

# Vaccines and Quality Roadmap

Using Healthcare Quality Levers to Increase  
Adult Immunization Rates in the U.S.



## Acknowledgement

### Prepared by Avalere Health

We would like to thank Avalere Health for preparing this document, for their role in facilitating the “Project Prevention: Dialogue to Advance the Use of Vaccines for Older Adults through Quality,” and for continuing to advance the conversation in the subsequent months. Avalere is a vibrant community of innovative thinkers dedicated to solving the challenges of the healthcare system and delivering a comprehensive perspective, compelling substance, and creative solutions to help clients make better business decisions. Avalere partners with stakeholders from across healthcare to help improve care delivery through better data, insights, and strategies. This work does not reflect the views of Avalere. For more information, please contact Richard Hughes at [RHughes@avalere.com](mailto:RHughes@avalere.com). You can also visit us at [www.avalere.com](http://www.avalere.com).

## Overview

Immunization was one of the greatest public health achievements of the 20th Century. Despite promising new opportunities to further reduce vaccine-preventable disease, improving adult immunization rates remains a persistent challenge. As our nation's healthcare system continues its shift from volume to value, quality reporting, measurement, and improvement can serve as important vehicles toward increasing adult immunization uptake.

Recognizing the need to increase immunization rates among the adult population, in 2010, the National Vaccine Program Office developed a National Adult Immunization Plan (NAIP), which provides a framework of four goals and corresponding objectives aimed at improving adult immunization rates. The first of the four NAIP goals is aimed at strengthening the adult immunization infrastructure. Under NAIP Goal 1, three objectives are particularly focused on improving immunization data, quality improvement, and evidence, key aspects of the infrastructure that would enable stakeholders to more effectively drive adult immunization uptake through quality-based efforts.<sup>i,ii</sup> These objectives are:

### NAIP OBJECTIVE 1.4

Increase the use of electronic health records (EHRs) and immunization information system (IIS) to collect and track adult immunization data

### NAIP OBJECTIVE 1.5

Evaluate and advance targeted quality improvement initiatives

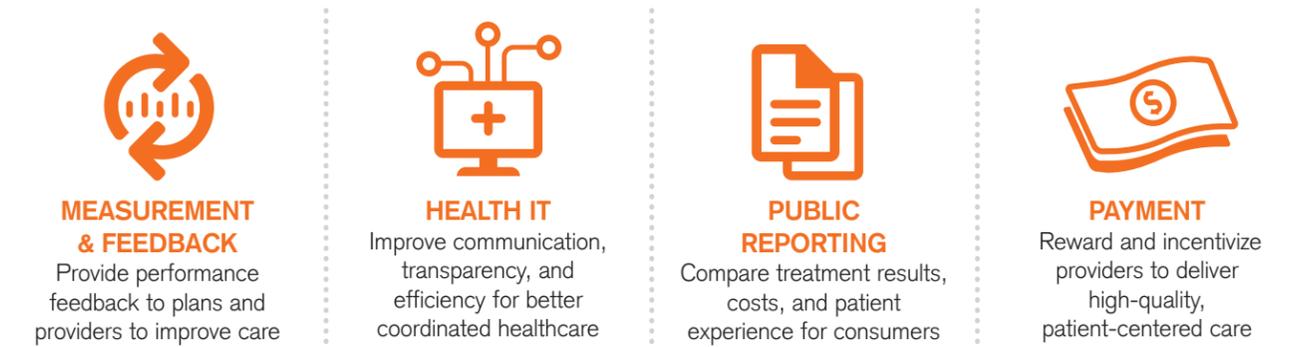
### NAIP OBJECTIVE 1.6

Generate and disseminate evidence about the health and economic impact of adult immunization, including potential diseases averted and cost-effectiveness with the use of current vaccines\*

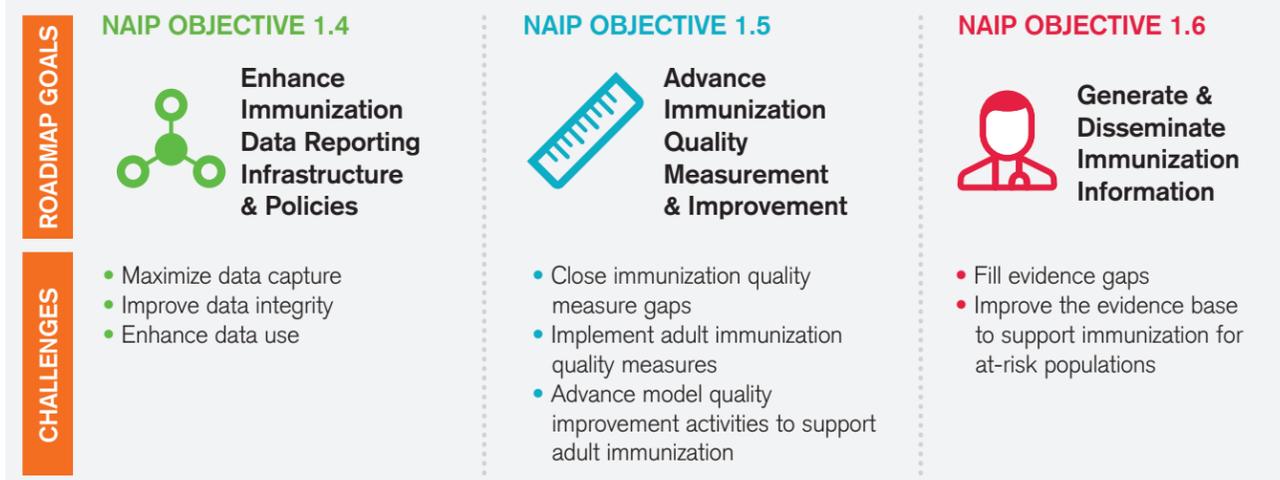
On September 28, 2016, GlaxoSmithKline (GSK) co-sponsored, along with America's Health Insurance Plans (AHIP), the Gerontological Society of America (GSA), and the Immunization Action Coalition (IAC), a roundtable meeting entitled "Project Prevention: Dialogue to Advance the Use of Vaccines for Older Adults through Quality," to develop strategies and supporting tactics for implementing these objectives of the National Adult Immunization Plan (NAIP) in the next one to five years. A total of 24 immunization, healthcare quality, and clinician stakeholders participated in the discussion and activities.



As the project evolved in 2017, stakeholder input from the Dialogue, as well as previous multi-stakeholder initiatives to address low adult immunization rates in the U.S., helped inform the development of potential strategies and tactics that could be operationalized through the use of select National Quality Strategy (NQS) levers developed by the U.S. Department of Health and Human Services (HHS).<sup>iii</sup>



This document provides an initial roadmap for leveraging quality to improve immunization uptake through three specific goals that correspond to the NAIP objectives:



To advance these strategies and tactics, quality and immunization stakeholders should identify opportunities and create forums to bridge gaps between activities in the quality measurement and immunization spaces, engage and educate traditional and non-traditional stakeholders in quality and immunization, and seek to leverage mutual goals to build partnerships and coalitions that advance immunization quality measurement. This roadmap will continue to evolve with ongoing feedback from stakeholders.

# Increasing Adult Immunization Rates In the U.S. Through Data and Quality: A Roadmap

## Roadmap Goal 1



MAXIMIZE DATA CAPTURE



STRENGTHEN DATA INTEGRITY



ENHANCE DATA USE



## Roadmap Goal 2



BUILD MODEL QUALITY IMPROVEMENT (QI) ACTIVITIES TO SUPPORT ADULT IMMUNIZATION



IMPLEMENT EXISTING AND FUTURE ADULT IMMUNIZATION QUALITY MEASURES



CLOSE IMMUNIZATION QUALITY GAPS



## Roadmap Goal 3



FILL EVIDENCE GAPS



GROW THE EVIDENCE BASE TO SUPPORT IMMUNIZATION FOR AT-RISK POPULATIONS



IMPROVED IMMUNIZATION UPTAKE



## Enhance Immunization Data Reporting Infrastructure and Policies

Immunization Information Systems (IIS) are important state- and local-level tools for capturing, storing, and accessing data on patients' immunization histories. IIS help improve quality of care by allowing providers to access timely data that can assist them in making appropriate immunization recommendations for their patients.<sup>iv</sup> IIS also benefit public health by allowing state and local health departments to quickly access immunization information during outbreaks.<sup>v</sup>

The widespread adoption of and advances in Electronic Health Records (EHRs) have improved the potential efficiency and quality of IIS by allowing providers to report into IIS through their EHRs.<sup>vi,vii</sup> This bidirectional interoperability creates additional potential uses for IIS, including "forecasting" when patients need new immunizations and sending patients reminders.<sup>viii</sup>

IIS are funded and administered differently among states and territories and are governed by varying state laws and regulations. The Centers for Disease Control and Prevention (CDC) and advocacy groups such as the American Immunization Registry Association (AIRA) publish best practices and recommendations to standardize IIS functionalities across states and territories. Stakeholders can work together to support implementation of these standards and further the effectiveness of IIS by taking steps to (1A) maximize data capture, (1B) improve data integrity, and (1C) enhance data use.

### 1A. CHALLENGE

#### Maximize Data Capture

IIS reporting rates for adult immunization are low compared to childhood reporting rates, due to a lack of interoperability, connectivity, and reporting among adult vaccination providers.<sup>ix,x</sup>

The gap between childhood and adult IIS data results from efforts to improve provider reporting requirements and incentives that have traditionally focused on the pediatric population. Many states lack strong registry connectivity requirements for providers who typically vaccinate adults, including non-traditional immunization providers, and a small number of IIS are not legally authorized to capture adult records. As a result, registries do not capture the maximum quantity of adult immunizations that occur.<sup>xi</sup> Because all IIS functions rely on the data in the system, limited initial adult data capture restricts IIS potential.

### 1A. OPPORTUNITY

**Address under-connectivity and under-reporting to improve the amount of adult immunization data that providers report into IIS. Looking to current state best practices and weaknesses in IIS policy is key to informing policy decisions.**

#### Actions:

- Support strong clinician reporting requirements by advocating with local immunization coalitions for state laws and regulations that mandate all provider types report immunization records into IIS for all patient ages
- Advocate that CMS elevate IIS and adult immunization in the context of federal initiatives to enhance EHR/HIT interoperability.
- Increase the number of providers reporting into adult IIS by advocating state-level immunization programming for provider on-boarding targeted at adult immunizers
- Raise awareness and visibility of reporting to IIS to fulfill federal-level quality program reporting opportunities
- Advocate for requiring IIS reporting as part of the advancing care information base score under the QPP's MIPS, as well as for receipt of bonus scores for both reporting and receiving immunization data (bidirectional information exchange) and reporting through EHR
- Work with IIS advocacy and provider groups to develop educational materials for providers on the MIPS IIS reporting opportunity
- Connect states and facilities with sufficient funding for IIS infrastructure and provider onboarding
- Assist state health departments in leveraging available CMS HITECH funds for onboarding of adult providers, incentive payments, and EHR adoption, and CMS MMIS grants to support ongoing operational costs
- Identify states should leverage Section 317 funding to support provider outreach on IIS connectivity and educate their health departments on how to do so
- Advocate for CDC to require states with low provider IIS participation that receive Section 317 funding for IIS projects to use the funds to complete specified provider onboarding initiatives

1B. CHALLENGE

**Improve Data Integrity**

Varying data sources and submission methods can result in inconsistent and inaccurate immunization data, calling into question the integrity of IIS data.<sup>xii,xiii</sup> The regional nature of IIS and rapidly advancing health information technology, including the increased use of EHRs, has resulted in a need to ensure the integrity of data reported from all sources into IIS. Recognizing this, the federal government’s current and past initiatives to improve data exchange, such as CMS’ EHR Incentive Program (“Meaningful Use”), require IIS systems to meet certain data standards. AIRA provides widely used guidelines around data quality assurance to help meet federal standards and generally ensure IIS data quality.<sup>xiv</sup>

IIS data must be complete and accurate to benefit patients, providers, and public health. This means meeting CDC’s “Core Data Element” recommendations, which detail required and optional information that providers should include in immunization records. Examples of the Core Elements include patient information such as patient name, date of birth, and gender, as well as vaccine information such as vaccine lot number and vaccine expiration date. These standards are important for facilitating consistent information exchange between IIS and EHRs. High-quality data is also crucial to increasing provider trust and use of IIS data.<sup>xv</sup>

Immunization stakeholders can assist IIS administrators and providers in implementing and maintaining these standards to ensure the integrity of IIS data.

1B. OPPORTUNITY

**Maximize use of mechanisms to ensure the integrity of immunization data submitted to IIS.**

**Actions:**

- Assist health agencies in using claims data to validate or report automatically into IIS by connecting them with Section 317 funding for provider implementation of interoperability enhancements
- Work with health agencies to implement guidelines in AIRA’s Data Validation Guide for the IIS onboarding Process
- Share IIS data integrity tools and standards with IIS administrators and immunization programs through local advocacy groups
- Consolidate a list of public and private funding sources available to support immunization programs’ efforts to implement IIS data integrity improvement activities
- Ensure provider trust in IIS data integrity by creating and disseminating educational materials for providers on processes that their IIS has in place to ensure data integrity

1C. CHALLENGE

**Enhance Data Use**

The most basic function of IIS is to allow providers to report immunizations into IIS and view their patients’ immunization histories.<sup>xvi</sup> However, with the advancement and adoption of EHRs and general advances in health information technology, IIS have potential to serve multiple functions for patients, providers, and health departments, ranging from assisting providers in reporting on quality measures and sending patients vaccination reminders, to allowing patients to view their vaccination histories, to informing public health policies around vaccination.<sup>xvii</sup>

These innovative functions require initiative, resources, and specific technological capabilities, which currently vary greatly among IIS across the country. Immunization stakeholders can help health departments and immunization programs consider and implement innovative IIS uses that would benefit their populations, and ensure they have the technological capabilities in place to implement them.

1C. OPPORTUNITY

**Advance technological capabilities that improve the functionality of IIS.**

**Actions:**

- Support health department and immunization program efforts to increase and/or improve IIS functionality by connecting them with funding and resources
- Survey state IIS to ensure all systems’ functionality includes, at a minimum, bidirectional information exchange that allows providers to both report into IIS and receive patient information from IIS
- Raise awareness of the full potential functionality of IIS
- Identify advocates in regions that currently lack strong IIS infrastructure and develop an advocacy and fundraising plan for their IIS



## Advance Immunization Quality Measurement and Improvement

Amid the ongoing shift toward value-based payment, quality measurement provides an increasingly important tool to support increased immunization rates.<sup>xviii</sup> Likewise, immunization focused quality improvement (QI) activities have the potential to help drive vaccine use and improve data reporting.<sup>xix</sup>

Despite the growing demand to leverage quality measures and QI strategies to increase adult vaccination rates, challenges such as the increasing complexity of adult vaccine schedules and disparate immunization data sources have hindered rapid advancements in the development of immunization-related quality improvement and measurement.<sup>xx</sup>

To more effectively leverage the quality measurement and quality improvement activities to increase adult vaccination rates, stakeholders may focus on (2A) closing immunization quality measure gaps, (2B) effectively implementing existing and future adult immunization quality measures, and (2C) advancing model quality improvement activities to support adult immunization.

### 2A. CHALLENGE

#### Close Immunization Quality Measure Gaps

In 2014, the National Quality Forum (NQF) conducted an assessment of the adult vaccine quality measure landscape and identified several priority measure gaps.<sup>xxi</sup> The dearth of tested, validated, and endorsed quality measures for several recommended adult immunizations prevents meaningful plan and provider performance measurement and impedes the ability to incentivize immunization performance improvement in programs such as value-based purchasing arrangements.

Furthermore, the fragmented use of standalone adult immunization measures has led to a growing focus on the need for composite measures to encourage a streamlined and comprehensive approach to improve adult vaccination rates.<sup>xxii</sup>

### 2A. OPPORTUNITY

#### Support the development, testing, evaluation, and maintenance of adult vaccine measure(s).

##### Actions:

- Identify opportunities to develop or revise adult immunization measures, such as those currently in use at the state or local levels
- Develop and make available for public use a vaccine quality measure that captures series completion and adherence to the ACIP-recommended vaccine schedule for adult immunizations that require multiple doses over set time intervals

- Refine, enhance, and make available for public use an Adult Composite measure for ACIP-recommended adult vaccines
- Develop a core set of adult immunization quality measures that address all ACIP-recommended vaccines for adults as well as measures that reflect provider assessment of a patient's immunization status

### 2A. OPPORTUNITY

#### Mobilize stakeholders to support adult immunization measurement-related activities.

##### Actions:

- Identify measurement gaps, particularly for population-specific immunizations, and create a process to engage stakeholders who can best drive or support efforts to fill those gaps (e.g. specialty societies, patient groups)
- Develop resources to guide immunization measure development, implementation, and evaluation, such as creating standards or leveraging educational materials to inform future work

### 2B. CHALLENGE

#### Implement Existing and Future Adult Immunization Quality Measures

Adult vaccine quality measures are underutilized in national-level quality initiatives and many existing measures do not consistently appear across quality programs due to lack of coordination.<sup>xxiii</sup> Furthermore, these measures are often independently developed by different measure developers, leading to multiple variations of similar measures. In FY 2017, only 27 immunization-related quality measures appeared in federal-level Medicare quality and payment programs.<sup>xxiv</sup> Additionally, with the exception of several influenza-specific vaccine measures, adult immunization measures generally lack NQF endorsement, which further hinders fast adoption in federal programs. Refinement, harmonization, rigorous evaluation, and endorsement of new and existing adult immunization measures are critical to expanding their adoption in quality programs and improving immunization data reporting.

2B. OPPORTUNITY

**Educate providers participating in federal quality reporting and payment programs about opportunities and benefits of reporting on immunization quality measures.**

**Actions:**

- Create a series of programs, materials, and resources in a centralized repository that educate providers on strategies to improve performance on adult immunization quality measures, including highlighting and addressing key barriers to initiating adult immunizations and completing immunization series that align with existing quality measures
- Develop a coordinated, multi-stakeholder approach to educate providers on reporting options for the Medicare QPP, highlighting opportunities for clinicians to report on adult immunization quality measures under MIPS
- Engage with QCDRs to identify opportunities for inclusion of new adult immunization measures, as well as expanded use and alignment of adult immunization measures across QCDRs

2C. CHALLENGE

**Advance Model Quality Improvement Activities to Support Adult Immunization**

Quality improvement (QI) projects that have successfully demonstrated improved vaccine uptake serve as potential models for expansion or dissemination. As with many QI programs, however, it is challenging to disseminate learnings and sustainably implement successful large-scale models of projects that have only been piloted on a small scale.<sup>xxv</sup> Furthermore, QI programs have historically focused on childhood immunization<sup>xxvi,xxvii</sup> and while these provide useful learnings to inform QI activities for the adult population, additional adult-focused immunization QI models are needed. Social factors and the complexity of adult vaccination schedules pose further challenges to implementing comprehensive adult immunization QI activities.<sup>xxviii</sup>

2C. OPPORTUNITY

**Identify opportunities at the federal, state, and local levels, as well as across a range of care settings to test, evaluate, and refine innovative QI strategies aimed at improving adult immunization rates.**

**Actions:**

- Create new or leverage existing sources of public and private funding to support the design of QI programs targeting adult immunization, including:

- Federal agencies with a focus on quality improvement activities (CMS, CDC, HRSA)
- Programs to test innovative care and payment models (i.e. CMMI State Innovation Models initiative, Section 1115 State Medicaid Demonstration Waivers) to test adult immunization QI strategies
- Private research grants and/or industry partnerships

- Compile a compendium of best practices based on successful QI projects and develop strategies to disseminate and replicate them, such as:
  - ACP I Raise the Rate Project
  - AMGA Foundation Adult Immunization Best Practices Collaborative
  - GSA ICAMP Academy
- Identify super-immunizers and conduct focus groups to understand their strategies, best practices, and lessons learned
- Identify opportunities for partnerships and optimal environments in which to test or implement QI programs with impact or system changes that can be isolated and transparently evaluated, such as integrated delivery networks and FQHCs

2C. OPPORTUNITY

**Develop strategies to implement or expand successful adult immunization QI programs.**

**Actions:**

- Develop public-private partnerships to fund the implementation of successful QI projects on a large scale to demonstrate their effectiveness (and facilitate broad, coordinated implementation across multiple sites), such as those described in:
  - ACP Quality Connect Adult Immunization Program
  - CDC's AFIX Program
- Collaborate with accreditation bodies to develop or strengthen existing requirements for accreditation and/or recognition programs (e.g. TJC, URAC, NCQA) for health plans, providers, and healthcare organizations, that incorporate quality and performance activities emphasizing adult immunization
  - For example: NCQA's redesigned 2017 PCMH Recognition Program standards require clinicians to remind patients of upcoming services for at least five different services across two categories; immunization is one of the five services listed in Annual Reporting Category 3: Population Health Management
- Engage chronic disease programs/teams (and/or firms that specialize in chronic disease management) to focus on immunization best practices utilizing other successful models



## Generate and Disseminate Immunization Information

Evidence on the health and economic impact of vaccines is needed to convey the value of vaccines and drive efforts to improve immunization uptake. For example, evidence demonstrating the impact of vaccine-preventable diseases on patient outcomes, daily activities, and quality of life can emphasize the importance of adult vaccination. Evidence is also fundamentally important to informing the development of clinical recommendations on which quality measures and a range of quality improvement efforts are based.<sup>xxix</sup>

More robust evidence showing the clinical and economic implications of undervaccination at the individual and population levels is also needed to show the importance and value of vaccines.<sup>xxx</sup>

While evidence demonstrating the clinical and economic impact of adult immunizations has grown in recent years, more research is needed to help further refine vaccine recommendations, particularly for at-risk populations, and drive efforts to improve vaccination rates. Stakeholders can support efforts to generate and disseminate immunization information by (3A) filling evidence gaps and (3B) improving the evidence base to support immunization for at-risk populations.

### 3A. CHALLENGE

#### Fill Evidence Gaps

Research and evidence generation have traditionally focused on childhood immunizations, however, a more robust evidence base on adult immunizations is needed to effectively communicate their value and to support activities that drive immunization uptake. Efforts to implement broad-based immunization strategies and educate immunization stakeholders rely on quantifiable data to demonstrate and compare changes over time.<sup>xxxi</sup> Furthermore, evidence and other information must be translated to meet the needs of specific stakeholders.

### 3A. OPPORTUNITY

#### Identify and fill evidence gaps on the health and economic impact of adult immunizations and translate information to ensure relevance for specific stakeholder audiences.

##### Actions:

- Support research efforts to fill evidence gaps in the adult immunization space and strengthen the existing evidence base
- Conduct studies on both the economic toll of vaccine-preventable infections on individuals and society, and the impact on patients' quality of life (e.g. pain, missed work days, interference with

activities of daily living, loss of independence)

- Conduct a claims-based analysis within health plans/hospital systems to assess the correlation of performance on adult immunization and vaccine-related outcomes (e.g., rates of hospitalization, mortality, and generalized diagnosis codes arising from vaccine-preventable diseases)

### 3B. CHALLENGE

#### Improve the Evidence Base to Support Immunization for At-Risk Populations.

At-risk populations, such as those with chronic medical conditions, pregnant women, or the immunocompromised, comprise a particularly under-immunized segment of the adult population.<sup>xxxii,xxxiii</sup> Limited studies on immunogenicity and immunization outcomes in these at-risk populations can lead to unclear or inconsistent clinical recommendations, which increases provider uncertainty in clinical practice.<sup>xxxiv,xxxv</sup> Studies have also shown sub-optimal provider awareness of recommended immunizations for at-risk populations.<sup>xxxvi</sup>

### 3B. OPPORTUNITY

#### Promote evidence generation focused on immunizations for at-risk populations to improve the quality and prominence of population-specific recommendations.

##### Actions:

- Conduct an evidence assessment to identify gaps in the existing evidence landscape surrounding immunizations for at-risk populations
- Conduct studies to better understand provider barriers and challenges to vaccinating at-risk populations and leverage findings to develop strategies that address those barriers through quality improvement and measurement
- Create a real-time process to alert immunization guideline developers, official recommendation-developing bodies, and measure developers of new evidence to ensure alignment in and systematic updates to clinical practice guidelines and recommendations
- Industry immunization stakeholders and researchers should systematically and proactively disseminate evidence on new vaccines and new study findings for existing vaccines to relevant specialty societies and guideline-developing organizations

### 3B. OPPORTUNITY

## Increase the visibility and provider awareness of existing immunization guidelines for at-risk populations.

### Actions:

- Develop provider communication and decision-support strategies
- Develop provider-specific tools and resources to implement immunization assessment into practice workflow, as well as for specific patient encounters, such as Welcome to Medicare and Medicare Annual Wellness Visits
- Test or implement strategies via PCORI broad funding grants and other funding designated for dissemination and implementation research that offer providers timely, accessible, relevant, and actionable information about vaccine recommendations and schedules, including those for at-risk populations (e.g. “pop-up” reminders for vaccination in EHRs, provider-oriented apps)
- Engage providers directly or through provider-based forums to raise awareness about under-vaccination in at-risk populations
- Create programs focused on immunization for at-risk adult populations through Learning Collaboratives to facilitate implementation of evidence-based immunization recommendations
- Engage with Practice-Based Research Networks that have successfully implemented community-based immunization strategies to replicate or disseminate their models
- Invite adult immunization measure developers to participate in and share updates, progress, or key learnings via presentations and expert panel discussions at key forums, including, at a minimum:
  - NAIS and National Immunization Conference Annual meeting
  - IDSA Week
  - Specialty society meetings focused on immunization, preventive care, or primary care
  - Conferences focused on public health or health services research (e.g. AcademyHealth, National Minority Quality Forum)
- Identify opportunities among vaccine expert panels and workgroups to disseminate new and updated evidence
- Participate and nominate qualified individuals to expert panels and workgroups focused on vaccine quality measure development and/or translation of guidelines into provider resources, including, at a minimum:
  - PQA Adult Immunization Task Force
  - NAIS Quality and Performance Measures Workgroup
  - State-level immunization task forces
  - Specialty societies (e.g. ACP Adult Immunization Advisory Board)
  - Public comment opportunities

## Footnotes

- i The National Vaccine Program Office. National Adult Immunization Plan. HHS Website. <https://www.hhs.gov/sites/default/files/nvpo/national-adult-immunization-plan/naip.pdf>. Accessed October 24, 2017
- ii The National Vaccine Program Office. National Adult Immunization Plan: A Pathway to Implementation. HHS Website. <https://www.hhs.gov/sites/default/files/nvpo/national-adult-immunization-plan/naip-path-to-implementation.pdf>. Accessed October 27, 2017
- iii National Quality Strategy: Using Levers to Achieve Improved Health and Health Care. Content last reviewed November 2016. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/workingforquality/about/nqs-fact-sheets/nqs-fact-sheet-using-levers.html>
- iv Kempe A, Beaty BL, Steiner JF, et al. The Regional Immunization Registry as a Public Health Tool for Improving Clinical Practice and Guiding Immunization Delivery Policy. *American Journal of Public Health*. 2004;94(6):967-972.
- v Immunization Registries – Potential Roles in Pandemic Outbreaks and Bioterrorism. American Immunization Registry Association (AIRA) Website. [http://www.immregistries.org/resources/bioterr\\_fact.pdf](http://www.immregistries.org/resources/bioterr_fact.pdf). November 2001. Accessed October 24, 2017
- vi Au L, Oster A, Yeh GH, Magno J, Paek HM. Utilizing an Electronic Health Record System to Improve Vaccination Coverage in Children. *Applied Clinical Informatics*. 2010;1(3):221-231. doi:10.4338/ACI-2009-12-CR-0028.
- vii JaWanna H, Yuriy P, Talisha S, Vaishali P. Adoption of Electronic Health Record Systems among U.S. Non-Federal Acute Care Hospitals: 2008-2015. The Office of the National Coordinator for Health Information Technology Website. <https://dashboard.healthit.gov/evaluations/data-briefs/non-federal-acute-care-hospital-ehr-adoption-2008-2015.php>. May 2016. Accessed October 24, 2017
- viii Nathan B, Amy M. Developing a Nationwide Consensus on Bidirectional Query Immunization Exchange. American Immunization Registry Association (AIRA) Website. Accessed October 24, 2017
- ix Martin DW, Lowery NE, Brand B, Gold R, Horlick G. Immunization Information Systems: A Decade of Progress in Law and Policy. *Journal of public health management and practice*: JPHMP. 2015;21(3):296-303. doi:10.1097/PHH.0000000000000040.
- x 2016 IISAR Data Participation Rates. Center for Disease Control and Prevention Website. <https://www.cdc.gov/vaccines/programs/iis/annual-report-iisar/2016-data.html>. September 22, 2017. Accessed October 24, 2017
- xi Martin DW, Lowery NE, Brand B, Gold R, Horlick G. Immunization Information Systems: A Decade of Progress in Law and Policy. *Journal of public health management and practice*: JPHMP. 2015;21(3):296-303. doi:10.1097/PHH.0000000000000040.
- xii Immunization Information Systems: Successes and challenges. American Pharmacists Association. <https://www.pharmacist.com/immunization-information-systems-successes-and-challenges>. May 1, 2014. Accessed October 24, 2017
- xiii Improving the Quality of Data Entering the IIS. American Immunization Registry Association (AIRA) Website. [http://www.immregistries.org/resources/AIRA-MIROW\\_Chap3\\_DQA\\_02112008.pdf](http://www.immregistries.org/resources/AIRA-MIROW_Chap3_DQA_02112008.pdf). Accessed October 26, 2017
- xiv Data Quality Assurance in Immunization Information Systems: Selected Aspects. American Immunization Registry Association (AIRA) Website. [http://www.immregistries.org/AIRA\\_MIROW\\_DQA\\_Mini-Guide.pdf](http://www.immregistries.org/AIRA_MIROW_DQA_Mini-Guide.pdf). Accessed October 24, 2017
- xv Improving the Quality of Data Entering the IIS. American Immunization Registry Association (AIRA) Website. [http://www.immregistries.org/resources/AIRA\\_MIROW\\_Chapter\\_3\\_Data\\_Quality\\_Mini-Guide.pdf](http://www.immregistries.org/resources/AIRA_MIROW_Chapter_3_Data_Quality_Mini-Guide.pdf). Accessed October 24, 2017
- xvi Nathan B, Amy M. Developing a Nationwide Consensus on Bidirectional Query Immunization Exchange. American Immunization Registry Association (AIRA) Website. Accessed October 24, 2017
- xvii Groom H, Hopkins DP, Pabst LJ, et al. Immunization information systems to increase vaccination rates: a community guide systematic review. *Journal of public health management and practice*: JPHMP. 2015; 21:227-248.
- xviii Groom H, Hopkins DP, Pabst LJ, et al. Immunization information systems to increase vaccination rates: a community guide systematic review. *Journal of public health management and practice*: JPHMP. 2015; 21:227-248.
- xix Fu LY, Weissman M, McLaren R, et al. Improving the Quality of Immunization Delivery to an At-Risk Population: A Comprehensive Approach. *Pediatrics*. 2012;129(2): e496-e503. doi:10.1542/peds.2010-3610.
- xx Bridges CB, Hurlley LP, Williams WW, Ramakrishnan A, Dean AK, Groom AV. Meeting the Challenges of Immunizing Adults. *American journal of preventive medicine*. 2015;49: S455-S464.
- xxi Prioritizing Measure Gaps: Adult Immunization. National Quality Forum Website. [http://www.qualityforum.org/Prioritizing\\_Measure\\_Gaps\\_-\\_Adult\\_Immunization.aspx](http://www.qualityforum.org/Prioritizing_Measure_Gaps_-_Adult_Immunization.aspx). Accessed October 24, 2017
- xxii James A, Michael H, David S, William S, LJ T. The Value and Imperative of Quality Measures for Adult Vaccines. Adult Vaccine Access Coalition (AVAC) Website. <http://www.adultvaccinesnow.org/wp-content/uploads/2016/07/AVN-White-Paper-FINAL.pdf>. July 2016. Accessed October 24, 2017
- xxiii The National Vaccine Program Office. National Adult Immunization Plan. HHS Website. <https://www.hhs.gov/sites/default/files/nvpo/national-adult-immunization-plan/naip.pdf>. Accessed October 24, 2017
- xxiv CMS Measure Inventory. CMS Website. <https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/QualityMeasures/CMS-Measures-Inventory.html>. Accessed October 24, 2017
- xxv Barker PM, Reid A, Schall MW. A framework for scaling up health interventions: lessons from large-scale improvement initiatives in Africa. *Implementation Science*: IS. 2016; 11:12. doi:10.1186/s13012-016-0374-x.
- xxvi Shefer A, Santoli J, Wortley P, et al. Status of quality improvement activities to improve immunization practices and delivery: findings from the immunization quality improvement symposium, October 2003. *Journal of public health management and practice*: JPHMP. 2006; 12:77.
- xxvii Tan L. Adult vaccination: Now is the time to realize an unfulfilled potential. *Human Vaccines & Immunotherapeutics*. 2015;11(9):2158-2166. doi:10.4161/21645515.2014.982998.
- xxviii A Pathway to Leadership for Adult Immunization: Recommendations of the National Vaccine Advisory Committee: Approved by the National Vaccine Advisory Committee on June 14, 2011. *Public Health Reports*. 2012;127(Suppl 1):1-42.
- xxix Faruque A. U.S. Advisory Committee on Immunization Practices (ACIP) Handbook for Developing Evidence-based Recommendations. CDC Website. <https://www.cdc.gov/vaccines/acip/recs/grade/downloads/handbook.pdf>. November 1, 2013. Accessed October 24, 2017
- xxx Ventola CL. Immunization in the United States: Recommendations, Barriers, and Measures to Improve Compliance: Part 2: Adult Vaccinations. *Pharmacy and Therapeutics*. 2016;41(8):492-506.
- xxxi Groom H, Hopkins DP, Pabst LJ, et al. Immunization information systems to increase vaccination rates: a community guide systematic review. *Journal of public health management and practice*: JPHMP. 2015; 21:227-248.
- xxxii Doherty M, Schmidt-Ott R, Santos JI, et al. Vaccination of special populations: Protecting the vulnerable. *Vaccine*. 2016; 34:6681.
- xxxiii Fu LY, Weissman M, McLaren R, et al. Improving the Quality of Immunization Delivery to an At-Risk Population: A Comprehensive Approach. *Pediatrics*. 2012;129(2): e496-e503. doi:10.1542/peds.2010-3610.
- xxxiv Khasnis, A. Vaccination: Special populations are not all the same. *Cleveland Clinic Journal of Medicine*. 2015 June;82(6):348-349.
- xxxv Papadatos I, Spoulou V. Pneumococcal Vaccination in High-Risk Individuals: Are We Doing It Right?. *Clinical and Vaccine Immunology*. 2016 May 6;23(5):388-95. doi: 10.1128/CVI.00721-15.
- xxxvi Ventola CL. Immunization in the United States: Recommendations, Barriers, and Measures to Improve Compliance: Part 2: Adult Vaccinations. *Pharmacy and Therapeutics*. 2016;41(8):492-506.

