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Review

Improving primary care vaccination rates in underserved and medically high-risk populations: A rapid review of strategies used in Australia and Aotearoa New Zealand

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ABSTRACT

Background: Despite excellent evidence for the effectiveness of vaccines and their inclusion within multiple clinical guidelines, vaccination coverage remains sub-optimal and inequitable in countries around the world, including in Australia and Aotearoa New Zealand. Interventions in primary care, and involving primary care providers, can be especially helpful to improve vaccination coverage.
Methods: We conducted a rapid review of research published between 2015 and 2024 that described either interventions, or barriers and enablers, to improving vaccination coverage for medically high-risk and underserved populations. Studies needed to be conducted in primary care in Australia or Aotearoa New Zealand. First, thematic analysis was used to describe barriers and enablers. Then, the content and outcomes of the included interventions were synthesised. Finally, barriers and enablers were mapped against the intervention strategies, to identify gaps between these factors.
Results: Of the 42 included articles, 37 identified barriers and enablers, 11 described an intervention to improve vaccination coverage, and six did both. Barriers and enablers were identified at the consumer, practitioner and practice, and healthcare system level. Consumer-level factors included mistrust and hesitancy (barriers), and high perceived benefits of vaccination (enabler). Practice-level factors included competing demands (barrier), and positive attitudes towards population health interventions (enablers). Healthcare system-level factors included a lack of culturally informed services and issues with digital health systems (barriers), and policy-level supports for the development of co-designed, culturally informed, and equitable vaccination care pathways (enablers). These multi-level factors were rarely comprehensively addressed in interventions aiming to improve coverage. Instead, effective interventions tended to be narrower in scope, and included personalised vaccination calendars, SMS-reminder programs, and structured health assessments.
Conclusions: The modest, but positive impacts of successful interventions may be improved using multi-level interventions that are tailored to target contexts and populations, which should be the focus of future work.

1. Background

Widely regarded as one of the most powerful preventative health interventions, vaccination has saved an estimated 154 million lives in the last 50 years, according to the World Health Organisation (WHO) [1]. However, despite excellent evidence for vaccine effectiveness and the inclusion of routine vaccination in policy and multiple clinical guidelines, vaccine coverage rates are sub-optimal and inequitable in both Australia and Aotearoa New Zealand [2–4]. The decline in vaccination rates has steepened after the COVID-19 pandemic, and has been associated with multiple factors, including ‘vaccination fatigue’ [5,6]; for example, the proportion of Australian parents who believed that children receive too many vaccines was 25.2% in 2023, compared to 17.2% in 2017 [7]. Vaccination coverage is either declining, or sub-

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optimal for multiple age groups of children. A 2023 report found that coverage rates for Australian children decreased at all three standard age assessment milestones in the preceding three years [8], and as of June 2025, in Aotearoa New Zealand, coverage for children at 24 months of age was only 82.0% [9]. At the other end of the age spectrum, a 2024 report from the Grattan Institute showed older Australians had falling rates in COVID-19 and influenza vaccination, and sub-optimal coverage for pneumococcal and shingles vaccination [10]. These rates represent a significant public health issue, especially considering the WHO's Immunisation Agenda 2030, which aims to maintain immunisation gains, recover from the disruptions caused by COVID-19, and ensure equitable vaccination in any situation or at any stage of life [11].

Importantly, in both Australia and Aotearoa New Zealand, the largest gaps in vaccination coverage are found in medically high-risk or underserved populations, including people from indigenous backgrounds, migrants and refugees, the elderly, and people with disabilities [9,12–14]. For example, vaccination coverage among Indigenous Australian children aged 24 months declined from 91% in 2019 to 88% in 2023 [15] and in Aotearoa New Zealand, childhood vaccination coverage among Indigenous tamariki Māori (Māori children) aged 24 months dropped from a pre-pandemic level of 87% to 69% towards the end of the pandemic [9]. These groups may also experience additional challenges in accessing healthcare due to diverse cultural, social, and cognitive considerations, which are not always adequately addressed by mainstream health systems [16]. For example, migrant populations face significant barriers to vaccination access in both countries [12,17], as do people experiencing homelessness [18] and those with developmental disabilities [19]. Compounding these issues, medically high-risk or underserved populations are often at higher risk of severe disease, hospitalisation, and mortality from vaccine preventable diseases [20]. Additionally, barriers often co-occur, leading to intersectional inequities for many populations [21]. Thus, increasing vaccine equity for people in these populations has been recognised as a national priority for both Australia and Aotearoa New Zealand [22,23].

The responsibility for vaccination is shared between primary care and public health in both countries [24,25]. In 2023, two primary care settings dominated vaccine delivery in Australia, with general practice accounting for 60.9% of vaccinations and pharmacy settings accounting for a further 18.2%, together representing nearly 80% of all vaccine delivery [8]. Similar delivery patterns occur in Aotearoa New Zealand, with restrictions on pharmacist vaccination reducing in recent years [26]. As such, primary care providers in these health systems are likely to be key actors in interventions aimed at improving vaccination coverage. Both Australia and Aotearoa New Zealand have high-functioning health systems and strong public health capabilities; however, primary care services are increasingly under pressure [27,28]. Primary care teams are being asked to maintain care quality with ever-shortening appointment times, restrictive billing models, increasing presentations of patients with high burden of disease and complex healthcare presentations, and a lack of appropriate resourcing [29]. Asking them to solve the vaccination coverage issue is but another pressure on an already stretched system. Thus, we need interventions that can support primary care teams and overcome common barriers and enablers to increasing vaccination coverage in underserved populations, rather than interventions that add additional requirements and pressures.

A 2024 synthesis of reviews investigated global efforts to boost vaccination coverage in high-risk populations. Of the 23 systematic reviews analysed, personalised communication strategies (such as home visits, phone calls and tailored reminders) were consistently effective in increasing vaccination uptake in vulnerable populations. Moreover, the review identified access as the biggest barrier to vaccination and underscored the need for tailored, evidence-based approaches to reduce vaccination inequities [30]. Two included reviews focused on studies from Australia, with none identified from Aotearoa New Zealand. Of the Australian reviews, one focused specifically on influenza vaccination [31], while the other, published in 2012, took a broad approach to vaccination interventions [32]. This broad evidence is critical; regardless of their form, interventions to improve vaccination coverage need to reflect the unique needs of their target populations and the context in which these populations live and receive healthcare [33,34]. The Australian context has changed vastly since this last broad review was conducted in 2012, including a global pandemic, and interventions to improve vaccination coverage in the Aotearoa New Zealand context have not yet been examined. Thus, we need an updated, context-specific understanding of not only the effectiveness of interventions on increasing vaccination coverage among underserved groups, but also the factors driving their effectiveness, for both Australia and Aotearoa New Zealand.

In response to this identified gap, we conducted a rapid review. We had three aims, each focusing on vaccination coverage for underserved and medically high-risk populations in both Australia and Aotearoa New Zealand. First, we aimed to describe barriers and enablers to increasing vaccination coverage for these populations in primary care. Second, we aimed to describe primary care-based interventions that have been implemented to improve vaccination coverage in these populations, and their associated vaccination-related outcomes. Finally, we aimed to map the structure of these primary care-based interventions against the identified barriers and enablers, to highlight gaps that could be addressed in future intervention planning. Our review focused on all publicly funded vaccinations listed on the National Immunisation Schedules, including COVID-19, of Australia [35] and Aotearoa New Zealand [36].

2. Methods

A rapid review of the literature published in Medline, Embase, and Web of Science Core Collection was conducted over the last 10 years, from January 2014 to November 2024. This review followed the Cochrane Rapid Review Guidelines [37]. This type of review is designed to meet time-sensitive needs while maintaining a balance between timeliness and methodological rigor.

2.1. Databases and search strategy

Medline, Embase, and Web of Science Core Collection were searched on 26 November 2024 using pre-defined terms. The search strategy was developed in collaboration with a university librarian and covered key terms related to vaccination, primary care, underserved populations, and Australia and Aotearoa New Zealand. Search strategies were adapted to the unique parameters of each database. See Appendix A for the Medline full search strategy.

2.2. Definitions

Primary care was considered to be any immunisation service provision in community settings, excluding hospital acute or outpatient settings, using the Australian definition of primary care [38]. For the purposes of this review, these included: general practices; Aboriginal Community Controlled Health Services; Māori health services, community health centres, walk-in clinics, nursing services, and pharmacies; oral health and dental services; mental health services; drug and alcohol treatment services; sexual and reproductive health service; maternal and child health services; and allied health services, such as psychologists, physiotherapists, occupational therapists.

Underserved or medically high-risk populations was defined as those that have "*limited access to services such as quality healthcare, education, healthy food sources, safe spaces, and other social determinants of health. These populations often experience 'physical, social, economic, and emotional vulnerability' when policies, systems and institutions are not in line with their needs*" [39]. For the purposes of this review, we considered people: experience homelessness; are Aboriginal and/or Torres Strait

Islander; Māori, or Pacific; are from culturally and linguistically diverse backgrounds; are in contact with criminal justice systems; identify as LGBTIQA+; experience mental health conditions; inject drugs; are older or younger; have a disability or multiple chronic illnesses; are women; live in rural areas or areas with higher socioeconomic deprivation; or are from refugee and migrant communities.

Importantly, people from medically high-risk or underserved populations may identify with more than one of the above populations, where their identity consists of multiple, intersecting factors [40]. These intersections may mean individuals have a greater degree of vulnerability or higher difficulty in interacting with the health system. We considered studies that reported on such populations.

2.3. Inclusion and exclusion criteria

Articles were included if they: 1) were published in a peer reviewed journal; 2) available in English; 3) were an empirical study published after 31 December 2013 until the date of the search; and 4) were conducted in primary care settings in Australia or Aotearoa New Zealand. We included studies with two possible foci. A study was included if it either: a) described an intervention to improve vaccination coverage in a medically high risk or underserved population and reported its outcome; or b) reported perceived barriers and enablers to improving vaccination coverage in a medically high risk or underserved population. Perceived barriers and enablers could be reported from the perspective of community members, clinicians, healthcare consumers, carers and their families, along with people in administrative and management roles. Interventions to improve vaccination coverage could take multiple forms; for example, an education or training program, a new or changed model of care, or public health promotion activities. Articles that did not satisfy the above criteria, or articles that did not have sufficient data for extraction were excluded. Review articles were excluded to prevent data duplication; however, relevant reviews were screened for additional records (see *Screening* below).

2.4. Screening

Title and abstract and then full text screening were conducted using Rayyan QCRI software [41]. During each screening stage, two reviewers (GF, BF) each screened half of the included records against the inclusion and exclusion criteria. A single reviewer (TV) then screened all excluded records to confirm the decision to exclude, resolving any disagreements through discussion with the team. The reference lists from included articles and any relevant systematic reviews that were identified during screening were also reviewed to identify additional relevant papers.

2.5. Data extraction

Data were extracted into a custom-developed REDCap (Research Electronic Capture) form [42]. The review team developed the form and piloted it on two articles, revising the form where necessary. Then, three reviewers (LP, GF, SS) met and co-extracted data from two full texts to facilitate agreement. After this, the same three reviewers (LP, GF, SS) extracted data from a third of included full texts. A fourth reviewer (TV) checked extracted data for completeness and correctness. The data extraction form included fields related to: article characteristics (e.g., first author name and country, year of publication, study type [design/methodology/approach], study aim); characteristics of the primary care context (e.g., type of setting, location, size); characteristics of target medically high-risk / underserved population(s); description of barriers and/or enablers to improving vaccination coverage in target populations; components of interventions to improve vaccination coverage; and outcome(s) of interventions to improve vaccination coverage. A full copy of the data extraction form is available in Appendix B.

2.6. Data synthesis

Characteristics of articles, primary care settings, and target populations were descriptively synthesised and tabulated. Data on barriers and enablers of improving vaccination coverage were analysed using an inductive content analysis [43]. One member of the research team (GF) developed categories for coding through immersion in the extracted data. Then, GF coded data to these categories, iteratively creating new categories where data did not fit into the extant structure. These categories, and their associated data, were then reviewed by a second reviewer (BF) and further refined. Next, three members of the research team (GF, BF, SS) reviewed all categories and achieved consensus. Outstanding disagreements were resolved using JB as an arbiter where required. After data had been coded, overarching categories were entered into a visual network analysis using Gephi software, version 0.10.1 [44], to identify their co-occurrence in individual studies. This dual analysis strategy was chosen to show not only the frequency and content of categories, but also the density with which they occurred in the same investigation of vaccination in primary care. In such networks, the nodes (circles) are the key categories that were identified, and the ties (connecting lines) represent their co-occurrence within an article). The size of each node indicates the number of times a category was identified in the articles included in this review. Interventions to improve vaccination coverage and their associated outcome measures were tabulated and presented according to their target population. Finally, the components of each intervention to improve coverage were mapped to the core barrier and enabler categories identified in included articles. This mapping process was conducted by two members of the research team (BW, TV) and then reviewed for accuracy by a third team member (GF). Disagreements were resolved using consensus.

2.7. Protocol and registration

The protocol for this rapid review was registered on Open Science Framework (DOI: 10.17605/OSF.IO/3ZVX7).

3. Results

3.1. Flow of studies

A total of 628 records were identified, of which 179 were duplicates. After title and abstract screening, 377 records were excluded. Three additional relevant articles were identified via reference list checking. A total of 75 full texts were screened for eligibility, after which 33 articles were excluded. Thus, a total of 42 studies were included in this rapid review (Fig. 1). Of these, 37 described barriers and enablers to increasing vaccination coverage, 11 described an intervention to improve vaccination coverage, and six studies described both.

3.2. Barriers and enablers to increasing vaccination coverage

3.2.1. Study characteristics

The 37 studies examining barriers and enablers employed qualitative ($n = 19$, 45%), quantitative ($n = 11$, 26%), mixed-methods ($n = 6$, 14%) and multi-method designs (n = 6, 14%). Of these, studies across diverse populations in Australia ($n = 31$, 84%) and Aotearoa New Zealand (n = 6, 16%) were included. Settings included general practices ($n = 26$, 62%), community health centres ($n = 18$, 43%), Aboriginal community-controlled health services ($n = 6$, 14%), pharmacies ($n = 18$, 43%), maternal child health services (n = 3, 7%) and walk-in clinics ($n = 18$, 43%). The studies included participants from the Aboriginal and Torres Strait Islander community (n = 6, 16%), culturally and linguistically diverse (CALD) groups ($n = 2$, 5%), refugees and migrants (n = 2, 5%), people experiencing homelessness (n = 1, 3%), people with chronic disease (n = 2, 5%), older adults (n = 1, 3%), as well as the perspectives of primary care clinicians about medically high-risk or underserved

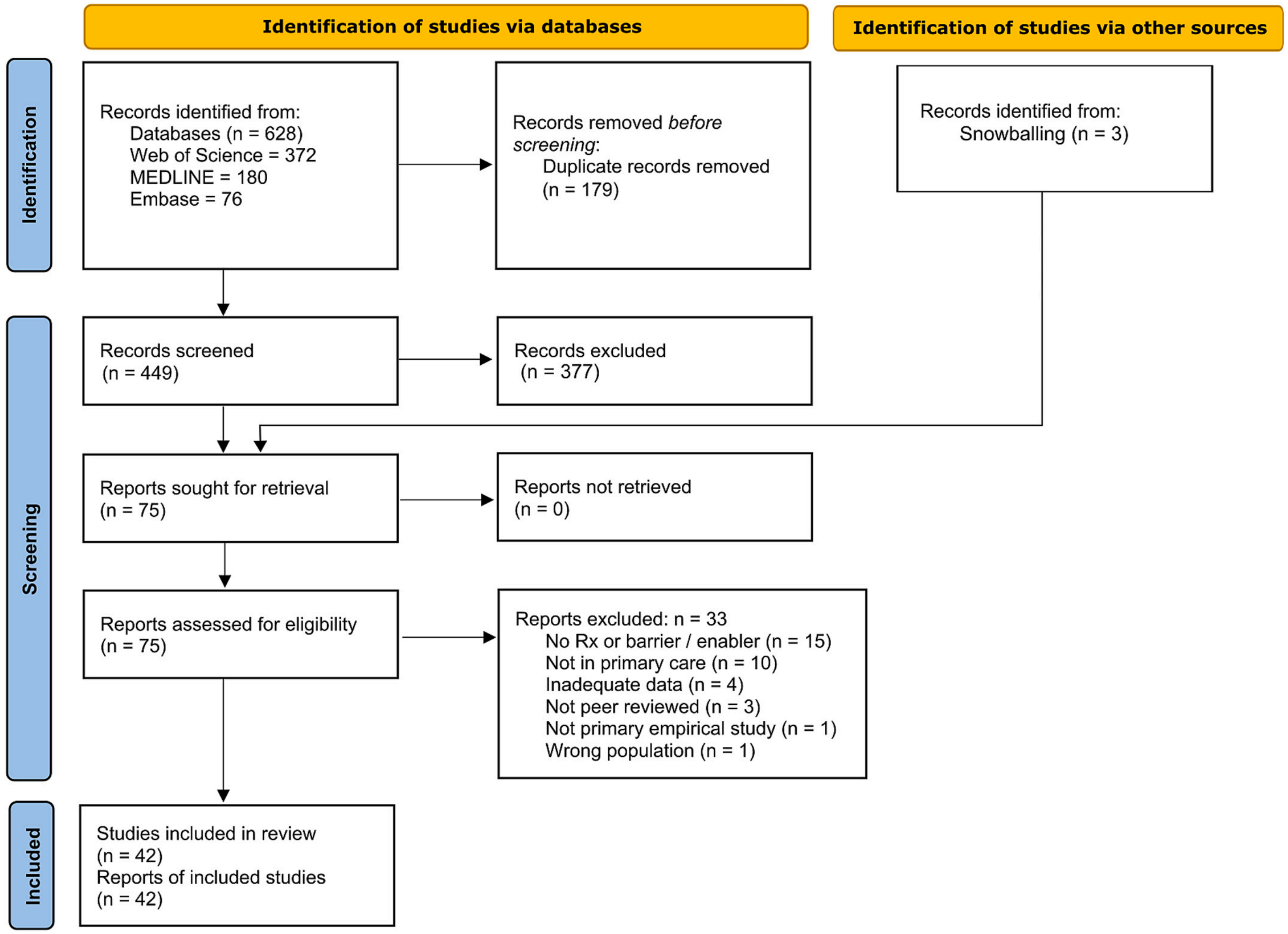

Fig. 1. PRISMA diagram. KEY: Rx = intervention.

populations (*n* = 15, 40%).

Six studies (14%) used multi-method designs, integrating interviews, surveys, and document analysis [45–50]. Some studies drew from structured theories, models, and frameworks, including; the Capability, Opportunity, Motivation, and Behavior (COM-B) model [51], the Theoretical Domains Framework (TDF) [52], Theory of Planned Behavior (TPB) [53], Behavioural and Social Drivers of Immunisation (BeSD) [54] and the integrated health literacy model (Sorenson's Integrated health literacy model, 2012) [55]. Data collection methods included semi-structured interviews (*n* = 24 studies, 65%), focus groups (*n* = 9 studies, 24%), online surveys (*n* = 14 studies, 38%), and retrospective audits (n = 1 study, 3%).

3.2.2. *Barrier and enabler categories*

Barriers and enablers to increasing vaccination coverage were clustered into three core categories: 1) consumer-related factors; 2) practitioner and practice-related factors; and 3) system-related factors. These three categories illustrate the different levels at which factors that influence vaccination uptake could operate, and the corresponding levels at which interventions could be designed to improve coverage. For example, the theme of consumer-related factors included perceptions of immunisation barriers and enablers related to healthcare consumers, their families, and carers, and how these factors influenced their ability to engage with practitioners, practices, and the broader healthcare system. For each category, several key sub-categories were identified and clustered into barriers and enablers. Table 1 describes each of the identified categories alongside exemplar quotes and the number of included articles that described them. The full list of identified themes and sub-themes, regardless of their frequency, are provided in Appendix C. The co-occurrence of barrier and enabler sub-categories within included articles are represented in a network graph in Fig. 2.

3.2.3. *Interventions to improve vaccination coverage*

In total, 11 studies reported interventions that were implemented across Australia and Aotearoa New Zealand to improve vaccination uptake among underserved or medically high-risk populations. These included personalised tools such as vaccination calendars for Aboriginal and Torres Strait Islander children [45], and automated SMS or printed reminders from general practices [56]. Co-designed models, such as vaccine hubs for people experiencing homelessness [46] and structured health assessments for older adults that included vaccination prompts [57], were also implemented. Multifaceted strategies, such as tailored SMS, home visits, and outreach clinics, were used to support Aboriginal and Torres Strait Islander families and socio-economically disadvantaged groups [58,59]. Policy-level interventions, such as the ‘No Jab, No Pay’ legislation (Australia), further aimed to incentivise childhood immunisation by tightening previous legislation so access to family assistance payments (e.g., childcare subsidy) was only available if children are vaccinated or have a recorded medical exemption [47]. In Aotearoa New Zealand, programs that aimed to increase access for priority populations included the provision of free influenza vaccinations delivered via general practices and school-based programs for Māori, Pacific, and younger populations [49], and the provision of pharmacy-based maternal pertussis immunisations for rural and socio-

Table 1
Barriers and enablers to vaccination identified in included studies. Percentages are expressed as percent of total articles discussing barriers and enablers (total $N = 37$).

Key category	Exemplar quote	N (%)
Consumer-related factors		
Barriers		
Negative emotions and beliefs	"Every week, there was somebody in tears because they were so anxious around the vaccine. People came in and then changed their mind" [46]	19 (51%)
Low information and knowledge	"I think it's not a common thing in some countries where people have come from to have kind of that proactive health care, it's more a reactive thing that people go to the doctor when they're sick." [58]	17 (46%)
Issues with service access	"It seemed to be a little bit problematic, because I was told there was basically a fellow in (town) that was doing it, and that's an hour and a half's drive for me." [58]	14 (38%)
Competing demands and vaccine prioritisation	"for new arrivals, it takes a while to get a GP, getting a job, a house, a school, immunisation falls behind while you're just doing those everyday things."	8 (22%)
Enablers		
Trust	"As it is a vaccination coming from the Australian government and through schools, I considered it safe." [60]	13 (35%)
Helpful beliefs about vaccines	"'Yeah, for sure. If I had to get it for my dad or my mum, or my aunties or uncles, I would get it for them. Yes." [57]	9 (24%)
High knowledge and awareness of vaccines	"Yeah I would like to know a bit more about them. Like when yous do give out information out about them do yous give the good side and the bad side?" [61]	6 (16%)
Provider and practice-related factors		
Barriers		
Staff and provider factors	"End of the day the last thing you want is to engage with a patient who is reluctant to have the vaccine so doctor fatigue is a barrier." [51]	21 (57%)
Ability to cater to priority populations	"Sometimes I feel like I've had trouble getting informed consent." [64]	9 (24%)
Immunisation information and guidelines	"67.4% of participants were either unsure of the vaccination coverage rates of Aboriginal children living in Perth or believed they were high" [48]	6 (16%)
Enablers		
Consumer-centred practice	"In the absence of an interpreter, many participants described using additional communication tools, such as translation apps, visual aids, and sign language." [58]	15 (41%)
Knowledge + skills	"Those that had participated in training specific to CALD groups described how this positively impacted their relationships with refugee patients through having as increased understanding of the refugee experience." [58]	11 (30%)
Collaborative approach	"I think the reality is that anytime we have really needed to intervene with the health of Aboriginal people, it's been most successful, most effective when we have got AHWs to do it." [48]	8 (22%)
Motivation + empowerment	'They look to me as someone who can be reliable and inform them correctly and that's part of my professional responsibility." [64]	6 (16%)
System-related factors		
Barriers		
Service and supply fragmentation	"It is ridiculous how often information is released through the news before it comes to us. It's embarrassing…and really undermines the trust that the public has in our expertise." [64]	21 (57%)
Inadequate resources, incentives, and planning	"As vaccinations ramped up, providers were under increasing pressure managing vaccination clinics, providing COVID-19-related clinical care, and trying to keep on top of 'business as usual'." [65]	14 (38%)
Technology and data fragmentation	"We're health workers, not data people. We're dealing with kids overdue from a national database which is a really old-fashioned system. Getting data, following kids up … has been complex." [67]	12 (32%)
Lack of responsive services for priority populations	"… translation services were described as necessary but inadequate, with some providers finding errors with professionally translated histories, others unsatisfied with the level of explanation [from] a translator." [63]	12 (32%)
Enablers		
Equity driven policy and resourcing	"the photo's on [the vaccination calendar], and it's got all our artwork on there, the Koori designs and borders and that, so that's really good. Because it's something just for us." [45]	19 (51%)
Information resource support	"the solution is you know providing some education and especially even you know education needs to be translated to their own language and explaining the benefits and this reduces barriers" [68]	11 (30%)
Integrated technology, tools, and platforms	"Practice software and resources that assist in identifying and follow-up of appropriate patients, allow recall and reminders to be sent to patients and resources such as leaflets and posters." [51]	7 (19%)
Person- or family centred service	"kids are nervous, but coming as a family approach you get that support and also the support of colleagues here as well." [62]	6 (16%)

Key: AHW – Aboriginal Health Worker, CALD – Culturally and linguistically diverse.

economically disadvantaged groups [60]. When considered together, these interventions addressed access issues using culturally appropriate, accessible, and often co-designed approaches. Characteristics of included studies and their interventions are summarised in Supplementary Table 1.

Several interventions across Australia and Aotearoa New Zealand significantly improved vaccination outcomes. Highly effective strategies included personalised calendars for indigenous families, where children in the intervention group had an 0.6 [95% CI −0.8 to 2.6] month vaccination delay, compared to the control group's 3.3 [95% CI −0.6 to 7.5] month delay [45]. SMS reminders sent one hour before appointments increased the chance of influenza vaccination by 65% (adjusted odds ratio 1.65, [95% CI 1.20 to 2.27]) among general high-risk groups [56] (e.g., adults aged 18 to 64 years with one or more medical risk factors). Tailored SMS with educational support improved the chance of infant immunisation rates in Aboriginal and Torres Strait Islander populations by 128% (adjusted risk ratio 2.28 [95%CI 1.05 to 4.94]) compared with a control intervention [58]. Zoster vaccination likelihood improved by almost 200% when routine health assessments that included vaccination checks were implemented for older Australians (adjusted odds ratio [aOR] 2.99 [95% CI: 2.76 to 3.23]) [61]. In Aotearoa New Zealand, free influenza vaccines for under-18 s from 2012 to 2013 [49] increased uptake in general (16.8% in 2012 vs 29.2% in 2013), but inequities persisted in uptake in Māori compared to non-

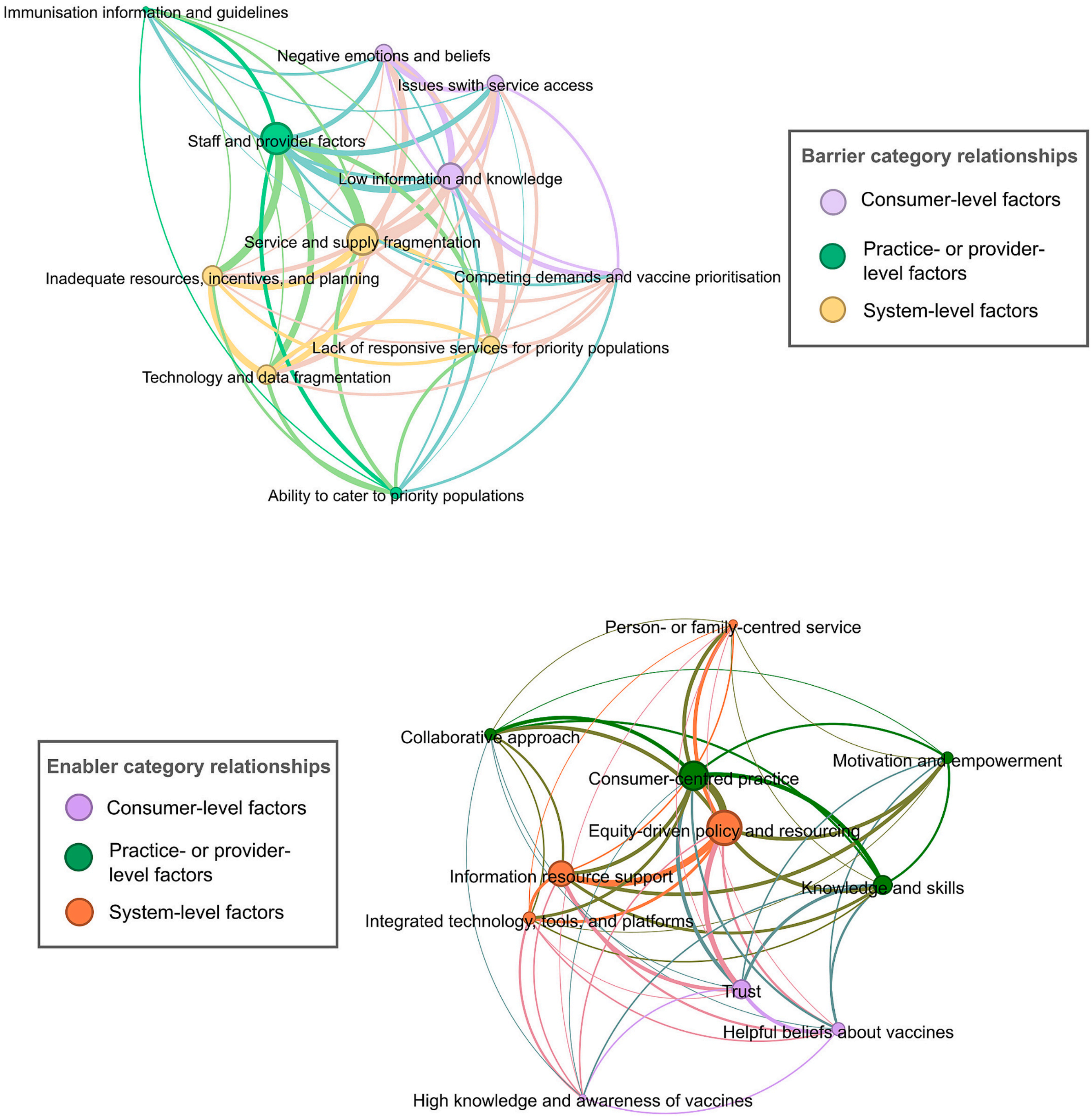

Fig. 2. Co-occurrence of barrier and enabler sub-categories to vaccination in included articles (n = 37). The top portion of the figure shows co-occurrence for enablers, while the bottom shows barriers. Each circle represents a single theme, with the size of the circle indicating the number of times that it was reported. The thickness of the lines connecting two circles represent the frequency with which those two themes co-occurred in included articles. In each graph, consumer-, practice – or provider-, and system level factors are coloured differently. See key in each picture for colour code.

Māori populations (17.1% vs 29.5%, $p < 0.001$), and in Pacific compared to non-Pacific populations (15.6% vs 28.6%, $p < 0.001$). The introduction of pharmacy-based maternal pertussis vaccination, including pharmacist education and promotion, appeared to slightly improve coverage (intervention group: +14.1% coverage, aOR 2.07 [95%CI1.89 to 2.27]; control group: +11.6% coverage, aOR 1.67 [1.52 to 1.84]; $p = 0.0014$) [60]. Some interventions, such as simple SMS reminders and SMS reminders immediately after booking, showed no significant change in coverage [56]. The most comprehensive intervention was conducted in Aotearoa New Zealand, and included customised action plans created by a practice champion, researcher and local coordinators plus additional support to implement the suggested strategies [62]. Interestingly, these interventions showed no impact on vaccination coverage, however supplementary qualitative data showed that they enhanced service delivery and engagement [62]. Details on the results of included interventions are reported in Supplementary Table 2.

3.2.4. Mapping of interventions against identified barrier and enabler categories

3.2.4.1. Overcoming barriers. Almost all included studies took a priority population approach to vaccination at the provider or practice level [45,46,50,56,58,60,62,63], with those that didn't relying instead on system-level approaches that targeted priority populations [47,49,50,61]. All studies conducted in Aotearoa New Zealand addressed access barriers [49,60,62]; however, these were less well addressed in Australian studies [45–47,50,56,58,61,63]. System siloes were the least commonly addressed barrier, accounted for in only one study [46], likely representative of the resources and support required to overcome these broad issues. The next least commonly addressed barriers were staff skills and perceptions, which were targeted in two studies from Aotearoa New Zealand [60,62], and consumer emotions and beliefs, addressed in one study from each country [45,62]. These results are of note, as they are both important factors in addressing vaccine hesitancy. The interventions by Turner et al. (2017) addressed the highest number of barriers, taking an approach that was tailored to the needs of consumers and practitioners alike [62]. Table 2 shows the mapping of barriers against interventions in included studies.

3.2.4.2. Leveraging enablers. The two most addressed enablers were the use of consumer-centred practice [45,46,49,60–62] and the introduction of information and resource support [46,49,50,60–62]. These enablers were leveraged in a variety of ways, including tailoring of reminder-based interventions [45] to the target population, co-designing intervention strategies with representatives from key groups [46,49], and the promotion of vaccination through community channels [60]. The next most leveraged enablers were consumer trust [45,46,56,60,62] and system-level integration of data, technology, and tools [47,56,58,62,63], and equity-driven policy [45,46,49,50,60].

Table 2

Interventions to improve vaccination in included articles, mapped against the key barrier and enabler categories that influenced coverage among underserved or medically high-risk populations.

	Abbott (2013)	Currie (2022)	Gonzalez-Chica (2024)	Lin (2022)	O'Grady (2022)	Rashid (2020)	Regan (2017)	Thomas (2018)	Calder (2014)	Howe (2022)	Turner (2017)
Intervention Effect	+	+	+	+	±	~	+	+	+	+	~
Barriers											
Consumer-level											
Access		✓	✓		✓				✓	✓	✓
Emotions and beliefs	✓										✓
Knowledge	✓		✓		✓		✓			✓	✓
Competing demands		✓		✓		✓		✓			✓
Provider- and practice-level											
Priority population approach	✓	✓	✓		✓	✓	✓			✓	✓
Vaccine information availability				✓		✓					✓
Staff skills and perceptions										✓	✓
System-level											
Data siloes			✓				✓				✓
Service siloes		✓									
Resources & incentives				✓		✓		✓	✓	✓	
Priority population approach				✓		✓		✓	✓		
Facilitators											
Consumer-level											
Helpful beliefs											✓
Trust	✓	✓	✓							✓	✓
High knowledge	✓		✓				✓				✓
Provider- and practice-level											
Consumer-centred practice	✓	✓		✓					✓	✓	✓
Knowledge & skills		✓								✓	✓
Collaborative approach	✓	✓						✓			✓
Motivation & empowerment		✓									✓
System-level											
Equity-driven policy	✓	✓				✓			✓	✓	
Information resource support		✓		✓		✓			✓	✓	✓
Integrated tech, tools, platforms			✓		✓		✓	✓			✓
Person- or family-centred systems		✓		✓							

Matching our findings above, the least addressed enablers were positive consumer beliefs about vaccinations [62], alongside provider knowledge and skills [46,60,62], and motivation and empowerment [46,62] in delivering vaccines. Thus, these factors represent potential avenues to increase the effectiveness of future interventions to improve vaccination coverage. Table 2 shows the mapping of enablers against interventions in included studies.

4. Discussion

This rapid review synthesised current evidence on strategies to enhance vaccination uptake among underserved and medically high-risk populations in Australia and Aotearoa New Zealand. While the act of delivering or indeed receiving a 'jab in the arm' is relatively simple, our findings illustrate that delivering vaccination interventions is far more complex. Our data highlighted a dynamic interplay between cultural, logistical, systemic, and individual-level factors that shape the success of primary care-based interventions designed to improve vaccination uptake. Many interventions demonstrated promise, including personalised vaccination calendars [45], SMS reminders [56,58,63], and structured health assessments [61]. Notably, our analysis showed that interventions often concentrated on a narrow subset of barriers and lacked broader address of structural determinants of vaccine delivery, such as the fragmentation of vaccination records and health services that limits providers' ability to identify and recall unvaccinated individuals (data and service siloes). The narrowness of these interventions likely reflects the boundaries that primary care can address independently, rather than a full range of factors that determine vaccination coverage. Thus, an overarching finding of this review is that in the context of both Australia and Aotearoa New Zealand, the capacity of primary care-based interventions to improve vaccination coverage has likely been constrained. That is, without addressing the systemic and interrelated barriers identified, efforts to enhance vaccine uptake may fall short in reaching populations who stand to benefit the most.

4.1. Barriers and enablers

Analysis of co-occurring barriers revealed a complex interplay between consumer-, practice-, and system-level factors, highlighting the interconnected nature of vaccination challenges. These barriers rarely operated in isolation; instead, they interacted synergistically, which compounded the difficulty of achieving equitable vaccine coverage. For example, staff and provider factors like competing demands and insufficient skills often interacted with health system fragmentation, with each factor contributing to the severity of the other. This interrelation has also been reported in other reviews of barriers to vaccine uptake in general populations [64], emphasising the complexity of vaccination as a preventative health intervention regardless of the target population. However, underserved and medically high-risk groups face greater barriers in access to healthcare than the general population, which are often intersectional in nature [65]. Future interventions aiming to improve vaccine equity must therefore account for these multi-level and intersecting determinants that influence access and uptake.

Vaccine hesitancy remains a persistent and evolving barrier. While historical scepticism towards vaccines is well-documented [66], the COVID-19 pandemic in an era of social media catalysed a global rise in anti-vaccination sentiment, especially in high-income countries [67–69]. This review found that over one-third of included studies ($n = 16$, 38%) identified vaccine hesitancy as a key barrier, often driven by misinformation, disinformation, mistrust in institutions, in addition to concerns about safety [50,70–84]. Primary care practitioners reported being unsure about how to manage hesitancy while maintaining a delicate balance of consumer autonomy and choice, and public health [77,84]. Many studies included in our review were conducted against the backdrop of the COVID-19 pandemic, and their results likely reflect the associated uncertain social context, rapid vaccine development, and public health restrictions. Despite the worst of the pandemic being over, vaccine hesitancy, propaganda and anti-vaccine sentiment are unlikely to abate, and may even intensify with the emergence of future pandemics [85]. Encouragingly, our review found that positive beliefs, health literacy, vaccine awareness, and trust in care providers continued to operate as protective factors supporting vaccination. Thus, sustained investment in public health promotion, accessible information, education and awareness campaigns, and evidence-based communication training for practitioners will be essential in the coming years.

Access related barriers in this review broadly spanned across consumer, practice and system levels, with time as a multifaceted constraint. Challenges included geographic isolation, limited clinic hours, and financial burdens such as travel costs and out-of-pocket expenses [47,48,50]. These barriers were particularly pronounced in rural and remote communities, where health infrastructure is often stretched and culturally appropriate services are scarce. Flexible service delivery models, such as after-hours clinics, mobile units, and home visits, have been positively received and shown to improve access, foster trust, and enhance engagement within the community [46,47,59,62,80]. Indeed, flexible services have already demonstrated success in Australia for non-vaccine-related public health interventions, such as mobile dental check vans [86], and mobile breast screening clinics [87]. To succeed in increasing vaccination coverage, these service models need support from government and policy at the whole-system level in both countries. This support is already emerging, with pillars of the National Immunisation Strategy for Australia 2025–2030 aiming to *"implement sustainable reform in vaccine program governance program delivery and accountability"* and *"use innovative service delivery models to increase equitable access to immunisation across the lifespan"* [23]. The corresponding strategy for Aotearoa New Zealand has similar goals, aiming to enhance system capability to create an immunisation system that *"is integrated, resilient and well governed to ensure effective delivery"* and to *"design and deliver immunisation services in ways that meet individual and community needs"* [22]. Targeted, evidence-based, and co-designed interventions and implementation strategies are needed to turn these goals into reality.

4.2. Interventions

From our analysis, the nature of interventions that were effective in improving vaccination coverage varied between Australia and Aotearoa New Zealand. The most effective strategies to improve coverage for Australia were reminder based [45,56,58,63], whereas Aotearoa New Zealand excelled in community-based and equity-focused approaches, such as combined primary care and school-based programs and funding and support for pharmacies [49,60]. The most impactful interventions used vaccination reminders for consumers [45,56,58,63], with a combination of education and tailored reminders being most effective [58]. These findings are supported by several, longstanding reports from other countries such as the United States and Denmark [88]. Thus, moving forward, the universal use of reminder-based strategies for consumers is recommended. In Australia, the National Immunisation Program (NIP) uses a reminder-based system for childhood vaccinations, however, regular reminders are not used for other populations covered by the NIP; for example, the elderly, and those with multiple chronic diseases [89]. In Aotearoa New Zealand, reminders are not standard for vaccinations covered under the National Immunisation Schedule and are instead contingent on an individual's enrolment with a particular primary care provider [90]. Thus, both countries could benefit from a uniform, system-level approach to vaccination reminders, using the data readily available in their respective national immunisation programs.

Notably, most successful interventions included in this review did not address the majority of our identified barriers or enablers, indicating that a targeted approach remained effective in increasing vaccination rates [45–47,49,56–58,63]. Our most unexpected finding was that the study evaluating strategies that addressed the *largest* number of barriers through a multi-component, co-designed intervention showed no clear difference in vaccination coverage between intervention and control, however the authors noted an insufficient sample size to draw any firm conclusion [62]. Considering vaccination uptake in general, there is mixed evidence in the literature for multi-component interventions. A recent systematic review showed no evidence for multi-component interventions (e.g., using education in combination with both reminder system and recall systems) aiming to improve vaccination coverage in children and adolescents [91]. Studies in other populations do show an impact; for example, a study in the United States used the '4 Pillars Program' to improve vaccination for high-risk adults in a primary care practice-based research network [92]. The program included evidence-based strategies designed to increase vaccination service convenience, enhance communication with patients, strengthen practice systems related to immunisation, and provide motivation through an immunisation champion, who was also supported by 1-on-1 coaching. The program was successful in increasing pneumococcal and DTaP (diphtheria, tetanus, and pertussis) vaccination in high-risk adults. Examining the success of previous multi-component interventions against the study included in our review, two differences are apparent. First, successful multi-component interventions tended to be implemented in established practice networks, while the study in Aotearoa recruited individual practices which operated as a study unit, with support from their local Primary Health Organisation and/or District Health Board coordinators, where appropriate. Second, and perhaps linked to this structure, the study in Aotearoa New Zealand did not achieve their planned sample size and was underpowered to detect differences in coverage [62]. Thus, it is likely that interventions to improve vaccination coverage require an approach that is coordinated between groups of primary care practices to both stimulate and measure impact. The effectiveness of targeted intervention does not indicate that addressing structural and system-level barriers is unimportant; rather, it reflects the scope of interventions that have been evaluated to date. Further research should include interventions that operate at the system level and consideration should be given to the feasibility of interventions targeting the practice level and if they can achieve meaningful equity gains in the absence of structural change.

4.3. Limitations and future directions

The main limitations of this review stem from the fact that many of the reported interventions were highly context specific. As a result, it was not possible to classify interventions into established typologies, nor draw strong inferences about the relative effectiveness of intervention types. Intervention effectiveness is likely to vary according to local contextual factors, and their relevance and applicability to other settings may be limited. There was also limited data available for some high-risk populations, for example there was only a single study that addressed psychosocial issues such as schizophrenia [78] and a single study exploring the population of those who inject drugs [83], or who are experiencing homelessness [46]. To deepen the understanding of these priority populations, further research needs to be undertaken in the respective areas. Rapid reviews maintain high rigor in their methodology, however, do not use the same comprehensive methodology as a full systematic review. We addressed this limitation via extensive team discussions and consensus-building, and by carrying out screening and data extraction with a small group of reviewers, which allowed for consistency and focus. We also used a multi-component analysis, showing influential and interrelated factors that could be used by future studies to implement change within the area of vaccination coverage. Barrier and enabler categories were classified according to the framing used in the original studies, therefore any apparent differences in categories may reflect variations in authors' framing rather than true differences in the prevalence of these factors across setting. Finally, given the nature of rapid reviews, a formal assessment of study quality was not included which may introduce some risk of selection and interpretive bias.

5. Conclusion

The data in our review suggest that persistent barriers continue to create immunisation inequities among underserved and medically high-risk populations. These barriers relate to access and logistics, workforce and system capacity, knowledge and training barriers, issues with trust and policy challenges. Critical enablers, such as consumer-centred practice, provider skills, equity-driven policy and adequate resourcing must be leveraged to improve access for these population. Interventions to improve vaccination rates should integrate consideration of practice- and system-level factors with a nuanced understanding of the unique needs and characteristics of each underserved population.

CRediT authorship contribution statement

Georgia Fisher: Writing – review & editing, Writing – original draft, Visualization, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Bree Wright:** Writing – review & editing, Writing – original draft, Visualization, Validation, Formal analysis. **Tina Vickery:** Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation. **Nadia A. Charania:** Writing – review & editing, Validation, Methodology. **Samantha Spanos:** Writing – review & editing, Validation, Methodology. **Lisa Pagano:** Writing – review & editing, Methodology. **Kate Churruca:** Writing – review & editing, Methodology. **Louise A. Ellis:** Writing – review & editing, Methodology. **Bianca Forrester:** Writing – review & editing, Visualization, Methodology, Formal analysis, Data curation. **Jeffrey Braithwaite:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

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Appendices. Supplementary data

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Data availability

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

References

[1] Global Immunization Efforts Have Saved at Least 154 Million Lives over the Past 50 Years Available online: https://www.who.int/news/item/24-04-2024-global-immunization-efforts-have-saved-at-least-154-million-lives-over-the-past-50-years (accessed on 7 August 2025).

[2] Immunisation Coverage - Health New Zealand | Te Whatu Ora Available online: https://www.tewhatuora.govt.nz/health-services-and-programmes/vaccine-information/immunisation-coverage (accessed on 11 December 2024).

[3] Care, A.G.D. of H. and A. Childhood Immunisation Coverage Available online: https://www.health.gov.au/topics/immunisation/immunisation-data/childhood-immunisation-coverage (accessed on 16 May 2025).

[4] NCIRS Fact Sheets, FAQs and Other Resources | NCIRS Available online: https://ncirs.org.au/resources (accessed on 7 August 2025).

[5] Covid Vaccination Fatigue Hurts the Most Vulnerable Available online: https://bond.edu.au/news/covid-vaccination-fatigue-hurts-most-vulnerable (accessed on 11 December 2024).

[6] All Eyes on Our Future Vaccination Strategy as COVID-19 Spikes. *InSight*+.

[7] Kaufman J, Hoq M, Rhodes AL, Measey M-A, Danchin MH. Misperceptions about routine childhood vaccination among parents in Australia, before and after the COVID-19 pandemic: a cross-sectional survey study. Med J Aust 2024;220.

[8] Hull B, Hendry A, Macartney K, Beard F. NCIRS Annual Immunisation Coverage Report 2023. 2023.

[9] Immunisation Coverage - Health New Zealand | Te Whatu Ora Available online: https://www.tewhatuora.govt.nz/health-services-and-programmes/vaccine-information/immunisation-coverage (accessed on 30 October 2025).

[10] Breadon, P.; Burfurd, I. A fair shot: How to close the vaccination gap; Grattan Institute report; Grattan Institute: Carlton, VIC, 2023; [ISBN 978-0-6457978-6-2].

[11] Organization, W.H. Immunization Agenda 2030: A Global Strategy to Leave No One Behind 2020.

[12] Charania NA, Paynter J, Lee AC, Watson DG, Turner NM. Exploring immunisation inequities among migrant and refugee children in New Zealand. Hum Vaccin Immunother 2018;14:3026–33. https://doi.org/10.1080/21645515.2018.1496769.

[13] Charania NA, Tonumaipe'a D, Barbarich-Unasa TW, Iusitini L, Davis G, Pacheco G, et al. Exploring the impact of the COVID-19 pandemic on perceptions of national scheduled childhood vaccines among Māori and Pacific Caregivers, Whānau, and healthcare professionals in Aotearoa New Zealand. Hum Vaccin Immunother 2024;20:2301626. https://doi.org/10.1080/21645515.2023.2301626.

[14] Patchy Protection: How to Boost GPs' Patient Vaccination Rates Available online: https://grattan.edu.au/report/patchy-protection/ (accessed on 19 July 2024).

[15] Care, A.G.D. of H. and A. Historical Coverage Data Tables for Aboriginal and Torres Strait Islander Children Available online: https://www.health.gov.au/topics/immunisation/immunisation-data/childhood-immunisation-coverage/historical-coverage-data-tables-for-aboriginal-and-torres-strait-islander-children (accessed on 12 December 2024).

[16] Cappelletti ER, Kreuter MW, Boyum S, Thompson T. Basic needs, stress and the effects of tailored health communication in vulnerable populations. Health Educ Res 2015;30:591–8. https://doi.org/10.1093/her/cyv033.

[17] Pourmarzi D, Fitzpatrick P, Allen K, Yuen A, Lambert S. "They said were all in it together, but we were kind of separated": barriers to access, and suggestions for improving access to official information about COVID-19 vaccines for migrants in Australia. BMC Public Health 2023;23:1690. https://doi.org/10.1186/s12889-023-15739-z.

[18] Tominc BL, Francis KL, Sawyer SM, Heerde JA, O'Neill J, Henning D. Immunization coverage in young people experiencing homelessness and the impact of a nurse-led program. J Prim Care Community Health 2023;14:21501319231204581. https://doi.org/10.1177/21501319231204581.

[19] O'Neill J, Elia S, Perrett KP. Human papillomavirus vaccine uptake in adolescents with developmental disabilities. J Intellect Dev Disabil 2019;44:98–102. https://doi.org/10.3109/13668250.2017.1310827.

[20] Vaccination of special populations: protecting the vulnerable. Vaccine 2016;34:6681–90. https://doi.org/10.1016/j.vaccine.2016.11.015.

[21] Robards F, Kang M, Luscombe G, Hawke C, Sanci L, Steinbeck K, et al. Intersectionality: social marginalisation and self-reported health status in young people. Int J Environ Res Public Health 2020;17:8104. https://doi.org/10.3390/ijerph17218104.

[22] *Strategic Approach to Immunisation in New Zealand 2025-2030*; Ministry of Health: Wellington, New Zealand, 2025; ISBN 978-1-991324-22-1.

[23] National Immunisation Strategy for Australia 2025–2030.

[24] Australian Government Department of Health, D. and A. Getting Vaccinated Available online: https://www.health.gov.au/topics/immunisation/getting-vaccinated (accessed on 7 August 2025).

[25] Immunisation Handbook - Health New Zealand | Te Whatu Ora Available online: https://www.tewhatuora.govt.nz/for-health-professionals/clinical-guidance/immunisation-handbook (accessed on 7 August 2025).

[26] Government, P.| T.P.W.| N. Decision on Joint Proposal with Health New Zealand to Enable Childhood Vaccinations to Be given in Pharmacies Available online: https://www.pharmac.govt.nz/news-and-resources/consultations-and-decisions/decision-on-joint-proposal-with-health-new-zealand-to-enable-childhood-vaccinations-to-be-given-in-pharmacies (accessed on 30 October 2025).

[27] Cabinet Paper - Update on Primary Health Care Strategic Priorities Redacted.Pdf.

[28] Australian Government Department of Health, D. and A. Primary Care and Workforce Reviews Taskforce Available online: https://www.health.gov.au/committees-and-groups/primary-care-and-workforce-reviews-taskforce (accessed on 7 August 2025).

[29] Mengistu, T.S.; Khatri, R.; Erku, D.; Assefa, Y. Successes and challenges of primary health care in Australia: a scoping review and comparative analysis. *J Glob Health 13*, 04043, doi:https://doi.org/10.7189/jogh.13.04043.

[30] Norman G, Kletter M, Dumville J. Interventions to increase vaccination in vulnerable groups: rapid overview of reviews. BMC Public Health 2024;24:1479. https://doi.org/10.1186/s12889-024-18713-5.

[31] Mohammed H, McMillan M, Andraweera PH, Elliott SR, Marshall HS. A rapid global review of strategies to improve influenza vaccination uptake in Australia. Hum Vaccin Immunother 2021;17:5487–99. https://doi.org/10.1080/21645515.2021.1978797.

[32] Ward K, Chow MYK, King C, Leask J. Strategies to improve vaccination uptake in Australia, a systematic review of types and effectiveness. Aust N Z J Public Health 2012;36:369–77. https://doi.org/10.1111/j.1753-6405.2012.00897.x.

[33] Mahimbo A, Tiwari P, Abdi I, Seale H, Charania N, Heywood AE. Designing an online educational program to improve immunisation service delivery for migrants and refugees in Australia and New Zealand. Discov Health Syst 2023;2:28. https://doi.org/10.1007/s44250-023-00043-9.

[34] Daniels SI, Cheng H, Gray C, Kim B, Stave CD, Midboe AM. A scoping review of implementation of health-focused interventions in vulnerable populations. Transl Behav Med 2022;12:935–44. https://doi.org/10.1093/tbm/ibac025.

[35] Australian Government Department of Health, D. and A. National Immunisation Program Schedule Available online: https://www.health.gov.au/resources/publications/national-immunisation-program-schedule?language=en (accessed on 29 July 2025).

[36] National Immunisation Schedule Available online: https://info.health.nz/immunisations/national-immunisation-schedule (accessed on 29 July 2025).

[37] Garritty C, Hamel C, Trivella M, Gartlehner G, Nussbaumer-Streit B, Devane D, et al. Updated recommendations for the cochrane rapid review methods guidance for rapid reviews of effectiveness. BMJ 2024;384:e076335. https://doi.org/10.1136/bmj-2023-076335.

[38] Australian Government Department of Health, D. and A. About Primary Care Available online: https://www.health.gov.au/topics/primary-care/about (accessed on 7 August 2025).

[39] Bantham A, Taverno Ross SE, Sebastião E, Hall G. Overcoming barriers to physical activity in underserved populations. Prog Cardiovasc Dis 2021;64:64–71. https://doi.org/10.1016/j.pcad.2020.11.002.

[40] Can intersectionality help with understanding and tackling health inequalities? Perspectives of professional stakeholders | Health research policy and systems | Full Text Available online: https://health-policy-systems.biomedcentral.com/articles/https://doi.org/10.1186/s12961-021-00742-w (accessed on 10 March 2025).

[41] Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan—a web and mobile app for systematic reviews. Syst Rev 2016;5:210. https://doi.org/10.1186/s13643-016-0384-4.

[42] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research Electronic Data Capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42:377–81. https://doi.org/10.1016/j.jbi.2008.08.010.

[43] Hsieh H-F, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res 2005;15:1277–88. https://doi.org/10.1177/1049732305276687.

[44] Bastian M, Heymann S, Jacomy M. Gephi: an open source software for exploring and manipulating networks. Proc Int AAAI Conf Web Soc Media 2009;3:361–2. https://doi.org/10.1609/icwsm.v3i1.13937.

[45] Abbott P, Menzies R, Davison J, Moore L, Wang H. Improving immunisation timeliness in aboriginal children through personalised calendars. BMC Public Health 2013;13:598. https://doi.org/10.1186/1471-2458-13-598.

[46] Currie J, Hollingdrake O, Grech E, McEnroe G, McWilliams L, Le Lievre D. Optimizing access to the COVID-19 vaccination for people experiencing homelessness. Int J Environ Res Public Health 2022;19:15686. https://doi.org/10.3390/ijerph192315686.

[47] Thomas S, Cashman P, Islam F, Baker L, Clark K, Leask J, et al. Tailoring immunisation service delivery in a disadvantaged community in Australia; views of health providers and parents. Vaccine 2018;36:2596–603. https://doi.org/10.1016/j.vaccine.2018.03.072.

[48] Carman R, Andrew L, Devine A, Oosthuizen J. Barriers to vaccination service delivery within general practice: opportunity to make a sustainable difference in aboriginal child health? Aust N Z J Public Health 2019;43:563–9. https://doi.org/10.1111/1753-6405.12937.

[49] Calder K, Bidwell S, Brunton C, Pink R. Evaluation of the Canterbury Under-18 seasonal influenza vaccination Programme. 2014.

[50] Rashid H, Dey A, Manocha R, Tashani M, Macartney K, Beard F. Australia's national zoster vaccination program: knowledge, attitudes and behaviour of general practitioners. Commun Dis Intell 2020;44. https://doi.org/10.33321/cdi.2020.44.59.

[51] Randall S, Williams A, Seale H, Beard F. Influenza vaccinations for high-risk adult populations: how well is general practice doing? Aust J Gen Pract 2021;50:681–6. https://doi.org/10.31128/AJGP-02-21-5847.

[52] Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. "Psychological Theory" group making psychological theory useful for implementing evidence based practice: a consensus approach. Qual Saf Health Care 2005;14:26–33. https://doi.org/10.1136/qshc.2004.011155.

[53] Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process 1991;50:179–211. https://doi.org/10.1016/0749-5978(91)90020-T.

[54] Behavioural and Social Drivers of Vaccination: Tools and Practical Guidance for Achieving High Uptake Available online: https://www.who.int/publications/i/item/9789240049680 (accessed on 30 September 2025).

[55] Davidson N, Hammarberg K, Fisher J. 'If I'm Not Sick, I'm Not Going to See the Doctor': access to preventive sexual and reproductive health care for Karen women from refugee backgrounds living in Melbourne, Australia —A qualitative study. Health Promot J Austr 2024;35:1136–48. https://doi.org/10.1002/hpja.844.

[56] Gonzalez-Chica D, Frank O, Edwards J, Hoon E, De Oliveira Bernardo C, Knieriemen A, et al. Effectiveness of patient reminders on influenza vaccination coverage among adults with chronic conditions: a feasibility study in Australian

general practices. Prev Med 2024;184:107983. https://doi.org/10.1016/j.ypmed.2024.107983.

[57] Lin J, Dobbins T, Wood JG, Hall JJ, Liu B. Impact of a structured older persons health assessment on herpes zoster vaccine uptake in Australian primary care. Prev Med 2022;155:106946. https://doi.org/10.1016/j.ypmed.2021.106946.

[58] O'Grady K-AF, Kaus M, Jones L, Boddy G, Rablin S, Roberts J, et al. SMS reminders to improve the uptake and timeliness of the primary immunisation series in infants: a multi-centre randomised controlled trial. Commun Dis Intell 2022;46. https://doi.org/10.33321/cdi.2022.46.15.

[59] Thomas S, Higgins H, Leask J, Menning L, Habersaat K, Massey P, et al. Improving child immunisation rates in a disadvantaged community in New South Wales, Australia: a process evaluation for research translation. Aust J Prim Health 2019; 25:310. https://doi.org/10.1071/PY19016.

[60] Howe AS, Gauld NJ, Cavadino AY, Petousis-Harris H, Dumble F, Sinclair O, et al. Increasing uptake of maternal pertussis vaccinations through funded administration in community pharmacies. Vaccines 2022;10:150. https://doi.org/10.3390/vaccines10020150.

[61] Lin J, Dobbins T, Wood JG, Bernardo C, Stocks NP, Liu B. Impact of a national immunisation program on herpes zoster incidence in Australia. J Infect 2022;84: 537–41. https://doi.org/10.1016/j.jinf.2022.01.011.

[62] Turner NM, Charania NA, Chong A, Stewart J, Taylor L. The challenges and opportunities of translating best practice immunisation strategies among low performing general practices to reduce equity gaps in childhood immunisation coverage in New Zealand. BMC Nurs 2017;16:31. https://doi.org/10.1186/s12912-017-0226-2.

[63] Regan AK, Bloomfield L, Peters I, Effler PV. Randomized controlled trial of text message reminders for increasing influenza vaccination. Ann Fam Med 2017;15: 507–14. https://doi.org/10.1370/afm.2120.

[64] Eiden AL, Barratt J, Nyaku MK. Drivers of and barriers to routine adult vaccination: a systematic literature review. Hum Vaccin Immunother 2022;18:2127290. https://doi.org/10.1080/21645515.2022.2127290.

[65] Cha E, Vyas V, King KD, Reifferscheid L, MacDonald SE. Inclusion of intersectionality in studies of immunization uptake in Canada: a scoping review. Vaccine 2023;41:3710–7. https://doi.org/10.1016/j.vaccine.2023.04.073.

[66] A Brief History of Vaccination Available online: https://www.who.int/news-room/spotlight/history-of-vaccination/a-brief-history-of-vaccination (accessed on 16 May 2025).

[67] Fridman A, Gershon R, Gneezy A. COVID-19 and vaccine hesitancy: a longitudinal study. PLoS One 2021;16:e0250123. https://doi.org/10.1371/journal.pone.0250123.

[68] Latkin C, Dayton L, Miller J, Yi G, Balaban A, Boodram B, et al. A longitudinal study of vaccine hesitancy attitudes and social influence as predictors of COVID-19 vaccine uptake in the US. Hum Vaccin Immunother 2022;18:2043102. https://doi.org/10.1080/21645515.2022.2043102.

[69] Nagase M. Factors associated with vaccine hesitancy against COVID-19 among adults in Europe: a descriptive study analysis applying socio-ecological framework. BMC Res Notes 2024;17:84. https://doi.org/10.1186/s13104-024-06739-2.

[70] Zwar N, Hasan I, Harris M, Traynor V. Barriers and facilitators to influenza vaccination among high-risk groups aged less than 65 years – views from general practitioners and practice nurses. Aust N Z J Public Health 2007;31:558–61. https://doi.org/10.1111/j.1753-6405.2007.00143.x.

[71] Tranter I, Magin P, Van Driel ML. Immunising older Australians: pre-COVID-19 vaccine perspectives from general practice training. Aust. J. Gen. Pract. 2021;50: 388–93. https://doi.org/10.31128/AJGP-02-21-5844.

[72] Biezen R, Grando D, Mazza D, Brijnath B. Why do we not want to recommend influenza vaccination to young children? A qualitative study of Australian parents and primary care providers. Vaccine 2018;36:859–65. https://doi.org/10.1016/j.vaccine.2017.12.066.

[73] Abdi I, Bolsewicz K, Bullivant B, Marques MD, Steffens MS. Understanding the factors that influence communication about COVID-19 vaccines with patients: perspectives of Australian immunisation providers. Vaccine X 2023;14:100304. https://doi.org/10.1016/j.jvacx.2023.100304.

[74] Damianopoulos N, Leigh J, Pugliese M, Frayne J, Richards T, STRIVE WA Collaborative. COVID-19 vaccine hesitancy in rural and metropolitan Western Australia: a mid-rollout cross-sectional analysis of why it exists and potential solutions. Aust J Rural Health 2023;31:1240–51. https://doi.org/10.1111/ajr.13047.

[75] Benedict Kpozehouen E, Raina Macintyre C, Tan TC. Coverage of influenza, pneumococcal and zoster vaccination and determinants of influenza and pneumococcal vaccination among adults with cardiovascular diseases in community. Vaccine 2024;42:126003. https://doi.org/10.1016/j.vaccine.2024.05.051.

[76] Menzies R, Aqel J, Abdi I, Joseph T, Seale H, Nathan S. Why is influenza vaccine uptake so low among aboriginal adults? Aust N Z J Public Health 2020;44:279–83. https://doi.org/10.1111/1753-6405.13004.

[77] Oversby S, Hamilton EM, Ratsch A, Kitchener S. Barriers and enablers to implementation of COVID-19 vaccine programs in a rural and regional Queensland: a provider perspective. Aust J Rural Health 2023;31:1191–202. https://doi.org/10.1111/ajr.13046.

[78] Maguire PA, Reay RE, Looi JC. Nothing to sneeze at – uptake of protective measures against an influenza pandemic by people with schizophrenia: willingness and perceived barriers. Australas Psychiatry 2019;27:171–8. https://doi.org/10.1177/1039856218815748.

[79] Hamilton EM, Oversby S, Ratsch A, Kitchener S. COVID-19 vaccination: an exploratory study of the motivations and concerns detailed in the medical records of a regional Australian population. Vaccines 2022;10:657. https://doi.org/10.3390/vaccines10050657.

[80] Bolsewicz KT, Steffens MS, Karpish L, Bullivant B, Beard F, Clark K. "Every interaction you have …should be an opportunity to discuss and offer influenza vaccination". Health service perspectives on influenza vaccination promotion and delivery to aboriginal families living in New South Wales, Australia. Vaccine 2022; 40:5814–20. https://doi.org/10.1016/j.vaccine.2022.08.057.

[81] Graham S, Blaxland M, Bolt R, Beadman M, Gardner K, Martin K, et al. Aboriginal peoples' perspectives about COVID-19 vaccines and motivations to seek vaccination: a qualitative study. BMJ Glob Health 2022;7:e008815. https://doi.org/10.1136/bmjgh-2022-008815.

[82] Frawley JE, Foley H, McIntyre E. The associations between medical, allied and complementary medicine practitioner visits and childhood vaccine uptake. Vaccine 2018;36:866–72. https://doi.org/10.1016/j.vaccine.2017.12.036.

[83] Price O, Dietze P, Maher L, Dore GJ, Sutherland R, Salom C, et al. High COVID-19 vaccine uptake following initial hesitancy among people in Australia who inject drugs. Vaccine 2024;42:2877–85. https://doi.org/10.1016/j.vaccine.2024.03.051.

[84] Thomas; Paden; Lloyd; Tudball; Corben tailoring immunisation programs in Lismore, New South Wales - we want our children to be healthy and grow well, and immunisation really helps. *Rural Remote Health* **2022**, doi:10.22605/RRH6803.

[85] Odame EA, Dada O, Nelson J, Ogunyiola A, Haley J. Preparing for future pandemics: a qualitative exploration of social media in light of the COVID-19 pandemic and vaccine hesitancy. PLOS Glob Public Health 2025;5:e0004317. https://doi.org/10.1371/journal.pgph.0004317.

[86] Department of Health. Victoria, A. Smile Squad Available online: https://www.health.vic.gov.au/smile-squad (accessed on 16 May 2025).

[87] Mobile Screening Services Available online: https://www.breastscreen.org.au/locations/mobile-screening-services/ (accessed on 16 May 2025).

[88] Jacobson Vann, J.C.; Szilagyi, P. Patient reminder and recall systems to improve immunization rates. *Cochrane Database Syst. Rev.* **2005**, *2005*, CD003941, doi: https://doi.org/10.1002/14651858.CD003941.pub2.

[89] Australian Immunisation Register (AIR) - Ceasing Correspondence and Release of Information Form (IM017) - Services Australia Available online: https://www.servicesaustralia.gov.au/im017 (accessed on 30 October 2025).

[90] Immunisations for Babies and Toddlers Available online: https://info.health.nz/immunisations/when-to-immunise/babies-and-toddlers (accessed on 30 October 2025).

[91] Siddiqui FA, Padhani ZA, Salam RA, Aliani R, Lassi ZS, Das JK, et al. Interventions to improve immunization coverage among children and adolescents: a meta-analysis. Pediatrics 2022;149:e2021053852D. https://doi.org/10.1542/peds.2021-053852D.

[92] Nowalk MP, Moehling KK, Zhang S, Raviotta JM, Zimmerman RK, Lin CJ. Using the 4 Pillars^{TM} to increase vaccination among high-risk adults: who benefits? Am J Manag Care 2017;23:651–5.