



Asia-Pacific
Economic Cooperation

Digital Tools as Enablers for Life-Course Immunization: A Policy Brief for APEC Economies



Table of Contents

Executive Summary	01
Introduction.....	02
Policies and Frameworks Supporting Digital Integration in Immunization Systems (e.g., interoperability across borders)	03
Interoperability and Standards	
Interoperability Across Borders	
Data Privacy and Security Regulations	
Financing and Incentive Mechanisms	
Case studies from APEC Economies	05
Australia: Whole-of-Life Immunization Registry	
Indonesia: Sistem Monitoring Imunisasi Logistik secara Elektronik (SMILE)	
Chile: Economy-Wide DHIS2 Health Platform	
Recommendations for strengthening digital health infrastructure for immunization	07
Key Performance Indicators.....	08
Conclusion	09
References & Notes - Acknowledgements.....	10

Executive Summary

Digital tools are transforming how APEC economies deliver, monitor, and optimize life-course immunization. From electronic immunization registries and mobile apps to AI-powered planning and digital supply chain tracking, these innovations enable more efficient, equitable, and resilient immunization systems. This policy brief supports the implementation of the APEC Action Plan on Vaccination Across the Life-Course (2021–2030) by identifying how digital solutions can enhance vaccine delivery across all ages, with a particular focus on reaching underserved groups and improving responsiveness during health emergencies. This brief is intended to support knowledge-sharing and policy dialogue among APEC economies. The recommendations are non-binding and advisory. Each economy retains full sovereignty in determining whether and how digital tools are adopted within its immunization programs, in accordance with domestic priorities, legal frameworks, and scientific processes.



Introduction

APEC economies are at different stages of digital maturity, but all face shared opportunities to use digital health to strengthen life-course immunization. By leveraging tools like electronic health records (EHRs) and mobile apps, health systems can track individual vaccination histories over decades and ensure people receive recommended vaccines according to schedule.¹ These digital systems improve coordination among healthcare providers by seamlessly sharing records, which facilitates better coverage monitoring and vaccine distribution at regional and economy levels.

Importantly, digital health tools can advance immunization strategies by tailoring services to hard-to-reach populations and specific patient needs. Mobile health (mHealth) apps and SMS reminders can alert both providers, individuals, and caretakers about recommended, due, or missed immunizations. Telehealth platforms help overcome geographic barriers by enabling virtual consultations and follow-ups, so individuals can access guidance and referrals without traveling long distances.

Newer technologies, including data-driven tools like artificial intelligence (AI), can be used to analyze immunization coverage in real time, helping optimize vaccine allocation, predict outbreak risks, and identify communities or regions with low uptake.²

Potential uses of digital health tools for immunization include:

- ✔ **Efficient Data Management:** Electronic Health Records (EHRs) and Immunization Information Systems (IIS) consolidate vaccination data, ensuring accurate tracking of individuals' immunization statuses across their lifespan. Open-source health management information systems can track key health indicators.
- ✔ **Personalized Communication:** Mobile health applications and SMS services provide tailored vaccination reminders and educational content, enhancing vaccine uptake by addressing individual concerns and improving accessibility.
- ✔ **Real-Time Monitoring of Immunization Campaigns:** Digital technologies support real-time monitoring of vaccination coverage and cold chain management, ensuring vaccines are stored and distributed effectively. This capability is crucial for rapid responses to outbreaks and maintaining vaccine efficacy.
- ✔ **Enhanced Accessibility:** Digital platforms enable the issuance of electronic vaccination certificates, simplifying verification processes for both individuals and health authorities. AI has also been leveraged for microplanning vaccination campaigns in low-resource settings.

This policy brief is intended to support APEC economies in implementing the *APEC Action Plan on Vaccination Across the Life-Course* by providing recommendations and best practices on how digital tools can enable life-course immunization.

Policies and Frameworks Supporting Digital Integration in Immunization Systems (e.g., interoperability across borders)

Implementing digital health for immunization at scale requires enabling policies, standards, and investments. Across APEC economies, several key policy areas have emerged to support digital integration:

Interoperability and Standards:

APEC members recognize that health data systems must be able to “talk” to each other for maximum impact. Many economies have voluntarily aligned with international standards and are exploring interoperable platforms that connect immunization registries with other health information systems, consistent with their domestic priorities and governance frameworks.³ This becomes particularly important when immunization registries are operated on a state or jurisdictional basis, ensuring that citizens can access their records regardless of where they live, and Ministries of Health have a comprehensive view of immunization rates across the economy.

Interoperability Across Borders:

Digital health systems can support pandemic preparedness and facilitate voluntary mechanisms for verifying vaccination status in cross-border contexts, while respecting domestic governance frameworks. During the COVID-19 pandemic, several APEC economies developed digital vaccination certificates—often QR-code-based—to support safe international travel. In 2022, APEC economies endorsed the Voluntary Principles for the Interoperability of Vaccination Certificates, which outline approaches to standards, privacy protections, and mutual recognition while respecting each economy’s domestic laws and policies.⁴



Building on these foundations, economies may explore, on a voluntary basis, how interoperable digital health tools could support life-course immunization—for example by enabling individuals to access or present vaccination records when traveling, migrating, or working abroad. Any such approaches should continue to prioritize privacy protections, trusted governance, and the ability of member economies to determine how digital health tools are adopted and implemented domestically. Such efforts could help facilitate safe mobility, continuity of preventive care, and regional health security.

Data Privacy and Security Regulations:

Trust is fundamental when handling personal health data. Economies have implemented privacy laws and regulations to protect individuals' immunization information in digital systems. For example, economies such as Singapore and Australia enforce strict data protection rules (e.g. Singapore's PDPA, Australia's Privacy Act) that cover health records, giving patients confidence that their information in immunization registries or vaccine apps is secure. Ensuring cybersecurity is also a priority, many digital immunization systems implement encryption, access controls, and audit trails to prevent breaches. Robust privacy and security policies not only comply with ethical standards but also encourage public uptake of digital health tools (people are more likely to use an app or registry if they trust that their data is safe).

Financing and Incentive Mechanisms:

Digital transformation of immunization requires investment, and APEC economies have explored various financing approaches. Some governments directly fund the development and maintenance of immunization information systems as critical health infrastructure (often with significant budget boosts following COVID-19). Others engage in public-private partnerships – for instance, the Philippines' VIMS was developed with support from both government and private tech partners, and Korea's system incentivizes private providers to participate by reimbursing vaccine costs when they log data into IRIS.⁵



Case studies from APEC Economies

Australia: Whole-of-Life Immunization Registry

The **Australian Immunisation Register (AIR)** is an electronic register that captures the vaccination status of all people in Australia. AIR records the administration of vaccines under the NIP, through school programs, and privately. Individuals can access their Immunization History Statement, which shows all vaccines administered since birth, through the online portal or a mobile Medicare app to keep track of their vaccines, check eligibility or need for boosters or additional vaccines, and provide proof of vaccination. Individuals can also add COVID-19 and influenza immunization history to digital wallets (e.g., Apple Wallet) for easy access.⁶ This comprehensive tracking has improved coordination - for instance, schools and workplaces can verify immunizations, and public health officials can monitor coverage across age groups.

Indonesia: Sistem Monitoring Imunisasi Logistik secara Elektronik (SMILE)⁷

SMILE is a mobile and web-based application implemented by the Indonesian Ministry of Health and supported by the United Nations Development Programme (UNDP) to strengthen Indonesia's immunization supply chain system. SMILE digitizes inventory management information to improve stock management. The system employs data loggers that continuously record storage temperatures throughout the cold chain, providing real-time visibility and automatic alerts for temperature excursions. These systems safeguard vaccine quality from the point of manufacture to the time of administration. The system was initially piloted in 54 Puskesmas (community health centers) across three provinces. As of October 2024, SMILE has managed the end-to-end delivery of over 800 million doses of vaccines and 100 million doses of medicines at 10,000 healthcare facilities across Indonesia's 38 provinces.⁸ In addition to geographic expansion, SMILE expanded its range of health commodities to include tuberculosis, malaria, HIV, and rabies. In 2024, Indonesia introduced SATUSEHAT Logistics, a medical supply chain and logistics platform for pharmaceuticals and medical devices, using the SMILE platform. Importantly, the introduction of SMILE and SATUSEHAT involved a diverse range of key stakeholders, including the Ministry of Health, the Office of Digital Transformation, provincial health leaders, and development partners.










Chile: Economy-Wide DHIS2 Health Platform

Chile's Ministry of Health implemented a domestic, cloud-based version of the open-source **DHIS2 platform** to modernize health data systems and support integrated service delivery. The platform consolidates multiple health programs into a single digital system, including **Notifying Units**, a surveillance program for rubella, measles, and poliomyelitis; the **Environmental Event Registry Program**, which monitors and enables timely responses to environmental impacts on health; and the **Epidemiological Isolation Control Program**, which was used during the COVID-19 pandemic and is available for future health emergencies to manage isolation units. The platform also includes stock management capabilities that allow warehouse and facility managers to monitor inventory levels, strengthen demand forecasting, and ensure consistent product availability while minimizing waste. The platform is estimated to reduce operational costs by 5–10% and is being expanded to support additional functions.⁹



Recommendations for strengthening digital health infrastructure for immunization

Digital transformation of immunization requires deliberate policy choices, sustained investment, and coordination across sectors. The following recommendations provide a clear set of practical actions that APEC economies can take to strengthen digital infrastructure for life-course immunization. While implementation approaches may vary, these steps are intended to promote greater consistency, interoperability, and accountability across the region—helping economies move from fragmented, paper-based systems toward integrated, data-driven immunization programs that support efficiency, equity, and health security.

	Establish or expand electronic immunization registries covering all ages
	Integrate immunization platforms with broader digital health systems (e.g., EHRs, civil registries), while ensuring strong privacy safeguards and protections for personally identifiable information (PII) in accordance with domestic laws and governance frameworks, and recognizing that implementation approaches remain voluntary and determined by each economy.
	Pilot and scale digital health innovations in sub-populations
	Improve interoperability through the adoption of international standards
	Ensure strong data privacy and cybersecurity frameworks to build trust in digital tools
	Leverage advanced analytics for decision-making
	Use mobile tools (e.g., SMS, apps) to support voluntary reminders, scheduling, and outreach, helping individuals and providers manage vaccination more conveniently. These tools should prioritize user choice, privacy protections, and the ability for individuals and providers to control notification preferences. Train healthcare workers to use digital platforms effectively and securely
	Enable real-time stock and cold chain monitoring to reduce waste and improve delivery
	Monitor, evaluate, and share best practices and progress, including through public reporting of aggregate immunization data.

Key Performance Indicators

To complement these recommendations, a set of Key Performance Indicators (KPIs) has been developed to help APEC economies assess their progress in adopting and scaling digital tools for life-course immunization. These indicators are not intended for comparison or ranking across economies but rather for self-assessment and internal performance tracking. They provide a standardized framework to help governments identify specific gaps, monitor implementation milestones, and measure tangible improvements over time in areas such as data systems, interoperability, and program delivery.

Domain	Indicator	Maturity Scale (0–3)
1: Electronic Immunization Information Systems (EIR/IIS)	1.1 Existence & Scope of EIR	0: No EIR 1: Limited (children only/pilot) 2: ≥80% population or facility coverage 3: Full life-course EIR covering all ages
	1.2 Timeliness of Digital Recording (% doses recorded within 7 days)	0: <40% 1: 40–69% 2: 70–89% 3: ≥90%
	1.3 Automated Analytics Availability	0: None 1: Manual/basic exports 2: Automated dashboards (coverage, dropout) 3: Real-time analytics with age/geography/provider views
2: Interoperability & Data Exchange	2.1 Linkage to Other Systems (civil registration, domestic ID, EMRs, supply chain)	0: 0 systems 1: 1 linked system 2: 2 linked systems 3: 3–4 linked systems
	2.3 Cross-Border Digital Certificate Readiness	0: No certificate 1: Digital certificate exists 2: Aligned with APEC Voluntary Principles 3: Recognized by ≥1 partner economy
3: Service Delivery & Demand Tools	3.1 Automated Reminder/Recall Coverage	0: <20% 1: 20–49% 2: 50–79% 3: ≥80%
	3.3 Access to Personal Digital Vaccination Records	0: No access 1: Access only via facilities 2: Access via portal/app 3: Mobile-friendly with downloadable certificate
4: Digital Supply Chain & Cold Chain	4.1 Digital Stock Reporting Coverage	0: <40% 1: 40–69% 2: 70–89% 3: ≥90%
	4.2 Real-Time Cold Chain Monitoring	0: <20% points monitored 1: 20–49% 2: 50–79% 3: ≥80%
	4.3 Visibility of Stock-Outs & Expiry	0: No visibility 1: Monthly reporting 2: Weekly/automated 3: Real-time dashboard with alerts

Conclusion

Digital transformation presents a powerful opportunity to strengthen immunization systems across the life course and ensure that every generation benefits from timely, equitable vaccination. By investing in interoperable data systems, leveraging real-time analytics, and integrating digital tools into primary and community health services, APEC economies can enhance efficiency, transparency, and responsiveness in vaccine delivery. The examples highlighted in this brief show that digital solutions are already improving supply chain management, expanding access, and supporting informed decision-making across the region. Continued collaboration through the APEC Health Working Group will be essential to translate these innovations into sustained, system-wide improvements. Ultimately, embedding digital tools within life-course immunization strategies will not only protect populations against infectious disease but also contribute to healthier, more resilient, and economically secure societies across APEC economies.



References & Notes

- 1 <https://pmc.ncbi.nlm.nih.gov/articles/PMC11359052/#:~:text=A%20source%20of%20real,patients%20about%20upcoming%20or%20missed>
- 2 <https://pmc.ncbi.nlm.nih.gov/articles/PMC11359052/#:~:text=A%20source%20of%20real,patients%20about%20upcoming%20or%20missed>
- 3 https://www.apec.org/docs/default-source/publications/2022/1/empowering-telehealth-solutions-in-apec-study-on-the-policy-landscape-for-telehealth-in-the-apec-region/222_hwg_apec-study-empowering-telehealth-solutions.pdf?sfvrsn=4e118d3f_2#:~:text=Align%20Standards%20%26%20Achieve%20Interoperability,and%20integrated%20digital%20hospitals%20initiatives
- 4 <https://www.apec.org/meeting-papers/sectoral-ministerial-meetings/trade/apec-ministers-responsible-for-trade-statement-of-chair/annex-b---voluntary-principles-for-the-interoperability-of-vaccination-certificates-in-the-apec-region>
- 5 <https://pmc.ncbi.nlm.nih.gov/articles/PMC10985501/#:~:text=assessing%20vaccination%20timeliness%20and%20coverage,22>
- 6 <https://www.servicesaustralia.gov.au/australian-immunisation-register>
- 7 <https://www.undp.org/indonesia/projects/sistem-monitoring-imunisasi-logistik-secara-elektronik-smile>
- 8 <https://www.undp.org/indonesia/press-releases/transforming-indonesias-medical-supply-chain-ministry-health-introducing-satusehat-logistics-collaboration-undp-indonesia>
- 9 <https://dhis2.org/chile-national-health-platform/>

Acknowledgements

This policy brief was prepared by the Vaccines Task Force, a work stream established by the Asia-Pacific Economic Cooperation (APEC) Health Working Group. Principal authors include **Ms. Alexa Trost**, **Ms. Megan Rauscher**, and **Dr. Ryan MacFarlane**, PhD, of Access Partnership. Special thanks to the **APEC Secretariat and the APEC Sub-Working Group on Vaccination for their support**. The views expressed in this paper are those of the authors and do not necessarily represent those of APEC Member Economies.



**Asia-Pacific
Economic Cooperation**