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REVIEW

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Adult vaccination against respiratory infections in Egypt: a review of expert opinions

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ABSTRACT

Introduction: Lower respiratory tract infection is one of the leading causes of morbidity and mortality all over the world, with a substantial impact on healthcare costs. In Egypt, local consensus on its burden, diagnosis, and vaccination is scarce. This expert opinion is the first to address the local recommendations for vaccinating adults against respiratory infection. It sheds light on the growing need to understand the barriers and underpublicized concept of adult vaccination in Egypt.

Areas covered: A collaborative multidisciplinary panel from Egypt developed an expert opinion-based suggestions/points, including epidemiology, microbiology, and highlights on vaccination in Egypt, as well as challenges and recommendations regarding adult vaccination.

Expert opinion: Adult vaccinations against respiratory infections are now recommended for high-risk people by all healthcare regulatory bodies. However, it was acknowledged that there may be hesitancy and concerns among patients; in addition, healthcare professionals' awareness about vaccination guidelines and benefits needs improvement. There are several strategies that could be implemented to enhance vaccine adherence in Egypt. These approaches encompass conducting community education programs, addressing the concerns of patients, and enhancing awareness among healthcare professionals through education, policy changes, and periodical reminders in each healthcare setting.

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1. Introduction

1.1. Epidemiology and burden of pneumonia

Community-acquired pneumonia (CAP) is a leading cause of morbidity, hospitalization, and death worldwide. It is a potentially life-threatening condition that primarily affects the elderly and those with comorbidities [1,2]. The global burden of pneumonia affects the health system, the economy, and society. CAP is responsible for more than four million outpatient and emergency department (ED) visits annually in the United States [3]. According to the Centers for Disease Control and Prevention (CDC), pneumonia is one of the most common hospitalization diagnoses. Approximately one-third of hospitalized patients with CAP die within one year, and nearly 10% of hospitalized ones will be readmitted to the hospital for a new episode of CAP during the same year [4]. Besides, pneumonia and influenza are among the ten leading causes of death in 2019 (17.4%) [5]. Furthermore, the economic burden was estimated to exceed $10 billion from 1997 to 2010 [6]. However, studies are limited in assessing the economic burden, especially in the employed population worldwide [7,8]. Other than short-term mortality [5], long-term complications from CAP are increasingly addressed. Prior studies showed an association between CAP and sepsis, respiratory failure, cardiovascular events (acute myocardial infarction, cardiac arrhythmias, congestive heart failure, pulmonary embolism, and stroke), or chronic obstructive pulmonary disease (COPD) [9–12].

In the Middle East, scarce studies reported the incidence of CAP, and most were hospital-based studies conducted in Egypt and the Gulf area concerned with the identification of pathogens involved in the cause of pneumonia [13–19].

1.2. Risk factors of CAP

Understanding the types of patients at greatest risk of getting CAP can aid in devising strategies to reduce the burden of the infection. The risk of CAP rises with age; it is three times higher among adults above 65 years compared to the general population [20,21]. In addition, having underlying medical conditions (chronic comorbidities such as COPD, chronic lung disease, chronic heart disease (CHD), chronic liver disease, diabetes mellitus, malnutrition, and immunocompromising conditions) place patients in the highest risk of hospitalization due to CAP [21,22]. Also, conditions or lifestyle factors that might alter consciousness, such as stroke, seizure, anesthesia, and drug or alcohol use, increase

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Article highlights

- Vaccination against respiratory infections is recommended for elderly populations, patients with underlying medical conditions, and patients receiving immunosuppressants.
- In Egypt, most of the population are not vaccinated against respiratory infections, primarily due to lack of awareness, patients' skepticism regarding preventive measures, and costs.
- Enhancing public awareness about vaccinations is crucial, either through media campaigns or community outreach programs supported by healthcare providers and influential figures.
- Informing physicians on the recommended vaccines for different age groups will decrease misconceptions and misinformation about vaccines that normally discourage patients in need of them.
- Addressing the gaps in the vaccination status in Egypt requires a multi-faceted approach that also involves expanding access to vaccines, addressing affordability issues, and strengthening healthcare infrastructure.

the risk of predisposition to CAP [21,22]. Moreover, viral respiratory tract infections may lead to primary viral pneumonia and might trigger secondary bacterial pneumonia [4,20,23,24]. According to a study conducted in Egypt, smoking and chronic conditions, particularly diabetes, are the most prevalent risk factors for CAP [14].

1.3. Pathogens involved in CAP

Bacterial infections, respiratory viruses, and fungi are all recognized as causes of CAP. However, the most common causes of CAP requiring hospitalization are *Streptococcus pneumoniae* and respiratory viruses [20,25–28]. The latter were isolated in up to one-third of patients with CAP. Influenza virus contributes the most to the etiology of CAP among viral viruses [27]. Other viruses, such as human rhinovirus, human metapneumovirus (HMPV), respiratory syncytial virus (RSV), parainfluenza viruses, coronaviruses, and adenovirus were detected in patients with CAP [25,26]. Typical organisms contributing to CAP include *Haemophilus influenza* and *Staphylococcus aureus*, while atypical organisms include Legionella spp, *M. pneumoniae*, and *C. pneumoniae* [28–30].

Regarding prior research in Egypt, *S. pneumonia*, followed by *Staphylococcus aureus*, were the main causes of CAP among Gram-positive bacteria, while *Klebsiella* was the most prevalent Gram-negative organism [23]. Another Egyptian study found that *K. pneumoniae* was the most prevalent bacteria, followed by *S. pneumoniae* and *P. aeruginosa* [14]. The relative prevalence of these viruses varies with country, comorbidities, lifestyle, season, and other factors [29–31]. After 2020, SARS-CoV-2 infection has been considered an important cause of CAP.

1.4. CAP prevention

Vaccination is one of the substantial pillars of decreasing the incidence of CAP and its associated mortality, hospitalization, and complications. There are currently some approved vaccinations for CAP infection in adults. Seasonal influenza vaccination and pneumococcal vaccinations (pneumococcal polysaccharide 23-valent (PPV23) and pneumococcal conjugate 13-valent (PCV13) are essential for CAP prevention [32–36]. The CDC's Advisory Committee on Immunization Practices (ACIP) recommended seasonal influenza vaccination for all individuals ≥6 months of age. In addition, pneumococcal vaccination is recommended for all adults older than 65 years and high-risk individuals aged less than 65 years [37,38].

For elderly population, the European Union of Geriatric Medicine Society (EUGMS) in collaboration with International Association of Gerontology and Geriatrics European Region (IAGG-ER) as well as and National institute of aging (NIA) recommend both influenza and pneumococcal vaccination [39]. Additionally, In May 2023, the U.S. Food and Drug Administration approved the first RSV vaccine to prevent lower respiratory tract disease caused by RSV in populations over 60 years of age [40].

Vaccination is also essential for populations with chronic illnesses. Kidney Disease Improving Global Outcomes (KDIGO) guidelines estimated that adults and children with chronic kidney disease (CKD) are at high risk of pneumococcal infection, and they, as well as their household contacts, should receive pneumococcal vaccination with the heptavalent conjugate vaccine (PCV7), PPV23 vaccine, and the annual influenza vaccination [37]. The European Society of Cardiology and the American College of Cardiology/American Heart Association recommends annual influenza and pneumococcal vaccination among patients with heart failure [38,41,42]. In addition, American Diabetes Association (ADA) encourages diabetic cases with pneumococcal infections to get vaccinated [43]. Moreover, European League Against Rheumatism (EULAR) also recommends both influenza and pneumococcal vaccination for patients with autoimmune inflammatory rheumatic diseases [44]. In addition, vaccination for whooping cough (pertussis) is particularly essential in adults who have direct contact with infants (e.g., grandparents or childcare providers), healthcare workers, and those who are obese or who have preexisting asthma [45]. ACIP recommended that adults older than 19 years who have not previously received Tdap (i.e. after age 11 years) should receive a single Tdap booster dose [46].

1.5. Vaccination burden in Egypt

Although vaccines provide a safe and cost-effective solution to vaccine-preventable diseases (VPDs) [32,47,48], the latter continue to confer a considerable economic and health burden among individuals and healthcare professionals. The uncertainty about the ideal timing to begin vaccinating is also one of the important obstacles to a proper vaccination process [49,50].

This expert opinion aims to discuss adult immunization against respiratory infections in Egypt through the eyes of experts in different specialties in terms of available adult vaccination for CAP prevention, population acceptance of the adult vaccination, cost-effectiveness, safety, virulence factors, coverage, scheduling, the burden of vaccination, and others.

2. Main body

2.1. Methods

2.1.1. Panel selection

A panel of Egyptian experts in multidisciplinary fields was selected. The panel comprised six experts: two from the internal medicine (endocrinology and rheumatology fields), two from the chest diseases field, one from the cardiology field, and one from the geriatric and gerontology field.

2.1.2. Expert opinion process

A literature search was conducted in Medline via PubMed database to identify the key points needed to assess the status of adult vaccination against respiratory infections in Egypt. A questionnaire of twenty questions was then drafted prior to the meeting. It was shared with the expert panel before the meeting to collect their votes. The input of the panel was discussed during the meeting held on the 16th of June 2023. The panel voted based on their expert opinion and real-world clinical practice in Egypt.

2.2. Results and discussion

Table 1 shows the agreement rates among the panel on the questionnaire.

2.2.1. Epidemiology and microbiology of pneumonia in Egypt

The panel indicated that a low percentage of patients with CAP visited clinics (nearly 5% to 10%). Patients who show clear respiratory symptoms typically seek a pulmonologist as their first point of care, whereas those with systematic symptoms tend to present to other specialties. Also, experts revealed that their elderly patients with pneumonia commonly show typical symptoms, including cognitive impairment, agitation or hypoactivity, and recurrent falls. *Streptococcus pneumoniae* is the most frequently identified pathogen associated with CAP in high-risk patients in Egypt, followed by *Haemophilus influenza* and *Mycoplasma pneumoniae*. This is in accordance with the literature on the most commonly identified causes of CAP, including typical bacteria such as *Streptococcus pneumoniae* and *Haemophilus influenzae* and atypical bacteria such as *Mycoplasma pneumoniae* [14,15,20,23,25–30,51]. The panel mentioned that initiating empirical therapy before identifying the causative organism is often recommended among those patients according to national and international guidelines. The type of chosen therapy mainly depends on the risk factors. According to the Infectious Diseases Society of America/American Thoracic Society consensus guidelines on managing CAP in adults, microbiologic testing is unnecessary for mild outpatients [1].

It was agreed upon that several common risk factors are associated with developing CAP, including smoking, older age, CHD, COPD/asthma, cancer, and receiving immunosuppressants and steroids, this goes in line with global reports [20–22], as well as reviews of data from the Middle East and North Africa region [52,53]

2.2.2. Burden of pneumonia in Egypt

The panel discussed that the standard hospitalization length among patients admitted due to CAP is typically one week. This length could be extended in elderly patients with comorbidities, aspiration, or recurrent infections. Prolonged periods may also be affected by caregivers' opinions. On the other hand, implementing primary management interventions without considering antimicrobial stewardship can result in extended hospitalization periods. The current guidelines recommend early hospital discharge of patients when they are clinically stable, have no other active medical problems, and have a safe environment for continued care. The mean hospital stay due to CAP varies among regions [1,52]. Previous studies found that underlying comorbidities increase the likelihood of prolonged hospitalization in patients with CAP [53,54]. Moreover, it was estimated by the experts that the mortality rate among high-risk patients is less than 10%, except for elderly patients and those with comorbidities [55–57].

2.2.3. Highlights on recommended vaccinations for adults in Egypt

The panel agreed that adult vaccinations against respiratory infections (both viral and bacterial infections) are highly recommended in high-risk patients [37–39,41]. Adverse events of vaccinations in patients with some neurological disorders (e.g., myasthenia gravis and polyneuropathy) are unpredictable. Neurological complications following vaccination are rare [58]; however, reports on some neurological complications have been identified following the vaccination with human papillomavirus and COVID-19 [57,58]. Additionally, the Egyptian experts, in agreement with prior recommendations, considered vaccinations against respiratory infection to be applied based on age and risk factors [59].

According to the Egyptian experts, the CDC guidelines are the most adhered-to guideline for vaccination recommendations among high-risk patients, followed by guidelines targeting special population such as the ADA and the American College of Rheumatology (ACR) [60]. However, the recommendations of the CDC and the WHO are being considered with caution after the COVID-19 pandemic handling, and more specialized organizations, such as the ADA, are more recommended.

The panel also recommended multiple vaccinations against respiratory infection to be administered by high-risk adult patients, including the influenza vaccine, the pneumococcal vaccination, and the COVID-19 vaccine [37,38,44]. The influenza vaccine is recommended for patients with different comorbidities in clinical practice and is a routine measure in practice. However, the real-world data estimated that the association between respiratory infections and cardiological complications enhanced the use of the influenza vaccine only [61]. The panel agreed that when the COVID-19 vaccine was introduced, other vaccinations rates has declined owing to the fear of interactions between the two vaccines. Nevertheless, further recommendations were made to administer the influenza vaccine with COVID-19 vaccination [62,63].

Table 1. Experts' opinion on adult vaccination against respiratory infections in Egypt.

Statements	Agreement rate among the panel (%)
(1) ***Epidemiology and Microbiology of Pneumonia in Egypt***	
a. The prevalence of CAP in outpatient clinics in Egypt is less than 10%.	50%
b. The most common pathogens associated with CAP in high risk-patients are:	
• *Streptococcus pneumonia*	100%
• *Haemophilus influenza*	83.3%
• *Mycoplasma pneumoniae*	83.3%
• Chlamydia pneumonia	66.7%
• Staphylococcus aureus	33.3%
• SARS-CoV-2	33.3%
• Other viral infections such as:	
• Influenza	33.3%
• Legionella	33.3%
• Klebsiella pneumonia	16.7%
• Moraxella catarrhalis	16.7%
• Anaerobes	16.7%
c. Risk factors attributed to developing CAP in adults include:	
• Being elderly	100%
• Smoking	100%
• CHD	100%
• COPD/Asthma	100%
• Cancer	83.3%
• Chronic kidney disease	66.7%
• Neurodegenerative disease	16.7%
• Taking immunosuppressants	100%
• Taking oral steroids	83.3%
• Poor dental health	66.7%
• Poor nutrition	16.7%
(2) ***Burden of pneumonia in Egypt***	
a. The prevalence of outpatients diagnosed with CAP and needing hospitalization is less than 10%	66.7%
b. The mean hospital stays for high-risk patients admitted due to CAP are around 4–7 days.	66.7%
c. Predictors for prolonged hospitalization:	
• Advanced age	100%
• Having comorbidities	100%
• Being Immunocompromised	16.7%
• Certain causative organisms	66.7%
d. Mortality rates of high-risk patients who developed CAP are less than 10% of the patients.	83.3%
(3) ***Highlights on recommended vaccinations for adults in Egypt***	
a. Adult vaccinations against respiratory infections are usually recommended in high-risk patients.	100%
b. Both bacterial and viral vaccinations are recommended in high-risk patients.	83.3%
c. Adult vaccinations reduce the mortality and morbidity associated with respiratory disease in high-risk patients.	100%
d. Followed guidelines for vaccine recommendations in high-risk patients:	
• Centers for Disease Control (CDC) guidelines	50%
• American Diabetes Association (ADA) and American College of Rheumatology (ACR) guidelines	33.3%
e. The recommended vaccinations against respiratory infection for high-risk adult patients are:	
• Influenza vaccine	100%
• Pneumococcal vaccination 13&23	83.3%
• COVID-19	50%
f. Vaccinations against respiratory infection should be based on age and risk factors.	100%
g. The recommended adult age group to receive vaccination against respiratory infection is older people above 65.	100%
(4) ***Pattern of adult vaccinations in Egypt***	
a. Adult vaccination in Egypt is extremely low.	83.3%
b. The vaccination acceptance among Egyptians ranges from … to … :	
• Acceptance	50%
• Neutrality	33.3%
c. High-risk Egyptian patients are more adherent to physicians' recommendations toward vaccinations than healthy individuals	100%
(5) ***Challenges and recommendations of adult vaccination in Egypt***	
a. Challenges for adult vaccination against respiratory infections:	
• HCPs awareness	100%
• Patients' hesitancy to vaccination	83.3%
• Vaccination-related doubts	66.7%
• Availability of vaccines in the market	66.7%
• Financial reasons	50%
b. Healthcare professional recommendation for vaccination is the strongest predictor of patients' getting vaccinated.	83.3%

(*Continued*)

Table 1. (Continued).

c. Recommend tactics to enhance adult vaccination against respiratory infections among high-risk patients:	
• Social media campaigns targeting the public	100%
• Medical education and training of HCPS	100%
• Addressing patients' questions and concerns	83.3%
• Enhancing access to vaccination	83.3%
• Recommendations from local scientific societies	83.3%

CAP: Community-Acquired Pneumonia; CHD: Coronary Heart Disease; COPD: Chronic Obstructive Pulmonary Disease; HCPs: Healthcare Professionals.

Regarding pneumococcal vaccination, it is highly recommended for patients with comorbidities. However, they are underutilized globally, and only 17% of the patients with rheumatic disorders are vaccinated, as per data from the COMOSPA and COMORA studies [64,65] on spondylarthritis and rheumatoid arthritis, respectively. The panel declared that about 99% of Egypt's population did not receive pneumococcal vaccination before. According to Egyptian hematologists, pneumococcal vaccines are crucial for immunocompromised patients due to splenectomy or other medical conditions. On the other hand, pulmonologists usually recommend this type of vaccine in their clinical practice. There are two types of pneumococcal vaccines commonly used worldwide with PCV13 being previously recommended to be followed by PPV23 to cover all 23 serotypes. However, the newly approved PCV20 provides sufficient protection for a significant number of serotypes and only requires a single dose.

Concerning revaccination, influenza vaccines should be administered annually, while pneumococcal vaccines offer lifelong protection once patients receive the full regimen. The ACIP does not recommend additional doses of pneumococcal vaccines beyond the high-risk group patients. Therefore, pneumococcal vaccines may be easier to be administered by patients compared to flu vaccines.

On the other hand, international and national guidelines are no longer mandate COVID-19 vaccine administration. In addition, the risk of venous thrombosis increased hesitancy about vaccination against COVID-19 in certain age groups. The COVID-19 pandemic has declined spontaneously and unexpectedly, which may be attributed to the consecutive mutations of the virus, cross-immunity, and herd immunity. On the other hand, RSV has recently caught public attention, and RSV infections have been prevalent nowadays in Egypt (especially in the elderly). Therefore, introducing more interventions became essential, especially among high-risk patients.

2.2.4. Pattern of adult vaccinations in Egypt

The panel agreed that vaccine introduction should be recommended based on both age and risk factors among patients. In terms of age group, vaccines should be administered to older patients above 65 years. This is in line with the literature, which reported that the decline in immunity is associated with aging and increased susceptibility to infections [66].

The Ministry of Health and Population (MoHP) in Egypt strongly recommends receiving the influenza vaccine, especially for specific high-risk groups such as pregnant women, the elderly, young children, and individuals with weakened immune systems. These groups are particularly vulnerable to complications arising from influenza. The MoHP assures that getting the annual influenza vaccine this year will offer protection against the four types of influenza viruses projected to circulate during the upcoming season [13].

In addition, the experts mentioned that their patients adhere to their recommendations for vaccination [67], and explaining the role of preventive therapies to their patients further convinces them of their benefits. They also indicated that around 90% of patients follow their recommendations immediately, and those who have doubts about the benefits of the recommendations are often convinced once they know that the doctor has been vaccinated. On the other hand, they may refuse any vaccines recommended by entities other than their treating physicians, e.g., vaccines recommended before traveling, such as the COVID-19 vaccine, which is a worldwide issue. An earlier study found that the most common reason made individuals not receiving immunizations were a lack of physician recommendations and mistaken assumptions, e.g., healthy people do not need vaccination [68].

2.2.5. Challenges and recommendations of adult vaccination in Egypt

The panel mentioned that healthcare professional awareness is the most common challenge for adult vaccination. They also emphasized the importance of community awareness towards vaccination. They focused on the importance of considering awareness and decision inertia to enhance the adoption of vaccination practices in Egypt. However, it was mentioned that some physicians may lack the necessary knowledge concerning the use and benefits of vaccines. It was explained that during the rise of the influenza vaccine campaigns, many physicians disregarded the broadcast recommendations and discouraged their patients from receiving the vaccine. The same phenomenon was observed during the COVID-19 vaccine campaigns. It was also discussed that the dose regimen of various types of vaccination, such as pneumococcal vaccine, may be unknown among some physicians. This indicates that raising awareness is the main factor in spreading out any lacking information. Furthermore, they agreed that pharmacists also represent a crucial factor in that issue, as they sometimes advise patients against vaccines claiming they are unnecessary and/or harmful.

Moreover, the panel agreed that patients' hesitancy and doubts may also be challenges for adult vaccination. Lack of awareness is the main issue for resistance to vaccination as well as safety concerns. For example, patients with diabetes are not aware of pneumococcal infections, and despite existing guidelines, priority is given to administering influenza vaccines to these patients. They stated that raising awareness

among diabetic patients might be the means to increase the adoption of pneumococcal vaccination. In particular, the Egyptian population does not normally opt for preventive measures, except in pediatrics. They clarified that most of the general population refrains from getting checked up even when sick. A Canadian study found that there are gaps in knowledge, beliefs, and attitudes among the populations and healthcare providers that lead to the misuse of vaccines [69].

The panel then emphasized the importance of encouraging patients to initiate vaccine discussions with their physicians. They explained that the timing of vaccinations may not always match the scheduled doctor's visits. Thus, community awareness is crucial, especially since around 10 to 15% of physicians do not adhere to vaccine guidelines [70,71]. On the other hand, they added that physicians' and patients' safety, efficacy, and cost concerns should be addressed as they may be skeptical.

The panel stated that media coverage and media-based campaigns could help increase awareness and help vaccination introduction to the community. They also noted that mega campaigns on pediatric vaccination prompted parents to actively seek vaccination for their children instead of waiting for their physician to recommend it. Amongst healthcare providers, the panel believed that meetings and symposiums have raised their awareness of them, and follow-up questionnaires on prescribing the vaccines ensured the proper delivery of information. All the advisors agreed that specialized advisory board meetings are the best channels for the best approach for raising their awareness of vaccinations.

They agreed that the vaccination concept is not well-established in Egypt, adding that change can arise from introducing new policies after proving disease prevention's financial and economic benefits.

3. Conclusion

Adult vaccinations against respiratory infections are now recommended for high-risk groups by all healthcare regulatory bodies. These groups include infants and elderly populations, patients with diabetes, patients with CHD, patients with chronic respiratory diseases, and patients receiving immunosuppressants. Influenza vaccination is currently the most recommended in different practices, followed by PCV13 and PCV23 and COVID-19 vaccines. However, in Egypt, adult vaccination against respiratory infections is extremely overlooked. Such low rates of adherence are attributed to a lack of awareness, patients' skepticism when it comes to preventive measures and increased costs of health care. Hence, improving adult vaccination against respiratory infections status in Egypt requires a comprehensive approach involving public awareness, healthcare provider engagement, expanded access, tailored strategies, data monitoring, and policy support.

4. Limitations

One limitation of our study was the panel composition being focused on health care providers directly involved in managing respiratory infections in high-risk adults, in contrary to also including epidemiologists and public health specialists. It is therefore recommended that future research consider including them for a more comprehensive perspective. Additionally, while the panel has provided valuable insights on means of increasing vaccination rates in Egypt, including recommendations related to utilizing media outlets, it is important to acknowledge that their expertise primarily lies in clinical and real-world experiences with similar campaigns and media outreach programs for other vaccines. Although they have observed the influence of such initiatives on patients' perception of vaccines, their insights may not encompass the depth and breadth of knowledge possessed by experts solely dedicated to media campaigns.

5. Expert opinion

Vaccination rates and their progression depend on various factors, including government policies, healthcare infrastructure, public awareness, and community engagement. In Egypt, efforts to enhance rates of annual influenza vaccination in high-risk groups were of great success, which calls for adapting the means used in these campaigns to also introduce pneumococcal vaccination as well as other novel respiratory vaccines to the Egyptian high-risk population as per the recent updates in international guidelines.

Media campaigns are the most efficient approach to raising community vaccination awareness. They have shown great success when utilized for previous vaccination campaigns, namely the influenza and polio vaccines. Awareness campaigns for adult vaccines target high-risk groups, employing guidelines' recommendations for vaccines that are currently available in the Egyptian market, such as pneumococcal vaccines. Coordinating with official governmental entities (e.g. the General Authority for Healthcare Accreditation and Regulation (GAHAR) and the Preventive Medicine Sector of the Egyptian Ministry of Health) will ensure the success of any public outreach campaigns. This will diminish logistic challenges and increase the campaign's credibility among the public. Physicians are a key element in bringing guidelines to action. Informing physicians of the benefits of vaccines as preventive measures will increase the likelihood of them recommending vaccination to their high-risk patients. Raising physicians' awareness can be achieved through organizing meetings and events on managing diseases within their areas of specialty, with vaccination incorporated as an essential step of disease management. Moreover, implementing a robust surveillance system to monitor adult vaccination coverage is essential. Accurate data on vaccination rates and vaccine-preventable diseases can help identify gaps, assess the impact of interventions, and guide policy decisions. Regular evaluation and reporting of vaccination coverage should then be encouraged.

By implementing these recommendations, adult vaccination rates can be significantly enhanced, reducing the burden of PVDs, and promoting a healthier population. It is therefore crucial for stakeholders, including healthcare professionals, and community leaders, to collaborate in establishing a nationwide strategy for promoting necessary adult vaccinations.

Additionally, a shift in the vaccination status in Egypt can arise from introducing new national policies derived from

cost-effectiveness and feasibility data for vaccines. Consistently, efforts should be made to ease patients' access to vaccine products, mainly through providing them free of charge or at reduced prices in numerous public hospitals and other governmental facilities.

Lastly, encouraging further research and conducting studies to understand barriers and determinants of adult vaccination uptake in Egypt can guide targeted interventions and propose tailored solutions to identified gaps. Additionally, conducting post-vaccination surveillance to assess vaccine effectiveness and safety in the Egyptian population can build trust and confidence among the targeted population.

Anticipated challenges that may hinder the actualization of the desired progress include the variation in levels of access and quality of healthcare across Egypt, where inadequate healthcare infrastructure, especially in rural areas, can hinder the availability and accessibility of vaccines for patients. Moreover, some HCPs may provide inconsistent vaccine recommendations associated with a general lack of emphasis on adult immunization during routine healthcare visits.

Concerted efforts to implement the recommendations previously mentioned, will potentially lead to positive changes over time; however, achieving significant improvements in adult vaccination status in Egypt requires sustained commitment, resource allocation, and collaboration among multiple stakeholders.

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Author contributions

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References

1. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2007 Mar;44 (Suppl 2):S27–72. doi: 10.1086/511159
2. File TM. Community-acquired pneumonia. Lancet (London, England). 2003 Dec;362(9400):1991–2001. doi: 10.1016/S0140-6736(03)15021-0
3. File TM, Marrie TJ. Burden of community-acquired pneumonia in north American adults. Postgrad Med [Internet]. 2010 Mar 1;122 (2):130–141. Available from 10.3810/pgm.2010.03.2130
4. Ramirez JA, Wiemken TL, Peyrani P, et al. Adults hospitalized with pneumonia in the United States: incidence, epidemiology, and mortality. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2017 Nov;65(11):1806–1812. doi: 10.1093/cid/cix647
5. Xu J, Murphy SL, Kochanek KD, Arias E. Deaths: final data for 2019 [internet], editor. (U.S.) NC for HS. Vol. 70. Hyattsville (MD): National Vital Statistics Reports. Available from: https://stacks.cdc.gov/view/cdc/106058
6. Pfuntner A, Wier LM, Steiner C. Costs for hospital stays in the United States. Rockville (MD): Agency for Healthcare Research and Quality; 2010.
7. Bonafede MM, Suaya JA, Wilson KL, et al. Incidence and cost of CAP in a large working-age population. Am J Manag Care. 2012 Jul;18 (7):380–387.
8. Colice GL, Morley MA, Asche C, et al. Treatment costs of community-acquired pneumonia in an employed population. Chest. 2004 Jun;125(6):2140–2145. doi: 10.1378/chest.125.6.2140
9. Violi F, Cangemi R, Falcone M, et al. Cardiovascular complications and short-term mortality risk in community-acquired pneumonia. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2017 Jun;64 (11):1486–1493. doi: 10.1093/cid/cix164
10. Eurich DT, Marrie TJ, Minhas-Sandhu JK, et al. Risk of heart failure after community acquired pneumonia: prospective controlled study with 10 years of follow-up. BMJ. 2017 Feb;356:j413. doi: 10.1136/bmj.j413
11. Ramirez J, Aliberti S, Mirsaeidi M, et al. Acute myocardial infarction in hospitalized patients with community-acquired pneumonia. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2008 Jul;47(2):182–187. doi: 10.1086/589246
12. Bruns AHW, Oosterheert JJ, Cucciolillo MC, et al. Cause-specific long-term mortality rates in patients recovered from community-acquired pneumonia as compared with the general Dutch population. Clin Microbiol Infect Off Publ Eur Soc Clin Microbiol Infect Dis. 2011 May;17(5):763–768. doi: 10.1111/j.1469-0691.2010.03296.x
13. Kandeel A, Fahim M, Deghedy O, Roshdy WH, Khalifa MK, El SR, et al. Resurgence of influenza and respiratory syncytial virus in Egypt following two years of decline during the COVID-19 pandemic: outpatient clinic survey of infants and children, October 2022. BMC Public Health [Internet]. 2023;23(1):1067. doi: 10.1186/s12889-023-15880-9
14. El-Sokkary RH, Ramadan RA, El-Shabrawy M, et al. Community acquired pneumonia among adult patients at an Egyptian university hospital: bacterial etiology, susceptibility profile and evaluation of the response to initial empiric antibiotic therapy. Infect Drug Resist. 2018;11:2141–2150. doi: 10.2147/IDR.S182777
15. Khalil MM, Abdel Dayem AM, Farghaly AAAH, Shehata HM. Pattern of community and hospital acquired pneumonia in Egyptian military hospitals. Egyptian J Chest DisTuberc [Internet]. 2013;62 (1):9–16. Available from: https://www.sciencedirect.com/science/article/pii/S0422763813000046
16. Balkhy HH, Cunningham G, Chew FK, et al. Hospital- and community-acquired infections: a point prevalence and risk factors survey in a tertiary care center in Saudi Arabia. Int J Infect Dis [Internet]. 2006;10(4):326–333. doi: 10.1016/j.ijid.2005.06.013
17. Al-Muhairi S, Zoubeidi T, Ellis M, et al. Demographics and microbiological profile of pneumonia in United Arab Emirates. Monaldi

arch chest dis = arch monaldi per le mal del torace. Monaldi Archives For Chest Disease. 2006 Mar;65(1):13–18. doi: 10.4081/monaldi.2006.580
18. Hanssens Y, Ismaeil BB, Kamha AA, et al. Antibiotic prescribing pattern in a medical intensive care unit in Qatar. Saudi Med J. 2005 Aug;26(8):1269–1276.
19. Al-Muhairi SS, Zoubeidi TA, Ellis ME, et al. Risk factors predicting outcome in patients with pneumonia in Al-ain, United Arab Emirates. Saudi Med J. 2006 Jul;27(7):1044–1048.
20. Jain S, Self WH, Wunderink RG, et al. Community-acquired pneumonia requiring hospitalization among U.S adults. N Engl J Med. 2015 Jul;373(5):415–427. doi: 10.1056/NEJMoa1500245
21. Torres A, Peetermans WE, Viegi G, et al. Risk factors for community-acquired pneumonia in adults in Europe: a literature review. Thorax. 2013 Nov;68(11):1057–1065. doi: 10.1136/thoraxjnl-2013-204282
22. Almirall J, Bolíbar I, Balanzó X, et al. Risk factors for community-acquired pneumonia in adults: a population-based case-control study. Eur Respir J. 1999 Feb;13(2):349–355. doi: 10.1183/09031936.99.13234999
23. Shaaban LH. Dilemma of community-acquired pneumonia. Egypt J Chest Dis Tuberc [Internet]. 2019;68(1). Available from 1. doi: 10.4103/ejcdt.ejcdt_189_18
24. Memoli MJ, Athota R, Reed S, et al. The natural history of influenza infection in the severely immunocompromised vs nonimmunocompromised hosts. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2014 Jan;58(2):214–224. doi: 10.1093/cid/cit725
25. Burk M, El-Kersh K, Saad M, et al. Viral infection in community-acquired pneumonia: a systematic review and meta-analysis. Eur Respir Rev An Off J Eur Respir Soc. 2016 Jun;25(140):178–188. doi: 10.1183/16000617.0076-2015
26. Wu X, Wang Q, Wang M, et al. Incidence of respiratory viral infections detected by PCR and real-time PCR in adult patients with community-acquired pneumonia: a meta-analysis. Respiration. 2015;89(4):343–352. doi: 10.1159/000369561
27. Alimi Y, Lim WS, Lansbury L, et al. Systematic review of respiratory viral pathogens identified in adults with community-acquired pneumonia in Europe. J Clin Virol Off Publ Pan Am Soc Clin Virol. 2017 Oct;95:26–35. doi: 10.1016/j.jcv.2017.07.019
28. Johansson N, Kalin M, Tiveljung-Lindell A, et al. Etiology of community-acquired pneumonia: increased microbiological yield with new diagnostic methods. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2010 Jan;50(2):202–209. doi: 10.1086/648678
29. Marrie TJ, Poulin-Costello M, Beecroft MD, et al. Etiology of community-acquired pneumonia treated in an ambulatory setting. Respir med. 2005 Jan;99(1):60–65. doi: 10.1016/j.rmed.2004.05.010
30. Cillóniz C, Ewig S, Polverino E, et al. Microbial aetiology of community-acquired pneumonia and its relation to severity. Thorax. 2011 Apr;66(4):340–346. doi: 10.1136/thx.2010.143982
31. Restrepo MI, Mortensen EM, Velez JA, et al. A comparative study of community-acquired pneumonia patients admitted to the ward and the ICU. Chest. 2008 Mar;133(3):610–617. doi: 10.1378/chest.07-1456
32. Grohskopf LA, Blanton LH, Ferdinands JM, et al. Prevention and Control of Seasonal Influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices - United States, 2022-23 Influenza season. MMWR Morb Mortal Wkly Rep. 2022 Aug;71(1):1–28. doi: 10.15585/mmwr.rr7101a1
33. Fiore AE, Uyeki TM, Broder K, et al. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2011 Aug;60(33):1128–1132.
34. Tomczyk S, Bennett NM, Stoecker C, et al. Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine among adults aged ≥65 years: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2014 Sep;63(37):822–825.
35. Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine for adults with immunocompromising conditions: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2012 Oct;61(40):816–819. doi: 10.1111/ajt.12073
36. Kobayashi M, Farrar JL, Gierke R, et al. Use of 15-valent pneumococcal conjugate vaccine and 20-valent pneumococcal conjugate vaccine among U.S. Adults: updated recommendations of the advisory committee on immunization practices - United States, 2022. MMWR Morb Mortal Wkly Rep. 2022 Jan;71(4):109–117. doi: 10.15585/mmwr.mm7104a1
37. Rovin BH, Adler SG, Barratt J, et al. KDIGO 2021 clinical practice guideline for the management of glomerular diseases. Vol. 100. United States: Kidney international; 2021. p. S1–276.
38. Ponikowski P, Voors AA, Anker SD, et al. ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2016;37(27):2129–2200m. doi: 10.1093/eurheartj/ehw128
39. Esposito S, Bonanni P, Maggi S, et al. Recommended immunization schedules for adults: clinical practice guidelines by the Escmid Vaccine Study Group (EVASG), European Geriatric Medicine Society (EUGMS) and the World Association for Infectious Diseases and immunological disorders (WAidid). Hum Vaccin Immunother. 2016 Jul;12(7):1777–1794. doi: 10.1080/21645515.2016.1150396
40. Venkatesan P. First RSV vaccine approvals. Lancet Microbe [Internet]. 2023 Aug 1;4(8):e577. Available from 10.1016/S2666-5247(23)00195-7
41. Yancy CW, Jessup M, Bozkurt B, et al. ACCF/AHA guideline for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American heart Association Task Force on practice guidelines. Circulation. 2013 Oct;128(16):1810–1852. doi: 10.1161/CIR.0b013e31829e8807
42. Davis MM, Taubert K, Benin AL, et al. Influenza vaccination as secondary prevention for cardiovascular disease: a science advisory from the American Heart Association/American College of Cardiology. J Am Coll Cardiol. 2006 Oct;48(7):1498–1502. doi: 10.1016/j.jacc.2006.09.004
43. American Diabetes Association Professional Practice Committee. Comprehensive medical evaluation and assessment of comorbidities: standards of medical care in diabetes-2022. Diabetes Care. 2022 Jan;45(Suppl 1):S46–59. doi: 10.2337/dc22-S004
44. Furer V, Rondaan C, Heijstek MW, et al. 2019 update of EULAR recommendations for vaccination in adult patients with autoimmune inflammatory rheumatic diseases. Ann Rheum Dis. 2020 Jan;79(1):39–52. doi: 10.1136/annrheumdis-2019-215882
45. Liu BC, McIntyre P, Kaldor JM, et al. Pertussis in older adults: prospective study of risk factors and morbidity. Clin Infect Dis An Off Publ Infect Dis Soc Am. 2012 Dec;55(11):1450–1456. doi: 10.1093/cid/cis627
46. Keitel WA, Muenz LR, Decker MD, et al. A randomized clinical trial of acellular pertussis vaccines in healthy adults: dose-response comparisons of 5 vaccines and implications for booster immunization. J Infect Dis. 1999 Aug;180(2):397–403. doi: 10.1086/314869
47. Demicheli V, Jefferson T, Ferroni E, et al. Vaccines for preventing influenza in healthy adults. Cochrane Database Syst Rev. 2018 Feb;2(2):CD001269. doi: 10.1002/14651858.CD004879.pub5
48. Ferdinands JM, Thompson MG, Blanton L, et al. Does influenza vaccination attenuate the severity of breakthrough infections? A narrative review and recommendations for further research. Vaccine. 2021 Jun;39(28):3678–3695. doi: 10.1016/j.vaccine.2021.05.011
49. Molinari NAM, Ortega-Sanchez IR, Messonnier ML, et al. The annual impact of seasonal influenza in the US: measuring disease burden and costs. Vaccine. 2007 Jun;25(27):5086–5096. doi: 10.1016/j.vaccine.2007.03.046
50. McLaughlin JM, McGinnis JJ, Tan L, et al. Estimated human and economic burden of four major adult vaccine-preventable diseases in the United States, 2013. J Prim Prev. 2015 Aug;36(4):259–273. doi: 10.1007/s10935-015-0394-3

51. Allam A, Salah K, Shokry D, Abdulla I, Yehia S, Hammad N. The incidence of mycoplasma pneumoniae in community acquired pneumonia among children: one centre study. Microbes Infect dis [Internet]. 2020;1(3):182–189. Available from: https://mid.journals.ekb.eg/article_91921.html
52. Bizri AR, Althaqafi A, Kaabi N, et al. The burden of invasive vaccine-preventable diseases in adults in the Middle East and North Africa (MENA) region. Infect Dis Ther [Internet]. 2021;10(2):663–685. doi: 10.1007/s40121-021-00420-y
53. Shibl AM, Memish ZA, Ibrahim E, et al. Burden of adult community-acquired pneumonia in the Middle East/North Africa region. Rev Res Med Microbiol. 2010;21(1):11–20. doi: 10.1097/MRM.0b013e3283377af7
54. Menéndez R, Cremades MJ, Martínez-Moragón E, et al. Duration of length of stay in pneumonia: influence of clinical factors and hospital type. Eur Respir J. 2003 Oct;22(4):643–648. doi: 10.1183/09031936.03.00026103
55. Kaysar M, Augustine T, Jim L, et al. Predictors of length of stay between the young and aged in hospitalized community-acquired pneumonia patients. Geriatr Gerontol Int. 2008 Dec;8(4):227–233. doi: 10.1111/j.1447-0594.2008.00480.x
56. Masotti L, Ceccarelli E, Cappelli R, et al. Length of hospitalization in elderly patients with community-acquired pneumonia. Aging. 2000 Feb;12(1):35–41. doi: 10.1007/BF03339826
57. Ashrafi-Asgarabad A, Bokaie S, Razmyar J, et al. The burden of lower respiratory infections and their underlying etiologies in the Middle East and North Africa region, 1990–2019: results from the Global burden of disease Study 2019. BMC Pulm Med [Internet]. 2023;23(1):1–14. doi: 10.1186/s12890-022-02301-7
58. Miravalle A, Biller J, Schnitzler E, et al. Neurological complications following vaccinations. Neurol Res [Internet]. 2010 Apr 1;32(3):285–292. doi: 10.1179/016164110X12645013515214
59. Chung JY, Lee SJ, Shin BS, et al. Myasthenia gravis following human papillomavirus vaccination: a case report. BMC neurol. 2018 Dec;18(1):222. doi: 10.1186/s12883-018-1233-y
60. Chatterjee A, Chakravarty A. Neurological complications following COVID-19 vaccination. Curr Neurol Neurosci Rep. 2023 Jan;23(1):1–14. doi: 10.1007/s11910-022-01247-x
61. Kobayashi M. Considerations for age-based and risk-based use of PCV15 and PCV20 among U.S. adults and proposed policy options [internet], editor. (U.S.) NC for I and RD. Vol. 202113. Atlanta (GA): ACIP meeting Pneumococcal Vaccines. Available from: https://stacks.cdc.gov/view/cdc/110908
62. Bass AR, Chakravarty E, Akl EA, et al. American College of Rheumatology Guideline for Vaccinations in patients with rheumatic and musculoskeletal diseases. Arthritis Care Res (Hoboken). 2023 Mar;75(3):449–464. doi: 10.1002/acr.25045
63. Behrouzi B, Araujo Campoverde MV, Liang K, et al. Influenza vaccination to reduce cardiovascular morbidity and mortality in patients with COVID-19: JACC state-of-the-art review. J Am Coll Cardiol. 2020 Oct;76(15):1777–1794. doi: 10.1016/j.jacc.2020.08.028
64. Toback S, Galiza E, Cosgrove C, et al. Safety, immunogenicity, and efficacy of a COVID-19 vaccine (NVX-CoV2373) co-administered with seasonal influenza vaccines: an exploratory substudy of a randomised, observer-blinded, placebo-controlled, phase 3 trial. Lancet Respir Med [Internet]. 2022 Feb 1;10(2):167–179. doi: 10.1016/S2213-2600(21)00409-4
65. McLean HQ, Petrie JG, Hanson KE, et al. Interim estimates of 2022-23 seasonal influenza vaccine effectiveness - Wisconsin, October 2022-February 2023. MMWR Morb Mortal Wkly Rep. 2023 Feb;72(8):201–205. doi: 10.15585/mmwr.mm7208a1
66. Moltó A, Etcheto A, van der Heijde D, et al. Prevalence of comorbidities and evaluation of their screening in spondyloarthritis: results of the international cross-sectional ASAS-COMOSPA study. Ann Rheum Dis. 2016 Jun;75(6):1016–1023. doi: 10.1136/annrheumdis-2015-208174
67. Dougados M, Soubrier M, Antunez A, et al. Prevalence of comorbidities in rheumatoid arthritis and evaluation of their monitoring: results of an international, cross-sectional study (COMORA). Ann Rheum Dis. 2014 Jan;73(1):62–68. doi: 10.1136/annrheumdis-2013-204223
68. Lord JM. The effect of ageing of the immune system on vaccination responses. Hum Vaccin Immunother. 2013 Jun;9(6):1364–1367. doi: 10.4161/hv.24696
69. Zhang R, Lu X, Wu W, et al. Why do patients follow physicians' advice? The influence of patients' regulatory focus on adherence: an empirical study in China. BMC Health Serv Res [Internet]. 2019;19(1):301. doi: 10.1186/s12913-019-4127-9
70. Johnson DR, Nichol KL, Lipczynski K. Barriers to adult immunization. Am J Med. 2008 Jul;121(7 Suppl 2):S28–35. doi: 10.1016/j.amjmed.2008.05.005
71. MacDougall DM, Halperin BA, MacKinnon-Cameron D, et al. The challenge of vaccinating adults: attitudes and beliefs of the Canadian public and healthcare providers. BMJ Open [Internet]. 2015 Sep 1;5(9):e009062. Available from: http://bmjopen.bmj.com/content/5/9/e009062.abstract