Implementing a Life-Course Approach to Immunization

Lessons learned from international best practice in policy and programming

IFPMA

The Health Policy Partnership

Contents

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Executive Summary

Taking a life-course approach to immunization offers a valuable opportunity to improve health,[1] support health system sustainability[2] and promote economic prosperity.[3 4]

Policies that support immunization across the life course, rather than restricting it to childhood, have the potential to:

- benefit individual and population health[1]
- promote healthy ageing[5]
- support the long-term sustainability of health systems through reduced healthcare costs[2]
- lead to wider economic benefits by promoting workforce productivity[4]
- support equity and universal access to primary care by providing a platform around which these services can be provided[4 6]
- reduce the spread of antimicrobial resistance (AMR)[7]

What do we mean by a life-course approach to immunization?

The life-course approach to immunization recognizes the role of immunization as a strategy to prevent diseases and maximize health over one's entire life, regardless of an individual's age. A life-course approach requires that immunization schedules and access to vaccination respond to an individual's stage in life, their lifestyle and specific vulnerabilities/risks to infectious disease that they may face.

Despite these and other benefits, and support at the global level, most countries have not yet implemented a life-course approach to immunization.[4] The World Health Organization (WHO) Global Vaccine Action Plan 2011–2020 established a range of immunization goals and recommended implementing a life-course approach to immunization in order to maximize its benefits.[1] This is in line with the WHO General Programme of Work, which advocates for a life-course approach to health.[8] While progress has been made, many of the goals will not be achieved by 2020,[9] and there is an urgent need to redress this situation in the decade to come.

This report aims to guide policymakers and other stakeholders looking to implement sustainable life-course immunization policies and programs. We selected six countries which were chosen because of their success in implementing a life-course approach to immunization. Drawing from desk research and expert interviews in these countries, we identified 15 case studies with important implementation lessons. This research helped us identify five key policy components that characterize effective life-course immunization strategies, which have been built into the policy framework presented below.

Policy framework for implementing a life-course approach to immunization

The five key areas presented in this framework characterize the key components needed for an effective life-course immunization policy. Robust data collection is at the centre of this framework as immunization and infectious disease data should be used to inform all aspects of policy and programming. These key policy components can be most effective when supported by a conducive legislative environment and long-term cross-governmental commitment.

Comprehensive immunization program that supports vaccine availability

- Immunization schedule covers whole life course
- Recommendations are evidence-based and reviewed regularly
- Reliable vaccine supply chain in place
- Immunization across the life course prioritized and adequately resourced
- Vaccines available for underserved communities

Public demand for immunization

- Public awareness campaigns encourage vaccine uptake across the life course
- Active civil society organizations involved in vaccine promotion

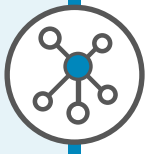
Engaged healthcare professionals (HCPs)

- HCPs educated about benefits of life-course immunization
- HCPs supported to be vaccinated

Multidisciplinary and cross-sectoral coordination

- Immunization integrated into healthy living and healthy ageing policies
- Collaboration with other sectors supports vaccine delivery in non-clinical settings

Robust data informing policies and programs



- Immunization coverage targets cover the life course
- Electronic databases collect and share immunization and infectious disease data
- Immunization data available to individuals and healthcare professionals

Drawing from this framework, we compiled a policy checklist against which each of the six countries was assessed. The Table below shows each country's progress in developing policies that support immunization across the life course. These countries were selected as they are leading the way in implementing a life-course approach to immunization but, as our analysis has found, few are doing so comprehensively.

Progress of countries against the policy checklist

		Aus	Bra	Fra	Jpn	UK	US
Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●	●	●	●	●	●
	Recommendations are evidence-based and reviewed regularly	●	●	●	●	●	●
	Reliable vaccine supply chain in place	●	●	●	●	●	●
	Immunization across the life course prioritized and adequately resourced	●	●	●	●	●	●
	Vaccines available for underserved communities	●	●	○	●	●	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●	●	●	●	●	●
	Active civil society organizations involved in vaccine promotion	●	●	●	●	●	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●	●	●	●	●	●
	Healthcare professionals supported to be vaccinated	●	●	●	●	●	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●	●	●	●	●	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●	●	●	●	●	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●	●	●	○	●	●
	Electronic databases collect and share immunization and infectious disease data	●	●	●	●	●	●
	Immunization data available to individuals and healthcare professionals	●	●	●	●	●	●

● Well developed ● In development ● Not yet developed ○ No data found

While all six countries we assessed are implementing different components of the life-course approach to varying degrees, few are yet to do so in a comprehensive way. It should be noted that the checklist is a high-level overview of the life-course immunization picture in the target countries. A detailed description of each country's implementation of these policy components, including key successes, gaps and challenges is included in *Annex 1*.

As ageing populations put increasing pressure on health systems,[10] vaccine hesitancy is on the rise[11] and the toll of AMR continues unabated,[12] implementing effective life-course immunization strategies remains a critical policy priority and opportunity.

We call on all stakeholders to consider the policy changes needed to improve population health and promote health system sustainability through increasing vaccination coverage across the life course.

1 Introduction

Immunization across the life course is a cost-effective way to improve health,[1] **support health system sustainability**[2] **and promote economic prosperity.**[3 4] At a global level, effective vaccination may help mitigate health risks such as infectious diseases and antimicrobial resistance (AMR),[7] which have a significant impact on health and wellbeing as well as on the global economy.[13]

As the global population continues to age, prevention of disease becomes more important for easing pressure on health systems and ensuring their sustainability.[2] Similarly, as retirement age increases and people work to older age, immunization across the life course is becoming more relevant to workforce productivity.[4]

What do we mean by a life-course approach to immunization?

Based on our research we developed a definition of the life-course approach to immunization to support a clearer, shared understanding of the concept:

'The life-course approach to immunization recognizes the role of immunization as a strategy to prevent disease and maximize health over one's entire life, regardless of an individual's age. A life-course approach requires that immunization schedules and access to vaccination respond to an individual's stage in life, their lifestyle and specific vulnerabilities/risks to infectious disease that they may face.'

The benefits of immunization across the life course are beginning to be recognized at a global level, but progress within countries has been slow. In 2010, the global health community declared a 'Decade of Vaccines' and experts developed the World Health Organization (WHO) Global Vaccine Action Plan 2011–2020 (GVAP), which includes a focus on establishing a life-course approach to immunization.[1] The WHO is continuing to develop and invest in the importance of a life-course approach to health, recently establishing a 'Universal Health Coverage and the Life Course' division[14] and highlighting the benefits of a life-course approach in its 13th General Programme of Work.[8] Most countries, however, have not yet implemented a life-course approach to immunization,[4] and many of the goals set out in the GVAP will not be achieved by 2020.[9] Furthermore, recent years have seen a rise in vaccine hesitancy,[11 15] leading to a resurgence of vaccine-preventable diseases such as measles.[16]

As the next decade approaches, there is an urgent need to embed a life-course approach to immunization in national health policies in order to improve population health and promote economic prosperity.[9 17]

This report presents a policy framework that was informed by our analysis of implementation lessons from six countries: Australia, Brazil, France, Japan, United Kingdom (UK) and United States (US). We reviewed grey and peer-reviewed literature to identify case studies from these countries which aimed to implement policy or program changes that would embed a life-course approach to immunization. A total of 28 case studies were identified, of which 15 were selected based on the likelihood of uncovering promising lessons and a desire to capture variation in both target group and approach. We also assessed the immunization policy context in each of the six countries to understand the circumstances that may have influenced the implementation or impact of the case studies, and to further inform the policy framework.

2 What are the benefits of a life-course approach to immunization?

Immunization throughout life, during childhood and beyond, holds significant benefits at the individual, population and socioeconomic levels. At the individual level, immunization offers people a range of benefits depending on their stage in life and the risks they face:[1]

- **Immunization during pregnancy can benefit a woman and her baby.** Pregnant women are more likely than the general population to experience complications from influenza, including premature birth.[18] Pertussis also poses a serious risk to infants but vaccination during pregnancy can protect them.[19]

- **Adolescence is the best time to immunize people against some diseases.** The human papilloma virus (HPV) vaccine is most effective when given in early adolescence.[20] In addition, immunizing adolescents against meningococcal bacteria can protect them and the wider population.[21]

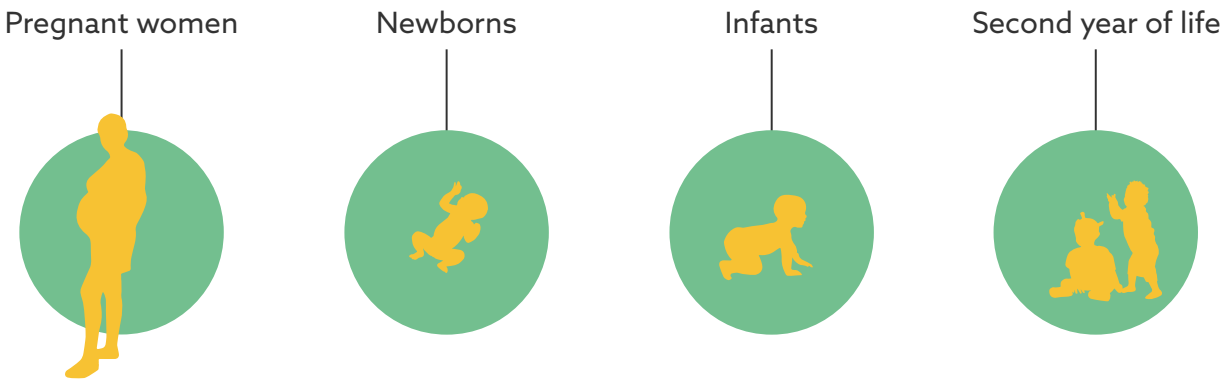
- **Immunizing older people can prevent unnecessary hospital admissions and mortality from vaccine-preventable diseases.**[22 23] Changes in our immune response as we age means that older people are at higher risk of infection[24] and are less responsive to vaccines.[5 25] When immunizations are kept up to date throughout adulthood, however, antibodies can be produced before the immune system beings to decline.[26]

- **People with some chronic conditions are more likely to develop serious complications from vaccine-preventable illnesses such as influenza or pneumococcal disease.** Immunizing people with diabetes, lung disease or cardiovascular disease, for example, can prevent such outcomes.[27]

- **Immunizing caregivers and healthcare professionals can have multiple benefits.** Protecting (paid and unpaid) caregivers and healthcare professionals against diseases such as influenza can prevent them from spreading the disease to more vulnerable people who may suffer serious complications.[28] In addition, by avoiding the flu, they can continue their work,[29] preventing increased pressure on health systems.

- **Some migrants may be particularly vulnerable to infectious diseases.** They may not have been immunized in their home countries and can experience worse health outcomes from disease than people in their host country.[30]

Examples of life-stages to be considered when taking a life-course approach to immunization



Source: Working together: an integration resource guide for immunization services throughout the life course. Geneva: World Health Organization; 2018.

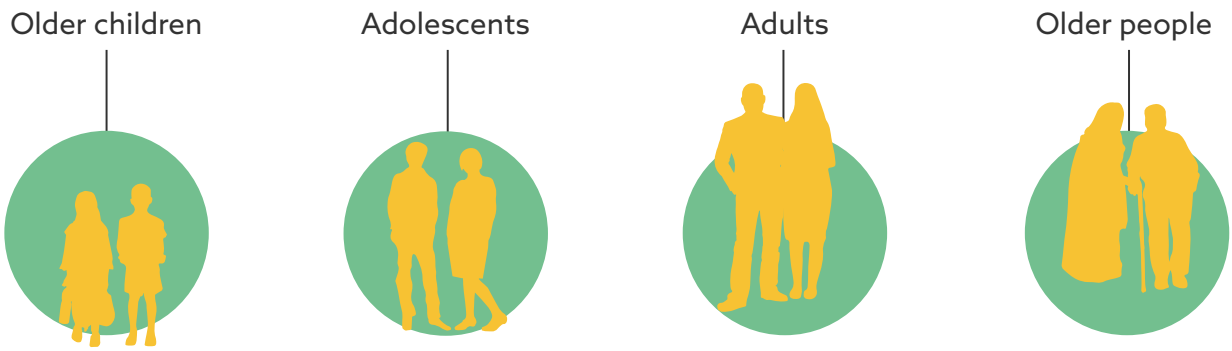
Immunization across the life course can also result in population-wide health and economic benefits:

- **High vaccine coverage offers benefits beyond the individual, having the potential to protect whole communities through herd immunity.** High levels of immunization against certain diseases such as measles[31] across the population can protect those who are unvaccinated or whose immune systems are compromised.[26 32]

- **Comprehensive immunization across the life course may also offer sustainable protection against AMR.** The overuse of antibiotics has encouraged disease-causing microbes to become resistant to many drugs.[33] Studies have found, however, that increasing vaccine coverage in the population can limit the spread of infections, including those which are drug resistant, and reduce the demand for antibiotics.[7] Furthermore, immunization represents a sustainable solution because pathogens do not usually develop resistance to vaccines.[7]

- **At a health-system level, a life-course approach to immunization offers a platform to achieve global targets for universal health coverage.**[4 6] Universal health coverage is a key component of the Sustainable Development Goals (SDGs).[34] It has been widely recognized that investing in immunization for all can support this goal by providing the infrastructure around which other primary healthcare services can be delivered,[9] thereby reaching people who may not otherwise access primary healthcare services.[6]

- **Immunization beyond childhood is recognized as a cost-effective intervention.** National investment in immunization programs is consistently shown to be an effective use of resources and some studies even suggest that immunization across the life course can be cost saving. An analysis of data from the Netherlands considered the wider benefits of vaccination of people aged 50 years and older, such as reduced mortality, work days gained and healthcare costs saved, and found an approximately fourfold return on investment.[32] In addition, immunization addresses health risks such as infectious diseases and AMR, which are internationally recognized as impacting significantly on the global economy.[13]



Source: Working together: an integration resource guide for immunization services throughout the life course. Geneva: World Health Organization; 2018.

3
Key policy areas for implementing a life-course approach to immunization

There are five key components needed for an effective life-course immunization policy. These components can be most effective when supported by a conducive legislative environment and long-term cross-governmental commitment.

Comprehensive immunization program that supports vaccine availability

- Immunization schedule covers whole life course
- Recommendations are evidence-based and reviewed regularly
- Reliable vaccine supply chain in place
- Immunization across the life course prioritized and adequately resourced
- Vaccines available for underserved communities

Public demand for immunization

- Public awareness campaigns encourage vaccine uptake across the life course
- Active civil society organizations involved in vaccine promotion

Engaged healthcare professionals (HCPs)

- HCPs educated about benefits of life-course immunization
- HCPs supported to be vaccinated

Multidisciplinary and cross-sectoral coordination

- Immunization integrated into healthy living and healthy ageing policies
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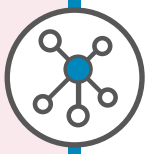


Robust data informing policies and programs

- Immunization coverage targets cover the life course
- Electronic databases collect and share immunization and infectious disease data
- Immunization data available to individuals and healthcare professionals

3.1 Comprehensive immunization program that supports vaccine availability

Immunization schedule covers the whole life course

Immunization schedules should be comprehensive and include all people at risk of catching or spreading infectious disease, depending on their stage in life and the risks they may face. This is necessary to ensure everyone at risk of infection gets the vaccines they need.[1]

All the countries we included in our analysis provide comprehensive recommendations which support immunization across a range of population groups at risk of infection. These countries have immunization schedules covering infants, children and older people, and most include recommendations for additional risk groups. For example, Brazil has a comprehensive immunization program which includes a tailored schedule for indigenous populations.[35] The US has a detailed immunization schedule for adults, which specifies vaccines according to age group and a range of medical conditions.[36] Australia has led the way in including adolescents in its immunization schedule by providing the HPV vaccine (*see case study 1*) for this group.[37]

Case study 1: Australia's advanced HPV vaccination program

Australia was the first country to introduce a comprehensive government-funded HPV program in 2007.[37] While it initially targeted adolescent girls, Australia expanded the program in 2013 to include boys, becoming the first country do so. The vaccine is usually administered in secondary school to girls and boys aged 12–13.[37]

This program been highly successful. In 2018, HPV vaccine coverage reached 80% of girls and 76% of boys at age 15.[38 39] This high level of coverage has led to a 77% reduction in prevalence of HPV strains that cause most cases of cervical cancer.[37] In 2018, it was announced that Australia was likely to become the first country to eradicate cervical cancer within 40 years.[39]

While a number of countries have implemented policies that support access to vaccines across the life course, there is a need to develop programs and policies that are consistent and sustainable. In the US, for example, Healthy People 2020 is a 10-year national agenda for population health, which includes objectives for immunization across the life course. However, the next iteration of this strategy, Healthy People 2030, is currently in development and the proposed objectives are less focused on life-course immunization and include a narrower range of vaccines, the majority of which are aimed at children.[40] In Japan, immunization policies have undergone various changes over

time, resulting in gaps in herd immunity and outbreaks of vaccine-preventable diseases such as rubella.[41,42]

Recommendations are evidence-based and reviewed regularly

Independent, evidence-based technical advice that is reviewed regularly is critical to ensuring appropriate and nationally relevant immunization recommendations across the life course. National Immunization Technical Advisory Groups (NITAGs) have been established in many countries to play this role, informing policy based on national health priorities, epidemiological data and economic analyses.[1]

All six countries included in this report have NITAGs that make recommendations on immunizations across the life course. In the US, the Advisory Committee on Immunization Practices (ACIP) comprises four permanent working groups and several temporary task-oriented work groups.[43] The ACIP evaluates new immunization programs using a prescriptive framework (GRADE) that takes into consideration clinical evidence, benefits and harms, health economic analysis and the likely acceptability of the program.[44] In Brazil, the Comite Tecnico Assessor em Imunização (Technical Advisory Committee on Immunization; CTAI) comprises immunization experts, members of professional societies and representatives from the Ministry of Health. In developing its recommendations, the CTAI considers a wide range of evidence, and it has been noted by an expert interviewed as part of this research that available supply is an important factor that influences whether a vaccine should be included on Brazil's National Immunization Program (NIP).[45]

Reliable vaccine supply chain in place

A strong supply chain is vital to ensure vaccines are available and accessible. This means that vaccine production must be reliable and that manufacturing, procurement, storage and distribution of vaccines should be based on robust monitoring and forecasting.[1]

Countries vary in their approaches to vaccine manufacturing and distribution. In Brazil, virtually all vaccines delivered across the life course are manufactured by national laboratories through technology transfer schemes,[46] and national shortages of vaccines are uncommon.[47] In contrast, Japan has recently experienced shortages of domestic vaccines[48] with experts pointing to gaps in local vaccine manufacturing capacity for a number of reasons, including reduced demand for vaccines among the population.[49] The UK has established a strong and reliable supply chain, which involves robust forecasting up to a year in advance and contracts with more than one manufacturer to avoid shortages.[50] General practitioners (GPs) order vaccines through a centralized system and delivery of the products is monitored by the Department of Health and Social Care.[50]

Immunization across the life course is prioritized and adequately resourced

Investment in immunization across the life course should be a policy priority. Given the benefits to individuals, public health and wider society, adequate funding of immunization programs is vital for promoting health equity and supporting health system sustainability.[1]

Many countries have chosen to prioritize immunization across the life course and have made significant investments to do so. All vaccines on the immunization schedules in Australia,[51] Brazil[52] and the UK[53] are reimbursed, which highlights the importance given to life-course immunization in these countries. On the other hand, in France, a co-payment is usually required for immunization and studies have found that people of lower socioeconomic status and those who do not have complementary health insurance are less likely to get certain vaccines.[54,55] Similarly, only selected vaccines are reimbursed in Japan and people may be required to pay for vaccines; this has been cited as the most common factor discouraging families from receiving voluntary vaccinations.[56]

The potential for benefits beyond health improvement are sometimes highlighted to drive policy change in support of life-course immunization. In the UK, for example, cost-effectiveness features heavily in the approach to evaluating new vaccines; the UK's NITAG, the Joint Committee on Vaccination and Immunisation (JCVI), states that vaccines must not only deliver health benefit but must deliver greater benefit than programs that would otherwise be funded if resources were not spent on the vaccination program.[57] In Japan, arguments related to population productivity, tourism and global image resonated well with policymakers and supported the implementation of a rubella catch-up program for men.[58]

Vaccines available for underserved communities

Dedicated programs may be required to make vaccines accessible to underserved or hard-to-reach communities. Target populations vary by context, but may include indigenous groups, migrants and geographically isolated people. Reaching these populations – who often have a greater burden of disease – is critical.[1]

Interesting approaches to providing immunizations for underserved groups have been trialled in some of the countries we assessed. In Brazil, high levels of vaccine coverage among indigenous communities have been achieved through a dedicated annual immunization campaign (*see case study 2*).[59] In Australia, a program of free catch-up vaccines for refugees and other humanitarian entrants was introduced in 2017 (*see case study 3*).[60]

Case study 2: Indigenous people's vaccination month in Brazil

The Brazilian government has been implementing the annual 'indigenous people's vaccination month' since 2012.[59] The campaign requires teams of healthcare workers to travel to indigenous communities with immunization supplies. While the priority groups are children, pregnant women and older people, the teams bring all the vaccines on the indigenous vaccination schedule and administer them as needed. It can be very difficult to get to some of these areas, particularly with immunization supplies and products that require refrigeration. Health teams have found ways of overcoming these barriers, including collaboration with the Ministry of Defense to transport supplies via helicopter.[61]

This strategy has been highly successful in improving access to immunization for hard-to-reach groups. The annual campaign has contributed to an increase in vaccination coverage of 30–40% among indigenous groups.[62] In 2019, reports estimated that nearly 700,000 people from indigenous communities would be reached by the campaign, requiring the involvement of around 3,500 healthcare professionals.[63]

Case study 3: Free catch-up vaccines for humanitarian entrants in Australia

Studies of newly arrived refugees to Australia have highlighted that many refugees are incompletely immunized.[64] To address this issue, Australia expanded its NIP in 2017 to make all refugees and humanitarian entrants eligible to receive free catch-up vaccinations.[60 65] The Commonwealth's guidance for vaccine providers recommends that refugees and other humanitarian entrants should have their vaccination status assessed before a catch-up plan is developed.[60] The objective of the catch-up plan should be to provide age-appropriate vaccination as soon as possible.[60 65]

3.2 Public demand for immunization

Public awareness campaigns encourage vaccine uptake across the life course

Awareness-raising campaigns represent opportunities to promote immunization across the life course. This involves educating individuals and communities about the importance and benefits of immunizations for all groups.[1] Increasing public confidence is necessary to reduce vaccine hesitancy and support vaccine acceptance.[15]

National and local health agencies, in the countries we studied, frequently implement public awareness campaigns targeted to specific groups. These include awareness-raising which accompanies annual influenza immunization campaigns for risk groups,[66] HPV vaccination campaigns for adolescents,[67] or hepatitis A vaccination campaigns targeted at men who have sex with men (MSM).[68] Different approaches to targeting specific groups have been used in the countries we assessed, including the use of a tailored campaign using manga characters to reach men in Japan (*see case study 4*)[69] and the use of the social media platform WhatsApp in Brazil to address 'fake news' (*see case study 5*).[70]

Case study 4: Rubella catch-up campaign for men in Japan

Japan experiences frequent outbreaks of rubella due to gaps in herd immunity and the spread of the disease was thought to be caused mainly by unvaccinated men.[41 42] In response, a government program has been initiated to offer free rubella vaccinations and antibody tests for men aged between 39 and 56 who have not yet received the vaccine.[42] The initiative involves distributing vouchers to eligible men, who are engaged via a communication campaign using manga characters from a series thought to resonate with the target population.[69]

This is an ongoing initiative and its impact has not yet been assessed, but the program aims to achieve herd immunity to rubella and thus significantly reduce the incidence of the disease within three years. The goals of the scheme are to achieve antibody positive rates greater than 90% coverage for the target cohort (94% for national population) by March 2022.[42]

Case study 5: Addressing 'fake news' through WhatsApp in Brazil

In Brazil, false information about vaccines is often shared on the social media platform WhatsApp, and as a result some people have been discouraged from getting the yellow fever vaccine.[71] In order to address the spread of 'fake news,' the Ministry of Health launched the 'Health Without Fake News' campaign in August 2018.[70] This service invites members of the public to send information they receive through social media to a dedicated WhatsApp account and ask whether the story is true or 'fake news'. The users receive an answer and the stories are also posted on the Ministry of Health's website with a comment about whether they are true.[72]

The system is very effective and can be used to fact-check any health-related story, but stories about vaccines are frequently received. It is reported that the Ministry of Health received 416 messages in the first month of the program, and the most common were related to vaccines.[73] This novel approach shows how governments can engage with the public to provide reliable information and promote immunization acceptance.

Active civil society organizations involved in vaccine promotion

Civil society organizations are valuable partners in promoting immunization across the life course. Patient organizations, professional societies and non-profit associations are well-positioned to advocate for immunization of target groups and engage in a range of activities to support vaccine uptake.[1]

The role of civil society in promoting vaccination across the life course varies by country. In some countries, vaccine-specific organizations such as the Immunisation Coalition in Australia[74] and the Sociedade Brasileira de Imunizações (Brazilian Society for Immunizations: SBIm) in Brazil[75] engage in a range of activities to promote vaccination. In the US, the Immunization Action Coalition (IAC) is a non-profit organization funded by the Centers for Disease Control and Prevention (CDC) that aims to improve vaccine coverage across the country.[76] The IAC partners with organizations and professional societies such as the Adult Vaccine Access Coalition, National Foundation for Infectious Diseases, and many others.[77] In Japan, cross-sectoral collaboration supported the establishment of travel clinics to improve access to travel vaccines (*see case study 6*).[78]

Case study 6: Increasing travel clinics in Japan

The Japanese Society of Travel and Health (JSTH) has been working to improve access to travel vaccinations. It has been delivering a project since 2011 to increase the number of travel clinics throughout Japan.[78] Between 2011 and 2018, 39 medical institutions were visited by the JSTH with the aim of facilitating the development of travel clinics.[78] By 2018, 26 of the 39 institutions had opened travel clinics and most of the remaining institutions were in the preparation stages of setting up a travel clinic.[78] Key drivers behind the project's success included an educational manual and training for healthcare professionals.[79] The JSTH also arranged for representatives of the medical institutions to visit experienced travel clinics to facilitate learning.[78]

This example shows how multidisciplinary collaboration including civil society organizations can promote immunization across the life course. By engaging and collaborating with medical institutions, the JSTH facilitated the establishment of dedicated clinics that will provide necessary immunizations for people who travel.

3.3 Engaged healthcare professionals

Healthcare professionals educated about the benefits of life-course immunization

Healthcare professionals (HCPs) are key to promoting immunization across the life course. Multiple studies have found that HCP recommendation or endorsement significantly influences vaccine uptake.[79-81] Therefore, it is important that HCPs understand the benefits of immunization across the life course – not just in childhood – and that they communicate this effectively with their patients.

Many countries have schemes to educate HCPs about the importance of vaccines beyond childhood and to keep them informed about changes in vaccine recommendations. Santé Publique France (Public Health France) has developed a website, vaccination-info-service.fr, to provide detailed information about immunization recommendations for all groups included in the immunization program, and there is a 'professionals' area of the website targeted at HCPs.[82] MesVaccins.net is another digital resource in France that helps professionals give correct and consistent advice about vaccines.[83 84] In the UK, a 'super-partnership' of GPs initiated a program to increase pertussis vaccination in pregnant women (*see case study 7*)[85] and in the US, the 4 Pillars program offers a suite of resources to support adult immunization in primary care (*see case study 8*).[86] However, a program that aimed to educate staff in a sexual health clinic in the UK was not successful in increasing hepatitis B vaccine uptake, primarily due to service reconfiguration challenges at the time (*see case study 9*).[87]

Case study 7: Improving pertussis vaccination rates of pregnant women through data sharing in the UK

While the pertussis vaccine is recommended and available to all pregnant women,[88] [89] coverage has not always been high.[90] In response to the death of two babies from pertussis, a GP organization called Modality, operating across the Midlands region of England, implemented a data-sharing initiative to increase pertussis vaccination in pregnancy. Practices in the Modality network share a dashboard that incorporates key clinical data. To identify pregnant women within the network who required the vaccine, a set of bespoke searches was developed and run weekly.[85] Women identified by the search were then contacted and invited for vaccination.

This initiative resulted in an increase in pertussis vaccination of pregnant women within the Modality network. The coverage rate rose from 63% to 73%,[85] highlighting the important role HCPs can play in promoting immunization across the life course. This initiative also demonstrates the value of interrogating routine data to identify individuals in need of vaccination.

Case study 8: The 4 Pillars Practice Transformation Program in the US

The 4 Pillars Practice Transformation Program is an evidence-based guide which aims to increase adult immunization in primary care settings.[86] The four pillars that make up the program are convenient vaccination services, communication with patients, enhanced office systems and motivation through an office Immunization Champion.[86] Practices can choose which strategies to implement, but they must select at least one from each pillar.[91]

A cluster randomized controlled trial showed that the program was effective.[86] Over the course of the trial, practices that were implementing the program had a significant increase in adult Tdap (tetanus, diphtheria, pertussis) immunizations of 12.7% and pneumococcal polysaccharide vaccination rates increased by 6.9%.[86] Every practice selected an Immunization Champion who worked with the research team to identify effective strategies and facilitate their implementation.[86 92] However, influenza vaccine was not significantly increased.[93] It was suggested that the involvement of Immunization Champions was a key determinant of intervention effectiveness.[91 92]

The success of this program shows the value of implementing holistic and flexible interventions in primary care services. In addition, having a designated member of staff who coordinates efforts to promote the program can contribute to greater staff motivation around vaccination and lead to increased vaccine uptake.

Case study 9: Improving uptake of hepatitis B vaccination in at-risk groups attending a sexual health service in the UK

Monitoring of electronic patient records in a sexual health clinic showed that the clinic was underperforming in all performance indicators for hepatitis B screening and immunization in high-risk groups.[87] In response, the clinic began a project in 2015 to improve uptake of vaccination among MSM, injecting venous drug users, commercial sex workers and people who change partners frequently.[87] The project found that reasons for low vaccine uptake included medical staff having low understanding of the importance of vaccination for these groups, and therefore not always offering opportunistic vaccination.[87]

Staff awareness was improved through a rolling education program which provided nurses with training tailored to their role.[87] Despite this, rates of hepatitis vaccination did not increase. The main barrier identified was a reconfiguration of services that was taking place at the time. While services were reconfigured and staff moved into new roles, the Sexual Health Department did not want to implement further changes, limiting the scope of innovations that could be introduced.[94] However, the service has now been transformed to a prevention-based model, which includes closer working with community pharmacists. As part of their role, the pharmacists can deliver hepatitis B vaccination to at-risk patients with the aim of increasing uptake.[95] Contextual factors should be carefully considered before implementing programs that require engagement of HCPs or changes in health service delivery.

Healthcare professionals supported to be vaccinated

It is important that HCPs keep their own immunization records up to date. Depending on their role, HCPs can be exposed to a wide range of vaccine-preventable diseases, so they should be vaccinated for their own protection. In addition, HCPs are regularly in contact with members of the public, many of whom may be vulnerable to disease or may not be able to be vaccinated themselves. By getting vaccinated, HCPs can protect the public and avoid spreading disease to their patients.[28]

Policies that support HCP immunization play an important part in increasing vaccine coverage in this group. In France, for example, selected vaccines are mandatory for all healthcare workers, including medical students.[82] Two surveys conducted in 2009 showed that vaccine coverage among healthcare workers in France was above 90% for the mandatory vaccines, but very low for the recommended vaccines.[96] In the US, some healthcare facilities have initiated mandatory influenza vaccination for HCPs and a 2018 survey found coverage was highest among those who were required by their employers to be vaccinated (94.8%) and lowest in settings where vaccination was not required, promoted or offered on site (47.6%).[97] In Australia, providers of residential aged care are now required to provide the influenza vaccine to all care staff and volunteers (*see case study 10*).[98]

Case study 10: Mandatory influenza vaccination program for residential aged care providers in Australia

In 2018, the Australian Government introduced an innovative policy requiring all government-subsidized providers of residential aged care to facilitate the annual influenza vaccine for all staff and volunteers. The vaccine must be provided for free and its benefits must be actively promoted.[99]

This scheme was primarily introduced in response to an increase in influenza in 2017, with people aged 65 and older accounting for over 90% of notified flu-related deaths.[98] A national survey of all care homes in Australia found that while most services had an infection control and vaccination policy in place, only 3.5% met the target of 95% vaccination coverage of their staff,[98] and 43% had experienced an influenza outbreak during the 2017 influenza season.[100] This policy aims to assist providers in reaching national vaccine coverage targets, but data on its impact are not yet available.

There is a clear need to monitor vaccination programs in target populations such as HCPs. While most residential aged care services had a vaccination program in place, very few facilities were reaching national coverage targets[98] and insufficient numbers of HCPs were getting the influenza vaccine. Ongoing data collection and monitoring are necessary to assess whether the new policy will result in vaccine coverage that meets national guidelines, and whether this measure can prevent influenza outbreaks in residential care services.

3.4 Multidisciplinary and cross-sectoral coordination

Immunization integrated into healthy living and healthy ageing policies

Taking a life-course approach to immunization can be effective when it is positioned as part of a wider ambition to improve health across the life course and increase healthy life expectancy. With the proportion of people aged over 65 increasing around the world, it is becoming more important to promote healthy ageing.[32]

Some countries' national health and ageing policies recognize immunization as an important strategy to achieve their aims. In the US, for example, immunization of target groups across the life course is included in Healthy People 2020, the 10-year agenda for improving public health,[101 102] indicating a commitment to immunization as part of a wider commitment to health improvement. In Brazil, the national health policy for older people highlights the importance of vaccination according to the national immunization program, which currently includes five different vaccines.[35 103] In the UK, the National Health Service (NHS) and charity Age UK have jointly produced a *Practical guide to healthy ageing* to help improve the health of people of any age, but with a focus on people aged 70 and over.[104] The guide mentions vaccinations as part of a holistic approach to healthy living, which also includes a healthy diet and exercise.

Collaboration with other sectors supports vaccine delivery in non-clinical settings

Establishing convenient access to immunization is critical for improving uptake. Indeed, convenience has been identified as a key factor influencing vaccine hesitancy, and encompasses such factors as physical availability, affordability, accessibility, and the time and place of delivery.[15]

In all the countries we assessed, convenient access to immunization has been enhanced through delivery in non-clinical settings such as pharmacies. In France, inequalities in access to healthcare are well-documented.[105] This is due, in part, to the unequal distribution of primary care physicians across the country, with most doctors choosing to establish practices in cities and more affluent areas.[105] As a result, many vulnerable people had limited access to the annual influenza vaccine until new legislation allowed trained pharmacists to administer the vaccine in 2017 (*see case study 11*).[106] In the UK, pharmacists were identified as best placed to deliver an influenza vaccination campaign targeting unpaid carers (*see case study 12*).[107 108]

Case study 11: Influenza immunization in pharmacies in France

In 2017, an influenza vaccination program in pharmacies was introduced in selected Agences Régionales de Santé (Regional Health Agencies; ARSs) to increase vaccine coverage. Through this program, pharmacists who attended specific training were permitted to administer the influenza vaccine at no cost to target groups.[109] This was implemented on a three-year experimental basis[110] and included four regions: Nouvelle-Aquitaine, Auvergne-Rhône-Alpes, Hauts-de-France and Occitanie.[111]

After two years, vaccination in pharmacies was deemed to be successful and the pilot was ended. It was reported that more than 743,554 people got the influenza vaccine in the experimental regions during the pilot, 23.5% of whom were getting the vaccine for the first time.[112] This program has now been rolled out nationwide.[112 113] In support of this new policy, vaccination training became compulsory for all pharmacy students.[114]

The success of this intervention demonstrates the potential of engaging pharmacists in the delivery of immunizations. A large proportion of pharmacists became vaccinators, showing that there is interest from pharmacists in offering this service. In addition, a considerable number of people got the vaccine for the first time,[112] showing that the intervention reaches people who were not previously getting the annual influenza vaccine.

Case study 12: Reaching Carers influenza vaccination campaign in the UK

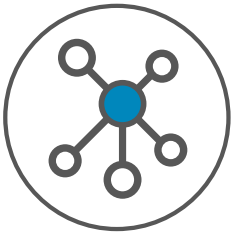
The Reaching Carers influenza vaccination campaign was implemented to reach unpaid carers, to prevent them from becoming ill and passing infections on to the vulnerable people they care for.[108] Unpaid carers are a hard-to-reach group who do not always identify as carers and may not be considered carers in a formal capacity, making outreach difficult.[115] Formative research found that community pharmacists were best placed to identify unpaid carers and deliver the intervention.[108]

The campaign was delivered during the 2015/16 and 2016/17 influenza seasons, primarily at community pharmacies in the London region.[107 115] A comprehensive range of resources and activities were developed to support pharmacists in delivering this intervention, including workshops, an online training tool and a flowchart outlining a '60-second chat' to have with those who could be considered as carers.[115] Computer system prompts and 'quick look' materials reminded community pharmacists to begin these conversations with customers and highlighted 'triggers' which should alert pharmacists to potential carers.[108]

This initiative resulted in increased influenza vaccine coverage among targeted carers. The number of carers vaccinated increased by 61% from 5,765 in 2015/16 to 9,262 in 2016/17.[107] The success of this campaign shows that community pharmacists are often best placed to increase vaccination uptake among hard-to-reach groups due to their role in the community and the regular contact that they have with members of the public.

In-school immunization programs have also been introduced in some countries to increase vaccine coverage among children and adolescents. There are successful school-based immunization programs in both Australia[116] and the UK,[117] which have resulted in high vaccine coverage among adolescents. In Brazil, the Ministries of Health and Education announced a collaborative campaign in 2017 to deliver the HPV vaccine in schools.[118] The program was very effective and resulted in high vaccine coverage, but has since been terminated and vaccines are no longer delivered in schools.[45] These examples point to the importance of engaging stakeholders in multiple sectors in order to improve access to vaccines for target groups.

3.5 Robust data informing policies and programs



Immunization coverage targets cover the life course

Coverage targets should be defined for vaccines in all groups across the life course. By establishing set targets, NITAGs and other key organizations can evaluate immunization program effectiveness and determine whether new initiatives are required.[119]

Some countries have set targets for all immunizations across the life course and use these targets to evaluate the success of immunization programs. The US has established clear targets for each vaccine on the national immunization schedule as part of Healthy People 2020.[101] These targets are used to inform immunization strategy and guide program objectives for target populations.[101] Brazil has also published targets for all immunizations and assesses vaccine coverage against these targets.[120] In Australia, the 'National Partnership on Essential Vaccines' agreement between the Commonwealth and the states and territories contains four coverage benchmarks to improve vaccine coverage, achievement of which makes local governments eligible for reward payments.[121] A performance report from 2017 found that all state and territory governments had met the four benchmarks.[122] Although the current benchmarks are limited to childhood vaccines, this points to the potential for the use of financial incentives to reach immunization targets.

Electronic databases collect and share immunization and infectious disease data

The use of timely and accurate data on vaccine uptake across the life course has the potential to support targeted programmatic changes. Immunization information systems (IISs) are databases that record all immunizations given to individuals in a population. By providing population-level data, IISs help determine how immunization programs are performing and can inform changes to improve vaccine coverage.[123]

Australia is the only country we assessed which collects comprehensive vaccine uptake data across the life course. The Australian Childhood Immunisation Register (ACIR) was expanded in 2017 to include people of all ages and is now the Australian Immunisation Register (AIR).[124] This is a relatively recent change and its impact has not yet been reported. In the US, access to, and use of, comprehensive vaccination data are limited because there is not yet a system in place for sharing patient data across state lines, although a government pilot is currently trying to address this issue by facilitating the development of a national IIS network.[125] In Brazil, the Sistema de Informações do Programa Nacional de Imunizações (Information System of the National Immunization Program; SI-PNI) is designed to collect immunization data on all citizens,[126] but there are many barriers to its consistent use.[127] In France, several sources are used for assessing vaccine coverage in the population, including health records, vaccine sales data and various surveys, but this system has been reported to be insufficient for developing responsive immunization policies.[128] In the UK, national IISs exist, but they only collect information on immunization during childhood and adolescence.[129]

Policymakers must use up-to-date infectious disease surveillance data to ensure they make timely and responsive changes to immunization strategies across the life course. By monitoring the incidence of vaccine-preventable diseases, governments can implement emergency vaccination initiatives, targeted campaigns or changes to immunization programs.[1]

Countries often use disease surveillance data to respond to outbreaks with new or intensified immunization campaigns. In Japan, for example, frequent outbreaks of rubella are thought to have resulted from gaps in vaccine coverage in previous decades. Identification of these outbreaks has led to the establishment of a catch-up vaccination program for men.[69] In the UK, an increase in meningitis W was reported by Public Health England (PHE), leading to the implementation of an immunization campaign targeting adolescents (*see case study 13*).[13]

Case study 13: Increasing herd protection against meningococcal disease by vaccinating adolescents in the UK

In 2015, PHE reported a steady increase in incidence of meningococcal capsular group W (MenW) across the whole population in England.[130] In response, the JCVI recommended implementing a MenACWY immunization program for adolescents as they are known to be the main carriers of the bacteria.[21] Targeting this group was projected to be a cost-effective way of protecting the whole population through herd immunity.[130] Strategies included a GP-based catch-up campaign,[131 132] offering the MenACWY vaccine in schools in place of the routine MenC vaccine,[130] and a university-based immunization program targeting first-year students.[131]

Immunization of adolescents has been successful in stopping the rise in MenW incidence, although it is still too early to know whether herd protection has been achieved.[131] The school-based approach has been particularly effective, with coverage reaching 85.4% in the 2017/18 academic year.[133]

A timely response to increasing rates of MenW was made possible by comprehensive monitoring of vaccine-preventable diseases and strong data on vaccine uptake among adolescents. By using surveillance data, the JCVI was able to make informed recommendations for changes to the national immunization schedule. In addition, the targeted immunization programs implemented were cost-effective and have stopped the increase in MenW infections.[21 130]

Immunization data available to individuals and HCPs

Systems that give HCPs and individuals access to immunization data can support increased coverage. HCPs can use immunization data to identify gaps and give people advice about which vaccines they need. Some systems assess individuals' immunization status and make tailored recommendations, which can help to inform both the public and HCPs about vaccine recommendations.[123] It has also been suggested that empowering individuals to assess which vaccines they need can encourage uptake.[123 134]

Australia is the only country identified in this report that has a comprehensive national database, the AIR, that can be accessed by individuals and HCPs. HCPs can use the AIR platform to generate various reports to identify whether their patients are due or overdue for any recommended vaccines.[135] While the other countries we reviewed do not yet have national programs that support data monitoring on an individual level, some interesting interventions have been implemented on a smaller scale. In France, for example, MesVaccins.net provides detailed immunization information to individuals and HCPs, supporting both education and increased uptake (*see case study 14*).[134] In the US, a similar program called MyIR was trialled in several states (*see case study 15*).[136]

Case study 14: Introduction of an electronic immunization record in France

MesVaccins.net is a web- and smartphone-based electronic vaccination record that stores individuals' vaccine records and makes personalized recommendations based on an individual's age and risk profile.[84] Created by an independent organization, the initiative provides individuals and HCPs with access to dashboards which contain personalized immunization recommendations based on the national immunization schedule. This service helps to support vaccine uptake by empowering individuals to take ownership of their immunizations and supports HCPs to give correct and consistent advice.[134]

There are currently 700,000 immunization records created in MesVaccins, so the data are limited. However, an expert linked to the initiative has commented that with additional funding and national coverage, the data could allow policymakers to monitor vaccine coverage across the life course in all risk groups.[134]

Case study 15: MyIR pilot project in the US

MyIR is an immunization-specific portal which aims to increase vaccine uptake by providing free, on-demand access to official immunization records, immunization history and forecasting schedules from each state's IIS.[136] MyIR was launched in 2013 in Alaska, Arizona, Louisiana, Washington and West Virginia.[136] Before the development of this platform, people could not easily access their own immunization records, making it difficult for people to show proof of immunization when required.[137]

Regular evaluation of the project has helped to ensure that the pilot is adapted to improve registration rates. Evaluation is done through weekly registration metrics, online consumer surveys and key stakeholder interviews.[136] Evaluations in the first two years showed that requiring HCPs to authenticate accounts was a significant barrier to registration. This was addressed by introducing an online authentication system, leading to a 125% increase in the number of authenticated accounts.[136]

Data suggest that MyIR has empowered people to take action, resulting in increased vaccine uptake. A survey of registered users found that 28% of respondents learned that they needed a vaccine through using the system and 41% of these contacted their healthcare provider to schedule an appointment.[136] Two states, Louisiana and Washington, are still involved and, by the fifth year of the project, 34,000 individuals had activated MyIR accounts across these two states.[136]

4
Conclusion

This report presents a unique policy framework which can be used by stakeholders looking to expand access to immunization beyond childhood. This framework is based on the lessons we have consolidated from six countries that have taken steps to implement components of a life-course approach to immunization. Fifteen case studies drawn from these six countries provide examples of good practice that can be emulated as other countries seek to increase vaccine coverage across the life course.

It is critical that efforts to implement such programmes are maintained and built upon in the long term to fully realize the benefits of immunization to global public health, healthcare systems and national economies. All of the countries we assessed are implementing different components of the life-course approach to varying degrees, but few are yet doing so in a comprehensive way (*see table below and Annex 1*). Furthermore, there are signs in the US, for example, that gains achieved thus far cannot be guaranteed in the long term, with upcoming policy changes having the potential to narrow the scope of immunization programs. In addition, many of the case studies we identified are small and short-term in nature. However, all point to the potential for successfully improving immunization access among target groups.

Greater investment in immunization data across the life course is vital to support improvements in all other policy areas. Gaps in data are common and a clear understanding of the impact of the different policy initiatives on immunization uptake is not always possible. It is for this reason that the need for robust data sits at the centre of our policy framework.

We call on all stakeholders to consider the policy changes needed to improve population health and promote health system sustainability through increasing vaccination coverage across the life course. Once implemented, it is critical that efforts to prioritize and implement life-course immunization programs are sustained in the long term. As 'the decade of vaccines' comes to an end, the need to implement effective life-course immunization strategies remains – and must continue to be – a policy priority. Policymakers and other key stakeholders at all levels should view immunization across the life course as an indispensable public health measure and prioritize ongoing investment in comprehensive vaccination programs.

Progress of included countries against the policy checklist

		Aus	Bra	Fra	Jpn	UK	US
Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●	●	●	●	●	●
	Recommendations are evidence-based and reviewed regularly	●	●	●	●	●	●
	Reliable vaccine supply chain in place	●	●	●	●	●	●
	Immunization across the life course prioritized and adequately resourced	●	●	●	●	●	●
	Vaccines available for underserved communities	●	●	○	●	●	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●	●	●	●	●	●
	Active civil society organizations involved in vaccine promotion	●	●	●	●	●	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●	●	●	●	●	●
	Healthcare professionals supported to be vaccinated	●	●	●	●	●	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●	●	●	●	●	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●	●	●	●	●	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●	●	●	○	●	●
	Electronic databases collect and share immunization and infectious disease data	●	●	●	●	●	●
	Immunization data available to individuals and healthcare professionals	●	●	●	●	●	●

● Well developed ● In development ● Not yet developed ○ No data found

Annex:
Country summaries

Australia

Policy checklist

Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

Australia is a world leader in vaccination policy across the life course. Australia has a comprehensive NIP[138] and is now monitoring vaccine coverage in all groups using a national IIS.[124] A range of programs have been implemented to increase vaccine coverage and improve population health, including school-based immunization[116] and policies to promote influenza vaccination in residential aged care.[98]

Comprehensive immunization program that supports vaccine availability

Australia has a comprehensive NIP[138] which covers the life course and includes infants, young children, teenagers, older people, and people of all ages who are at greater risk of harm from certain diseases, such as pregnant women and people with chronic conditions.[51] In 2013, the world's first national HPV immunization program for adolescent boys was added to the NIP.[37]

Case study: Australia's advanced HPV vaccination program

Summary: Australia's HPV vaccination program was launched in 2007 following extensive consultation with experts.[37] The program targeted girls when it was first introduced, but was extended to include boys in 2013.[37] The vaccine is provided free of charge to boys and girls under 20 years old and is usually administered in schools to adolescents aged 12–13.[37]

Impact: This vaccination program has been successful in promoting vaccine uptake and reducing HPV prevalence. Nearly all secondary schools across the country have chosen to participate in the program,[139] resulting in high vaccine coverage. In 2018, HPV vaccine coverage reached 80% of girls[38] and 76% of boys at age 15.[39 140] This high level of coverage has led to a 77% reduction in prevalence of HPV strains that cause most cases of cervical cancer.[37] In 2018, it was announced that Australia was likely to become the first country to eradicate cervical cancer within 40 years.[39]

Lessons: It is clear from this example that introduction of new vaccination programs which target groups beyond childhood can lead to significant improvements in population health. Informed by evidence and expert opinion, Australia's government implemented a pioneering program that is set to eradicate HPV, which is the main cause of cervical cancer.[37] Furthermore, by fostering cross-sectoral collaboration and administering the vaccine in schools, high levels of vaccine coverage have been achieved.

Australia's vaccination schedule is reviewed and revised by the Australian Technical Advisory Group on Immunisation (ATAGI),[141] while strategic direction is provided by the 'National Immunisation Strategy for Australia 2013–2018'.[142] State and territory health departments also have local schedules which can include additional funded vaccines.[143]

While Australia has achieved high immunization rates for children,[144] and relatively high rates of full immunization among adolescents for HPV,[144] efforts to reach adult groups have been less effective. Only 51% of Australians aged 65 and over received the funded pneumococcal and annual influenza vaccines when last measured (2009).[145]

The Commonwealth has taken over responsibility for purchasing all essential vaccines on behalf of the states and territories under the National Procurement of Essential Vaccines (NPEV) strategy. The strategy aims to secure the continual supply of essential vaccines in Australia.[142] Under the strategy, the states/territories have agreed to ensure vaccination services are delivered cost-effectively, including the minimization of wastage and unauthorized use of vaccines, in return for reward payments.[142] States/territories have responsibility for providing the Commonwealth with forecasts of required volumes of essential vaccines in order to assist with the national procurement and supply of vaccines under the NIP.[121]

A range of policy initiatives is helping to increase the availability of vaccination across the life course. All vaccines included in the NIP are reimbursed, including those for adults and adolescents.[142] All government-subsidized providers of residential aged care are required to have in place an influenza vaccination program which provides staff and volunteers with access to free annual influenza vaccination.[98] Another national program provides free vaccines for all refugees and other humanitarian entrants to Australia.[60]

Case study: Expansion of free catch-up vaccines to refugees and other humanitarian entrants

Summary: Studies of newly arrived refugees to Australia have highlighted that many refugees are not fully immunized.[64] To address this issue, Australia expanded its NIP in 2017 to make all refugees and humanitarian entrants eligible to receive free catch-up vaccinations.[60 65]

Anticipated impact: This program aims to immunize refugees and other humanitarian entrants with all vaccines on the NIP. The Commonwealth's guidance for vaccine providers recommends that refugees and other humanitarian entrants should have their vaccination status assessed before a catch-up plan is developed.[60] The objective of the catch-up plan should be to provide age-appropriate vaccination as soon as possible.[60 65]

Lessons: While catch-up vaccines are not generally provided to those aged 20 years and older on the NIP, refugees were identified as a target group with unique requirements. By reviewing available evidence, policymakers made a change to the immunization program that makes vaccines available to this group, highlighting Australia's commitment to life-course immunization.

Public demand for immunization

The benefits of immunization are promoted through awareness-raising campaigns and resources by non-governmental organizations (NGOs),[74 146] researchers, HCPs and patient organizations. A national NGO called the Immunisation Coalition is focused on whole-of-life vaccination in Australia,[74] conducting a range of advocacy activities and running an annual Adult Immunisation Forum.[146]

Engaged healthcare professionals

Ensuring an adequately skilled workforce through promoting effective training for vaccination providers is the seventh strategic priority area of the 'National Immunisation Strategy for Australia 2013–2018'.[142] The ATAGI has developed the *Australian Immunisation Handbook*, which provides clinical advice for HCPs on the safest and most effective use of vaccines across the life course.[147] Individual states/territories have also developed educational programs that address adult vaccination and are a prerequisite for HCPs undertaking programs of study to be authorized vaccination providers.[116]

Immunization requirements for HCPs vary by state or territory.[148] For example, Queensland Health has designated certain roles as 'Vaccination Preventable Disease risk roles' where applicants must be able to provide evidence that they have been vaccinated against the diseases listed in the role description.[149] All healthcare workers across the country are recommended to receive routine vaccinations as well as vaccines against hepatitis and seasonal influenza, but influenza vaccine coverage has historically been very low.[150] All Australian Government-subsidized providers of residential aged

care are required to have an influenza vaccination program in place which provides staff and volunteers with access to free annual influenza vaccination.[98]

Case study: Mandatory influenza vaccination program for residential aged care providers

Summary: In 2018, the Australian Government introduced a policy which requires that all government-subsidized providers of residential aged care have in place a program to provide staff and volunteers with access to free annual influenza vaccination.[98] The vaccine can either be offered directly, for example on site, or indirectly, by facilitating access to a vaccine at a local pharmacy or general practice. Residential aged care providers are also required to actively promote the benefits of an annual vaccination, both for the health of their staff and volunteers, and for the health of the older people receiving residential care.[99] Providers must also record the number of staff who receive the vaccination each year.[98]

This scheme was primarily introduced in response to an increase in influenza in 2017, with people aged 65 and older accounting for over 90% of notified flu-related deaths.[98] The Minister for Aged Care ordered the Australian Aged Care Quality Agency to conduct reviews at two aged care homes where 18 people had died during the 2017 influenza season.[100] The review found that less than half of the staff had been vaccinated, and led to a national survey of Australia's 2,609 care homes.[100] The national survey then found that, while most services had an infection control and vaccination policy in place, only 3.5% met the target of 95% vaccination coverage of their staff,[98] and 43% had experienced an influenza outbreak during the 2017 influenza season.[100]

Anticipated impact: This policy aims to assist providers in reaching national vaccine coverage targets. The Communicable Diseases Network Australia has established targets of 95% coverage in both staff and residents.[98] However, the policy was introduced in May 2018 so data on its impact on vaccine coverage or incidence of influenza are not yet available.

Lessons: There is a clear need to monitor vaccination programs in target populations such as aged care providers. While most residential aged care services had a vaccination program in place, a national survey found that very few facilities were reaching national coverage targets[98] and insufficient numbers of staff were getting the influenza vaccine. Ongoing data collection and monitoring are necessary to assess whether the new policy will result in vaccine coverage that meets national guidelines, and whether this measure can prevent influenza outbreaks in residential care services.

Multidisciplinary and cross-sectoral coordination

Civil society organizations are engaged in the promotion of specific aspects of vaccination across the life course. The Immunisation Coalition in Australia is a not-for-profit organization that collaborates with a range of stakeholders to promote vaccination at all ages.[74] Professional societies are also engaged in promoting vaccination across the life course. The Lung Foundation Australia, for example, joined with researchers, HCPs and patients during Pneumonia Awareness Week to highlight the benefits of pneumonia vaccination for older people, to address the declining vaccination rates in this group.[151]

Policies are in place to allow for immunization in non-clinical settings such as schools and pharmacies. Immunizations provided in schools include HPV, diphtheria, tetanus and meningococcal ACWY.[116] Evaluation of the HPV vaccination program shows that immunization in schools is very effective and leads to high levels of vaccine coverage.[39] Policies have been introduced in all states and territories to allow trained community pharmacists to administer vaccinations, but the range of vaccinations and the allowable age of patients varies from one jurisdiction to another.[152] Victoria is the only state that allows pharmacists to administer government-funded vaccines through the NIP for high-risk groups such as older adults.[152]

Robust data informing policies and programs

A national IIS exists in the form of the Australian Immunisation Register (AIR), which records vaccines given to people across the life course.[124] The AIR was created in September 2016 through the expansion of the Australian Childhood Immunisation Register (ACIR), and only includes vaccines given since the start of the ACIR (1996).[124] Issues have been highlighted, however, concerning the proper reporting of vaccinations by HCPs.[153]

Australia has a well-established and comprehensive surveillance system for monitoring vaccine-preventable diseases, including a national sero-surveillance program[154] and a national notifiable diseases surveillance system.[155]

Brazil

Policy checklist

Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

Brazil's implementation of a life-course approach to immunization is part of a wider ambition to ensure healthcare for all citizens. Brazil has a comprehensive NIP which covers the life course,[35] and there is a dedicated immunization schedule for indigenous populations.[35] Immunization in Brazil is a public health priority, with programs established to extend immunization to hard-to-reach communities.[59] There are, however, some challenges including variation in health services between regions and difficulties in establishing a national IIS.[127]

Comprehensive immunization program that supports vaccine availability

Brazil has a comprehensive immunization schedule which covers the life course. As part of the Sistema Único de Saúde (Health System; SUS), Brazil's NIP provides 45 different vaccines for infants, children, adults, pregnant women and older people.[35] Indigenous populations are also covered by the NIP, with a separate immunization schedule targeted at this group.

Brazil's immunization strategy also aims to meet the needs of people for whom the national calendar is not suitable – usually those who are immunocompromised.[156] Each of the 26 states has at least one Centro de Referência de Imunobiológicos Especias (Reference Center for Specialized Immunobiologicals; CRIE).[156] In these centres, people are given vaccines and immunoglobulins according to their specific needs. These specialized centres are valuable in that they provide targeted vaccines that are not on the NIP to specific risk groups, although the need for more CRIEs across the country has been pointed out as they can be difficult for many people to access.[45]

Brazil's immunization schedule is informed by the recommendations of independent experts, based on the latest evidence. The Comite Tecnico Assessor em Imunização (Technical Advisory Committee on Immunization; CTAI), established in 1991, advises the Ministry of Health on the NIP.[157] The CTAI meets biannually and comprises immunization experts, members of professional societies and representatives from the Ministry of Health. In developing its recommendations, the CTAI considers immunization programs in other countries, epidemiological data, cost-effectiveness data and other clinical data on safety and effectiveness.[45] It has been noted that available supply is also an important factor that influences whether a vaccine can be provided on the NIP, given the country's large population.[45]

Brazil's vaccine supply chain is heavily supported by the government and shortages are uncommon, although gaps in availability at the local level have been noted. Almost all (96%) of Brazil's vaccines are produced by public pharmaceutical laboratories,[46 158 159] through technology transfer schemes, meaning Brazil is largely self-sufficient with regard to vaccine production.[47] It has been reported, however, that vaccination clinics at the local level do not always have an adequate supply of vaccines.[160] The cold chain for transporting vaccines from national laboratories to local communities is generally effective, but there are some local vulnerabilities that the Ministry of Health aims to address.[161] In addition, the decentralized nature of the Brazilian health system means that local variation in access to immunization services can vary considerably across the country.[162]

The Brazilian government has mandated that all vaccines on the NIP, including those delivered beyond childhood, are provided free at the point of access. While a wider range of vaccines can be accessed in private clinics, the vast majority of the population are immunized through the NIP.[45] Vaccines are usually provided through the Family Health Strategy in clinics called vaccine rooms, which are the responsibility of local municipal governments.[160 163] One study in the region of Minas Gerais identified a number of barriers to accessing vaccines in vaccine rooms including lack of available vaccines, geographical distribution of vaccine rooms, cultural beliefs and economic barriers.[160] An expert commentator also highlighted that vaccine rooms are only open during working hours, meaning that working adults would have to take time off work to get vaccinated or to get their children vaccinated, which is often not possible.[45]

Brazil faces a number of challenges in making vaccines available to all groups across the country. An immunization expert in Brazil noted that the large and widespread population, many of whom live in very remote areas that cannot easily be accessed, makes it difficult to operate an NIP.[45] There are communities that can only be reached via rivers, and many of these are not able to access any vaccines.[45] However, there are some programs in place to access hard-to-reach groups such as indigenous populations.[59]

Case study: Indigenous people's vaccination month

Summary: Vaccination of indigenous groups in Brazil is challenging but has been identified as an important means of improving their health and reducing inequalities. In 2012, the month of vaccination of indigenous people was started in April, linked to the annual vaccination week in the Americas.[59] This is now an annual campaign that runs in April or May, requiring teams of health workers to travel to indigenous communities with immunization supplies. While the priority groups are children, pregnant women and older people, the teams bring all the vaccines on the indigenous vaccination schedule and administer them as needed. It can be very difficult to get to some of these areas, particularly with immunization supplies and products that require refrigeration. Health teams have found ways of overcoming these barriers, including collaboration with the Ministry of Defense to transport supplies via helicopter.[61]

Impact: This strategy has been highly successful in improving access to immunization for hard-to-reach groups. The annual immunization campaign has contributed to an increase in vaccination coverage of 30–40% among indigenous groups.[62] In 2019, it was reported that the program aimed to update vaccination schedules of nearly 700,000 indigenous people, an effort which required the involvement of around 3,500 healthcare professionals.[63]

Lessons: The annual implementation of indigenous people's vaccination month demonstrates Brazil's commitment to immunization across the life course. By targeting these marginalized communities and providing vaccines for all those who need them, the campaign makes immunization accessible to people of all ages within a hard-to-reach group that has specific immunization requirements.

Public demand for immunization

The Ministry of Health is dedicated to promoting immunization at all stages of life.[45 164] In response to recent increases in vaccine hesitancy and 'fake news,' it has implemented a novel WhatsApp campaign to give the public accurate information.[70] In addition to the WhatsApp program, 'fake news' is being addressed by immunization experts who regularly appear on television to provide correct information or monitor social media sites and respond to false information as quickly as possible.[45]

Case study: Addressing 'fake news' through WhatsApp

Summary: Vaccine hesitancy is increasing in Brazil, largely driven by untrue stories about vaccine safety being shared on social media.[45] These messages are often circulated via WhatsApp, and have recently discouraged some people from getting the yellow fever vaccine.[71] In order to address the spread of 'fake news,' the Ministry of Health launched the 'Health Without Fake News' campaign in August 2018.[70] This service invites members of the public to send information they receive through social media to a dedicated WhatsApp

account and ask whether the story is true or 'fake news'. The users receive an answer and the stories are also posted on the Ministry of Health website with a comment about whether they are true.[72]

Impact: The system can be used to fact-check any health-related story, and stories about vaccines are frequently received. It is reported that the Ministry of Health received 416 messages in the first month of the program, and the most common were related to vaccines.[73] The Ministry of Health is very active and responsive to public queries, with new stories frequently appearing on the website;[45] however, the program is very recent and evaluations of its impact have not been published.

Lessons: Using a social media platform to directly address misconceptions about vaccines is a unique way of promoting vaccine acceptance. Public engagement with this program reflects trust in the government to provide reliable information and shows that official organizations are well placed to implement public awareness campaigns.

Brazil is supported by a non-profit organization which works to promote immunization across the life course. Sociedade Brasileira de Imunizações (Brazilian Society for Immunizations: SBIm) aims to promote vaccines and develops immunization calendars and other materials.[75] It has published reports, promotional materials and a website (familia.sbim.org.br) that promote the benefits of immunization across the life course.[165] SBIm is a non-governmental organization and its recommendations are not bound by the same financial or supply constraints as the NIP, so its recommendations may be used to guide specialist clinicians and members of the public who choose to pay for additional immunizations that are not included on the NIP.[45]

Engaged healthcare professionals

Education for HCPs about immunization across the life course is limited in Brazil. An expert commentator stated that detailed immunization education is largely limited to paediatricians, while other HCPs – including infectious disease specialists – receive very little immunization training.[45] However, there is a program of professional development for HCPs in Brazil that aims to increase skills and support personal and social development.[166] For professionals working in vaccine rooms, most of the training is related to technical skills of handling and storing vaccines or using computer systems, although the program also aims to keep employees informed about changes to vaccine recommendations and expansion of vaccines to different populations.[166] A qualitative study found that HCPs generally find this program to be infrequent and insufficient for improving knowledge about vaccinations.[166]

Multidisciplinary and cross-sectoral coordination

Immunization is well-integrated into Brazil's approach to healthy ageing. As the proportion of the population over 60 years old is increasing rapidly,[167] healthy ageing is becoming more of a health policy priority.[103] To this end, the national health policy for older people highlights the importance of vaccination according to the NIP, which currently includes five different vaccines for people aged over 60.[35 103]

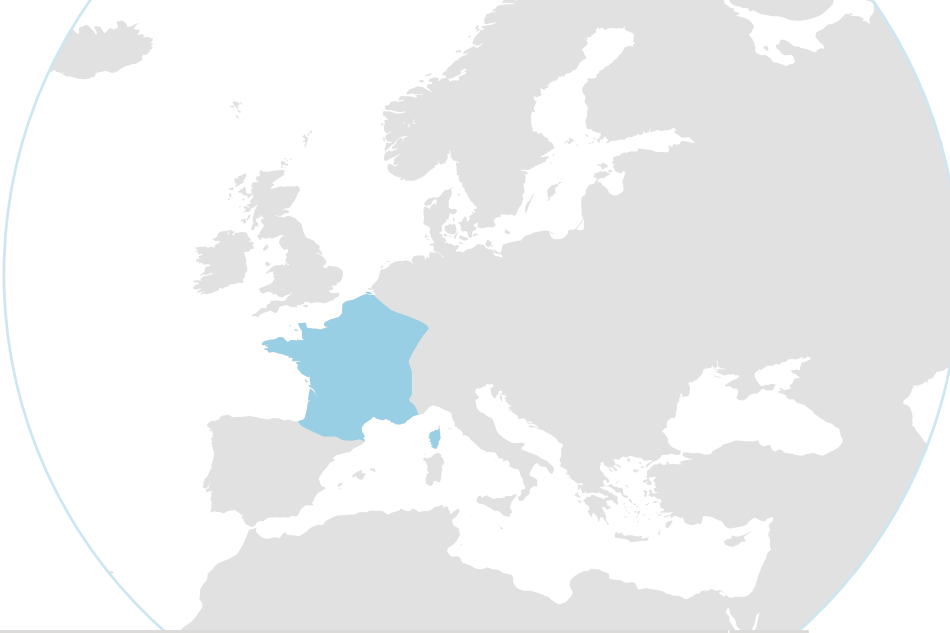
Immunization is usually only provided in clinical settings in Brazil.[45] In 2017, the Ministries of Health and Education collaborated to implement a program to immunize adolescents against HPV in schools.[118] The program was very effective and resulted in high vaccine coverage. However, the program was ended by the Minister for Education,[45] demonstrating the need for long-term commitments to immunization strategies across the life course.

Robust data informing policies and programs

Brazil has developed a national IIS which covers the life course, but vaccine surveillance is an ongoing challenge.[45] The Ministry of Health is currently in the process of integrating healthcare information services into a single system called e-SUS.[168] The information system for evaluating the NIP (SI-PNI) was implemented in 2010, but there are various barriers to its consistent use including lack of equipment, unreliable internet connections and inadequate staff training.[127] The expansive population of Brazil has also been identified as presenting multiple challenges, as it can be difficult to implement a unified program across thousands of vaccine rooms, and the work involved in recording very large numbers of immunizations during some campaigns can be prohibitive.[45]

France

Policy checklist



Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	○
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

France's immunization program has been designed to support key groups throughout the life course. While the vaccination schedule covers all ages and some specific groups,[169] low uptake of vaccination among children has led to a tendency for policies and interventions to focus on the young.[170] There have, however, been a number of campaigns to increase uptake of the annual influenza vaccine in risk groups such as older people,[106] and to support vaccination of MSM against hepatitis A.[68]

Comprehensive immunization program that supports vaccine availability

France has a comprehensive immunization schedule which includes all key age and risk groups. The NIP in France includes required and recommended vaccines for infants, children, adolescents, adults, older people,[169] travellers[171] and people with chronic disease.[169 172] Only the influenza vaccine is recommended in pregnancy, while guidance states that women should be vaccinated against diseases such as pertussis before becoming pregnant.[173] The vaccine schedule also specifies which vaccines are recommended and which are obligatory for various categories of HCP.[173] The recommendation of specific vaccines for target groups, however, has not necessarily led to high uptake among all groups. Despite the HPV vaccine being included in the NIP for adolescent girls, for example, promotion has been limited and coverage rates are only around 20%.[174]

The NIP is informed by independent expert advice which considers the evidence for vaccines across the life course. The current technical commission on vaccinations was established in 2017 under the Haute Autorité de Santé (High Authority of Health; HAS).[175]

HAS considers immunization across the life course in developing its recommendations, and has identified pregnant women as a target group on which it is currently focusing.[176]

There have occasionally been shortages of some vaccines in France.[177] A law was introduced in 2016 to strengthen the supply chain of vaccines and to avoid shortages.[178] According to this law, laboratories involved in the production of vaccines must implement reinforced surveillance measures, including timely reporting of low levels of stock and maintaining and communicating a balance sheet of stocks and supplies. This is done under the oversight of the Agence nationale de sécurité du médicament et des produits de santé (National agency for the safety of medicines and health products; ANSM). In the event of a shortage, the ANSM is responsible for implementing corrective measures.[177 178]

In France, a co-payment or complementary insurance is required for most vaccines. This is because the majority of vaccines are reimbursed by the national health system at 65%.[179 180] There is some evidence that this may present a barrier to uptake, with studies finding that people of lower socioeconomic status and those who do not have complementary health insurance are significantly less likely to be vaccinated against HPV.[54 55] The seasonal influenza vaccine for recommended groups, however, is 100% covered.[180]

Public demand for immunization

The prevalence of vaccine hesitancy in France is among the highest around the world and this is impacting on vaccine uptake. A recent survey showed that 41% of the population believe vaccines are unsafe,[181] contributing to vaccine coverage that is well below target for many vaccines.[128 182]

Government bodies and civil society organizations are involved in promoting immunization across the life course. As part of Immunization Week 2016, Public Health France announced the launch of vaccination-info-service.fr.[183] This website contains extensive information about vaccines, including vaccine safety, vaccine-preventable diseases, and recommendations for different groups across the life course. MesVaccins.net is an online resource that supports individuals and HCPs to access personal immunization information.[134 184]

Case study: Introduction of an electronic vaccination record

Summary: MesVaccins.net is a web- and smartphone-based electronic vaccination record that stores individuals' vaccine records and makes recommendations based on age and risk profile thanks to a rule-based intelligent system on vaccination that is updated by immunology experts in real time.[84] Initiated in 2010, the system uses current vaccine recommendations from the NIP to provide tailored advice based on a person's disease risk factors and external factors (e.g. new legislation, vaccine-preventable disease outbreak or vaccine shortage). This advice is updated whenever vaccine recommendations are changed or based on information from individuals or healthcare professionals.[83 185] In addition to helping make individuals aware of their own immunization status and recommendations, the MesVaccins platform supports healthcare providers to give correct

and current advice in line with the national immunization program.[84] The system is free for the public to use, and HCPs subscribe to the service.

With expansion to national or international implementation, MesVaccins.net has the potential to serve as a comprehensive tool for vaccine monitoring. The details collected by the system could allow policymakers to monitor coverage of vaccines across the life course in all risk groups.[134]

Impact: Despite these benefits, expansion of the program has been relatively slow, with 700,000 records now created. This is largely due to limited resources as MesVaccins.net is committed to remaining independent and does not accept funding from industry or through advertising.[134 184] Furthermore, it is committed to providing anonymized data to health authorities exclusively, and will not charge for access to any data collected.[134 184]

Lessons: Support from government and health agencies is critical to the implementation and expansion of MesVaccins.net. Buy-in from various health agencies has bolstered the success of the program to date. For example, the ARS in Occitanie has supplied subscriptions to the service for all vaccination centres in the region and the ARS in Nouvelle-Aquitaine has launched advertising campaigns.[134] Further collaboration is needed, however, to support wider implementation.

Recent outbreaks of communicable diseases have led the government to make virtually all childhood vaccines mandatory, rather than recommended.[186] This controversial change was made following a complex public consultation that aimed to take account of experts' and citizens' opinions, and included over 10,000 comments left on an online platform.[186] Unlike some other countries with mandatory childhood vaccines, France offers no exemptions except in the case of medical contraindications.[187] In a press conference in April 2019, the Minister for Health announced that the first year of this new policy saw significant improvements in vaccine coverage including an increase in meningococcal C vaccine coverage of 36.4 percentage points from 2017 to 2018.[188]

Engaged healthcare professionals

Public Health France launched an online vaccine information platform for HCPs in 2018. Professionnels.vaccination-info-service.fr provides detailed information about how vaccines work, recommendations and coverage data, guidance for different population groups and disease-specific information.[172] Public Health France promotes this website through relevant trade websites and press.[189] In some regions, subscriptions to MesVaccins.net have also been provided to physicians and pharmacists by regional health agencies, supporting HCPs to give correct and consistent immunization advice.[134]

The vaccination schedule specifies which vaccines are recommended or obligatory for HCPs.[173] Mandatory vaccines for healthcare workers were introduced in 1991 and have changed over the years. Currently, hepatitis B, DTP (diphtheria/tetanus/pertussis) and BCG are mandatory for all healthcare workers. Other vaccines may be recommended or required according to job role and risk assessment. This also applies to medical students and laboratory staff.[82] Two surveys conducted in 2009 showed that vaccine coverage

among healthcare workers was above 90% for the mandatory vaccines, but very low for the recommended vaccines.[96]

Multidisciplinary and cross-sectoral coordination

Immunization is integrated into France's wider healthy living policies. The 2018–2022 National Health Strategy includes, as its first priority, promotion of lifelong health.[190] Key components of this priority are healthy lifestyle factors including a healthy diet, sufficient physical activity and other healthy behaviours. While immunization is discussed under this priority, it is mainly in relation to mandatory childhood immunizations, although the expansion of influenza vaccination to pharmacies is also discussed in the context of older people's health.[170]

Initiatives are being implemented to make vaccines increasingly available in non-clinical settings. For example, vaccination in schools has been trialled in the region of Grand-Est.[191] The immunization records of 1,000 students were checked and more than half were found to be out of date. Parents were notified of their children's immunization status and asked for consent to provide these vaccines in school. In two years,[254] children received vaccinations as a result of this trial.[191] Following this, the regional health agency in Grand-Est may extend the intervention to more regions. In addition, a relatively new initiative allows specially trained pharmacists to administer the annual influenza vaccine in pharmacies.[192]

Case study: Seasonal influenza vaccination in pharmacies

Summary: In 2017, an influenza vaccination program in pharmacies was introduced in selected ARSs to increase vaccine coverage. Through this program, pharmacists who attended specific training were permitted to administer the influenza vaccine at no cost to target groups.[109] This was implemented on a three-year experimental basis,[110] and Nouvelle-Aquitaine and Auvergne-Rhone-Alpes were the only authorities included in the first year.[193] In this first year, the target population was limited and pharmacists were not permitted to vaccinate pregnant women, people with certain chronic conditions or those who had never had the vaccine before.[193] In the 2018/19 influenza season, the program was extended to include Hauts-de-France and Occitanie, and the groups that could receive the vaccine in pharmacies were expanded to include all people who were eligible on the NIP.[111]

Impact: After two years, vaccination in pharmacies was deemed to be successful and the pilot phase was ended.[194] By the end of the pilot phase, three quarters of pharmacies in pilot regions were offering the influenza vaccine and the majority of people who received the vaccine in pharmacies were aged over 65.[195,196] It was reported that more than 743,554 people got the influenza vaccine in the experimental regions during the pilot phase, of whom 23.5% were getting the vaccine for the first time.[112] On 1 March 2019, the right to administer the influenza vaccine to target populations was expanded to pharmacists nationwide.[112,113] Furthermore, vaccination has become part of pharmacists' role; it is now a compulsory part of training[114] and a list of vaccines to be provided in pharmacies is soon to be set by the Ministry for Health.[194]

Lessons: The success of this intervention demonstrates the potential of engaging pharmacists in the delivery of immunizations within the community. A large proportion of pharmacists became vaccinators, showing that there is buy-in from pharmacists in offering this service. In addition, a considerable number of people got the vaccine for the first time,[112] showing that the intervention reaches people who were not previously accessing influenza vaccination services.

Robust data informing policies and programs

A national system for surveillance of vaccination coverage has not yet been established in France. A report published in 2013 described numerous sources for assessing vaccine coverage in the population, consisting of health records, vaccine sales data and various surveys.[128] The report concluded that the mechanisms for assessing vaccine coverage were insufficient and should be improved in order to develop more responsive public health policies. Since then, regional systems have been developed but they are not interoperable.[123]

All diseases on the immunization schedule are monitored.[197] The main mechanism for monitoring these diseases is through mandatory reporting. Currently, diphtheria, hepatitis B, polio, measles, rubella, tetanus and tuberculosis are notifiable. National Reference Centres also monitor most of the diseases on the vaccine schedule.[197]

Japan

Policy checklist

Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	○
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

Japan has developed an immunization program which covers many target groups, but this is not as well developed as in some other countries. While key at-risk groups have been included in the national immunization schedule,[198] the number and range of vaccines are lower than in countries such as Australia and the UK, and a generally negative public sentiment has an impact on uptake.[49] Despite this, the Japanese government is continuing to make efforts to improve uptake of some vaccines beyond childhood through targeted campaigns.[42]

Comprehensive immunization program that supports vaccine availability

Japan's national immunization schedule covers key age and risk groups, although there are gaps. While infants, children, adolescents, older populations and people over age 60 with chronic diseases are all included,[198] immunization recommendations for people below the age of 60, including catch-up or booster vaccines, are limited. One exception is the rubella catch-up program targeted at men aged between 39 and 56 who have not yet had the vaccine.[42]

Case study: Rubella catch-up campaign for men

Summary: Japan experiences frequent outbreaks of rubella due to gaps in herd immunity.[41] In response, a government program has been initiated to offer free rubella vaccinations and antibody tests to men aged between 39 and 56 who have not yet received the vaccine.[42] The program is being rolled out over three years (2019–2022) and the vaccine will only be administered to individuals whose antibody test is negative (about 20%) to prevent vaccine shortages.[42] The media have reported that the program will be publicized via a communication campaign using manga characters from a series thought to resonate with the target population.[69]

Industry outreach and media reporting played a role in initiating the program by highlighting to The National Diet (Japan's parliament) the potential impact of the rubella outbreak.[58] According to an expert from the Japanese pharmaceutical industry, key arguments thought to resonate well with stakeholders were the potential impact on Japan's already declining birth cohort and the impact on productivity and wellbeing of the country's workforce.[58] It was also highlighted that the global image of Japan was already being affected as the CDC had put out a travel advisory for Japan and that this could negatively affect tourism to the country.[58] National and global media were also thought to put considerable pressure on the Japanese government by regularly reporting on the rubella outbreak.[58] Industry associations conducted and facilitated proactive in-person and group-learning educational sessions between government policymakers, media and leading national medical experts.[58]

Anticipated impact: This program aims to achieve herd immunity to rubella and significantly reduce the incidence of the disease within three years. Its goals are to achieve antibody positive rates of 85% for the target cohort (93% for national population) by July 2020, and greater than 90% coverage for the target cohort (94% for national population) by March 2022.[42] In addition, the government aims to reduce the incidence of rubella to zero by 2020, and is particularly focused on preventing infections in pregnancy.[70]

Requiring antibody testing before vaccination has been identified as a major barrier to increasing uptake in the target cohort.[58] This requirement means that eligible males will have to visit a medical clinic two to three times before they are vaccinated: to have the antibody test, to get the results of the antibody test, and to get the vaccination.[58] This issue is significant as the target population is men of working age who are likely to need to take time off work to visit a medical clinic.[58]

Lessons: There are multiple lessons to take from this case study. The outbreaks of rubella in adults resulted from gaps in herd immunity because of transitions in vaccination policy,[41 42] demonstrating the importance of consistent and comprehensive national immunization policies. While the policy of only giving the vaccine to those whose antibody test is negative is intended to result in more effective allocation of resources, this measure has been identified as a key barrier due to lack of convenience and the requirement to take time away from work.[58] This may suggest that formative work, such as consultation with key stakeholders, should be conducted ahead of implementing a novel immunization program.

Experiences from initiating this program show the importance of considering wider implications of immunization policy that go beyond health. In this case, it was reported that arguments related to population productivity, tourism and global image resonated well with policymakers and were instrumental for motivating rapid change.[58]

Japan's immunization recommendations across the life course are informed by the recommendations of an expert group. In 2013, a Vaccine Committee was set up by the Ministry of Health, Labour and Welfare (MHLW) to evaluate vaccines and make evidence-based recommendations.[56] The MHLW is legally required to consult the Committee when planning vaccination programs.[199] However, unlike NITAGs in other countries, professional societies do not have any direct involvement in the Vaccine Committee's decisions.[199] The Committee has, however, positively influenced inclusion of new vaccines on the NIP and helped to improve access to the varicella vaccine by moving it from the voluntary to the routine vaccine list in 2014.[56] It was also instrumental in adding the pneumococcal vaccine for older people and the hepatitis B vaccine for newborns to the NIP.

Recently, shortages of domestic vaccines have occured.[48] It has been suggested that modelling of the national vaccine stockpile needs to be initiated to protect against unexpected events causing shortages, along with greater transparency in the vaccine distribution system.[48] Further challenges have been noted in relation to the smaller scale of Japanese vaccine manufacturers compared to foreign vaccine-producing pharmaceutical companies.[49]

Some vaccines on the NIP are fully funded by the Japanese government. 'Routine' vaccinations are divided into two groups; Category A vaccines, which aim to achieve social-level protection, are primarily paediatric vaccines and are fully reimbursed, while Category B vaccines are targeted at older people and are partially reimbursed. 'Voluntary' vaccines, however – which include mumps, rotavirus, meningitis and hepatitis A – are only available at a cost to the individual.[56] Vaccine cost has been cited as the most common factor discouraging families from receiving voluntary vaccinations.[56]

Public demand for immunization

Public and media perceptions of vaccines in Japan have sometimes been negative. In 2013, the media began reporting on adverse effects that might be linked to the HPV vaccine, although no link had been proven.[41] Reportedly without considering all the scientific evidence, the MHLW suspended its active recommendation of the HPV vaccination.[41] As a result, the HPV vaccination rate among Japanese girls who turned 12 during 2014 dropped to 0.1% compared with 70% in 2012.[41]

Civil society groups have been working to address public attitudes and knowledge levels around immunization across the life course, as well as trying to influence government policy. The Friends of the International Federation on Ageing Japan, for example, recently petitioned the Japanese government to improve national policy on adult immunization.[200] The Japan Medical Association has devised various activities promoting the benefits of immunization across the life course[201] and initiated a successful campaign to push for the incorporation of seven new vaccines into the routine NIPS, including the adult pneumococcus vaccine.[202] The Japanese Society of Travel and Health (JSTH) has also worked to promote vaccination through travel clinics.[78]

Case study: Increasing travel clinics

Summary: While travel clinics are standard in many Western countries, this sector has remained underdeveloped in Japan.[78] In order to address these gaps, the JSTH began a project in 2011 to increase travel clinics throughout Japan.[78] Between 2011 and 2018, 39 medical institutions were visited by the JSTH with the aim of facilitating the development of travel clinics.[78]

Impact: By 2018, 26 of the 39 medical institutions had opened travel clinics and the majority of the remaining institutions were in the preparation stages of setting up a travel clinic.[78] Key drivers behind the project's success included an educational manual and training.[78] The JSTH also arranged for representatives of the medical institutions to visit experienced travel clinics to facilitate learning.[78]

Lessons: This example shows how civil society organizations can promote immunization across the life course. By engaging and collaborating with medical institutions, the JSTH facilitated the establishment of dedicated clinics that will provide necessary immunizations for people who travel.

Engaged healthcare professionals

No strategies appear to be in place to improve the knowledge of HCPs on immunization across the life course. Expert commentators have reported that medical colleges do not provide classes or teaching materials devoted specifically to vaccinations.[49]

Vaccines for HCPs are not included in the NIPS.[198] In the case of accidental exposure to blood contaminated with hepatitis B, immunization for HCPs is covered by the public insurance system rather than the NIPS.[203] It has been noted that medical institutions are sometimes wary of introducing mandatory vaccination policies.[204]

Multidisciplinary and cross-sectoral coordination

Heath policies in Japan do not appear to explicitly frame immunization as part of a wider approach to healthy living.[58] Healthy ageing is currently a key theme of governmental health strategies in Japan. However, immunization experts in the country have reported that immunization is not explicitly part of this agenda.[58]

There are some examples of delivering vaccines in schools, although delivery of vaccines in non-clinical settings is not common. Some local governments in Japan initiated highly effective school-based vaccination programs for providing the HPV vaccine to adolescent girls.[205] However, it is likely that these have now ended since, as noted above, the government stopped actively recommending the HPV vaccine, despite its availability as a routine vaccination.

Robust data informing policies and programs

Japan has not yet developed a comprehensive system to collect vaccine uptake data across the life course. Japan does not have a national vaccine registry.[206] Instead, immunization records are managed independently by approximately 1,700 municipalities. This has led to an absence of official national statistics on vaccination coverage across the life course, and a lack of data on the extent to which immunization coverage is equally distributed.[207]

Vaccine-preventable diseases are tracked via the National Epidemiological Surveillance of Infectious Diseases (NESID) system. This encompasses passive case-based reporting from all healthcare facilities in Japan, and weekly sentinel surveillance covering approximately 3,000 paediatric clinics for paediatric infectious diseases[208] and 450 clinics for adult measles surveillance.[209] However, it lacks catchment population data for sentinel surveillance which limits the ability to estimate population-based incidences for sentinel disease,[208] and appears to be focused primarily on children's health.

United Kingdom

Policy checklist

Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

The UK has an extensive immunization program with clear strategies in place to support its success. The routine immunization schedule and ad hoc campaigns are all informed by the latest disease surveillance, vaccine efficacy and cost-effectiveness evidence.[57] This has led to relatively high uptake of key vaccines.[210 211]

Comprehensive immunization program that supports vaccine availability

The UK has a comprehensive immunization schedule which covers all key groups. The NIP covers the life course and includes infants, children, teenagers, older people and people of all ages who are at greater risk of harm from certain diseases.[88] Vaccination coverage for children is high, with herd immunity levels reached for diphtheria, tetanus, pertussis and measles.[210]

In addition to the vaccines provided as part of the NIP, numerous separate national programs provide vaccines to specific groups across the life course. These programs include a catch-up meningitis ACWY vaccination program for those under 25 years of age,[212] an HPV vaccine program for MSM under 46 years of age,[213 214] and a travel vaccination program which provides several vaccines to protect against diseases thought to represent a significant risk to public health.[215]

The NIP is regularly reviewed and revised by experts, based on the latest available evidence. The JCVI provides recommendations to policymakers on vaccines across the life course.[216 217] Recommendations made by the JCVI resulted in the NIP being updated in 2016 to include the pertussis vaccine for all pregnant women.[88 89]

The UK has a strong and responsive vaccine supply chain. The Department of Health and Social Care (DHSC) aims to contract more than one vaccine manufacturer when possible to help ensure security of supply.[50] Vaccine stockholdings are forecasted up to a year in advance, with the DHSC aiming to ensure a strategic reserve of all vaccines, with the reserve increased for vaccines with only one supplier.[50] GPs order vaccines from a central distributor, with allocation control only imposed if the DHSC anticipates a shortage.[50] The UK's supply of vaccines is currently dependent on the pharmaceutical industry, but the government is in the process of setting up the UK's first dedicated Vaccines Manufacturing Innovation Centre (VMIC), set to open in 2022, to facilitate the rapid manufacture of vaccines in the event of a pandemic.[218]

All vaccines on the NIP are provided free of charge as part of the NHS.[53] In considering changes to the NIP, the JCVI carefully considers the cost implications of investing in new vaccines and requires evidence of cost-effectiveness. That is, the vaccine must not only deliver health benefit, but must deliver greater benefit than other programs that would otherwise be funded if resources were not spent on the vaccine program.[57]

Public demand for immunization

Public awareness of the benefits of life-course immunization is being targeted by a range of media and communication campaigns, including a strategy to encourage vaccine uptake.[219] Communication materials have been produced by the NHS to aid health facilities and HCPs in promoting the benefits of different aspects of life-course immunization. Examples include posters and information leaflets promoting the MSM national HPV vaccination program[220] and the shingles vaccination for people aged over 70.[221] These communication efforts are being aided by the development of complementary resources by national HCP bodies[222] and the activities of health policy[217] and academic organizations.[223] However, experts in the country have suggested that efforts are needed to increase public awareness of the availability of free catch-up vaccines beyond childhood as uptake rates are generally low.[115]

Engaged healthcare professionals

HCPs in the UK are engaged in promoting immunization across the life course. PHE has developed a set of national minimum standards and a core curriculum for immunization training which corresponds to the NIP.[224] PHE has also launched an e-learning resource, designed in line with the national minimum standards, to support HCP training.[225] It provides a wide range of training and educational resources on different aspects of life-course immunization.[117] In England, a GP 'super-partnership' introduced a successful program to increase pertussis vaccination rates in pregnancy.[85] In contrast, a program of hepatitis B vaccination targeting at-risk groups attending a sexual health service did not increase uptake.[87]

Case study: Improving pertussis vaccination rates of pregnant women through data sharing

Summary: This program was implemented by a primary care organization called Modality. Modality is a GP partnership operating across Birmingham, Hull, Sandwell, Walsall and Wokingham in England, which shares a clinical dashboard that incorporates data from participating practices. The dashboard is regularly updated and used to improve performance and standardize care across the network.[85]

The Modality clinical dashboard was used to identify pregnant women in need of the pertussis vaccine. In response to the deaths of two babies in the Modality network from whooping cough, the members of this partnership introduced a drive to increase pertussis vaccination rates of pregnant women by interrogating primary care data.[85] In order to identify pregnant women within the network who had not yet received the vaccine, a set of bespoke searches was developed and run weekly.[85] Women identified by the search were then contacted and invited for vaccination.

Impact: This initiative increased vaccine coverage in the population. Pertussis vaccination of pregnant women in the Modality network increased from 63% to 73%.[85] The majority of pregnant women who were not vaccinated either declined vaccination or could not be contacted.[85]

Lessons: The success of the Modality partnership in increasing pertussis vaccination rates among pregnant women demonstrates the value of engaging HCPs in promoting immunization across the life course. It also shows that centralized sources of data can be used effectively to identify individuals in need of vaccines and target efforts to improve uptake.

Case study: Improving uptake of hepatitis B vaccination in at-risk groups attending a sexual health service

Summary: Monitoring of electronic patient records in a sexual health clinic showed that the clinic was underperforming in all performance indicators for hepatitis B screening and immunization in high-risk groups.[87] In response, the clinic began a project in 2015 to improve uptake of vaccination among MSM, injecting venous drug users, commercial sex workers and people who change partners frequently.[87] The project identified reasons for low vaccine uptake, which included staff not always understanding why vaccination was important for these groups and not always offering opportunistic vaccination, and differences in staff's willingness to vaccinate patients.[87]

Impact: Staff awareness was improved through a rolling education program which provided nurses with training tailored to their role.[87] A key element of the education program focused on introducing the topic of hepatitis B vaccination in consultations.[94] Despite the increase in staff awareness, rates of hepatitis vaccination did not increase. Uptake of the first dose of the vaccine varied between risk groups, but ranged from 22% to 59.8%.[87] One barrier identified was a reconfiguration of sexual health services that was

taking place at the time. During this transformation, staff turnover rates were high, creating a further challenge in finding ways to educate staff and disseminate information. It was suggested that a super-accelerated vaccination course could improve attendance for follow-up doses, but as community education for the accelerated vaccination schedule was already in place, the Sexual Health Department did not wish to implement changes that were considered non-essential and could potentially introduce further staff confusion.

While the service reconfiguration posed barriers, it has now been transformed from a treatment-based clinic to a prevention-based model that focuses on health promotion, self-care and closer working with community pharmacists to deliver sexual health services, enabling them to provide hepatitis B vaccination to at-risk patients and aiming to increase vaccine uptake. The impact of this program on hepatitis B vaccination uptake will continue to be evaluated.[95]

Lessons: Some key lessons from this program can help inform the development of targeted immunization programs. Firstly, it is necessary to consult with staff at all levels and assess their understanding of the issues surrounding life-course immunization in order to develop an effective educational program. Secondly, the results of this program highlight the importance of context when implementing a new initiative to promote immunization. In this case, concurrent changes to Trust services limited program implementation, showing that it is necessary for all those involved to collaborate effectively.

Strategies are in place to actively support immunization among HCPs, although this is not mandatory. For example, employers of healthcare staff are required to have an effective employee immunization program in place[226] and there is a national campaign to provide advice, guidance and materials to support local health staff influenza vaccination campaigns.[227] These strategies are relatively successful and in the 2017/18 influenza season, influenza vaccine coverage among healthcare workers was 68.7%, with 27.5% of NHS Trusts reaching the target of 75% coverage.[211]

Multidisciplinary and cross-sectoral coordination

A range of high-level policy documents briefly address immunization as part of a wider approach to healthy living. The recent update to the NHS *Five Year Forward View* highlights the progress that has been made under the title 'Better Health', including plain packaging for cigarettes, sugar tax to reduce childhood obesity, and public vaccination campaigns.[228] In England, key documents include PHE's *Strategic plan for the next four years: Better outcomes by 2020*, which sets out the health goals of PHE,[229] and the Local Government Association's local government guide to healthy ageing, *Adding extra years to life and extra life to those years*.[230]

The NHS has also worked with civil society groups to advance the uptake of immunization across the life course. In partnership with the NGO Age UK, the NHS has produced a *Practical guide to healthy ageing* to help improve the health of people at any age, but with a focus on people aged over 70.[104] The guide mentions the importance of immunization as part of a holistic approach to healthy living, which also includes a healthy diet and exercise.

The UK has successfully integrated immunization access in non-clinical settings. This includes school-based immunization programs[117 231] which have been very successful, first for the rubella and BCG vaccines and then more recently for the HPV, measles-mumps-rubella (MMR) and MenACWY vaccines.[117] Providing the MenACWY vaccine in schools resulted in high levels of coverage that stopped the spread of MenW in the population.[131] Some regions have transitioned their entire school-aged immunization service to a school-based model.[231] Some regions are also investigating the practicality and impact of using self-consent procedures for adolescent girls to increase uptake of the school-based HPV vaccination.[232]

Pharmacists have also been successfully integrated into immunization delivery services. The role of community pharmacists has been expanded to enable the delivery of NHS influenza vaccinations for patients in at-risk groups and for care home and domiciliary care workers.[233] In the London region, a program of providing the influenza vaccine to unpaid carers was implemented in community pharmacies.[107]

Case study: Reaching Carers influenza vaccination campaign

Summary: The Reaching Carers influenza vaccination campaign was implemented to reduce crisis situations among high-risk groups by providing the influenza vaccine to those responsible for their care.[108] This was driven by a multi-agency partnership including NHS England (London Region), Pharmacy London, Local Pharmaceutical Committees, London-wide community pharmacies, and Sonar Health Informatics and Reaching Carers.[107] During the campaign, the eligibility criteria for free influenza vaccination were expanded to include any person who was caring for another person, rather than only those who are the main 'informal' carer.[115] Unpaid carers were considered to be a hard-to-reach group as they do not always identify as carers and may not be considered carers in a formal capacity.[115] Formative research found that community pharmacists were best placed to identify unpaid carers and deliver the intervention.[108]

The campaign was run during the 2015/16 and 2016/17 influenza seasons, primarily at community pharmacies in the London region.[107 115] A comprehensive range of resources and activities was developed to support pharmacists in delivering this intervention, including workshops, an online training tool and a flowchart outlining a '60-second chat' to have with suspected carers.[115] Computer system prompts and 'quick look' materials reminded community pharmacists to begin these conversations with customers and highlighted triggers which should alert pharmacists to potential carers.[108] Triggers included customers collecting prescriptions for others and buying products that are associated with frailty or ill-health when they were not obviously disabled or frail themselves.[108]

Impact: This initiative resulted in increased influenza vaccine coverage. The number of carers vaccinated increased by 61% from 5,765 in 2015/16 to 9,262 in 2016/17.[107]

Lessons: The success of this campaign shows that community pharmacists are often best placed to increase vaccination uptake among hard-to-reach groups due to their position in the community and the regular contact that they have with members of the public.

Robust data informing policies and programs

There are IISs in England, Northern Ireland, Scotland and Wales, but they differ in approach and only collect information up to adolescence.[234] In Scotland, for example, the IIS is the responsibility of the NHS. In England, on the other hand, there is no national IIS but local IISs are increasingly interoperable and have the ability to track people moving between regions.[235] PHE is also able to extract data from the local IISs, and national guidelines specify what data each IIS should collect.[235] However, IISs across the UK only collect information on immunization during childhood and adolescence.

There are various additional systems for collecting vaccination data in the UK. While not part of the IISs, PHE collects vaccine coverage data for specific immunization programs through its online ImmForm system.[123 236 237] Coverage data are automatically extracted from the records of participating general practices, with immunization programs covered including the herpes zoster (shingles) immunization program[237] and the pneumococcal polysaccharide vaccine (PPV) program.[236] Health Boards and Local Teams across the UK provide data for the Cover of Vaccination Evaluated Rapidly (COVER) program, which evaluates childhood immunization data for each routine vaccine.[238]

Vaccine-preventable diseases are monitored across the life course through a comprehensive system made up of a notifiable diseases reporting system[239] and enhanced surveillance programs.[213] Identification of an outbreak of MenW led to the swift implementation of a targeted immunization program.[130]

Case study: Increasing herd protection against meningococcal disease by vaccinating adolescents

Summary: In 2015, PHE reported a steady increase in incidence of MenW across the whole population in England.[130] In response, the JCVI recommended implementing a MenACWY immunization program for adolescents as they are known to be the main carriers of the bacteria.[21] Targeting this group was projected to be a cost-effective way of protecting the whole population through herd protection.[130]

The immunization program was rolled out in three phases. Due to an insufficient supply of the MenACWY vaccine, the first phase of the initiative was limited to GP-based catch-up campaigns for adolescents who were leaving school in the summer of 2015.[130 131] From September 2015, the MenACWY vaccine was offered in place of the routine MenC vaccine in schools to students in Year 9 or 10.[130] University-based immunization programs targeting first-year students have also been implemented and are supported by advertising campaigns.[130 131]

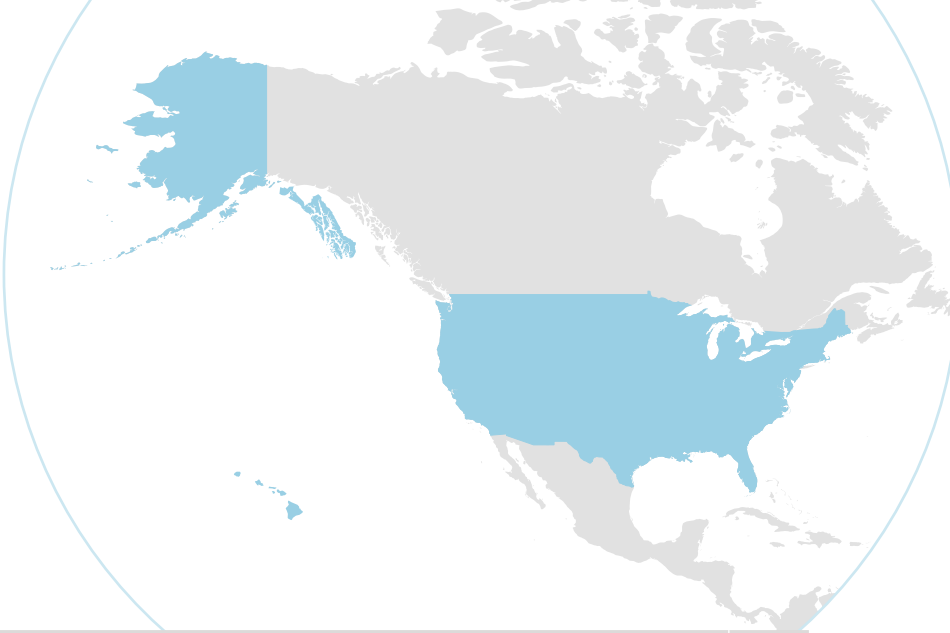
Impact: Immunization of adolescents has been successful in stopping the rise in MenW incidence, although it is still too early to know whether herd protection has been achieved.[131] While uptake of the vaccine through the GP-based strategies has been low, reaching 39.8% coverage by the third year,[132] the school-based program has achieved high levels of coverage. By 2017/18, most local authorities had transitioned to routinely offering the MenACWY vaccine to Year 9 students and this program resulted in 85.4% coverage.[133]

The university-based program faces a significant challenge in that it should achieve high levels of coverage within two weeks of new students arriving at university to be effective.[131] A cross-sectional study conducted at a British university found vaccine uptake to be relatively high, at 68.1%.[240]

Lessons: A timely response to increasing rates of MenW was made possible by comprehensive monitoring of vaccine-preventable diseases. By using surveillance data, the JCVI was able to make informed recommendations for changes to the national immunization schedule. In addition, the targeted immunization programs implemented were cost-effective and have stopped the increase in MenW infections.[21 130] Adolescents can be hard to reach through routine primary care and immunization in non-clinical settings such as schools may be necessary to achieve sufficient coverage.

United States

Policy checklist



Comprehensive immunization program that supports vaccine availability	Immunization schedule covers the whole life course	●
	Recommendations are evidence-based and reviewed regularly	●
	Reliable vaccine supply chain in place	●
	Immunization across the life course prioritized and adequately resourced	●
	Vaccines available for underserved communities	●
Public demand for immunization	Public awareness campaigns encourage vaccine uptake across the life course	●
	Active civil society organizations involved in vaccine promotion	●
Engaged healthcare professionals	Healthcare professionals educated about benefits of life-course immunization	●
	Healthcare professionals supported to be vaccinated	●
Multidisciplinary and cross-sectoral coordination	Immunization integrated into healthy living and healthy ageing policies	●
	Collaboration with other sectors supports vaccine delivery in non-clinical settings	●
Robust data informing policies and programs	Immunization coverage targets cover the life course	●
	Electronic databases collect and share immunization and infectious disease data	●
	Immunization data available to individuals and healthcare professionals	●

Well developed ● In development ● Not yet developed ● No data found ○

Summary

The US has a highly comprehensive and detailed immunization schedule which offers a range of first-time and catch-up vaccines for individuals across the life course.[36 241] Clear targets have been set for all vaccines[101] and investments are being made in improving the availability of comprehensive national vaccine data to ensure a clear picture is available of how well these are being achieved.[125]

Comprehensive immunization program that supports vaccine availability

The US has a comprehensive NIP, which is presented in two schedules: one for children and one for adults. These schedules together include infants, young children, teenagers, older people, and people of all ages who are at greater risk of harm from certain diseases, such as pregnant women and people with chronic conditions.[36 241] The specific vaccines recommended on the NIPs are comprehensive across all at-risk groups.

The NIP is informed by independent, expert advice based on the latest available evidence. The ACIP develops recommendations for the use of vaccines in the civilian population. Its recommendations stand as public health guidance for the safe use of vaccines.[242] Subgroups of the committee, known as Work Groups, review relevant data and develop recommendation options to present to the ACIP. Four Work Groups cover the life course, including a Work Group for the Adult Immunization Schedule and one for the Child/Adolescent Immunization Schedule.[43]

Effective multi-agency coordination has contributed to a strong vaccine supply chain. For example, the Vaccine Management Business Improvement Project (VMBIP) was

established to manage vaccines provided through the publicly funded Vaccines for Children program, which provides free vaccines to children who would not otherwise be able to access them.[243 244] VMBIP is a collaborative project of the CDC, participating state, local and territorial immunization programs, and partner agencies.[244] Actions include: federal funds flowing directly to vaccine manufacturers through one account, significantly lowering administrative costs; the monthly forecasting of projected vaccine need and funding source of each health department; centralized vaccine distribution; and the development of a new web-based system for vaccine ordering/forecasting and budget/contract management.[244]

Vaccines are funded through a combination of government resources, insurance contributions and private funding. For individuals with eligible health insurance, vaccines on the national schedules are fully covered, with no cost-sharing for individuals provided the vaccines are administered by an in-network provider.[245] Adults who lack health insurance may have difficulty accessing recommended vaccinations due to the cost.[246] Various federal and state health insurance schemes for deprived or vulnerable groups exist, however, and may cover part or all of the cost of vaccines.[247 248]

Public demand for immunization

The National Vaccine Program Office, which is responsible for developing the National Vaccine Plan and National Adult Immunization Plan, has identified both adult immunization and vaccine confidence as featured priorities.[249] It calls for cross-sectoral coordination to achieve gains in these priority areas. Despite these efforts, greater success is being achieved among children, with childhood vaccination rates typically exceeding 90%.[246] In contrast, the vaccination of adult groups is still well below the national targets outlined in Healthy People 2020.[246] Barriers to the immunization of adult groups include concerns about vaccine safety, scepticism about effectiveness, vaccines not being integrated into adult medical care, and HCPs not recommending, or weakly recommending, vaccines.[246]

Public awareness of the benefits of life-course immunization is being targeted by a range of media and communication campaigns, which are addressing subjects such as influenza vaccination for adults[245] and HPV vaccination for adolescents,[245] along with the development of a range of online communication materials produced by the CDC and the Department of Health and Human Services (HHS).[250-252]

Engaged healthcare professionals

The CDC hosts a number of education and training opportunities aimed at improving HCPs' knowledge of immunization.[253] These include immunization courses and Immunization NetConferences conducted by the National Center for Immunization and Respiratory Diseases four to five times a year, which cover immunization across the life course.[253] Education and training opportunities aimed at improving HCPs' knowledge of life-course immunization have also been developed by HCP bodies. For example, the American College of Physicians has developed a mentoring program which connects HCPs who want to offer or expand their adult immunization services with national experts.[254] The 4 Pillars immunization toolkit was developed to support HCPs in primary care to increase vaccine uptake among adults.[86]

Case study: 4 Pillars Practice Transformation Program

Summary: The 4 Pillars Practice Transformation Program is an evidence-based guide which provides step-by-step directions for making system changes to increase vaccination rates in primary care settings.[86] The four pillars are convenient vaccination services, communication with patients, enhanced office systems and motivation through an office Immunization Champion.[86] Each pillar contains multiple strategies and, while practices can choose which strategies to implement, they must select at least one from each pillar.[91 92]

A cluster randomized controlled trial was used to test the effectiveness of the program to increase adult influenza and Tdap vaccination rates. The trial was run in primary care practices in Pittsburgh and Houston over two years and included 70,549 patients with an average age of 55 years.[86] Every practice selected an Immunization Champion who worked with the research team to identify effective strategies and facilitate their implementation.[86 92]

Impact: The program was successful in increasing Tdap vaccine uptake. Over the course of the trial, practices that were implementing the 4 Pillars program had an increase in Tdap immunizations of 12.7% and pneumococcal polysaccharide vaccination rates increased by 6.9%.[86] However, the program did not appear to influence influenza vaccine uptake as there was no difference between the intervention and control practices.[93]

Immunization Champions appeared to be key to program success. Those clinics with a strong Immunization Champion were seen to achieve high levels of staff motivation around vaccination and were thought to have greater levels of vaccine uptake.[92] On the other hand, some practices were viewed as not having chosen an effective Champion because the person did not demonstrate the ability to encourage behaviour changes through either influence or authority.[91 92]

Lessons: The success of this program shows the value of implementing holistic and flexible interventions in primary care services. Experts involved in the study identified critical components for effectively implementing such a program. Firstly, having a designated Immunization Champion can contribute to greater staff motivation around vaccination and lead to increased vaccine uptake.[92] In addition, system interventions such as standing vaccination orders are key, but must be triggered by a routine process such as an electronic health record prompt.[91]

Increasingly in the US, healthcare facilities are requiring HCPs to be vaccinated against certain diseases.[255] In some cases, requirements in state statutes and regulations are facilitating the establishment of these requirements.[255] The ACIP recommends mandatory influenza vaccination for all HCPs, and some healthcare facilities have initiated mandatory influenza vaccination for this group. An opt-in internet survey of 2,265 US healthcare personnel for the 2017/18 influenza season found coverage was highest among those who were required by their employer to be vaccinated (94.8%) and lowest in settings where vaccination was not required, promoted or offered on site (47.6%).[97]

Multidisciplinary and cross-sectoral coordination

Immunization across the life course is well integrated into the US's national policy agenda for healthy living. Healthy People 2020 is a 10-year strategy for improving the nation's

health. One of its overarching goals is to 'attain high-quality, longer lives free of preventable disease, disability, injury, and premature death'.[102] Immunization objectives within Healthy People 2020 are detailed and cover the life course.[101] However, the objectives for the next iteration of the agenda, Healthy People 2030, have recently been proposed and do not show the same focus on life-course immunization. The revised objectives include a narrower range of vaccines and there is no longer any detail under the proposed objectives.[40] Vaccine advocacy organizations have commented on these new objectives and call for a stronger emphasis on immunization beyond childhood.[256]

National initiatives support immunization in pharmacies and in schools. The US Department of Veterans' Affairs (VA) has partnered with the pharmacy chain Walgreens to provide influenza vaccines to veterans enrolled in VA healthcare.[257] School-located vaccination is carried out, but traditionally has been reserved for brief catch-up interventions, with routine vaccination recommendations generally conducted by a primary care provider.[258]

Robust data informing policies and programs

Immunization data are collected nationally but there are challenges in allowing timely access. Virtually every state has an IIS in place collecting immunization data across the life course,[259] but access to real-time immunization data is not always facilitated,[260] and individuals often do not have access to their own immunization records.[245] In addition, there is no national IIS and systems for sharing data between different states have not been established, increasing the chance that individuals will have gaps in their immunization records.[125] A government pilot is currently trying to address this issue by facilitating the development of a national IIS network.[125] In 2013, the HHS launched a pilot project to assess an immunization portal that gives individuals access to their immunization records.[136]

Case study: MyIR pilot project

Summary: MyIR is an immunization-specific portal which aims to increase vaccine uptake by providing free, on-demand access to official immunization records, immunization history and forecasting schedules from each state's IIS.[136] MyIR was launched in 2013 in Alaska, Arizona, Louisiana, Washington and West Virginia, as part of the HHS Consumer Engagement for IISs Project.[136] Before the development of this platform, people could not easily access their own immunization records,[137] making it difficult to show proof of immunization when required.

Regular evaluation of the project has helped to ensure that the pilot is adapted to improve registration rates. Evaluation is done through weekly registration metrics, online consumer surveys and key stakeholder interviews.[136 137]

An online authentication process was key to promoting enrolment in the program. In the first two years of the pilot, accounts could only be authenticated by visiting a healthcare provider, which was a barrier to participation for both providers and the public. Providers were concerned about the time commitment involved in authenticating accounts and few people authenticated their accounts after creating them.[137]

When an online authentication process was introduced, the number of accounts increased by 125%.[136] Effective marketing of the system has also been cited as positively influencing awareness and use of MyIR.[137]

Impact: Data suggest that MyIR has empowered people to take action, resulting in increased vaccine uptake. A survey of registered users found that 28% of respondents learned that they needed a vaccine through using the system and 41% of these contacted their healthcare provider to schedule an appointment.[136] Two states, Louisiana and Washington, are still involved and, by the fifth year of the project, 34,000 individuals had activated MyIR accounts across these two states.[136]

Lessons: Lessons learned from the MyIR pilot are valuable for developing IISs that provide individuals with access to their immunization records. Regular, in-depth evaluation of these systems is critical to ensure that barriers to use are identified early and that sustainable adaptations are developed and implemented. In the case of MyIR, it was vital to establish a registration process that was quick and convenient, and that did not require significant time commitment from HCPs.

A comprehensive system exists for monitoring vaccine-preventable diseases across the life course, made up of the National Notifiable Diseases Surveillance System,[261] the Active Bacterial Core Surveillance[262] and the National TB Surveillance System.[263] At least six different systems monitor vaccination rates across the life course for different populations including adults,[264] children,[265 266] adolescents,[265] and residents of long-term care facilities participating in Medicare or Medicaid.[267]

List of Abbreviations

ACIP – Advisory Committee on Immunization Practices (United States)

ACIR – Australian Childhood Immunisation Register (Australia)

AIR – Australian Immunisation Register (Australia)

AMR – antimicrobial resistance

ANSM – Agence nationale de sécurité du médicament et des produits de santé (National agency for the safety of medicines and health products; France)

ARS – Agences Régionales de Santé (Regional Health Agencies; France)

ATAGI – Australian Technical Advisory Group on Immunisation (Australia)

CDC – Centers for Disease Control and Prevention (United States)

COVER – Cover of Vaccination Evaluated Rapidly (United Kingdom)

CRIE – Centro de Referência de Imunobiológicos Especias (Reference Center for Specialized Immunobiologicals; Brazil)

CTAI – Comite Tecnico Assessor em Imunização (Technical Advisory Committee on Immunization; Brazil)

DHSC – Department of Health and Social Care (United Kingdom)

DTP – diphtheria/tetanus/pertussis

GP – general practitioner

GVAP – Global Vaccine Action Plan 2011–2020

HAS – Haute Autorité de Santé (High Authority of Health; France)

HCP – healthcare professional

HHS – Department of Health and Human Services (United States)

HPV – human papilloma virus

IAC – Immunization Action Coalition (United States)

IIS – immunization information system

JSTH – Japanese Society of Travel and Health (Japan)

JCVI – Joint Committee on Vaccination and Immunisation (United Kingdom)

MenW – meningococcal capsular group W

MHLW – Ministry of Health, Labour and Welfare (Japan)

MMR – measles, mumps, rubella

MSM – men who have sex with men

NESID – National Epidemiological Surveillance of Infectious Diseases (Japan)

NGO – non-governmental organization

NHS – National Health Service (United Kingdom)

NIP – National Immunization Program

NITAG – National Immunization Technical Advisory Group

NPEV – National Procurement of Essential Vaccines (Australia)

PHE – Public Health England (United Kingdom)

PPV – pneumococcal polysaccharide vaccine

SBIm – Sociedade Brasileira de Imunizações (Brazilian Society for Immunizations; Brazil)

SDG – Sustainable Development Goal

SUS – Sistema Único de Saúde (Health System; Brazil)

SI-PNI – Sistema de Informações do Programa Nacional de Imunizações (Information System of the National Immunization Program; Brazil)

Tdap – tetanus, diphtheria and pertussis

VA – Department of Veterans' Affairs (United States)

VMBIP – Vaccine Management Business Improvement Project (United States)

VMIC – Vaccines Manufacturing Innovation Centre (United Kingdom)

WHO – World Health Organization

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