Hilla University College Journal For Medical Science

Manuscript 1074

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ORIGINAL STUDY

Hilla Univ Coll J Med Sci

COVID-19 Vaccination Coverage in AL-Qassim District, Iraq: Epidemiological Analysis (2021–2022)

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Abstract

Background: Vaccines against COVID-19 have been instrumental in preventing the spread and severity of the disease in the world. In Iraq, coverage and distribution of vaccines across regions have differed.

Objectives: The objective of this study was to assess the coverage of three types of COVID-19 vaccines in Al-Qasim District, Babil Governorate, Iraq, in the years 2021 and 2022.

Materials and Methods: In a retrospective observational study, local health authority vaccination data were utilized. The study population was approximately 310,000 residents of three sub-districts. Monthly data for 2021 and 2022 were included for the quantity of vaccine doses (first and second doses) administered and the types of vaccines received (Pfizer, Sinopharm, and AstraZeneca). Statistical analysis with SPSS was carried out to determine trends and differences over time in vaccination uptake.

Results: There were 33,108 individuals who received the COVID-19 vaccination in 2021, most of whom received the initial dose. In comparison, 12,197 individuals were vaccinated in 2022, and more individuals received second doses than in 2021. Based on evidence, a decline in the number of individuals who received the vaccination in 2021 versus 2022 was noted, despite an increase in second dose completion in 2022.

Conclusion: The outcome reveals heightened early vaccine coverage in 2021, which is likely due to early public health engagement and increased urgency in early vaccine rollout. The lower rates of 2022 reflect public interest waning or logistical ineffectiveness. However, the greater percentage of completion of second doses in 2022 reveals improved follow-through and may be increased trust in the vaccination process. Targeted interventions may be required to maintain and enhance vaccine coverage, particularly among disadvantaged groups.

Keywords: COVID vaccine, Vaccination coverage, Public health, Iraq, Al-Qasim district

1. Introduction

In late 2019, a corona virus outbreak named "SARS-CoV-2 virus, caused COVID19 disease. The outbreak began in the city of Wuhan, China and developed very quickly and spread to other parts China, and from there to many countries of the world [1]. On March 2020, WHO declared COVID-19 as pandemic [2]. Because of the outbreak and its severity, thousands were fighting for their lives in hospitals of all countries and the world take, strict measures to limit,the spread of the virus [3]. In an unprecedented. record period that did not,exceed one year, scientists were able to develop a number of safe, and effective vaccines, which have been tested on tens of, thousands of volunteers around the world [4]. The globa regulator has given green light for a number of these vaccines for emergency use to prevent COVID 19 infection, such as Pfizer's Biontech, Moderna, AstraZeneca University of Oxford, Johson & Johnson, Chinese Sinopharma, and Sputnik Russian [5]. Importance of Vaccines represent one of the greatest success

Received 10 July 2025; accepted 1 August 2025.
Available online 27 September 2025

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https://doi.org/10.62445/2958-4515.1074

stories in the history of moderna medicine, With the authorization and availability of highly effective COVID-19 vaccines by early 2021, vaccination became an effective tool to reduce COVID-19–associated morbidity and mortality worldwide. During 2021–2023, the COVID-19 Vaccines Global Access (COVAX), a global, multilateral initiative led jointly by Gavin, the Vaccine Alliance, the Coalition for Epidemic Preparedness Innovations, and the World Health Organization (WHO) in partnership with UNICEF, was established to ensure COVID-19 vaccine equity [6],

In July 2022, WHO recommended that all countries redirect efforts and focus on vaccinating priority populations, including health care workers, older adults (persons aged ≥50 years), and other high-risk groups (e.g., pregnant women, persons with comorbidities, and those with immunocompromising conditions) [7] Vaccines help the body's immune system to fight pathogens through the release of specialized immune responses. Vaccines often consist of weakened or killed forms of microorganisms or one of the Its surface proteins, which retain their ability to stimulate the immune system of the recipient, to produce antibodies and killer T cells capable, of recognizing the virus, attacking and destroying it. It generally takes several weeks, after vaccination for the body to produce and store immunoglobulins, "memory B cells, and memory T" cells, which are Long-lived cells can, "remember" the pathogen and prevent and eliminate the pathogens if attack the body in the future [8]. Vaccine Development and Testing Stages The development and production of a vaccine usually go through two main stages: the preclinical (or prehuman trial)stage, where researchers give the vaccine to laboratory animals such as mice or monkeys to see if it will lead to a good immune response, followed by the clinical phase (human trials) [9].

The test consists of three stages: Phase I: A small number of people are given the vaccine by scientists, usually including about 20 volunteers tested for safety and dosage, and to learn more about the response of the immune system it provokes [10]. In phase 2, scientists administer the vaccine to hundreds of people, divided into categories such as children and the elderly, to determine whether the vaccine is effective in different age groups. These trials also assess the vaccine's safety and dosage, as well as its capacity to boost the immune system [10]. If the vaccine is proven to be effective and does not cause health problems, it will be expanded to include thousands of volunteers, which is called phase 3. These experiments can determine whether the vaccine protects against the emerging corona virus. This stage is also important to confirm the safety of the use of the vaccine by determining the true reactions including rare side effects, FDA approval then manufacturing and distribution will take place [11]. How Do Vaccines Work? Scientists us different, techniques in their experiments to develop vaccines, two of which work in the same way that has been proven to be effective in previous vaccines. The first two methods is to inject the body with a weak (attenuated) or dead virus (inactivated), as is used in polio, smallpox, and influenza vaccines. The third method depends on injecting the body with a small part of the virus to stimulate the body's immune system [12]. The "Swedish-British company, AstraZeneca, and is partner, the University of Oxford", are taking a forth approach, during which experts transfer some corona virus proteins to a different virus without causing disease, which enhances the immune system's ability to recognize signs of future virus invasion [13].

The American company "Pfizer" and its partner, the German "Biontech", and the American company., "Moderna" are also using a 5and 6 methods in developing the vaccine, which depends on the production of a "genetic vaccine", by injecting the patient with "mRNA" or the genetic code that carries the information to produce viral proteins, in the body .cells. The immune system recognizes these foreign, proteins and initiates an immune reaction against them. [14].

2. Materials and methods

2.1. Subject study

This retrospective study was conducted to assess the coverage of the three types of COVID-19 vaccines administered in Al-Qasim District, Babylon Governorate, Iraq. The total population of the district is approximately 310,000 individuals, distributed across three sub-districts: Ibrahimiyya with a population of 30,000, Al-Tali'ah with 140,000, and the district center, with 140,000 residents.

Data were collected from local vaccination centers and covered the period spanning the years 2021 and 2022. The data were categorized on a monthly basis for each year and included information on the number of individuals vaccinated, the type of vaccine administered (first or second dose), and the specific brand of vaccine used, where applicable.

Statistical analysis was performed using SPSS software. Descriptive statistics were used to calculate vaccination coverage rates by vaccine type, subdistrict, and time period. Coverage percentages were computed relative to the total population in each area. Temporal trends in vaccination rates were analyzed to evaluate changes over time. Appropriate statistical tests, such as the Chi-square test, were applied to determine significant differences in vaccination

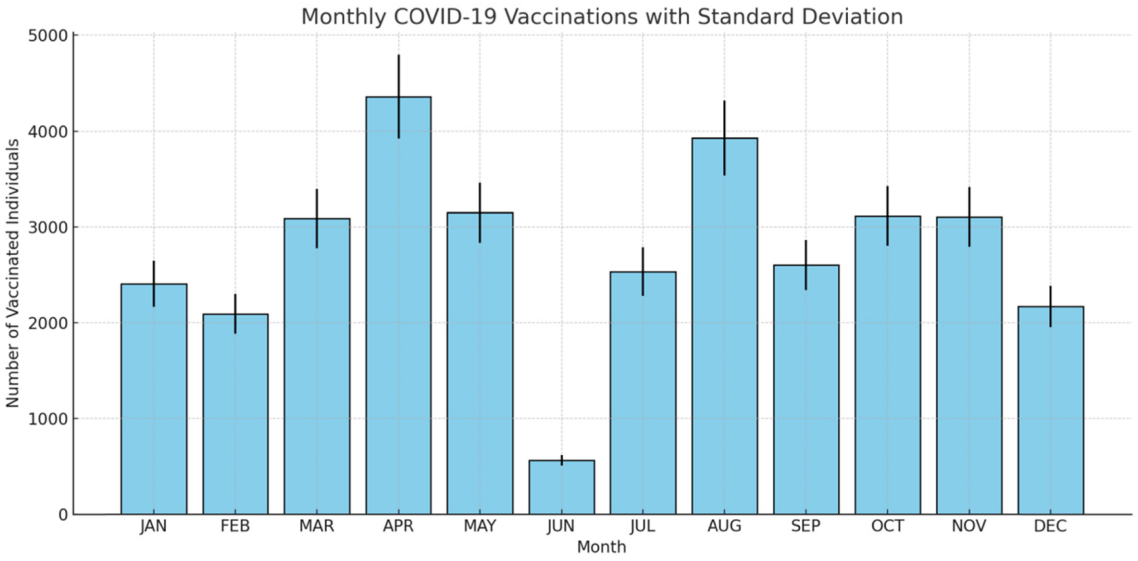

Fig. 1. Vaccination in Al-Qassem District by months during 2021.

coverage between regions or across months, when necessary.

Data accuracy was verified by cross-referencing with official records from the Babil Health Directorate. Ethical considerations were adhered to throughout the data collection and analysis process, in accordance with scientific and professional standards.

3. Results

Fig. 1 shows the number of individuals vaccinated with the Corona vaccine during the year 2021, according to the months of the year. It is clear that the number of people vaccinated for all types of vaccines reached 33,108.

Fig. 2 shows the number of individuals vaccinated with the Corona vaccine during the year 2022, according to the months of the year. It is clear that the number of people vaccinated for all types of vaccines reached 12197.

In Fig. 3 reveals the vaccination coverage for COVID19 in AL-Qassem district during 2021 and 2022. The results show the number of vaccinated people during the years 2021 and 2022, from which it becomes clear that the number of vaccinated people in 2021 is greater than those vaccinated in 2022. Also, the majority of those vaccinated in 2021 took the first dose from the subscriptions, while you see for the year 2022, the vaccinated individuals are fewer, but they took the second dose. Most of them received the first dose, and we conclude that those vaccinated with the

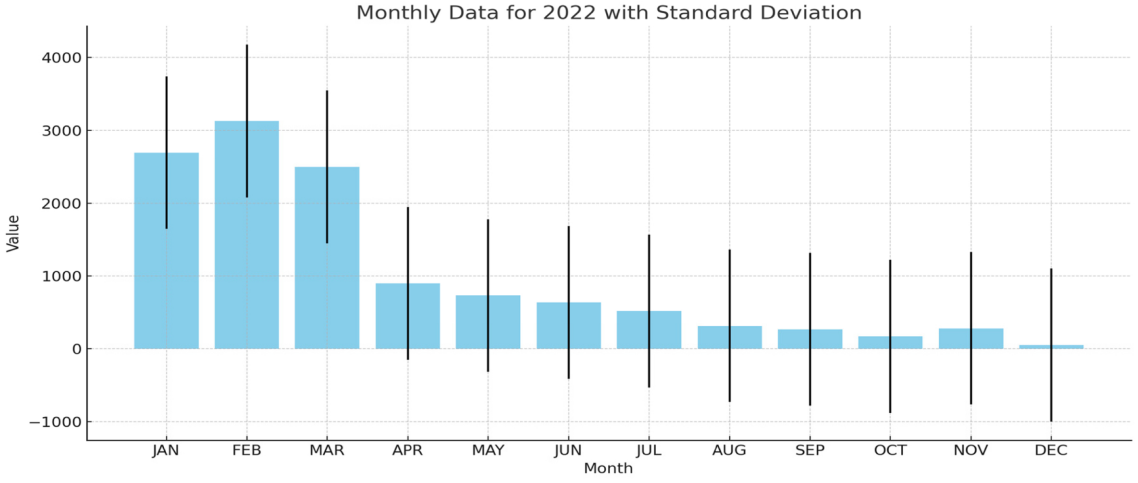

Fig. 2. Vaccination in Al-Qassem District by months during 2022.

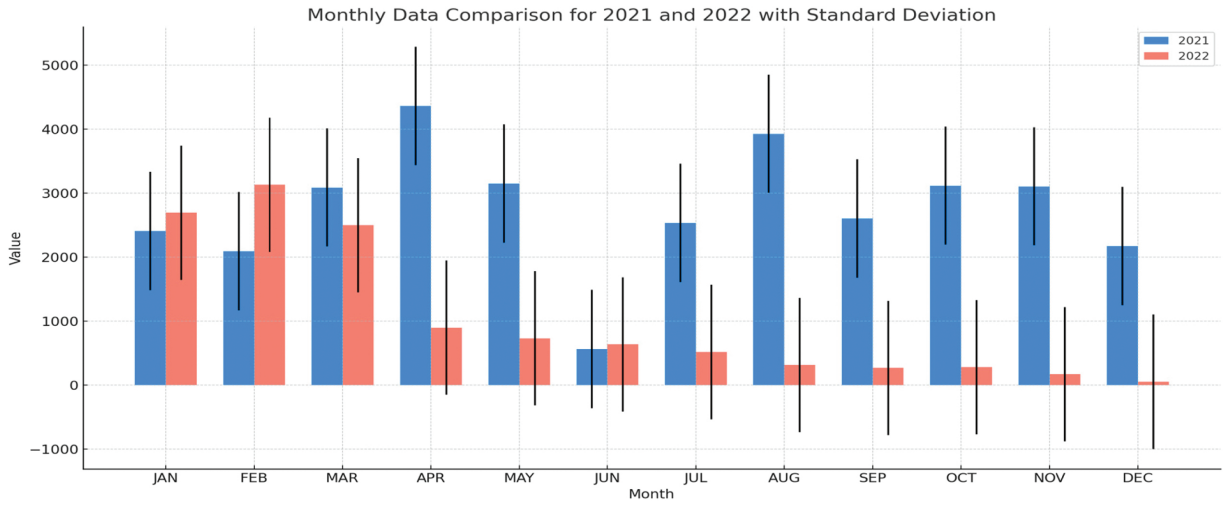

Fig. 3. The vaccination coverage of COVID 19 during 2021 and 2022 years.

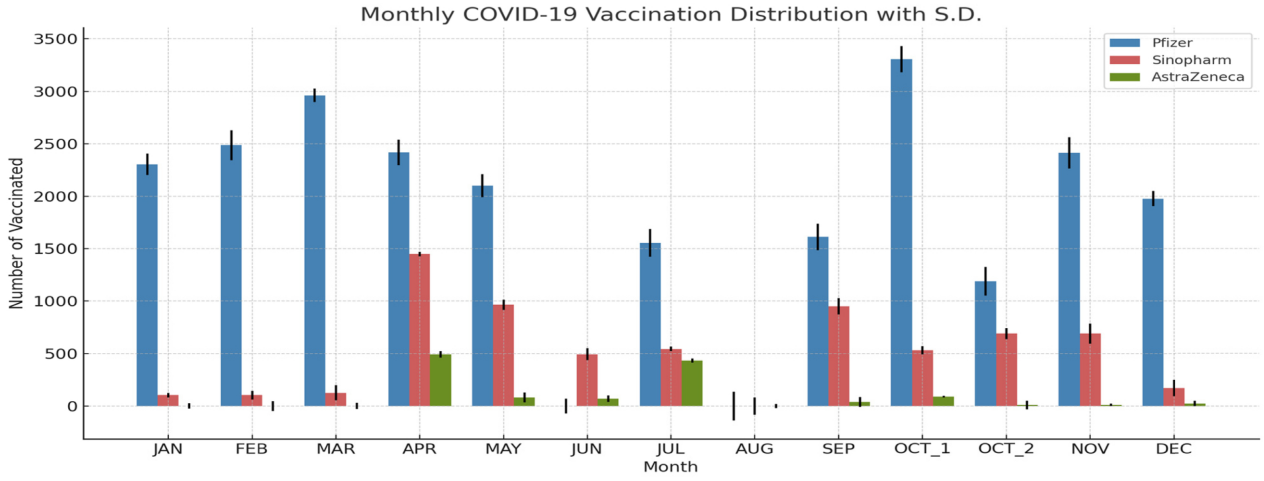

Fig. 4. Vaccine figures by vaccine types in Al Qassim district -Iraq 2021.

first dose only are more likely to receive the second dose of COVID vaccine.

Fig. 4 This report presents the monthly distribution of COVID-19 vaccinations categorized by vaccine type: Pfizer, Sinopharm, and AstraZeneca. The chart includes standard deviation (S.D.) error bars to reflect the variability in data.

Fig. 5 This document illustrates the monthly COVID-19 vaccination figures categorized by Pfizer, Sinopharm, and AstraZeneca. The chart includes standard deviation (S.D.) error bars to reflect variability across reported months.

4. Discussion

During epidemiological week 32, 2,767 new COVID-19 cases were registered in Iraq, a significant 57% decline from the previous week. While there was a decline in case numbers, there was an increase of 9% in reported deaths (12 cases) that indicates severity of the disease persists in certain patient subsets, possibly because of comorbidities, delayed presentation to care being offered, or the virulence of strains [15]. The national positivity rate (PR) fell sharply from 16.1% in week 31 to 9.2% in week 32. Yet, this average conceals starkly differing regional variations. Regional high positivity rates were seen in Missan (23%), Dhi-Qar (22%), and Diyala (21%) but low values in Muthanna (1%) and Kirkuk (4%). This heterogeneity of transmission patterns could be attributed to the differences in public health interventions, levels of testing, population density, and compliance with protective behavior [16].

As of 14 August 2022, Iraq had administered 19,026,929 vaccine doses. Approximately 26.1% of the population had received at least one dose, and

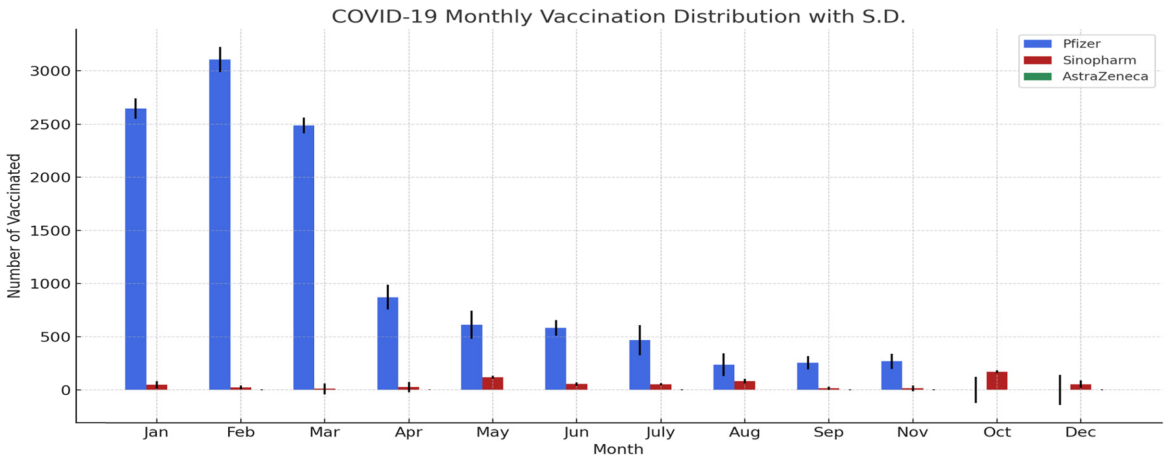

Fig. 5. Vaccine figures by vaccine types in Al Qassim district -Iraq 2022.

18.4% (7,759,616 individuals) were fully vaccinated. During that week, 41,766 vaccine doses were administered, marking a 32% increase from the previous reporting period. This trend may reflect increasing public awareness or improved vaccine access [17]. Cross-sectional studies have documented fluctuating vaccine acceptance across the country. While 77.6% of respondents expressed a willingness to be vaccinated, 64.3% indicated a preference to delay immunization, reflecting cautious optimism or lingering concerns over vaccine safety and efficacy, Among the unvaccinated, 61.4% were unwilling to accept the vaccine. Factors influencing hesitancy included limited trust in authorities, prevailing negative social norms, perceived logistical barriers, and reduced confidence in vaccine benefits [18].

Findings from the Iraq High-Frequency Phone Survey further revealed that vaccine hesitancy was disproportionately higher among women, individuals with lower educational attainment, and rural populations. The most commonly cited reason for reluctance was fear of side effects—an issue consistent with global reports of vaccine misinformation and anxiety [19].

Seroprevalence data from Duhok indicated that 62.6% of study participants had SARS-CoV-2 antibodies, with 56.3% of them reporting no prior symptoms [20]. This finding aligns with international estimates indicating that a substantial proportion of infections are asymptomatic [21]. Consequently, reported case numbers likely underestimate true infection rates. These results highlight the importance of active case finding, routine antibody surveillance, and integrating serological testing into national public health strategies [22–25].

5. Conclusion

Epidemic indicators in Iraq still demand a concerted effort from health partners to bolster prevention, vaccination, and surveillance—backed by sustainable funding, robust field support, and ongoing public communication—to effectively manage any potential rise in cases in the coming months.

Acknowledgments

No financial source was received for this study.

Ethical considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Data availability statement

All data generated or analyzed during this study are included in this published article.

Conflict of interest

The authors declare that there is no conflict of interests.

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