

# Palestinian analysis of COVID-19 vaccine compliance and reported death by vaccination type

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## ABSTRACT

**Background:** This study aims to compare mortality and adherence to the second dose between different types of vaccines administered in Palestine. **Methods and Participants:** A retrospective cohort study of individuals vaccinated against COVID-19 from February 14, 2021 through January 2022. Data were retrieved from the Palestinian Ministry of Health database and included identity number, date of birth, vaccination date, vaccine type, and mortality. **Results:** The study included 16,726 individuals who were vaccinated and later diagnosed with COVID-19. The mean age was 42.1 years, and females comprised 48.5% (8,112) of the population. Only 62.7% of individuals adhered to receiving the second dose of a vaccine, and the average duration of effectiveness of all vaccines was 126 days after completing the double dose. Seventy-five COVID-related deaths were recorded among vaccinated individuals who were significantly older ages. **Conclusion:** Our study design demonstrated the disparity in vaccine uptake and adherence due to delay in vaccination and dependence on COVAX and other countries for the donated vaccines. It highlights the importance of a global approach and higher-income countries assisting lower-income countries in securing vaccine.

**Keywords:** Compliance, COVID-19 vaccine, death types

## Introduction

Coronavirus Disease 2019 (COVID-19) vaccinations are now available globally to help prevent the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As of February 25<sup>th</sup>, 2022, with 146 COVID-19 vaccinations were in clinical trials.<sup>[1]</sup> Numerous vaccines have been investigated with Pfizer-BioNTech and Moderna being the most often used RNA-based vaccines. Two nonreplicating viral vector vaccines are also available: Sputnik V and Oxford-AstraZeneca. COVID-19 vaccines in the form of whole-virus vaccines, such as Sinopharm and Sinovac, are also available.

According to a Malaysian study, unvaccinated people died at a higher rate than vaccinated people in COVID-19 deaths. In addition, the age-standardized death rate for fully vaccinated persons was continuously lower than that of the partially vaccinated group.<sup>[2]</sup> Participants who received a booster at least 5 months following a second dose of BNT162b2 had a 90% reduced mortality due to COVID-19 than participants who did not receive a booster.<sup>[3]</sup>

COVID-19-related mortality has emerged as a concern following the vaccine's launch. Because several vaccines have been marketed with varying reported efficacy in clinical trials, the deaths' following vaccination are being researched. In Singapore, unvaccinated individuals accounted for 70% of mortality. The Moderna vaccination resulted in the fewest deaths, whereas the Sinovac vaccine resulted in the greatest number of deaths; 11

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per 100,000 people among those received Sinovac, while 7.8 people died among those received Sinopharm vaccine. There were 6.2 deaths associated with Pfizer-BioNTech, compared to one associated with Moderna vaccines.<sup>[4]</sup>

Palestine eventually had access to and used several vaccines in our vaccination campaign. We started with Sputnik V and Sinopharm vaccines, and then a COVAX fund provided Pfizer-Biontech and AstraZeneca with the final shipment arriving in December 2021 included Moderna.<sup>[5-7]</sup> This vaccination variety enables our occupied state to assess the efficacy of various types of vaccinations in terms of vaccine adherence, post-vaccine infection and mortality.

While numerous meta-analyses of COVID-19 vaccinations concluded that they are extremely effective at preventing symptomatic disease, with no statistically significant difference between vaccines in terms of ability to prevent symptomatic disease and decreased risk of severe COVID-19 infection,<sup>[8,9]</sup> only a few researchers have studied the mortality of several vaccines following a duration of administration. Additionally, research is required to ascertain changes in vaccine effectiveness over time, as well as cases reported by vaccine recipients. The purpose of this study was to determine the number of cases and death from COVID-19 linked with various vaccine types.

## Materials and Methods

COVID-19 death statistics from the Palestinian Ministry of Health (MoH) were retrieved and mapped to vaccination type through January 2022. We limited our research to the period following the commencement of COVID-19 vaccinations on February 14, 2021. Individuals were considered fully vaccinated 14 days following the final dose of all vaccine types.

### Participants and eligibility criteria

As of January 2022, we identified all laboratory-confirmed COVID-19 cases reported to WHO by the Palestinian MoH. Anyone with a positive real-time polymerase chain reaction (PCR) for the SARS-CoV-2 virus and laboratory confirmation of COVID-19 infection was considered a confirmed case. All respiratory samples tested for SARS-CoV2 were done at a regional lab of the Palestinian Ministry of Health (MoH) in the north, central, and southern Occupied Palestinian Territories. Another system, which is integrated into the MoH's DIHS2 platform, collected information on vaccinated persons, including their identity number, date of birth, vaccination date, and vaccine type. After combining the two systems, an excel spreadsheet was created that contained all the cases with COVID-19 vaccination variables. COVID-19 treatment centers frequently notify the Palestinian Ministry of health of COVID-19-related deaths. On an Excel spreadsheet, reported deaths were then matched with vaccinated people.

### Statistical analysis

Counts and percentages were used to represent categorical variables. The independent sample t-test was used to compare

the mean. We used the Chi-square test to compare nominally significant variables and the ANOVA test to evaluate continuously significant variables. The SPSS statistical tool (version 21) was used to conduct the analysis (IBM Corp., Armonk, NY, USA). The significance level was set to 0.05.

## Results

Nearly half, 8112 (48.5%), of the 16,729 individuals who were vaccinated and later diagnosed with COVID-19 were females with a relatively young age ( $42.1 \pm 17.1$ ). The Pfizer vaccine was used most often, accounting for 36.7% of vaccines, followed by Sputnik light, Sinopharm, and AstraZeneca, with Moderna coming in last. The patients who received the Pfizer vaccine were primarily females with an average age of  $36.3 \pm 16.7$ . Males were substantially more likely to receive the Moderna, Sputnik light and Sputnik V vaccinations. Though Pfizer vaccination patients were the youngest, AstraZeneca vaccine recipients were the oldest, with an average age of  $58.2 \pm 15.2$ .

In terms of vaccine adherence, only 62.7% of those who received the first dose of any vaccine received a second dose. Whereas the greatest reported percentage of cases receiving two doses of vaccination was Sputnik V with 85.2%, and the lowest reported percentage was Moderna (44.3%).

Finally, patients were diagnosed with COVID-19 after approximately three months following the second dosage of any type of vaccine ( $126.2 \pm 61.2$ ). Moderna and Sinopharm had the longest periods of effectiveness ( $154.4 \pm 69.9$  and  $148.9 \pm 51.6$ , respectively) as shown in Table 1.

In 2021, 75 COVID-related deaths were reported in Palestine among vaccinated individuals. The average age of those who died was significantly older than those who survived ( $69.9 \pm 12.2$  and  $42.0 \pm 17.1$ , respectively). The mean duration between the first dose and death was  $153.1 \pm 76.8$  months, and between the second dose of any vaccine and death was  $144.2 \pm 51.8$  months as shown in Table 2.

We studied the factors that may affect the adherence of individuals to the second dose of a vaccine. Older aged individuals were significantly more likely to receive a second vaccination. The mean age for individuals who took two doses was  $44.6 \pm 16.4$  years, while the mean age for individuals who took only one dose of any vaccine was  $38.3 \pm 17.1$  years. Additionally, females were significantly less likely to adhere to receiving a second dose than males (47.4% of females compared to 49.5% of males). Finally, the mean time between taking the first dose of the vaccine and a diagnosis of COVID-19 was significantly less in individuals who had only one vaccination ( $48.5 \pm 54.2$  days compared to  $148.4 \pm 79.1$  days in individuals who took two or more doses), see Table 3.

## Discussion

Researchers were able to investigate the uptake of six vaccines used in Palestine and the frequency of COVID 19 infections after

Table 1: COVID-19 cases in relation to vaccine type

Variable	Total (%)	Vaccine						P
		AstraZeneca	Moderna	Pfizer	Sinopharm	Sputnik light	Sputnik V	
Age (mean)	42.1±17.1	58.2±15.2	40.2±12.8	36.3±16.7	50.0±16.5	38.3±14.2	42.5±12.2	<0.0001
Sex								
Female	8112 (48.5)	1001 (12.3)	151 (1.9)	3270 (40.3)	1316 (16.2)	1820 (22.4)	554 (6.8)	<0.0001
Male	8615 (51.5)	983 (11.4)	819 (9.5)	2876 (33.4)	1240 (14.4)	1958 (22.7)	738 (8.6)	
Total (1 <sup>st</sup> dose)	16726	1984 (11.9)	970 (5.8)	6146 (36.7)	2556 (15.3)	3778 (22.6)	1292 (7.7)	
Two doses	8121 (62.7)*	1388 (69.9)	430 (44.3)	3225 (52.4)	1977 (77.3)	-----	1101 (85.2)	<0.0001
Three doses	132 (0.8)	-----	31 (3.2)	116 (1.8)	2 (0.07)	-----	1 (0.07)	<0.0001
Duration between vaccination & COVID-19 diagnosis (days)								
First dose <sup>†</sup>	99.4±78.8	139.9±76.7	89.2±96.7	80.4±76.7	140.4±77.5	69.8±48.7	138.6±75.8	<0.0001
Second dose <sup>‡</sup>	126.2±61.2	116.1±46.7	154.4±69.9	110.3±63.5	148.9±51.6	-----	133.5±64.7	<0.0001

\*Sputnik light was not included, <sup>†</sup>Min=1, Max=359 <sup>‡</sup>Min=1, Max=329

Table 2: Vaccinations rates and deaths caused by COVID-19 after vaccination

Variable	Total	Deaths		P
		Yes	No	
Age (mean)	42.1±17.1	69.9±12.2	42.0±17.1	0.001
Sex n (%)				
Male	8614 (51.5)	49 (0.6)	8565 (99.4)	0.016
Female	8112 (48.5)	26 (0.3)	8086 (99.7)	
Vaccination n(%)				
One dose	8615 (51.5)	26 (0.3)	8589 (99.7)	0.008
Two doses	7979 (47.7)	49 (0.6)	7930 (99.4)	
Three doses	132 (0.8)	0 (0)	132 (100)	
Vaccine (two doses)				
AstraZeneca	1379 (17)	24 (1.7)	1355 (98.3)	<0.0001
Moderna	428 (5.3)	2 (0.5)	426 (99.5)	
Pfizer	3192 (39.4)	8 (0.3)	3184 (99.7)	
Sinopharm	1974 (24.4)	11 (0.6)	1963 (99.4)	
Sputnik V	1100 (13.6)	4 (0.4)	1096 (99.6)	

Table 3: Factors affecting adherence to vaccine

Variables	One dose	Two or more doses	P
	Frequency (%) n=8615	Frequency (%) n=8111	
Sex			
Male	4348 (50.5%)	4266 (49.5%)	0.006
Female	4267 (52.6%)	3845 (47.4%)	
Age*	38.3±17.1	44.6±16.4	<0.001 <sup>†</sup>
Time between the dose and COVID-19 diagnosis (days)*	48.5±54.2	148.4±79.1	<0.001 <sup>†</sup>

\*Mean±SD, <sup>†</sup>independent t-test

vaccinations using Palestinian MoH data. In 2021, 16,726 people received at least one dose of COVID-19 vaccine, with a slight gender disparity indicating that men received the vaccine at a higher rate than women, a finding consistent with various vaccine acceptance studies.<sup>[10,11]</sup> Social media may have been used to disseminate false information about the dangers of the vaccine, making people reluctant to get vaccinated. Persistent misinformation exists regarding the link between the vaccine and infertility in sexually active women and miscarriages in pregnant women.<sup>[12]</sup>

Individuals of varying ages received a variety of vaccines; older mean-aged individuals received the Sinopharm vaccine, one of the first to be used in Palestine, while younger mean-aged individuals received the Pfizer vaccine. This is largely due to the science-guided FDA decisions which approved the Pfizer vaccine for ages five and up.<sup>[13]</sup> While the mean age of the sample was 42.1 (±17.1) years, we found that the highest mean of ages (58.2 ± 15.26) took the AstraZeneca vaccine. This is likely due to the availability of a large quantity of AstraZeneca vaccine through the COVAX shipment during the early stages of the vaccination campaign.<sup>[14]</sup> Because Palestine was significantly behind their neighbors with vaccination efforts, they were forced to begin the campaign with the AstraZeneca vaccine, despite the risk of thrombotic events observed in older adults.<sup>[15]</sup> Palestine was dependent on the timing and types of vaccination made available. The Pfizer vaccine was the most widely used in Palestine followed by Sinopharm, Sputnik light, AstraZeneca, Sputnik V, and Moderna due to availability.

Trust in vaccines and the institutions charged with their provision is vital to the success of any vaccination program. Rather this may have eroded trust and lead to a plethora of misinformation and conspiracy theory about vaccinations.<sup>[11,16]</sup> Numerous studies have examined individuals' willingness to receive a prospective COVID-19 vaccination in low-income countries.<sup>[17]</sup> The efficacy of the COVID-19 vaccine influenced vaccine acceptability.<sup>[18]</sup> The Pfizer vaccine with its excellent efficacy, being one of the first to be emergently authorized,<sup>[19]</sup> and its availability in Palestine as well its safety profile for pregnant women,<sup>[20]</sup> all likely contributed to the vaccines high level of adoption in Palestine.

Waning immunity after vaccination has been found to be a problem. About two third (62.7%) of individuals who received the first dose of any vaccine received the second. Individuals who are hesitant to take the second dose have stated that it is possible to reduce the prevalence of COVID-19 without a second vaccine dose.<sup>[21]</sup> Compliance with Sinopharm and Sputnik V was particularly high. We believe this is due to the vaccine's low risk of side effects beyond the initial dosage.<sup>[22]</sup>

Individuals who received two doses of the Pfizer vaccine developed post-vaccine infection the fastest, while two doses of the Moderna vaccination provided the longest protection. Sputnik light which was thought to be a one-dose vaccine resulted in the soonest post-vaccine infection. Consistent with CDC data, AstraZeneca vaccine had the longest time protection before contracting the virus following the initial dose. Nevertheless, unvaccinated individuals continue to have a greater risk of infection than those who have received vaccinations.<sup>[23]</sup>

In 2021, 75 cases of death were reported among vaccinated individuals with a mean age of  $69.9 + 12.2$ , with most deaths occurring after the second dose. Individuals who received the AstraZeneca vaccine had a greater mortality rate than the Sinopharm vaccine, but both may be explained by the fact that the mean age of individuals who received these vaccines were higher than those who received the other vaccines. The lower death rate of Pfizer vaccination group may be due to their younger age. Our results are similar to other studies: Scotland with a higher death among individuals who received the AstraZeneca vaccine followed by a Pfizer vaccine,<sup>[24]</sup> and a Bahrain study that showed a higher death among individuals who received the Sinopharm vaccine followed by Sputnik, with the least deaths recorded among individuals who received the Pfizer vaccine.<sup>[25]</sup>

Our study's primary limitation is the absence of variables such as hospitalization and comorbid diseases that can affect mortality. The secondary data analysis did not allow their inclusion. However, the use of MOH data provided a large sample of individuals seen in primary care clinics, hospitals and laboratories across Palestine who received the variety of vaccines made available to Palestine. While the data is readily available and well maintained, COVID-19 cases following vaccination that were not tested at MoH are not captured which may underestimate the true extent of post-vaccine infections.

Our study design demonstrated the disparity in vaccine uptake and adherence that occurred due to delay in vaccination and dependence on COVAX and other countries for donated vaccine. While most studies link death to increasing age, as was the case in this study, compliance to the second dose of sputnik was higher in our results because it was the most widely available vaccine. It highlights the importance of a global approach and higher income countries assisting lower income countries in securing vaccine.

### Declaration of patient consent

All procedures performed in this study complied with the institutional and/or national research committee ethical standards and the 1964 Helsinki declaration and subsequent amendments or equivalent ethical standards. The study was approved by the review board of the Palestinian Ministry of Health.

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Nil.

### Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

### References

1. World Health Organization: COVID-19 NMA. Available from: <https://covid-nma.com/vaccines/mapping/>. [Last accessed on 2022 Feb 28].
2. Abdul Taib NA, Baha Raja D, Teo AKJ, Kamarulzaman A, William T, Hs A-S, *et al.* Characterisation of COVID-19 deaths by vaccination types and status in Malaysia between February and September 2021. *Lancet Reg Health West Pac* 2022;18:100354.
3. Arbel R, Hammerman A, Sergienko R, Friger M, Peretz A, Netzer D, *et al.* BNT162b2 vaccine booster and mortality due to covid-19. *N Engl J Med* 2021;385:2413-20.
4. De Wei L. Singapore breaks down covid deaths by vaccine, with Moderna seeing lowest rate. Bloomberg, 2022, Available from: <https://www.bloomberg.com/news/articles/2022-01-10/singapore-lists-death-rate-divergence-on-covid-vaccine-type>. [Last accessed on 2022 Feb 27].
5. OCHA: Palestine receives its largest COVAX shipment, funded by the Governments of Germany and Italy-occupied Palestinian territory | ReliefWeb. Available from: <https://reliefweb.int/report/occupied-palestinian-territory/palestine-receives-its-largest-covax-shipment-funded> [Last accessed on 2022 Mar 01].
6. UNICEF: State of Palestine receives its third allocation of COVID-19 vaccines. Available from: <https://www.unicef.org/sop/press-releases/state-palestine-receives-its-third-allocation-covid-19-vaccines>. [Last accessed on 2022 Mar 01].
7. WHO-EMRO: Arrival of first wave consignment of COVAX COVID-19 vaccine doses. Available from: <http://www.emro.who.int/media/news/arrival-of-first-wave-consignment-of-covax-covid-19-vaccine-doses.html>. [Last accessed on 2022 Mar 01].
8. Cheng H, Peng Z, Luo W, Si S, Mo M, Zhou H, *et al.* Efficacy and safety of COVID-19 vaccines in phase III trials: A meta-analysis. *Vaccines (Basel)* 2021;9:582.
9. Rotshild V, Hirsh-Raccah B, Miskin I, Muszkat M, Matok I. Comparing the clinical efficacy of COVID-19 vaccines: A systematic review and network meta-analysis. *Sci Rep* 2021;11:22777.
10. Alqudeimat Y, Alenezi D, AlHajri B, Alfouzan H, Almokhaizeem Z, Altamimi S, *et al.* Acceptance of a COVID-19 vaccine and its related determinants among the general adult population in Kuwait. *Med Princ Pract* 2021;30:262-71.
11. Maraqa B, Nazzal Z, Rabi R, Sarhan N, Al-Shakhra K, Al-Kaila M, *et al.* COVID-19 vaccine hesitancy among health care workers in Palestine: A call for action. *Prev Med (Baltim)* 2021;149:106618.
12. Moodley J, Khaliq OP, Mkhize PZ. Misrepresentation about vaccines that are scaring women. *Afr J Prim Heal Care Fam Med* 2021;13:e1-2.
13. FDA: FDA Authorizes Pfizer-BioNTech COVID-19 vaccine for emergency use in children 5 through 11 years of age | FDA. Available from: <https://www.fda.gov/news-events/press-announcements/fda-authorizes-pfizer-biontech>



- covid-19-vaccine-emergency-use-children-5-through-11-years-age. [Last accessed 2022 Apr 14].
14. WHO EMRO: Arrival of first wave consignment of COVAX COVID-19 vaccine doses | News | Media centre. Available from: <http://www.emro.who.int/media/news/arrival-of-first-wave-consignment-of-covax-covid-19-vaccine-doses.html>. [Last accessed on 2022 Apr 14].
  15. Whiteley WN, Ip S, Cooper JA, Bolton T, Keene S, Walker V, *et al.* Association of COVID-19 vaccines ChAdOX1 and BNT162b2 with major venous, arterial, or thrombocytopenic events: A population-based cohort study of 46 million adults in England. *PLoS Med* 2022;19:e1003926.
  16. Abu-Odah H, Su J, Musa SS. Unwillingness or reluctance of Palestinians to get the COVID-19 vaccine: The reasons behind it and how to persuade them. *Int J Infect Dis* 2022;119:53-5.
  17. Wouters OJ, Shadlen KC, Salcher-Konrad M, Pollard AJ, Larson HJ, Teerawattananon Y, *et al.* Challenges in ensuring global access to COVID-19 vaccines: Production, affordability, allocation, and deployment. *Lancet* 2021;397:1023-34.
  18. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, *et al.* A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021;27:225-8.
  19. Pfizer-BioNTech. Pfizer-BioNTech covid-19 vaccine (bnt162, pf-07302048) vaccines and related biological products advisory committee briefing document meeting date: 10 December 2020.
  20. Skjefte M, Ngirbabul M, Akeju O, Escudero D, Hernandez-Diaz S, Wyszynski DF, *et al.* COVID-19 vaccine acceptance among pregnant women and mothers of young children: Results of a survey in 16 countries. *Eur J Epidemiol* 2021;36:197-211.
  21. Ahmed MH, Siraj SS, Klein J, Ali FY, Kanfe SG. Knowledge and attitude towards second covid-19 vaccine dose among health professionals working at public health facilities in a low income country. *Infect Drug Resist* 2021;14:3125-34.
  22. Beatty AL, Peyser ND, Butcher XE, Cocohoba JM, Lin F, Olgin JE, *et al.* Analysis of COVID-19 vaccine type and adverse effects following vaccination. *JAMA Netw Open* 2021;4:e2140364.
  23. CDC: Vaccine breakthrough infections: The possibility of getting COVID-19 after getting vaccinated. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/effectiveness/why-measure-effectiveness/breakthrough-cases.html>. [Last accessed on 2022 Apr 14].
  24. Grange Z, Buelo A, Sullivan C, Moore E, Agrawal U, Boukhari K, *et al.* Characteristics and risk of COVID-19-related death in fully vaccinated people in Scotland. *Lancet* 2021;398:1799-800.
  25. AlQahtani, M., Du, X., Bhattacharyya S, *et al.* Post-vaccination outcomes in association with four COVID-19 vaccines in the Kingdom of Bahrain. *Sci Rep* 12, 9236 (2022). DIO:10.1038/s41598-022-12543-4.