






Stakeholder perspective and sentiment in a rapidly growing United States adult vaccination environment

Graphical abstract

Stakeholder	Identified Challenges	Actionable Strategies
Community Pharmacies 	<ul style="list-style-type: none"> Limited staff capacity for vaccine education and administration Bottlenecks during flu season Gaps in vaccine knowledge with new product introductions Fragmented communication with HCPs 	<ul style="list-style-type: none"> Increase training for staff on new vaccines and eligibility criteria Promote year-round vaccination to balance workloads Integrate EHR systems for streamlined patient data sharing
IDNs 	<ul style="list-style-type: none"> High operational costs from preventable hospitalizations Fragmented vaccine records across settings Inconsistent vaccine quality metrics 	<ul style="list-style-type: none"> Generate real-world evidence linking vaccines to reduced hospitalizations Standardize quality metrics to align with performance incentives Improve interoperable data-sharing tools
Non-Pharmacy HCPs 	<ul style="list-style-type: none"> Limited time to discuss vaccines with patients Lack of interoperability with pharmacies Vaccine hesitancy among patients 	<ul style="list-style-type: none"> Use EMR prompts to facilitate brief, effective vaccine discussions Establish data-sharing protocols with pharmacies Deploy patient navigators for vaccine follow-up
Patients 	<ul style="list-style-type: none"> Lack of awareness about recommended vaccines High sensitivity to out-of-pocket costs Needle fatigue from multiple injections Poor adherence to multi-dose series 	<ul style="list-style-type: none"> Expand DTC campaigns for vaccine education Advocate for policy measures to lower vaccine costs Develop combination vaccines to reduce injection burden
Policy Influencers and Advisors 	<ul style="list-style-type: none"> Absence of standardized vaccine prioritization guidelines Misalignment of financial and public health incentives 	<ul style="list-style-type: none"> Develop easy-to-follow prioritization frameworks with professional organizations Provide data on vaccine cost-effectiveness to inform policy decisions

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In brief

Medicine; Public health; Social sciences

Highlights

- Multi-stakeholder research reveals barriers to adult vaccine uptake
- Pharmacy-led vaccination and patient adherence are key challenges
- Misinformation and operational constraints hinder vaccination efforts
- Coordinated strategies needed to optimize uptake in a complex market



Article

Stakeholder perspective and sentiment in a rapidly growing United States adult vaccination environment

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SUMMARY

The United States adult vaccine landscape is rapidly expanding, raising critical questions about prioritizing vaccines. Through comprehensive market research involving healthcare providers, pharmacies, integrated delivery networks, policy influencers, and pharmaceutical leaders, this study identifies key barriers to vaccine uptake. Findings reveal significant trends including pharmacy-led vaccination, patient adherence challenges, misinformation influence, and operational constraints. Results underscore the need for coordinated efforts to improve vaccine accessibility, streamline processes, enhance public trust, and develop clearer guidelines. Insights provide actionable strategies for stakeholders to collaborate and ensure optimal uptake in an increasingly complex market.

INTRODUCTION

The United States is facing an increasingly complex healthcare landscape, with an aging population, a rise in chronic conditions, and the ongoing threat of known and emerging infectious diseases.^{1–3} As these complexities grow, ensuring widespread adult vaccination coverage has become critical to achieving public health goals in both the United States and globally. In the U.S., the population aged 60 and older is projected to nearly double from 52 million in 2018 to 95 million by 2060.⁴ Simultaneously, the prevalence of multiple chronic conditions (MCCs) among adults aged 60 and older is high, with 94.9% having at least one and 78.7% having at least two, according to National Council on Aging (NCOA) research in 2022.⁵ These factors, combined with advancements in vaccine technologies such as the rise of mRNA platforms, have propelled a rapid evolution in the adult vaccine landscape.⁶ Over the next decade, we anticipate a tripling in the number of approved adult vaccine products globally, from 35 products targeting 13 disease areas today to 100–120 risk-adjusted products designed to protect against 40 different disease areas.⁶

The expansion of the adult vaccine market presents both opportunities and challenges for public health systems. One notable shift is the growing role of patient influence in vaccine decisions, especially following the COVID-19 pandemic, which redefined adult vaccines as a cornerstone of healthy aging.⁶ This change is accompanied by a move to other vaccination sites, such as pharmacies, which accounted for 90% of

COVID-19 vaccinations and 60–70% of vaccinations during flu season.⁷ This shift has increased accessibility but also coincides with ongoing challenges within the vaccine space. One such challenge is the rapid spread of misinformation and disinformation through social media, which has helped to fuel vaccine hesitancy, a barrier exacerbated by the COVID-19 pandemic.^{8,9} In June 2021, in the United States, it was found that up to a third of respondents reported being unsure about or unwilling to receive a COVID-19 vaccine.¹⁰ Additionally, the intense focus on COVID-19 vaccinations has contributed to public fatigue around vaccinations overall, with significant implications for other recommended vaccines such as those for influenza.¹¹

In addition to vaccine hesitancy, current adult vaccination behavior offers limited opportunities for immunization, with patients typically willing to receive a maximum of two shots per arm and attend one to two vaccination visits per year.⁶ This makes the prioritization of vaccines critical, particularly given the absence of a standardized adult immunization schedule in the United States and the complexity of Shared Clinical Decision-Making (SCDM) recommendations.⁶ In contrast, some countries, such as Italy, have implemented national adult vaccination calendars to streamline prioritization and improve adherence. For instance, Italy's 'Immunization for Life' calendar provides a cohesive framework to ensure consistent vaccination across adult populations,¹² demonstrating a model that could inform future U.S. strategies for improving vaccine uptake in this evolving landscape.

Our previous work established that the adult vaccine market is becoming increasingly crowded, with a rapid influx of new



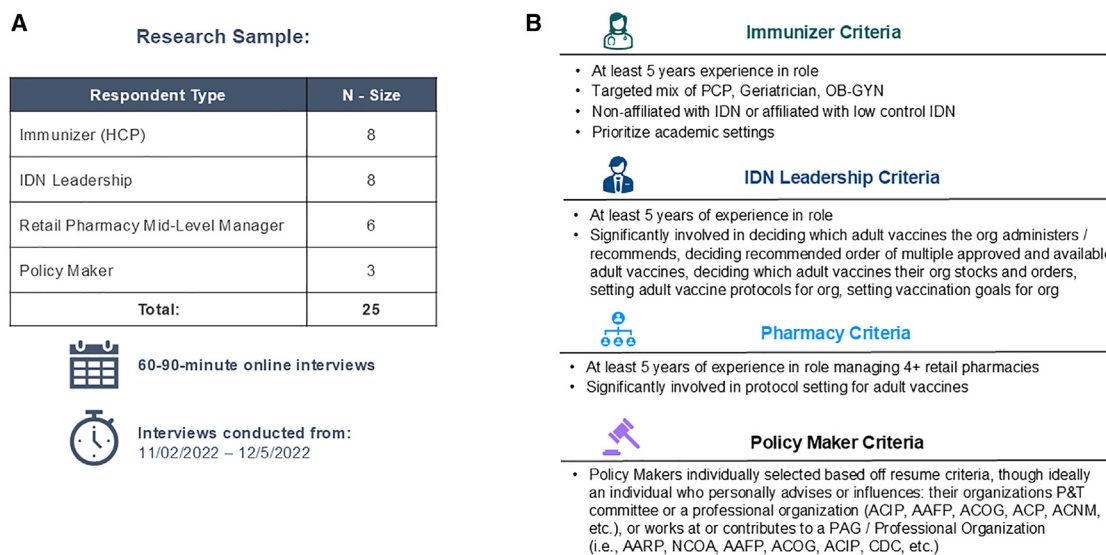


Figure 1. Market Research Design: Respondent Sampling and Inclusion Criteria

(A) Breakdown of respondent types (Immunizers, IDN Leadership, Retail Pharmacy Mid-Level Managers, and Policy Makers) and their respective sample sizes (N = 25). All participants engaged in 60–90 min online interviews conducted between November 2 and December 5, 2022.

(B) Inclusion criteria for each respondent type, specifying minimum experience requirements, professional responsibilities, and selection criteria for policy influencers or advisors with advisory roles in vaccination protocols. These criteria ensured comprehensive representation of stakeholders critical to addressing the crowded adult vaccination landscape.

vaccine products anticipated over the next decade.⁶ This crowded landscape raises critical questions about the factors that will drive vaccine uptake, especially as decision criteria around vaccine prioritization, sequencing, and stocking become more complex. While our previous findings focus on the current dynamics of the U.S. adult vaccine landscape, it is important to note that external factors, such as changes in the political environment or administration, could significantly influence this ecosystem. These uncertainties add further complexity to an already dynamic market and underscore the need for adaptable strategies to ensure continued progress. Therefore, as vaccine options expand, it becomes essential to understand how the ecosystem can adapt to manage these changes effectively. This study aims to address these questions by identifying the criteria influencing vaccine adoption and exploring how vaccines will be prioritized across different settings. In this evolving landscape, identifying which stakeholders – such as community pharmacies, IDNs, healthcare providers (HCPs), and policy influencers or advisors – hold the greatest influence is critical to developing strategies that optimize vaccine uptake. Through a multi-phase market research study, we sought to provide actionable insights that clarify the factors driving vaccine uptake and outline how key stakeholders can collaborate to ensure optimal vaccine uptake in the crowded adult vaccination market.

RESULTS AND DISCUSSION

Through interviews as part of our multi-phase market research study using five adult vaccine archetypes (Figure 1; Table 1), we identified key insights, challenges, and opportunities for

each stakeholder group (Table 2). Detailed summaries of stakeholder interview insights are presented in Table S1 (Community Pharmacy Considerations), Table S2 (IDN Considerations), Table S3 (Non-Pharmacy HCP Considerations), Table S4 (Patient Considerations), and Table S5 (Policy Influencer and Advisor and Considerations).

Community pharmacies

Our interviews with community pharmacy managers ($n = 6$) revealed critical operational challenges and strategic considerations in adapting to the crowded adult vaccine landscape. Staff capacity and expertise emerged as a primary concern among respondents. Pharmacy teams reported approaching the limits of their ability to confidently discuss and administer an expanding array of vaccines. While some pharmacists have developed significant expertise in vaccination, respondents expressed concerns about staying updated with new vaccine products and evolving guidelines, particularly as the pace of innovation accelerates. The potential future knowledge gap would particularly affect their confidence in conducting detailed vaccine consultations and responding to patient inquiries, potentially impacting patient trust and overall vaccine uptake. This brings to light the broader need for targeted education and training whenever there are changes to vaccine product availability or recommendations. Importantly, this need extends beyond pharmacists to all healthcare professionals involved in vaccination efforts, as maintaining competence in administering new vaccines and addressing patient questions is critical to sustaining trust and improving vaccine uptake.

Staffing constraints and resource limitations posed significant operational barriers. Pharmacy managers consistently described

Table 1. Adult vaccine archetypes: A simplified framework to streamline stakeholder discussions in a crowded vaccine landscape

Dimension	Archetype 1	Archetype 2	Archetype 3	Archetype 4	Archetype 5
Patient Demographics	All Adults	50+ Adults and younger immuno-compromised	Younger Adults and Women of Childbearing Age	At-Risk Adults	At-Risk Adults
ACIP Recommendation	Routine	50+: routine Young: risk-based	Catch-up and Risk-based	Risk-based (travel)	Risk-based (endemic)
Seasonality	Seasonal	Mixed	Mixed	Year-round	Year-round
Site of Care	Mixed – Office, Pharmacy	Mixed – Office, Pharmacy	Mixed – Office, Pharmacy	Mixed – Office, travel clinics	Mixed – Hospital, Pharmacy
HCP Education Burden	Medium	Medium	Medium	High	Medium
Example Vaccines	Flu, COVID	RSV, Pneumo, Shingles	RSV, Tdap, CMV, GBS, COVID booster	ZIKA, Dengue, Japanese Encephalitis	Hepatitis, Lyme, Rabies

Abbreviations: ACIP – Advisory Committee on Immunization Practices; CMV – Cytomegalovirus; COVID – Coronavirus Disease; GBS – Group B Streptococcus; HCP – Healthcare Provider; Pneumo. – Pneumococcal; RSV – Respiratory Syncytial Virus; Tdap – Tetanus, Diphtheria, and Pertussis.

Note: These archetypes are not comprehensive of all adult vaccines.

their teams as overworked and under-resourced, with high volumes of routine prescriptions leaving minimal time for meaningful vaccine consultations. To address these constraints, respondents strongly advocated for operational improvements. Their specific recommendations included implementing easy-to-understand patient eligibility documentation, providing pre-filled syringes to streamline administration, and expanding educational support for pharmacy staff.

The concept of “forced seasonality” emerged as a critical operational challenge. Pharmacy managers reported that their current vaccine care model, centered around the fall flu season, already creates significant strain due to increased foot traffic and limited staff availability. This seasonal concentration of vaccine administration creates substantial bottlenecks as pharmacy teams attempt to balance influenza vaccinations with an expanding roster of other vaccines, including COVID-19. Respondents expressed significant concern about their capacity to manage additional vaccines during these peak periods without substantial operational changes.

Financial considerations played a notable role in pharmacy managers’ perspectives. Respondents characterized vaccines as potential “loss-leaders” – services that, while potentially operating at a loss, drive valuable store traffic and customer engagement. However, this business dynamic created tension with operational constraints, as many pharmacies lack adequate staff time or incentives to fully capitalize on vaccine-related opportunities.

Patient scheduling and convenience emerged as additional areas requiring improvement. Pharmacy managers indicated that streamlined appointment systems and expanded vaccination hours could help distribute demand more evenly throughout the year. However, respondents noted that implementing such changes would require careful consideration of staffing patterns and resource allocation.

Pharmacy teams also highlighted challenges in coordinating with other healthcare providers. Respondents reported difficulties in accessing comprehensive patient vaccination histories and communicating with primary care providers about shared patients. This fragmentation in care coordination often resulted in missed opportunities for vaccine administration and potential gaps in patient care.

These findings align with broader industry trends showing community pharmacies’ increasing centrality to adult vaccination, a shift accelerated by the COVID-19 pandemic and recent policy changes that favor accessible, community-based healthcare.¹³ Once primarily focused on medication dispensing, pharmacies are now pivotal sites for vaccination, patient engagement, and health education. The high accessibility of pharmacies, with over 90% of Americans living within five miles of one,¹⁴ has positioned them as convenient locations for vaccination, especially as over 60–70% of flu season vaccinations and nearly 90% of COVID-19 vaccinations are delivered at pharmacies.⁷ Pharmacists, consistently ranked among the most trusted professionals in healthcare, are viewed positively by the public, with over 70% of Americans trusting their local pharmacist to provide accurate vaccine information and safe administration.¹⁵ Pharmacies also often have longer hours of operation than traditional healthcare offices, offering patients more flexibility to receive vaccines during evenings and weekends. These factors have collectively established pharmacies as primary points of care in advancing public health goals.

These advantages, however, are challenged by significant operational and logistical constraints identified in our research. With the vaccine market projected to include up to 120 adult vaccines targeting 40 disease areas over the next decade,⁶ pharmacies are expected to play a central role in managing both seasonal and non-seasonal vaccines. The Public Readiness and Emergency Preparedness (PREP) Act, extended through December 2024, has expanded the role of pharmacy staff, allowing pharmacists, technicians, and students to administer vaccines to adults and children aged 3 years and older across the U.S.^{1,16} However, significant variations in state regulations and age restrictions, with only 26 states allowing pharmacists to prescribe vaccines, add complexity for pharmacies. Pharmacists must also stay updated on vaccine protocols, potential drug interactions, and the latest immunization guidelines, which require ongoing education and can contribute further to workload strain. This increasing demand has strained the pharmacy workforce, with over 50% of pharmacists experiencing symptoms of burnout, particularly during and following the COVID-19 pandemic.¹⁷

Table 2. Key stakeholder challenges and strategies to enhance adult vaccine uptake and coordination

Stakeholder	Challenge	Strategies
Community Pharmacies (6)	Overburdened staff with limited time for vaccine education and administration.	Increase staffing and training during peak seasons for vaccine administration.
	Challenges in patient eligibility determination and vaccine alignment with patient history. Data interoperability remains a challenge.	Integrate patient eligibility tools with EHR for streamlined recommendations.
	Seasonal workflow bottlenecks during flu season limit capacity for additional adult vaccines.	Promote year-round vaccines to alleviate seasonal bottlenecks.
	Insufficient communication with office-based, non-pharmacy HCPs affects cross-coordination in vaccine administration.	Establish communication protocols with HCPs for coordinated patient records.
IDNs (8)	High operational costs from preventable vaccine-related readmissions.	Generate and share real-world evidence demonstrating how improving vaccination rates can reduce readmissions. This evidence can inform both operational improvements and potential reimbursement models.
	Lack of comprehensive vaccine quality metrics impacting performance incentives.	Standardize vaccine quality metrics tied to performance incentives.
	Fragmented patient vaccination records complicate coordination and lead to missed vaccinations.	Promote interoperable data-sharing for comprehensive vaccine records across IDNs.
Non-Pharmacy HCPs (8)	Limited time for vaccine discussions during appointments, complicated by vaccine hesitancy.	Utilize EMR prompts to facilitate vaccine discussions in limited appointment time.
	Lack of interoperability with pharmacies, causing fragmented vaccination records.	Enable data-sharing with pharmacies for cohesive vaccination records.
Policy Influencers and Advisors (3)	Absence of standardized, clear prioritization guidance for vaccines from professional organizations.	Partner with professional organizations (e.g., ACIP, AAFP) to develop easy-to-follow, clinically validated vaccine prioritization guidelines.
	Challenges in integrating financial and public health incentives to improve vaccine adoption.	Provide robust cost-effectiveness and health impact data to align with policymakers' priorities and funding decisions.
	Misalignment of messaging between manufacturers and public health institutions.	Collaborate with manufacturers to develop unified public health campaigns emphasizing the importance of adult vaccination.
Patient challenges from the perspective of interviewed stakeholders	Confusion and lack of awareness about necessary vaccines and schedules.	Expand DTC campaigns to improve vaccine awareness and engagement.
	High sensitivity to out-of-pocket costs, impacting vaccine uptake.	Advocate for policy measures to reduce out-of-pocket vaccine costs.
	Needle fatigue from multiple injections reduces adherence to recommended vaccines.	Develop combination vaccines to reduce needle fatigue.
	Poor follow-through on multi-dose vaccines due to complex referral processes.	Use reminder systems to improve adherence to multi-dose schedules.

Abbreviations: AAFP – American Academy of Family Physicians; ACIP – Advisory Committee on Immunization Practices; DTC – Direct-to-Consumer; EHR – Electronic Health Records; EMR – Electronic Medical Records; HCP – Healthcare Provider; IDN – Integrated Delivery Network, N - Number.

The concept of “forced seasonality” also presents particular challenges.⁶ Currently, most pharmacies have organized vaccine care around the fall flu season, which already strains pharmacy capacity. This “forced seasonality” results in bottlenecks, as pharmacies prioritize influenza vaccines while attempting to manage an expanding list of other vaccines such as those for COVID-19. Estimates suggest that to accommodate the demands of a “forced seasonality” scenario with today’s vaccine volume, productivity would need to increase by approximately 72.7%.⁶ By 2032, productivity may rise even more substantially, by approximately 300%, to handle the projected vaccine demand.⁶ Unfortunately, early research suggests that the health-care industry as a whole, including pharmacies, may not have the capacity to handle the volume of adult vaccines that will be needed to meet the demand during a true “forced seasonality” scenario.⁶

To address these challenges, our findings suggest several actionable recommendations. First, pharmacies should consider increasing education and support for pharmacists through enhanced training on new vaccines, eligibility criteria, and effective patient communication strategies. Additionally, task-shifting could be valuable: outsourcing routine prescription fulfillment to centralized locations could free up staff time for vaccinations and patient education. Incorporating pharmacy technicians as immunizers could also significantly enhance operational efficiency. In this model, pharmacists would continue to oversee patient education and ensure vaccine appropriateness, while technicians handle the administration aspect, effectively expanding vaccination capacity while maintaining patient-centered care.¹⁸ Moreover, partnerships with healthcare organizations to establish alternative vaccination sites, such as pop-up clinics or mobile units, could alleviate some of the in-store burden during peak seasons.

Finally, our research indicates that breaking the dependency on a single-season model is essential for optimizing vaccine delivery within pharmacies. Encouraging year-round vaccination through proactive advertising and expanding the role of pharmacies as vaccination hubs for both seasonal and non-seasonal vaccines could contribute to better utilization of pharmacy resources and increased patient engagement.

Integrated delivery networks (IDNs)

Our interviews with IDN leadership ($n = 8$) revealed several critical dimensions of vaccine program implementation and strategic priorities in an increasingly complex vaccine landscape. Financial and operational metrics emerged as primary drivers of vaccine-related decision-making. IDN leaders consistently emphasized the importance of efficiency at scale, expressing strong preferences for streamlined contracting with limited manufacturers and single-brand vaccine portfolios. This approach reflected their need to optimize resource allocation across numerous facilities while maintaining consistent care delivery standards.

Quality measures and performance metrics significantly influenced vaccination strategies. Respondents highlighted the impact of Centers for Medicare & Medicaid Services (CMS) Star ratings, emergency department (ED) utilization, and patient health outcomes on their operational decisions. High ED utiliza-

tion for vaccine-preventable illnesses emerged as a particular concern, with respondents noting substantial resource consumption from preventable hospitalizations that could be better allocated to higher-acuity patients.

IDN leaders described leveraging their extensive network infrastructure to coordinate vaccine delivery. Respondents noted that their organizations typically encompass inpatient facilities, outpatient clinics, and pharmacies, enabling multiple patient touchpoints for vaccine administration. However, they identified challenges in ensuring consistent vaccine recommendations across these diverse care settings, sometimes leading to care gaps where patients might not receive complete vaccination series depending on their point of entry into the system.

Technology integration emerged as both an opportunity and a challenge. While most respondents reported having established electronic medical record (EMR) systems connecting their various care sites, they identified opportunities to better utilize these systems for vaccine program coordination. Leaders emphasized the potential for improved patient tracking and automated reminder systems to enhance vaccine series completion rates.

Population health considerations strongly influenced vaccine program design. IDN leaders reported carefully evaluating disease severity and affected population size when making vaccine-related decisions. They expressed particular interest in clinical data demonstrating vaccine efficacy across different patient subpopulations, noting that such evidence strengthens their ability to implement targeted vaccination strategies.

Addressing these challenges requires an understanding of the role IDNs have in vaccination campaigns. IDNs have a crucial part in adult vaccination by coordinating large-scale healthcare delivery across a range of settings, from hospitals and outpatient clinics to pharmacies.^{19,20} Positioned as key players in healthcare’s shift toward integrated, population-focused care, IDNs have become central to efforts that improve access to adult vaccinations, particularly within complex vaccine landscapes. Given their extensive network reach and ability to consolidate care for large patient populations, IDNs are uniquely situated to implement comprehensive vaccination strategies that align with broader healthcare trends emphasizing preventative care and population health management. Partnerships with IDN large hospital systems, for example, have been a notable strategy for increasing human papillomavirus (HPV) vaccination rates in the U.S.^{21,22}

Our findings emphasize the importance of generating and effectively communicating real-world evidence that links increased vaccination rates to improved health and financial outcomes. By demonstrating the direct impact of vaccinations on reducing hospital readmissions and ED visits, IDNs can build a stronger case for prioritizing immunization efforts within their networks. Efforts such as expanding vaccination access using this evidence-based approach applied to community-based initiatives such as pop-up clinics or mobile units can provide patients with convenient options while simultaneously reducing the flow of preventable cases into hospital settings.

Integrated technological systems, such as EMRs and patient tracking tools,^{23,24} emerged as another strategy to further

support IDNs' capacity to deliver vaccinations consistently across their networks. By consolidating patient records, EMRs enable IDNs to monitor vaccination status in real-time across different facilities, facilitating timely follow-up appointments and helping to prevent missed doses. Automated reminders, patient outreach programs, and consistent vaccine recommendations at every point of contact can drive higher vaccine adherence,^{25,26} providing continuity across the IDN and contributing to the overall goal of improving population health outcomes.

Clear, evidence-based guidelines developed in partnership with professional societies could alleviate the challenge of ensuring consistent vaccine recommendations by streamlining vaccine prioritization across IDNs, reducing variability in care, and supporting HCPs in making informed, consistent vaccination recommendations. Furthermore, the referral process for vaccinations could benefit from improvements that minimize patient attrition between initial referral and actual vaccine administration. By implementing patient navigators or automated follow-up systems, IDNs could significantly enhance adherence, especially for multi-dose vaccines that require coordinated follow-through.

Non-pharmacy immunizers

Our interviews with non-pharmacy healthcare providers (HCPs) ($n = 8$) revealed significant insights into the challenges and operational realities of vaccine delivery in traditional medical settings. Time constraints emerged as a critical barrier to comprehensive vaccine care. Respondents reported that vaccine-related discussions during appointments were typically brief, lasting only one to 2 min in standard care settings, with slightly longer durations observed in geriatric care due to this population's higher vulnerability. These time limitations particularly affected providers' ability to address vaccine hesitancy and provide detailed information about the expanding array of available vaccines.

Our results also reveal that both HCPs and patients are experiencing vaccine fatigue, which poses a significant challenge to vaccine adherence and uptake. With limited time during appointments, many HCPs struggle to accommodate the needs of vaccine-hesitant patients or provide detailed information on the array of vaccines now available. This fatigue, coupled with increased workload and complexity, places added pressure on immunizers, who must prioritize efficiency while balancing the need for patient education. The introduction of new vaccines into an already crowded immunization schedule will likely leave HCPs with insufficient capacity to discuss multiple options fully, especially when addressing vaccine hesitancy requires extensive, personalized conversations.

Patient follow-through presented another significant challenge identified by respondents. HCPs expressed particular concern about patients failing to complete vaccine series when referred to external vaccination sites or when multiple doses were required. This challenge was compounded by what providers described as fragmented communication between medical offices and retail pharmacies, often placing an undue burden on patients to coordinate their own vaccine care.

EMR systems received a mixed assessment from respondents. While providers acknowledged that EMR prompts helped initiate vaccine discussions during patient visits, they noted that

the brevity of these interactions limited their effectiveness in driving comprehensive vaccine education. The lack of seamless integration between HCP offices and pharmacy systems created additional complications in tracking patient vaccination status.

Financial considerations significantly influenced vaccine offerings in office settings. Respondents indicated that reimbursement complexities, particularly variations between Medicare Part B and Part D, often led them to limit their vaccine inventory based on financial considerations rather than clinical necessity. While providers recognized this approach might require patients to visit multiple locations for a complete vaccination series, they viewed it as necessary for maintaining practice viability.

Office-based healthcare providers (HCPs) – including primary care physicians, geriatricians, OB-GYNs, and other clinical staff – have historically served as the main point of contact for adult vaccinations,²⁷ often administering vaccines during routine check-ups and chronic disease management appointments. HCPs are highly trusted medical authorities and play a critical role in educating patients about the importance of vaccinations, which is essential for overcoming vaccine hesitancy.^{28,29} However, with the growing complexity of the vaccine landscape and limited time for each patient interaction, HCPs are likely to become increasingly constrained in their ability to deliver comprehensive vaccine guidance during consultations.⁶

These trends observed in the literature align with our findings and reflect broader systemic challenges. Approximately 66% of HCPs in the U.S. already do not check their patients' vaccine statuses with every visit, and more than half do not even include vaccine administration within their practice scope.³⁰ AMA research from 2023 has also found that 48.2% of HCPs report experiencing burnout due to escalating demands and lack of enough physicians and support staff,³¹ which affects the quality of patient care and limits the depth of vaccine-related discussions they can provide during patient visits.

Interoperability issues between HCP offices and retail pharmacies also present substantial challenges to vaccine coordination and patient care.³² As adult vaccines are increasingly administered at pharmacies, many HCPs express concern over the fragmentation of patient health records, both in our interviews and in literature.^{33,34} This lack of seamless communication between HCPs and pharmacies can lead to inconsistencies in vaccine histories, as patients move between these sites for different vaccinations.

Financial constraints have historically influenced HCPs' capacity to offer a full range of adult vaccines. Reimbursement complexities, particularly variations between Medicare Part B and Part D, have shaped decisions on which vaccines to stock, often leading providers to limit vaccine offerings based on reimbursement incentives rather than clinical necessity.^{35,36} This approach, while financially feasible for providers, has required some patients to visit multiple locations to complete their recommended immunizations, creating additional logistical and financial burdens. However, with the passage of the Inflation Reduction Act (IRA) in 2022, all ACIP-recommended adult vaccines are now covered under Medicare Part D without cost-sharing, which significantly eases patient access.³⁷ Although this change reduces financial barriers for patients, logistical challenges persist for HCPs, including variations in vaccine procurement

processes, stocking requirements, and reimbursement timelines across Medicare plans.

To alleviate these challenges, several actionable strategies could be employed. Task-shifting, which involves delegating vaccine management tasks to designated vaccine coordinators or clinical staff trained specifically in vaccination protocols and patient education, could help distribute responsibilities more effectively. However, considerations will need to be made regarding state Collaborative Drug Therapy Management (CDTM) protocols, as well as ensuring that these coordinators are qualified to deliver specific vaccines in line with state requirements.

Fostering stronger partnerships between pharmacies and HCP offices and increasing interoperability between the two is essential to mitigate the issues arising from fragmented records. Integrating digital platforms that allow HCPs and pharmacies to access shared vaccination records would help bridge care gaps and reduce the administrative burden on patients. Such a system could improve tracking across multiple vaccination sites, ensuring that patients receive all recommended immunizations without duplications or lapses.

Patients

While our study did not include direct patient interviews, stakeholder discussions across healthcare providers ($n = 8$), IDN leadership ($n = 8$), retail pharmacy managers ($n = 6$), and policy influencers and advisors ($n = 3$) provided consistent insights into patient-related challenges and behaviors in the evolving vaccine landscape.

Vaccine understanding and decision-making emerged as primary concerns reported by stakeholders. Immunizers consistently indicated that patients demonstrated a greater willingness to pursue vaccination when they understood both the diseases being prevented and the personal health benefits offered. This finding particularly applied to newly recommended vaccines, where patient education played a crucial role in acceptance.

Record management challenges were frequently cited by respondents. Healthcare providers and pharmacy managers reported that patients often struggled with the responsibility of tracking their own vaccination histories, leading to confusion about completed vaccinations and outstanding needs. This challenge was exacerbated by the lack of continuity across different healthcare settings, requiring patients to actively manage their records to ensure comprehensive vaccine coverage.

Multiple injection concerns significantly influenced patient behavior according to stakeholders. Providers consistently reported that patients expressed strong preferences for combination vaccines that could reduce the number of needle pricks per visit. This “crowded arm” challenge – where patients must decide which vaccines to prioritize in limited arm space – was identified as a recurring barrier to completing recommended vaccination schedules.

Financial sensitivity emerged as a substantial barrier to vaccine uptake. Stakeholders reported that even modest differences in out-of-pocket costs (e.g., \$20 versus \$50) could significantly impact patient willingness to receive certain vaccines. This cost sensitivity was noted to be particularly pronounced among uninsured or underinsured individuals.

Vaccination follow-through presented significant challenges according to providers. Stakeholders reported that patients frequently failed to complete multi-dose vaccine series or follow-through on vaccinations when referred to external sites. This pattern was particularly evident when patients were directed to secondary vaccination sites or needed to return for subsequent doses in a series.

Our findings align closely with literature^{6,38,39} and reveal that many patients face challenges in understanding their vaccine history, navigating multiple vaccination sites, and managing out-of-pocket (OOP) costs, all of which contribute to reduced vaccine engagement and follow-through. The insights underscore the need for vaccine-specific direct-to-consumer (DTC) campaigns that effectively educate patients, particularly those who are “vaccine-curious” or hesitant, about the value of newly recommended vaccines.⁴⁰ Clear, targeted DTC advertising could address misinformation and increase vaccine acceptance, aligning with the broader goal of improved public health through informed patient choice.

While tools such as vaccine registries, EMR integration, and patient-held vaccine cards could potentially reduce this burden, current gaps in continuity across healthcare sites mean that patients must still actively manage their records to ensure comprehensive vaccine coverage.⁴¹ Providing patients with tools such as accessible vaccine cards and digital health records could help reduce the risk of missed vaccines and streamline adherence to immunization schedules.

Legislative provisions, such as those under the IRA, aim to make vaccines more affordable by covering or reducing OOP costs, which may increase vaccine uptake across adult populations.^{42,43} However, vaccination coverage is dependent on ACIP recommendations and insurance status.^{42,43} Ensuring access to affordable vaccinations requires ongoing policy adjustments to maintain cost-effective access and expand coverage for all adults.

Tools such as electronic prescriptions (e-scripts) and automated reminder systems are effective in ensuring patients complete their vaccine schedules.^{44,45} These systems keep patients engaged throughout the vaccination process, ultimately reducing preventable disease burden and improving public health outcomes.

By expanding patient education initiatives, simplifying vaccination logistics, and enhancing inter-provider communication, stakeholders can create a more patient-centered vaccination experience. Streamlined processes that give patients clear, accessible vaccine information and facilitate coordination between healthcare providers and pharmacies are essential for improving vaccine adherence and ensuring continuity of care. These improvements can support patients in navigating the adult vaccine landscape, enabling more consistent vaccine coverage and contributing to broader public health goals.

Policy influencers and advisors

Our interviews with policy influencers and advisors ($n = 3$), who included key opinion leaders participating in ACIP discussions and those advising medical or professional organizations on vaccination guidelines, revealed distinct insights into policy-level considerations in the evolving vaccine landscape.

Data-driven evidence emerged as a primary driver of policy recommendations. Respondents emphasized the importance of clear evidence demonstrating both the health and economic impacts of vaccines. They specifically highlighted the value of data showing reductions in hospital admissions and ED visits for vaccine-preventable diseases, combined with economic models projecting healthcare cost savings, as critical elements for gaining policy support.

Operational feasibility significantly influenced policy development according to respondents. Policy influencers noted the importance of crafting guidelines that account for real-world implementation challenges. They emphasized that recommendations must consider practical elements such as vaccine schedules, patient eligibility criteria, and storage requirements to ensure feasibility for providers.

Provider constraints emerged as a key consideration in policy development. Respondents acknowledged that healthcare providers face significant operational barriers - including time limitations, storage constraints, and financial pressures - which impact their ability to prioritize adult vaccinations. They indicated that these practical challenges must be considered when developing vaccination recommendations and guidelines.

Infrastructure development received significant attention from respondents. Policy influencers emphasized the need for flexible funding mechanisms and infrastructure enhancements, such as expanded vaccine storage capabilities, to support providers in offering a broader range of adult vaccines without compromising operational efficiency.

The role of policy influencers and advisors is pivotal in shaping adult vaccination uptake in the United States. Agencies such as the ACIP and the Centers for Disease Control and Prevention (CDC) set recommendations that impact healthcare practices nationwide, with ACIP being responsible for developing evidence-based guidelines for vaccine usage, including adult immunizations.^{46–49} Once ACIP formulates recommendations, the CDC formalizes them, providing essential guidance to healthcare providers, public health agencies, and insurers.⁵⁰ This collaborative effort ensures that policy recommendations are both medically sound and accessible, supporting public health objectives while responding to population health needs.

Such evidence is particularly useful for crafting policies and guidelines that align with financial incentives for providers, ensuring that preventative care efforts are both clinically effective and economically sustainable. This approach avoids reliance on payer-focused strategies, instead emphasizing the alignment of policies with provider practices and priorities. These measures create a strong rationale for broader adult vaccination initiatives while addressing practical considerations in implementation.

To further improve vaccine adherence, policy influencers and advisors are encouraged to promote standardized vaccination recommendations and support interoperable data systems that facilitate coordination across healthcare settings. Integrated vaccine records and streamlined guidance can reduce gaps in vaccination histories, support continuity of care, and enable providers to focus on clinical care rather than administrative

complexities. Together, these policy-driven measures can strengthen adult vaccination infrastructure, improve care coordination, and ensure that public health objectives are met efficiently and effectively.

The establishment of standardized vaccination recommendations and support for interoperable data systems emerges as a crucial strategy for improving vaccine adherence. Such systems can facilitate better coordination across healthcare settings while reducing gaps in vaccination histories. This approach enables healthcare providers to focus more on clinical care and less on administrative complexities, ultimately supporting more efficient and effective public health outcomes.

Vaccine manufactures

Our interviews with pharmaceutical industry leaders ($n = 6$) provided insights into manufacturers' perspectives on facilitating vaccine uptake in an increasingly complex landscape. Vaccine manufacturers play an essential role in facilitating adult vaccine uptake by collaborating with healthcare providers, policy influencers or advisors, and pharmacies to address barriers to access and support informed decision-making across the adult population. Recognizing the challenges in today's crowded vaccine landscape, pharmaceutical leaders interviewed as part of our research emphasized their commitment to working with all stakeholders as part of the solution to addressing the growing care gap. They support efforts to create streamlined vaccine portfolios that reduce logistical burdens on healthcare providers. Simplified portfolios, backed by robust clinical data, patient education materials, and assured supply, enable healthcare providers to manage complex vaccination schedules more effectively. This approach is particularly beneficial to stakeholders such as community pharmacies, which handle high patient volumes, and IDNs, which manage broad patient populations with diverse care needs. By leveraging data on vaccine efficacy, safety, and population health benefits, manufacturers can also actively support policy influencers or advisors in crafting data-driven recommendations that enhance public trust and streamline vaccine delivery across healthcare settings.

Moreover, leaders in the pharmaceutical industry noted that patients will only change their behavior when they believe it is in their best interest to do so and prefer simplicity in their vaccine options. As such, vaccine manufacturers can focus on practical, patient-centered education that improves patients' comfort with emerging vaccines. They can also invest in innovative solutions - such as developing combination vaccines and enhancing distribution methods - that align with the practical needs of adult patients, particularly in reducing barriers such as "crowded arm space" and increasing vaccine accessibility across diverse care settings. Through such efforts, the industry can support equitable vaccine access and strengthen the overall adult vaccination infrastructure.

Conclusion

The increasingly crowded adult vaccination landscape presents both significant challenges and opportunities, with

vaccine uptake influenced by a complex interplay of stakeholder actions, patient perceptions, and policy structures. This study highlights that successful vaccine uptake hinges on coordinated efforts across key stakeholders – healthcare providers, community pharmacies, IDNs, policy influencers or advisors, and manufacturers. For providers and pharmacies, addressing operational constraints and enhancing patient engagement through accessible, targeted education will be essential. IDNs can leverage their integrated infrastructure and technological tools to streamline vaccine delivery and ensure continuity of care, while policy influencers or advisors have the unique capacity to support these efforts through policies that reduce financial barriers and incentivize preventative care. Further work could explore the longitudinal impact of targeted education initiatives and changes to vaccine policy on uptake and health outcomes across different populations. Additionally, incorporating patient-reported barriers and preferences in future research could provide critical insights into optimizing vaccination strategies.

In a crowded market, these stakeholders must work in concert to make vaccines accessible, understandable, and easily integrated into routine care. By advancing collaborative and data-informed strategies, stakeholders can overcome the complexities of this rapidly evolving landscape and drive equitable access for all adults in the U.S.

Limitations of the study

While this research provides valuable insights into stakeholder perspectives, some limitations should be acknowledged. The sample sizes for each stakeholder group were relatively small, potentially limiting the generalizability of findings. Additionally, the study did not directly include patient perspectives, relying instead on stakeholder perceptions of patient behaviors. Future research incorporating patient-reported experiences could provide a more comprehensive understanding. Finally, the rapidly evolving nature of the adult vaccine market means that stakeholder priorities and challenges may shift over time, necessitating ongoing research to capture emerging trends.

RESOURCE AVAILABILITY

Lead contact

Requests for further information and resources should be directed to and will be fulfilled by the lead contact, Charles Jones (charles.jones@pfizer.com).

Materials availability

This study did not generate new unique reagents.

Data and code availability

- This article does not report original code.
- All data supporting the findings of this study are included within the article and its [supplemental information](#).
- Any additional information required to reanalyze the data reported in this article is available from the [lead contact](#) upon request.

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AUTHOR CONTRIBUTIONS

A.H., R.A., and C.H.J. led the design and execution of the market research study. A.H. and R.A. also contributed strategic input to the article. M.B., C.G.-Q., V.W., and J.M.T. provided strategic input and supported drafting and editing. C.H.J. conceptualized the publication and led the drafting and editing of the article.

DECLARATION OF INTERESTS

A.H., C.G.-Q., V.W., J.M.T., and C.H.J. report that they are employees of Pfizer Inc. and may hold stock or stock options in the company. M.B. is an employee of Bulmore Consulting, which was a paid consultant to Pfizer in connection with the development of this article. ZS was commissioned by Pfizer to conduct the primary market research referenced in this article and was compensated accordingly by Pfizer.

STAR★METHODS

Detailed methods are provided in the online version of this paper and include the following:

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SUPPLEMENTAL INFORMATION

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STAR★METHODS

KEY RESOURCES TABLE

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Deposited data		
All data is included in manuscript and supplementary materials	N/A	N/A
Software and algorithms		
Qualitative analysis was done manually	Expert Network from ZS Associates	N/A

EXPERIMENTAL MODEL AND STUDY PARTICIPANT DETAILS

This study did not involve experimental models such as animals, human participants, or cell lines. Instead, it employed market research methodologies to gather insights from key stakeholders in the U.S. adult vaccine landscape.

Stakeholder participants were recruited through third-party market research panels based on predefined inclusion criteria, including professional role, experience level, and involvement in vaccine decision-making. The study included representatives from.

- (1) Community pharmacies (n = 6).
- (2) Integrated Delivery Networks (IDNs) (n = 8).
- (3) Non-pharmacy healthcare providers (HCPs) (n = 8).
- (4) Policy influencers and advisors (n = 3).
- (5) Pharmaceutical industry leaders (n = 6).

Participants were screened based on years of experience, role in vaccine administration, and decision-making authority to ensure comprehensive and relevant insights. To maintain impartiality and confidentiality, all interviews were conducted in a fully double-blind manner by an independent third-party research firm.

Ethical considerations

- (1) Since this study involved expert interviews and market research, it did not require Institutional Review Board (IRB) approval.
- (2) All participants provided informed consent to participate in interviews. No personally identifiable information (PII) was collected.

METHOD DETAILS

This study was conducted in five phases to develop a comprehensive understanding of stakeholder challenges within an evolving and increasingly crowded adult vaccine market. The multi-phase approach allowed us to identify key drivers of vaccine uptake, understand stakeholder priorities, and develop actionable insights for addressing care gaps. This study was designed as a collaborative effort between Pfizer and a third-party consultant (ZS). While Pfizer's interest in addressing the "crowded arm" challenge guided the research focus, the study outcomes and recommendations were data-driven and stakeholder-informed. To mitigate potential biases, the interviews were conducted in a double-blind manner by ZS to ensure impartiality, data analysis was performed independently by trained third-party researchers, and findings were validated through triangulation with quantitative data and stakeholder feedback. These measures ensured that the insights generated reflect the broader themes relevant to the U.S. adult vaccine market and extend beyond Pfizer-specific interests to benefit the broader public health domain.

Scenario alignment

We first set out to define potential future adult vaccine landscape scenarios in the U.S., thus providing a foundation for identifying market pressures and anticipating stakeholder behaviors under different conditions. Existing research on the adult vaccine market, in collaboration with subject matter experts (SMEs) input, was leveraged to align upon future scenarios, environments, and assumptions to operate under. This approach allowed the research team to simulate varying levels of vaccine demand, patient engagement, and logistical complexities, providing a structured lens through which stakeholders could anticipate and address the implications of increased vaccine diversity and volume. Three distinct scenarios – Base, Downside, and Upside – were defined ([Figure S1](#)).

The Base scenario projected a moderate increase in vaccine products in the next one to two years, with three seasonally emphasized vaccines and a steady level of patient influence over vaccine decisions. This scenario was grounded in observed trends and represents a continuation of current market conditions, providing a stable baseline against which more extreme scenarios could be assessed. Here, patients were anticipated to receive common and seasonally emphasized vaccines primarily in pharmacy settings,

with few changes to established administration practices and no official prioritization guidelines from organizations such as the U.S. Center for Disease Control (CDC) or Advisory Committee on Immunization Practices (ACIP). This scenario served as the reference point, simulating a continuation of current vaccine behaviors but with slight increases in product offerings.

The Downside scenario represented the most challenging environment, characterized by a higher number of recommended vaccines (up to four seasonally emphasized vaccines) and increased patient autonomy over the next three-to-five years, which could contribute to further complexity in vaccine administration. This scenario was designed to capture potential operational barriers under heightened vaccine demand and fragmented guidance, reflecting concerns raised by stakeholders during interviews. In this scenario, seasonally emphasized vaccines were expected to be administered primarily in pharmacy settings, while other vaccines might require multiple sites of care, creating logistical strain. The lack of prioritization recommendations from health authorities compounded the complexity, requiring stakeholders to navigate vaccination without centralized guidelines.

In contrast, the Upside scenario envisioned a streamlined vaccine landscape, with two seasonal vaccines and a return to pre-pandemic levels of patient engagement with vaccines over the next three-to-five years. This optimistic scenario aimed to evaluate how improved coordination, reduced patient burden, and clear prioritization could enhance the vaccine delivery process for stakeholders. As in the Base scenario, pharmacies were expected to play a central role in the administration of common and seasonally emphasized vaccines, simplifying coordination needs. In this case, prioritized recommendations from professional organizations were assumed to ease decision-making and reduce redundancies in vaccine administration, making it the most favorable scenario for stakeholders in terms of efficiency.

These scenarios formed the foundation for analyzing stakeholder responses by simulating potential market pressures and administration challenges in the coming years. Stakeholders were asked to consider how each scenario would impact their decision-making processes, resource allocation, and priorities.

Vaccine grouping

To simplify the complex array of current and future adult vaccines in the U.S., we utilized archetype-based grouping. This methodology involved clustering vaccines into distinct categories based on shared characteristics. In collaboration with SMEs and industry stakeholders, we organized adult vaccines into archetypes based on several key dimensions (Table 1). These dimensions included target demographics (e.g., adults aged 50 and older or immunocompromised individuals), ACIP recommendation types (routine versus risk-based), seasonality (seasonal versus year-round), and preferred site of care (pharmacy, clinic, or hospital). This grouping provided standardized vaccine archetypes that prompted consistent and comparable responses from stakeholders during interviews and focus groups, ensuring that insights reflected real-world conditions across multiple types of vaccine offerings. While this framework was meant to encompass the majority of available adult vaccines, it is important to note that it is not fully comprehensive of all vaccines.

Influence mapping

We then undertook a comprehensive influence mapping exercise that identified the hierarchy of decision-makers across the vaccine journey, encompassing policy influencers, integrated delivery networks (IDNs), community pharmacies, and individual healthcare providers (Figure S2). This step was critical to understanding how decisions on vaccine prioritization and administration are made and identifying points of intervention where strategies could yield the greatest impact. Stakeholders were segmented according to their level or participation within the vaccine journey, including roles in stocking and contracting (e.g., pharmacy managers), immunizer incentivization (e.g., corporate owners, organized healthcare networks), vaccine recommendation and administration (e.g., primary care providers, geriatricians, OB-GYNs, pharmacists), and policymaking (e.g., regulatory and advisory agencies such as ACIP, and medical organizations and associations). This mapping provided insights into the complex hierarchy of decision-makers and highlighted each stakeholder group's influence on vaccine uptake, allowing for targeted recommendations for each phase of the vaccination journey.

Market research

Representatives of stakeholder groups identified during as a part of influence mapping were then interviewed, using the vaccine landscape scenarios and archetypes to guide the discussions. Primary market research was conducted using 60-to-90-min online interviews with each stakeholder. Study design and stakeholder inclusion criteria are presented in Figure 1. A total of 25 external stakeholders participated, including immunizers, IDN leadership, community pharmacy managers, and policy influencers or advisors. Participants were recruited through third-party market research panels and screened based on specific criteria, including years of experience, role, and level of involvement in vaccine decision-making. To ensure impartiality, interviews were conducted in a fully double-blind manner by a third-party consultant. Stakeholders were presented with each of the three scenarios and asked to describe their anticipated challenges, resource needs, and strategic responses under each scenario. Interviews were recorded, transcribed verbatim, and de-identified to protect participant confidentiality.

Data synthesis and analysis

This study employed a rigorous qualitative methodological approach to integrate insights from multi-phase research. Interview transcripts, derived from discussions with stakeholders, served as the primary data source for analysis. A hybrid coding framework was

utilized, incorporating both deductive and inductive techniques. Deductive codes were aligned with predefined research objectives, such as vaccine prioritization, operational barriers, and stakeholder engagement strategies. Concurrently, inductive codes emerged organically from the data, capturing the nuanced perspectives of stakeholders.

Data were systematically segmented by stakeholder groups, including healthcare providers, community pharmacy managers, IDNs, and policy influencers, to delineate role-specific insights while enabling cross-comparison of themes. Themes were coded based on stakeholder responses to each scenario, allowing for cross-comparison across the Base, Downside, and Upside contexts. This scenario-based analysis facilitated the development of targeted recommendations that addressed specific challenges and needs identified by stakeholders in each potential future market state. Thematic coding was conducted, adhering to a standardized protocol to ensure consistency and reproducibility in the identification and interpretation of themes.

To enhance reliability, at least two independent coders reviewed each transcript, resolving discrepancies through collaborative discussion. This inter-coder agreement process minimized subjectivity and reinforced the validity of the thematic structures. Findings were refined iteratively and validated through feedback from internal and external stakeholders to confirm their resonance and applicability. This feedback loop ensured the insights accurately reflected real-world challenges and priorities.

Interviews with pharmaceutical leaders

Six interviews were conducted with pharmaceutical industry leaders to gain their perspective on operating within a crowded adult vaccine market. These interviews offered an industry-wide view on how pharmaceutical companies plan to adapt to the challenges associated with increased vaccine availability and market complexity. Their perspectives were incorporated into the final analysis to broaden the study's applicability, allowing for recommendations that reflect both stakeholder and industry considerations.

QUANTIFICATION AND STATISTICAL ANALYSIS

This study employed qualitative thematic analysis rather than statistical modeling or quantitative analysis. Thematic analysis was used to systematically interpret and synthesize insights from stakeholder interviews.

ADDITIONAL RESOURCES

No additional resources, databases, or external repositories were generated as part of this study. All relevant data are included in the manuscript and supplementary materials.