lack of trust about vaccine efficacy and its adverse events - Key facilitator: Protection for self, family & community (55.5 %)
Alame [37]	Lebanon	HCWs	40.4 % received influenza vaccine	- Key barriers: Concerns regarding vaccine efficacy & side effects, cost of vaccine (willingness decreased with fee)
Awad [38]	Jordan	Parents	60.2 % accepted influenza vaccines for their children	- Reasons for refusing vaccine: side effects of vaccine (20.3 %), lack of knowledge about vaccine (16.8 %) & the vaccine not being beneficial (11.4 %) - 62.2 % of those refused influenza vaccine for their children if they were

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Table 2 (*continued*)

First author, year	Country	Key study population	Willingness to receive influenza vaccination	Factors associated with willingness to receive influenza vaccination
				paying full price would agree to vaccinate their children if they received the vaccine for free - Urban households with higher monthly income, and healthcare workers had higher KAP
Bukhsh [39]	Pakistan	Parents with 1 child <6 months	6.6 % reported vaccinating their child against influenza	- Key facilitators: 'immunization is important to keep my children healthy' ($p < 0.000$), awareness of influenza vaccines - Key barriers: 18.5 % parents believed influenza is not a serious disease, 24.6 % believed vaccines are accompanied by several side effects & 35 % believed influenza vaccines are not required for healthy children
Abu-Rish [40]	Jordan	General adult population	Low vaccination rate (20 %)	- Key facilitators: physician recommendation & government role - Key barriers: concern about the safety and the efficacy of the vaccine
Worasathit [41]	Thailand	Older adults	- 92.8 % acceptance - 43.5 % previously received >1 vaccination	Acceptance was associated with a positive attitude towards vaccination (OR 2.1, 95 % CI 1.5–2.9) & a history of receiving vaccination (OR 4.1, 95 % CI 2.8–6.1)
James [42]	Sierra Leone	Healthcare professionals	6.5 % vaccinated against influenza	Key barriers: less awareness about influenza vaccination among HCPs (82.73 %, $\beta = 0.154$ CI 0.058–0.163), high cost of influenza vaccines (55.92 %, $\beta = 0.150$ CI 0.063–0.186)
Khan [43]	Pakistan	Healthcare professionals	Very low vaccination rate (<1 %)	Key barriers: not everyone is familiar with the availability of the influenza vaccination at their institution, due to needle fear, & it is not compulsory for healthcare professionals
Hudu [44]	Malaysia	HCWs	51.4 % vaccinated against influenza	- 83.5 % of vaccinated HCWs believing they were vaccinated to protect themselves - Higher proportion of vaccinated HCWs ($p < 0.05$) agreed that influenza is a serious threat to their health
Zakhour [45]	Lebanon	Parents of school-aged children	29.4 % vaccinated their children	- Key facilitators: Younger age, paternal employment and higher household income associated with higher vaccination rates ($p = 0.01$, 0.02 & <0.0001 respectively) - Key barrier: Lack of vaccine recommendation by physician was the most common reason for not taking it (47 %)

highlighted the influence of physician recommendations during previous vaccination [27], as the main reason for accepting vaccination [34], and as a factor for intention to vaccinate [32,40]. On the contrary, a lack of physician recommendation was stated as a reason for not accepting the vaccine among parents of school-going aged children in Beirut [45].

3.7. Awareness of influenza illness and vaccine

Four studies reported on limited awareness or knowledge of the vaccine as a barrier to willingness to accept the vaccine [30,38,42,43]. Only one study reported relatively high awareness of the influenza vaccine accompanied by positive attitude towards vaccination [39]. In addition, a South American study noted vaccine promotion and communication as a factor of vaccine demand creation [35].

3.8. Paying for vaccines

Of the articles looking at the cost of influenza vaccine, parents and healthcare professionals identified the prospect of having to pay for/the cost of vaccines as a barrier to vaccine uptake [37,38,42].

3.9. Vaccination history

Only one Thailand-based study of older adults linked the history of previous vaccination with vaccine acceptance [41]. However, several studies reported on the previous vaccination rates, ranging between 15.3 %–30.7 % for vaccination during the preceding season and 28.8 %–46.8 % for previous vaccinations [27,33,34,36,41].

3.10. Interventions to improve influenza vaccine acceptance and uptake

Four articles based in Kenya ($n = 2$), South Africa ($n = 1$), and El Salvador ($n = 1$) reported on influenza intervention delivery methods in addition to two studies in Jordan and Thailand which tested the influence of educational messaging in improving willingness to accept influenza vaccination. The latter studies reported that their in-person and video educational campaigns for parents and older adult participants positively changed attitudes towards influenza vaccination [38,41]. Studies recommended integrating year-round vaccination campaigns with routine services as most effective in terms of vaccine delivery [26,29]. These interventions are summarized in Table 3.

4. Discussion and conclusion

To our knowledge, this is the first study to review current evidence on improving influenza vaccine uptake in low- and middle-income countries. The review highlights the lack of studies looking at interventions or campaigns to improve influenza vaccine uptake in low- and middle-income countries with six included articles exploring national campaigns or researcher-led interventions. The 24 studies included in our review predominantly targeted vulnerable populations including elderly, pregnant women, and young children as well as healthcare workers. Overall, these studies reported high levels of participant willingness to receive the influenza vaccination but lower levels of uptake. In terms of key determinants, having positive perceptions and attitudes towards the efficacy and safety of the vaccine, greater belief in disease susceptibility, physician recommendations, and a history of being vaccinated were associated with greater willingness to receive the influenza vaccine.

Several studies included in this review indicated that individuals with positive perceptions and attitudes towards the safety and efficacy were more likely to be willing to receive the influenza vaccine than those who held negative attitudes and perceptions. These findings are consistent with those reported by other researchers [46,47]. For example, in a South African study, over 86 % of participants who were willing to accept the influenza vaccine agreed that it was safe and effective [47].

Numerous studies have identified concerns regarding vaccine safety and effectiveness as well as potential adverse side effects associated with the influenza vaccine as the main reason for hesitancy [48]. Interestingly, studies included in our review indicated that concerns about the safety and effectiveness of the influenza vaccine as well as potential side effects were associated with unwillingness to receive the influenza vaccine across different demographic groups including parents and

Table 3
Summary of influenza vaccination interventions reported across six studies

Country, ref	Type of intervention	Duration of intervention	Description	Target population	Effectiveness
South Africa [22]	Seasonal influenza vaccination strategy led by government	Mar-Jul 2018 (5 months)	Vaccinating vulnerable populations with trivalent inactivated influenza vaccine during routine facility visits	Vulnerable populations [a]	- Relatively low vaccination rate for all risk groups except pregnant women - Cost-effective for all vulnerable populations (US$ 1750–2090 per quality-adjusted life year), except for children aged 6–59 months (US $7490 per quality-adjusted life year)
Kenya [25]	Seasonal children's influenza vaccine campaign led by researchers	Apr-Jun 2011 (3 months)	Trivalent influenza vaccine offered free-of-charge to children in rural western Kenya	Children (6 months-10 years)	Following associated with increased likelihood of vaccination against influenza: a. Shorter distance from the vaccination center b. Older maternal and child age c. Household administrator's work not requiring them to be away from the home d. Sibling hospitalized during the past year
El Salvador [26]	Delivery of maternal influenza vaccination strategy	- Year-round - Seasonal	- "Vaccination Week of the Americas": annual campaign occurring several weeks before influenza season & mobilize HCWs & volunteers to identify priority groups - Seasonal influenza vaccine through routine antenatal care (ANC) services to pregnant women - Rural vaccination through community health system with local health promoters	Pregnant women	- Success of high maternal vaccination coverage partly due to multifaceted approach to delivery - Seasonal influenza vaccination campaign well suited for targeted, time-limited campaigns - Integrating vaccination with routine services may be more appropriate as year-round strategy for maternal vaccines
Kenya [b] [29]	Delivery of maternal influenza immunization strategy	- Year-round - Annual - Semi-annual	Estimating number of outcomes that occurred & may have been averted through vaccination using: a. Year-round immunization strategy through ANC b. Annual vaccination campaigns c. Semi-annual vaccination campaigns	- Pregnant women - Young infants (0–5 months)	- 13-31 % influenza-associated disease in pregnant women and 12–22 % infants may have been prevented through immunization - Disease averted through year-round or semi-annual higher than single annual campaign [c]
Jordan [38]	Educational campaign through awareness raising and printed pamphlets led by researchers	Nov 2016 (1 month)	10-min face-to-face awareness campaign and educational pamphlets about influenza illness and vaccination for research	Parents	Campaign changed attitudes positively in 29 % of parents who refused the influenza vaccine for their children ($p < 0.0001$)
Thailand [41]	Educational video led by researchers	Jun-Jul 2013 (1 month)	10-min educational video describing people as taking action to prevent disease as part of intervention arm of research	Older adults	- 34.9 % increase ($p < 0.001$) in proportion of participants in intervention group with positive attitude after watching video (52.4 % to 70.7 %) - Control group had similar percentage of positive attitude in pre- & post-interviews (57.3 % vs 58.5 %)

[a] Persons aged >65 years, pregnant women, persons living with HIV/AIDS, persons of any age with underlying medical conditions and children aged 6–59 months; [b] Study used 2010–2014 surveillance data to statistically model influenza-related negative health outcomes averted through different deliveries of maternal influenza immunization; [c] With overlapping confidence intervals.

primary caregivers [24,38,39], the general adult population [40], the elderly with underlying conditions [34], and healthcare workers [36,37]. This contrasts with previous research that found that pregnant women primarily have concerns about the safety of vaccination during pregnancy [49]. Recent studies have also linked COVID-19 vaccine hesitancy to a lack of confidence in vaccine safety and concerns regarding vaccine efficacy and effectiveness [50,51]. Moreover, as this review did not yield any studies matching our inclusion criteria for 2023–2024, future research could provide valuable insight into the impact of the COVID-19 pandemic on influenza vaccination uptake and hesitancy in LMIC settings.

The present study's findings revealed that individuals' willingness to vaccinate is influenced by perceptions of the likelihood of contracting influenza and their assessment of the seriousness of the illness. Despite evidence suggesting that influenza may result in severe complications, studies in both low- and middle-income and high-income countries have shown that misconceptions about the severity of influenza are a barrier to influenza vaccination. For example, a study conducted in Singapore found that 34.2 % of the participants regarded other diseases such as cancer and diabetes as very serious and more important than influenza [52]. Similarly, some participants in Malawi did not perceive influenza to be as dangerous as other conditions such as malaria, measles, and pneumonia because it has less impact on daily activities and did not result in death [53].

Some studies included in this review indicated that a physician's recommendation was positively associated with intent to receive the influenza vaccine. Healthcare provider recommendation is an important determinant of general vaccine uptake and more so following the COVID-19 pandemic. Studies have shown that healthcare providers are a trusted source of health information, and a clear recommendation from them is positively associated with influenza vaccine uptake [13,54,55]. A systematic review of factors influencing seasonal influenza vaccination behavior among elderly people showed that provider recommendations could overcome negative perceptions about vaccination [56]. Healthcare providers are more likely to recommend vaccines to patients if they are vaccinated themselves and if vaccines are available during the healthcare visit, if they're aware of vaccination guidelines, have received relevant influenza vaccination training [57], and if they have confidence in the safety and efficacy of vaccines [58].

Only one Thailand-based study identified by this review reported on the association between previous vaccination history and greater influenza vaccine acceptance [41]. These findings are in line with other studies where participants with previous vaccination history had a positive attitude towards influenza vaccines [54,59].

Our findings show that vaccination costs hinder influenza vaccine uptake which is in line with global evidence showing that free and accessible influenza vaccines lead to a greater likelihood of getting vaccinated [57,60,61]. In some LMICs, however, vaccines are exclusively accessible through private markets, with individuals seeking vaccination covering the associated costs [62]. For example, parents of

unvaccinated children in Kenya said they would never pay for the influenza vaccine because they could not afford it [60].

Six of the 24 studies included in this review reported on interventions to improve influenza vaccine uptake in LMICs. These interventions targeted specific demographic groups including pregnant women, infants <5 months old, children aged between 6 months to 10 years, parents, and older adults. The findings showed that integrating vaccination with routine antenatal care, and year-round or semi-annual vaccination campaigns could prevent influenza illness in pregnant women. Additionally, awareness and educational campaigns about influenza illness and vaccination positively influenced parents' and older adults' attitudes towards the influenza vaccine. Most studies on determinants and interventions to improve influenza vaccine uptake in LMICs have focused on pregnant women. These studies have underscored the importance of knowledge, awareness, beliefs, and attitudes in influencing influenza vaccine uptake [46]. For instance, a targeted influenza vaccination initiative aimed at pregnant women in South Africa demonstrated that increased vaccine supply, healthcare provider education on the benefits of influenza vaccination for pregnant women and improved maternal vaccine awareness resulted in a 78 % increase in vaccine coverage [63]. Multifaceted strategies, including providing training and educational materials for schools, conducting educational activities, and sending reminders to parents and students, led to vaccination rates of 71.3 % and 76 % among school children aged 7 to 8 years [64].

This review has several limitations. Firstly, we did not conduct a formal quality assessment and therefore cannot report on the quality of the included studies beyond the reviewers' own perspectives. Secondly, our search did not incorporate gray literature or research that was not peer reviewed and/or published in other languages about influenza vaccination. We did, however, search for relevant citations and examples within the included peer reviewed articles. Thirdly, the search strategy may not have identified communications interventions outside of public health, potentially limiting the scope of the review. Fourthly, we were not able to generalize our analysis for all LMICs due to a gap in current research. This was a finding in itself as more research is required to compare within and between countries as well as varying demographic groups. Subsequently, given that only six articles explored interventions to improve influenza vaccine uptake, we could not infer which types of campaigns would be most effective in improving influenza vaccine uptake across different LMIC contexts. Additionally, variability in influenza seasonality between countries meant that the timing of data collection in the included studies may have influenced the results. Finally, while a second reviewer screened over 15 % of records, data extraction was completed by a single reviewer.

CRediT authorship contribution statement

Prima Alam: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Lerato Tsotetsi:** Writing – review & editing, Methodology, Investigation. **Tshepiso Msibi:** Writing – review & editing. **Mulalo Mashamba:** Writing – review & editing. **Janan Dietrich:** Writing – review & editing, Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. PRISMA 2020 checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	P1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	P2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	P3–4
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	P4
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	P5
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	P6
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	P4–5
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Appendix B
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	P4–6
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	P5–6

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SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Appendix C
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	P5–6
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	P8
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	P10–12
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	P6–20
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	P6–20
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	P21–24
Limitations	20	Discuss the limitations of the scoping review process.	P24
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	N/A
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	P25

Appendix B. Search strategies

PubMed search strategy.

		Terms
1		"Sub-Saharan Africa"[Title/Abstract] OR "Sub Sahara"[Title/Abstract] OR "Sub Saharan"[Title/Abstract] OR "Sub Saharan Africa"[Title/Abstract] OR "Subsaharan Africa"[Title/Abstract] OR Africa[Title/Abstract] OR "low- and middle-income"[Title/Abstract] OR "low and middle income"[Title/Abstract] OR "low-income"[Title/Abstract] OR "middle-income"[Title/Abstract] OR LMIC[Title/Abstract] OR "global South"[Title/Abstract] OR "developing countr*"[Title/Abstract]
2		"sub saharan african people"[MeSH Terms] OR "africa"[MeSH Terms] OR "developing countries"[MeSH Terms]
3	*1 OR 2*	
4		"Behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR "behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR behavior[Title/Abstract] OR behavior[Title/Abstract] OR "health promotion" [Title/Abstract] OR "health communication" [Title/Abstract] OR communication [Title/Abstract] OR communications[Title/Abstract] OR intervention[Title/Abstract] OR interventions[Title/Abstract] OR "social media" [Title/Abstract] OR media[Title/Abstract] OR "social marketing" [Title/Abstract] OR campaign[Title/Abstract] OR campaigns[Title/Abstract] OR "online campaign" [Title/Abstract] OR "online campaigns" [Title/Abstract] OR incentive[Title/Abstract] OR incentives[Title/Abstract] OR educatio*[Title/Abstract] OR progra* [Title/Abstract]
5		"health promotion"[MeSH Terms] OR "health communication"[MeSH Terms] OR "health behavior"[MeSH Terms] OR "health knowledge, attitudes, practice"[MeSH Terms] OR "social media"[MeSH Terms] OR "health education"[MeSH Terms]
6	*4 OR 5*	
7	3 AND 6	
8		influenza[Title/Abstract] OR "seasonal influenza"[Title/Abstract] OR "seasonal influenza vaccin*"[Title/Abstract] OR "influenza vaccin*"[Title/Abstract] OR "influenza vaccination*"[Title/Abstract] OR flu[Title/Abstract] OR "flu vaccin*"[Title/Abstract] OR "flu vaccination*"[Title/Abstract] OR "flu jab"[Title/Abstract] OR "flu shot"[Title/Abstract]
9		"influenza a virus"[MeSH Terms] OR "influenza vaccines"[MeSH Terms]
10	*8 OR 9*	
11	**7 AND 10**	
		2014–2024 filter

Scopus search strategy.

	Terms
1	"Sub-Saharan Africa"[Title/Abstract] OR "Sub Sahara"[Title/Abstract] OR "Sub Saharan"[Title/Abstract] OR "Sub Saharan Africa"[Title/Abstract] OR "Subsaharan Africa"[Title/Abstract] OR Africa[Title/Abstract] OR "low- and middle-income"[Title/Abstract] OR "low and middle income"[Title/Abstract] OR "low-income"[Title/Abstract] OR "middle-income"[Title/Abstract] OR LMIC[Title/Abstract] OR "global South"[Title/Abstract] OR "developing countr*"[Title/Abstract]
2	"Behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR "behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR behavior[Title/Abstract] OR behavior[Title/Abstract] OR "health promotion" [Title/Abstract] OR "health communication" [Title/Abstract] OR communication[Title/Abstract] OR communications[Title/Abstract] OR intervention[Title/Abstract] OR interventions[Title/Abstract] OR "social media" [Title/Abstract] OR media[Title/Abstract] OR "social marketing" [Title/Abstract] OR campaign[Title/Abstract] OR campaigns[Title/Abstract] OR "online campaign" [Title/Abstract] OR "online campaigns" [Title/Abstract] OR incentive[Title/Abstract] OR incentives[Title/Abstract] OR educatio* [Title/Abstract] OR progra* [Title/Abstract]

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(*continued*)

		Terms
3		"health promotion"[MeSH Terms] OR "health communication"[MeSH Terms] OR "health behavior"[MeSH Terms] OR "health knowledge, attitudes, practice"[MeSH Terms] OR "social media"[MeSH Terms] OR "health education"[MeSH Terms]
4		influenza[Title/Abstract] OR "seasonal influenza"[Title/Abstract] OR "seasonal influenza vaccin*"[Title/Abstract] OR "influenza vaccin*"[Title/Abstract] OR "influenza vaccination*"[Title/Abstract] OR flu[Title/Abstract] OR "flu vaccin*"[Title/Abstract] OR "flu vaccination*"[Title/Abstract] OR "flu jab"[Title/Abstract] OR "flu shot"[Title/Abstract]
5	*1 AND 2 AND 3 AND 4*	
6		2014–2024 filter

PsychInfo search strategy.

		Terms
1		"Sub-Saharan Africa"[Title/Abstract] OR "Sub Sahara"[Title/Abstract] OR "Sub Saharan"[Title/Abstract] OR "Sub Saharan Africa"[Title/Abstract] OR "Subsaharan Africa"[Title/Abstract] OR Africa[Title/Abstract] OR "low- and middle-income"[Title/Abstract] OR "low and middle income"[Title/Abstract] OR "low-income"[Title/Abstract] OR "middle-income"[Title/Abstract] OR LMIC[Title/Abstract] OR "global South"[Title/Abstract] OR "developing countr*"[Title/Abstract]
2		"Behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR "behavior change" [Title/Abstract] OR "behavioral change" [Title/Abstract] OR behavior[Title/Abstract] OR behavior[Title/Abstract] OR "health promotion" [Title/Abstract] OR "health communication" [Title/Abstract] OR communication[Title/Abstract] OR communications[Title/Abstract] OR intervention[Title/Abstract] OR interventions[Title/Abstract] OR "social media" [Title/Abstract] OR media[Title/Abstract] OR "social marketing" [Title/Abstract] OR campaign[Title/Abstract] OR campaigns[Title/Abstract] OR "online campaign" [Title/Abstract] OR "online campaigns" [Title/Abstract] OR incentive[Title/Abstract] OR incentives[Title/Abstract] OR educatio* [Title/Abstract] OR progra* [Title/Abstract]
3		"health promotion"[MeSH Terms] OR "health communication"[MeSH Terms] OR "health behavior"[MeSH Terms] OR "health knowledge, attitudes, practice"[MeSH Terms] OR "social media"[MeSH Terms] OR "health education"[MeSH Terms]
4		influenza[Title/Abstract] OR "seasonal influenza"[Title/Abstract] OR "seasonal influenza vaccin*"[Title/Abstract] OR "influenza vaccin*"[Title/Abstract] OR "influenza vaccination*"[Title/Abstract] OR flu[Title/Abstract] OR "flu vaccin*"[Title/Abstract] OR "flu vaccination*"[Title/Abstract] OR "flu jab"[Title/Abstract] OR "flu shot"[Title/Abstract]
5	*1 AND 2 AND 3 AND 4*	
6		2014–2024 filter

Global Health search strategy.

		Terms
1		"Sub-Saharan Africa" OR "Sub Sahara" OR "Sub Saharan" OR "Sub Saharan Africa" OR "Subsaharan Africa" OR Africa OR "low- and middle-income" OR "low and middle income" OR "low-income" OR "middle-income" OR LMIC OR "global South" OR "developing countr*"
2		"Behavior change" OR "behavioral change" OR "behavior change" OR "behavioral change" OR behavior OR behavior OR "health promotion" OR "health communication" OR communication OR communications OR intervention OR interventions OR "social media" OR media OR "social marketing" OR campaign OR campaigns OR "online campaign" OR "online campaigns" OR incentive OR incentives OR educatio* OR progra*
3		influenza OR "seasonal influenza" OR "seasonal influenza vaccin*" OR "influenza vaccin*" OR "influenza vaccination*" OR flu OR "flu vaccin*" OR "flu vaccination*" OR "flu jab" OR "flu shot"
4	*1 AND 2 AND 3*	
		2014–2024 filter

Google Scholar search strategy.

		Terms
1		"Sub-Saharan Africa" OR "Sub Sahara" OR "Sub Saharan" OR "Sub Saharan Africa" OR "Subsaharan Africa" OR Africa OR "low- and middle-income" OR "low and middle income" OR "low-income" OR "middle-income" OR LMIC OR "global South" OR "developing countr*"
2		"Behavior change" OR "behavioral change" OR "behavior change" OR "behavioral change" OR behavior OR behavior OR "health promotion" OR "health communication" OR communication OR communications OR intervention OR interventions OR "social media" OR media OR "social marketing" OR campaign OR campaigns OR "online campaign" OR "online campaigns" OR incentive OR incentives OR educatio* OR progra*
3		influenza OR "seasonal influenza" OR "seasonal influenza vaccin*" OR "influenza vaccin*" OR "influenza vaccination*" OR flu OR "flu vaccin*" OR "flu vaccination*" OR "flu jab" OR "flu shot"
4	*1 AND 2 AND 3*	
		2014–2024 filter

Appendix C. Coding framework

- First author
- Year of publication
- Country
- Study setting
- Research topic

- Study design
- Method of data collection
- Date of data collection
- Key study population
- Age of sample
- Sample size
- Primary outcome(s)
- Reporting intervention – yes/no
- Type of intervention
- Duration of intervention
- Description of intervention
- Target population of intervention
- Effectiveness of intervention
- Willingness to receive influenza vaccination
- Factors associated with willingness to receive influenza vaccination

Data availability

No data was used for the research described in the article.

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