Original Article

Impact of COVID-19 vaccines on older people: relationship between doses, manufacturers, and mortality

Impacto das vacinas contra a COVID-19 em pessoas idosas: relação entre doses, fabricantes e mortalidade

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ABSTRACT

Objective: to analyze the relationship between the number of doses and manufacturers of COVID-19 vaccines and the impact on mortality in older people. **Methods:** this was an analytical ecological study of people aged 60 and over. The data were obtained from the official Vaccinometer and Coronavirus Dashboard websites and analyzed using descriptive statistics and a generalized linear model with a negative binomial distribution. **Results:** the COVID-19 mortality coefficient was 498.360/100,000 elderly people before vaccination began and 327.880/100,000 elderly people after vaccination began. Notably, the Janssen vaccine showed a 54.6% reduction in the risk of death in this population group. **Conclusion:** the analysis of the relationship between the number of doses and manufacturers of COVID-19 vaccines and the impact on mortality showed a positive result, with a significant reduction in the annual mortality rate of the disease among the elderly population after vaccination began. **Contributions to practice:** the study shows the importance of immunization against COVID-19 in the elderly, highlighting the importance of adherence to booster doses so that this population remains protected.

Descriptors: COVID-19; Vaccination; Mortality; Aged.

RESUMO

Objetivo: analisar a relação entre o número de doses e fabricantes das vacinas contra a COVID-19 e o impacto na mortalidade de pessoas idosas. **Métodos:** estudo ecológico analítico, realizado com pessoas com 60 anos ou mais. Os dados foram obtidos nas páginas oficiais Vacinômetro e Painel Coronavírus e analisados por meio da estatística descritiva e modelo linear generalizado com distribuição binomial negativa. **Resultados:** o coeficiente de mortalidade por COVID-19 foi 498,360/100.000 pessoas idosas no período anterior ao início da vacinação; e, posteriormente, foi de 327,880/100.000 pessoas idosas. Destaca-se que a vacina da Janssen apresentou diminuição de 54,6% no risco de óbito nesse grupo populacional. **Conclusão:** a análise da relação entre o número de doses e os fabricantes das vacinas contra a COVID-19 e o impacto na mortalidade evidenciou um resultado positivo, com redução expressiva da taxa de mortalidade anual da doença entre a população idosa após o início da vacinação. **Contribuições para a prática:** o estudo sinaliza a importância da vacinação contra a COVID-19 nos idosos, destacando a relevância da adesão às doses de reforço para que essa população continue protegida.

Descritores: COVID-19; Vacinação; Mortalidade; Idoso.

Introduction

With the rapid spread and evolution of the novel coronavirus disease (COVID-19) in the world, it was possible to observe that advanced age became a significant factor in the development of complications, since the elderly go through the natural process of immunosenescence, making them more vulnerable to infections, which undermines the immunological protection conferred through vaccination[1]. In addition, the presence of comorbidities, such as diabetes, cardiovascular disease, lung disease, hypertension, and cancer, is more significant among the elderly, thus increasing the complexity of the condition in these individuals[2].

It should be noted that at the beginning of the spread of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), in 2020, the World Health Organization (WHO) worked intensively, as well as countries, to disseminate and adopt recommendations to the population for non-pharmacological measures such as hand hygiene or the use of 70% alcohol; respiratory etiquette, with guidance on the proper way to cough and sneeze; and the cleaning and disinfection of surfaces; in addition to physical distancing and the use of masks. Restrictive measures were adopted differently by various countries, even varying between states and municipalities, as was the case in Brazil. They were adjusted according to the epidemiological scenario, especially during 2020 and 2021[3].

With the urgency of controlling the spread of the disease and the number of deaths, there has been an intense race to develop safe and effective vaccines. Thus, in December 2020, countries such as the United States and England began immunizing their populations[4-5]. In Brazil, vaccination started on January 17, 2021, with the aim of first immunizing populations classified as a risk group by the Ministry of Health, including elderly people in different age groups[6].

In this context, COVID-19 vaccines have been essential for controlling the pandemic since mass vaccination has led to significant changes in the pattern of hospitalizations and deaths from the disease, with an overall reduction in hospitalizations, especially among individuals aged 60 and over[7].

In Brazil, the National Immunization Program (PNI, in Portuguese), part of the Brazilian Unified Health System, has made COVID-19 immunizers available for vaccinating different age groups. Initially, the CoronaVac and AstraZeneca vaccines were approved for emergency use; later, Pfizer and Janssen followed[6].

It is worth noting that the Pfizer vaccine (BN-T162b2) conferred 85% immunization in elderly people in England aged 70 and over[5]; and in China, this vaccine reduced the risk of death by 98.4% in elderly people after three doses, and CoronaVac induced 54% immunization against new infections in elderly Chinese people[8].

Over time, it was observed that the monovalent vaccines initially used had reduced immune protection, especially in the elderly population. This made booster doses necessary to recover protection. As of 2023, the recommended vaccines began to have bivalent formulations, such as the BNT162b2 immunizer (PfizerBioNTech). After the emergence of the XBB and XBB.1.5 subvariants, the vaccines underwent further modifications, and the World Health Organization recommended that monovalent vaccines exclude the original strain of the virus and include the XBB underlining[9].

Brazil currently has the Covid-19-RNAm Vaccine, Moderna (Spikevax), the Covid-19-RNAm Vaccine, Pfizer (Comirnaty), and the Covid-19-recombinant Vaccine, Serum/Zalika. The recommendation is that the elderly receive two doses with a six-month interval between them, regardless of the doses already received[10].

In addition to immunizers, there have been advances in treating mild symptoms on an outpatient basis, with the combination of antiviral drugs, corticosteroids, and non-steroidal anti-inflammatory drugs. The antiviral Remdesivir improves clinical outcomes in COVID-19 patients on oxygen support. There was

an increase in the percentage of recovered patients, a reduction in severe lung damage, and a reduction in the need for mechanical ventilation[11].

However, it is understood that the immunization of elderly people should be continued even after the end of the health emergency. The virus that causes COVID-19 has endemic characteristics, and high vaccination coverage prevents new outbreaks of the disease. Vaccination was one of the primary measures for controlling the pandemic, reducing mortality rates in this population[12].

Although several studies in the literature address vaccine efficacy among the elderly, manufacturers are analyzed in isolation. There are still gaps in the joint analysis of doses and manufacturers concerning the outcome of the disease among the elderly. Therefore, this study aimed to analyze the relationship between the number of doses and manufacturers of COVID-19 vaccines and the impact on mortality among the elderly.

Methods

This is an analytical ecological study with population aggregates[13]. Data collection took place in June 2024, considering deaths from COVID-19 in people aged 60 and over in the state of São Paulo from February 25, 2020, to February 25, 2024, which refers to the first case of the disease until the beginning of this study.

The variables in this study were defined as death, municipality of residence, date of death, gender, and age group, obtained from the Coronavirus Panel, which provides information on the pandemic in Brazil. The variables on vaccine doses, manufacturers, vaccination dates, gender, and age group were obtained from the COVID-19 Vaccinometer website[14].

A complete vaccination schedule is understood to mean people who have received two doses of the CoronaVac, AstraZeneca, and Pfizer vaccines or a single dose of the Janssen immunizer, as recommended by the Ministry of Health at the time of the study.

To analyze the relationship between the number of people with a complete vaccination schedule and the rate of death from the disease, the study included individuals aged 60 or over who had received the full vaccination schedule — second dose, single dose, and/or booster dose (D2, DU and/or booster dose) — totaling 3,335,412 elderly people.

The analysis of vaccination and the COVID-19 death rate, aimed at the vaccine manufacturers (CoronaVac, AstraZeneca, Pfizer, and Janssen), considered only those who received the first and second doses from the same manufacturer, in addition to those with a single dose record. Examples: (D1 and D2 CoronaVac); (D1 and D2 AstraZeneca); (D1 and D2 Pfizer) or (DU Janssen), totaling 1,440,728 elderly people.

In addition, elderly people aged 100 or over were excluded, considering the population size distribution according to the Brazilian Institute of Geography and Statistics, i.e., only elderly people aged between 60 and 99. Also excluded were elderly people who were not residents of the state of São Paulo and had no information on their place of residence, elderly people with incomplete vaccination schedules and doses from different manufacturers, duplicates, and those with records of vaccines not intended for this age group. These vaccines were: Bavarian Nordic smallpox vaccine, COVID-19-RNAm, Pfizer (Comirnaty) pediatric under five, trivalent influenza, tetravalent influenza, COVID-19-RNAm, Pfizer (Comirnaty) pediatric, VVBN, INF3, INF4 and COVID-19 Pfizer-Comirnaty Pediatric.

For data analysis, the variables of interest with the mortality rate were related to estimate the rates of interest and the Incidence Risk Ratio (IRR), using a generalized linear model with Binomial-Negative distribution, log link function, and repeated measures. The sample units considered were the municipalities in the state of São Paulo, with repeated measures in the quarters between February 2020 and February 2024, evaluating the municipalities before and after the start of vaccination in the elderly. A 5% significance level was used for the statistical analysis. All the analyses were carried out using Excel and SAS 9.4.

Results

We identified 6,049,879 elderly people who had received at least one dose of the COVID-19 vaccine. Of this total, 3,335,412 individuals completed the vaccination schedule with a second or single dose, of which 1,440,728 had the schedule carried out with vaccines from the same manufacturer, i.e., first and second doses with the same manufacturer or a single dose. There were also 1,904,477 positive cases and 125,941 deaths from the disease in this population group in the state of São Paulo.

The mortality rate from COVID-19 among the elderly in 2020, at the start of the pandemic, was 160.92 deaths/100,000 elderly people. It should be noted that in the first quarter of 2021, when vaccination against the disease began, the mortality coefficient in this population group was 398.740 deaths/100,000 elderly people. The 2121Q2 period shows an increase in fatalities after vaccination began due to the circulation of the P.1 (Gamma) strain. This variant caused a high number of cases and deaths from COVID-19, mainly due to the shortage of doses of the vaccine, which at that time was directed to a reduced portion of the population, prioritizing health professionals and elderly people over 80 years old (initially). There is a relationship between the increase in vaccination coverage and the reduction in the COVID-19 mortality coefficient among older people. By the end of 2021, the mortality rate was already 22.128/100,000 older people (Table 1).

At the start of the vaccination, 171,911 doses of the CoronaVac vaccine were applied, totaling 736,161 doses by 2024, 653,862 doses by AstraZeneca, and 47,752 doses by Pfizer by 2024 (Table 2).

Table 1 – Analysis of the relationship between the number of people with a complete vaccination schedule and the COVID-19 mortality coefficient from February 25, 2020, to February 25, 2024 (n=3,335,412). São Paulo, SP, Brazil, 2024

Quarter	Total deaths	Total cumulative number of deaths	Total vaccinations	Total vaccinations (accumulated)	Vaccination coverage (%)	Mortality*	CI 95%
2020Q1	1,493	1,493	0	0	0	7.9	6.3 – 10.0
2020Q2	16,207	17,700	0	0	0	102.2	91.9 – 113.7
2020Q3	13,658	31,358	0	0	0	160.9	151.4 – 170.9
2020Q4	10,832	42,190	0	0	0	118.2	111.6 – 125.1
2021Q1	33,002	75,192	148,256	148,256	1.9	398.7	383.6 - 414.3
2021Q2	22,470	97,662	571,709	719,965	9.8	314.4	302.2 – 327.1
2021Q3	7,394	105,056	574,774	1,294,739	17.6	92.6	87.5 – 98.0
2021Q4	2,092	107,148	790,554	2,085,293	28.4	22.1	20.1 – 24.2
2022Q1	10,036	117,148	210,702	2,295,995	31.1	144.3	138.1 – 150.9
2022Q2	2,877	120,061	238,836	2,534,831	34.5	38.4	35.9 – 41.1
2022Q3	1,578	121,639	81,686	2,616,517	35.5	23.7	21.9 – 25.6
2022Q4	1,854	123,493	27,644	2,644,161	35.9	24.3	22.5 – 26.3
2023Q1	1,117	124,610	371,246	3,015,407	40.0	13.2	12.0 – 14.7
2023Q2	350	124,960	211,312	3,226,719	42.5	5.0	4.3 – 5.8
2023Q3	361	125,321	22,242	3,248,961	42.6	5.1	4.4 – 6.0
2023Q4	606	125,927	41,797	3,290,758	42.975	8.4	7.3 – 9.7
2024Q1	14	125,941	44,654	3,335,412	43.3	0.1	0.1 – 0.3

*Per 100,000 inhabitants (estimated); Q: Quarter; CI: Confidence Interval

Table 2 – Description of the number of people vaccinated with each manufacturer (Pfizer/Pfizer Bivalent, AstraZeneca, CoronaVac, Janssen), complete vaccination schedule, and COVID-19 death rate (n=1,440,728). São Paulo, SP, Brazil, 2024

Quarter	Total deaths	Total accumulated vaccinations	AstraZeneca	CoronaVac	Pfizer*	Janssen	Mortality[†]	CI 95%
2020Q1	1,493	0	0	0	0	0	7.9	6.3 – 10.0
2020Q2	16,207	0	0	0	0	0	102.2	91.9 – 113.7
2020Q3	13,658	0	0	0	0	0	160.9	151.4 – 170.9
2020Q4	10,832	0	0	0	0	0	118.2	111.6 – 125.1
2021Q1	33,002	172,228	284	171,911	8	25	398.7	383.6 – 414.3
2021Q2	22,470	837,420	116,325	720,505	79	511	314.4	302.2 – 327.1
2021Q3	7,394	1,416,213	646,412	729,754	37,935	2,112	92.6	87.5 – 98.0
2021Q4	2,092	1,432,799	652,256	733,905	44,492	2,146	22.1	20.1 – 24.2
2022Q1	10,036	1,436,775	653,189	734,957	46,202	2,427	144.3	138.1 – 150.9
2022Q2	2,877	1,439,016	653,493	735,745	46,898	2,880	38.4	35.9 – 41.1
2022Q3	1,578	1,439,709	653,762	735,945	47,080	2,922	23.7	21.9 – 25.6
2022Q4	1,854	1,440,070	653,818	736,075	47,227	2,950	24.3	22.5 – 26.3
2023Q1	1,117	1,440,337	653,838	736,133	47,414	2,952	13.2	12.0 – 14.7
2023Q2	350	1,440,504	653,862	736,151	47,539	2,952	5.0	4.3 – 5.8
2023Q3	361	1,440,565	653,862	736,155	47,595	2,953	5.1	4.4 – 6.0
2023Q4	606	1,440,620	653,862	736,158	47,647	2,953	8.4	7.3 – 9.7
2024Q1	14	1,440,728	653,862	736,161	47,752	2,953	0.1	0.1 – 0.3
Total	125,941	1,440,728	653,862	736,161	47,752	2,953	–	–

*Pfizer and Pfizer Bivalent; [†]Per 100,000 inhabitants (estimated); Q: Quarter; CI: Confidence Interval

Pfizer's vaccine showed a 1.5% reduction in the risk of death among the elderly, while Janssen's vaccine showed a 54.6% reduction in the risk of death among this population group. In addition, the death rate from COVID-19 among older people was 498.360/100,000 before vaccination began and then 327.880/100,000 after vaccination began. The annual mortality rate from the disease among older people before vaccination began was around 50% higher than after vaccination (Table 3).

Table 3 – Analysis of the efficacy of vaccines against COVID-19 in the elderly population in the state of São Paulo from January 17, 2021, to February 25, 2024. São Paulo, SP, Brazil, 2024

Vaccines	IRR	CI 95%	p-value*	Decrease (%)
AstraZeneca	0.9	0.9 – 0.9	<0.001	0.3
CoronaVac	1.0	0.9 – 1.0	0.700	–
Pfizer	0.9	0.9 – 0.9	<0.001	1.5
Janssen	0.4	0.3 – 0.6	<0.001	54.6

*Generalized linear model with Binomial-Negative distribution, log link function and repeated measures; IRR: Incidence Risk Ratio; CI: Confidence Interval

Compared to the pre-vaccination period, the total number of deaths before vaccination began was 49,633, rising to 76,308, with a reduction in estimated mortality from 498.360 to 327.880 per 100,000 older people. The annual mortality rate from COVID-19 among older people before vaccination began was around 50% higher than after vaccination (Table 4).

Table 4 – Comparison of COVID-19 mortality rates in São Paulo before and after vaccination. São Paulo, SP, Brazil, 2024

Variables	Before (346 days)	After (1,115 days)	Before vs After
Total deaths	49,633	76,308	–
Total deaths/year*	523,943	249,968	–
Mortality[†]	498.3	327.8	–
Incidence Risk Ratio	–	–	1.5
p-value[‡]	–	–	<0.001
95% confidence interval	478.4 – 519.1	319.4 – 336.5	1.4 – 1.5

*Standardized by the total number of days in each period; [†]100,000 people/year (estimated); [‡]Generalized linear model with Binomial-Negative distribution, log link function and repeated measures

Discussion

The results show the vulnerability of the elderly to COVID-19, and the high number of deaths, especially in 2020 and 2021, demonstrates not only the severity of the disease but also the fragility of this population group. The strategies adopted to control the disease have been essential in reducing the death rate among the elderly, with vaccination standing out as the indispensable tool for managing the disease.

Brazil began the immunization campaign against the disease on January 17, 2021. The Ministry of Health's National Immunization Program defined priority populations to receive immunizations: health professionals, *quilombolas*, Indigenous people, and the elderly[15].

The elderly were stratified by age group, with the oldest prioritized for immunization. The first group comprises individuals aged 90 or over due to their greater vulnerability and high risk of morbidity and mortality. The National Plan for the Operationalization of Vaccination Against COVID-19 prioritized age groups: 80 years and over, 75 to 79, 70 to 74, 65 to 69, and 60 to 64[15]. This stratification was necessary due to insufficient vaccine doses to cover the entire population.

It is worth noting that, concurrently with the start of vaccination, Brazil was facing the worst moment of the pandemic, with a high number of deaths and cases of the disease. This was due to the Gamma variant, which was highly transmissible and aggressive [16]. In parallel with the aggressive circulating variants, the advance of vaccination and the gradual increase in vaccination coverage were accompanied by changes in the patterns of hospitalizations and deaths from COVID-19 in older people. Thus, the risk of hospitalization and complications from the disease became higher in unvaccinated individuals[6].

As of the second half of 2022, vaccination coverage has grown gradually, while mortality has decreased, reaching stability. The control of COVID-19 deaths was possible thanks to more excellent vaccination coverage, including adherence to booster doses, which ensured the durability of immunity against new variants[5-6].

However, the lack of national planning for dealing with the pandemic, including coordination for the acquisition and distribution of vaccines, has slowed down the control of hospitalizations and deaths from COVID-19. Many countries started vaccination at the end of 2020, while the federal government in Brazil delayed the purchase of immunizers. In addition, there was a shortage of vaccine doses and difficulties in producing and distributing immunizers in the national territory, which delayed mass immunization and extended the health emergency. This made it difficult to control the pandemic, directly implying the number of cases and deaths from the disease[3].

In this sense, despite the delays in purchasing the vaccines, vaccination began in January 2021 due to the more intense movement by the governors, who were looking for control of the pandemic and more efficient strategies. Thus, the CoronaVac and AstraZeneca immunizers were the first used in the country[3].

The CoronaVac vaccine, with a two-dose vaccination schedule, was essential for controlling the pandemic in the country despite being less effective in the elderly population than in the general population. It provided 61% immunization against death, with a decrease in protection as age increased[5]. On October 23rd, 2023, the Butantan Institute ended the supply of the immunizer[17].

Using the CoronaVac vaccine in Brazil in the first quarter of 2021 reduced hospitalizations by 86% in the elderly. On the other hand, low adherence to the second dose of the vaccine among people aged 60 and 69 compromised protection against COVID-19[18]. Thus, the immunizer cannot be considered a solution in isolation, especially if there is incomplete vaccination since this impairs vaccine efficacy, considering that two doses were required for complete immunization[5-6].

It should be noted that the effectiveness of the immunobiological can be compromised during pe-

riods of increased transmission, as observed during the Gamma variant, which caused a high number of deaths during the first quarter of 2021. This was a period in which vaccination in the country was advancing slowly[12]. In addition to Brazil, CoronaVac was widely used in Chile, offering adequate immunization against symptomatic infection and hospitalizations in 67.4% and 83.3% of cases, respectively[19].

All the emergency vaccines used in Brazil had adverse reactions after vaccination, whether mild and/or moderate. In this sense, the person could have a low-grade fever, fatigue, headache, pain at the injection site, or muscle pain. These reactions indicate that the immune system responds to the vaccine and forms antibodies against the virus[5].

Among the primary vaccines used in Brazil, AstraZeneca's showed an overall efficacy of 88.6%, although this efficacy can be impaired during periods of more excellent variant circulation. This is due to the greater likelihood of new variants that escape vaccination coverage, with the aggravating factor in places with low vaccination coverage, requiring continuous surveillance to prevent outbreaks[3].

AstraZeneca's immunizer showed an adequate antibody response and efficacy for both symptomatic and severe cases in risk groups. This suggests the application of a third dose for elderly people since the vaccine response may be reduced for individuals aged 70 or over[20]. After two doses of the immunizer, efficacy was 73%, and there was a 43% reduction in the risk of hospitalization[5].

The AstraZeneca vaccine is no longer used in Brazil but remains valid until its registration expires in March 2024. The reason for the expiry was AstraZeneca's decision not to renew its registration with the Oswaldo Cruz Foundation[15]. The WHO currently recommends a single-dose regimen for the primary immunization of all individuals, and monovalent Omicron XBB vaccines offer excellent protection compared to bivalent variants or monovalent index virus vaccines[9].

The Pfizer vaccine began to be used more frequently in the third quarter of 2021, although its registration was granted on February 23, 2021[15]; however, due to management problems in the purchase, there were delays at the start of the distribution of this immunizer[3]. This immunizer is highly effective in controlling new infections and reducing the risk of death. Among elderly people aged 65 to 74, the vaccine conferred 96% protection, while in individuals aged 75 and over, protection was 91%[21]. Furthermore, among those aged 80 and over vaccinated with two doses, the vaccine offered 89% protection (85 to 93%) and reduced the risk of death by 51%[5].

On July 24, 2023, the National Health Surveillance Agency (ANVISA) approved using the bivalent BA.4 and BA.5 Pfizer vaccine as a booster dose for those who had completed the vaccination schedule. This included two doses of the monovalent vaccine or a single dose[9].

In this scenario, periodic vaccine boosters are essential for continued protection in the elderly. The bivalent mRNA vaccines provide protection, although there is a sharp drop-off 180 days after vaccination, and varying efficacy has been observed, with up to 39% protection against infection by any variant[22]. In Portugal, the second booster dose of the mRNA immunizer (Pfizer) given to individuals aged 80 and over was 81% effective[23]. The Janssen vaccine was also used in Brazil, and ANVISA approved it in April 2021[15]. The vaccine use was low in this population, with records of only 2,953 doses applied until 2024.

The analysis indicates that the Janssen vaccine, a single dose, reduces the severe form of COVID-19 and serious adverse events. It has the advantage of being administered in a single dose, making it easier for the population to adhere to it. Its observed efficacy was between 66% and 72%[24]. In addition, the immunizer conferred protection of over 84% in elderly people aged 65 to 74 in the United States, increasing to 85% in elderly people aged 75 and over[21].

In another analysis, the Jansen vaccine showed

efficacy of over 76% in people aged 60 and over, with protection against severe COVID-19, 93% for hospitalizations, and protection against several variants[4].

With clinical and epidemiological evidence of vaccine efficacy, it has been possible to control the pandemic in Brazil and globally. In 2023, the World Health Organization declared an end to the public health emergency caused by COVID-19 but stressed that this does not mean an end to the spread of the disease since the virus continues to circulate. Abandoning continuous immunization through booster doses can cause new outbreaks and increased mortality, especially among the elderly[25].

The impact of vaccination against COVID-19 on morbidity and mortality in the elderly has been demonstrated, reducing the incidence rate of cases by more than 81%. This highlights the need for continuity, acceptance, and expansion of immunization campaigns to control the disease[26].

During the emergency phase of the COVID-19 pandemic, anti-science and anti-vaccine movements strengthened in the face of political and ideological polarizations. They were boosted by the ease of mass dissemination of fake news related to treatments without scientific proof, especially about vaccines, which directly influenced adherence. Skepticism and distrust on the part of the population have also contributed to the high mortality rates from COVID-19, mainly due to the significant increase in vaccine hesitancy, a global phenomenon[25].

Currently, elderly people have easier access to the internet and, consequently, to fake news, which influences adherence to vaccination against COVID-19, especially booster doses, making this public more vulnerable to the disease. There has been a process of "nonchalance." In other words, many individuals have stopped continuing with booster doses or new doses of the vaccines; this raises an alarm about the need for vaccine adherence since the virus is circulating and susceptible to mutations[27].

It has been proven that antibodies tend to decrease over time and that the booster or annual dose, recommended by the Ministry of Health for everyone, including the elderly, is the most effective measure to guarantee prolonged protection. Those who keep their vaccinations up to date show an increase in virus-neutralizing antibodies compared to those who stop getting vaccinated or don't keep vaccinating[26-27].

Health professionals are essential in ensuring vaccination adherence by priority groups, including the elderly. These professionals can promote educational actions using videos and booklets to disseminate scientific evidence proving vaccine safety and effectiveness. Nursing plays a key role in immunization, acting at various stages of the process, providing guidance, and clarifying doubts about immunizers. It is, therefore, essential to talk to users about possible adverse events so that immunization in subsequent doses is not interrupted[28].

Although this study showed relatively low incidence and mortality rates for COVID-19, cases of severe acute respiratory syndrome continue to be more frequent among the elderly, and vaccination is the best strategy to prevent deaths. Deaths in elderly people hospitalized for the disease were studied, and in high age groups, the presence of comorbidities, especially diabetes mellitus, was related to deaths. In addition, vaccination has been observed to be beneficial in promoting protection for elderly people exposed to the COVID-19 virus[29].

It is worth noting that non-pharmacological measures have been essential for controlling the disease; the Ministry of Health also recommends using masks and physical distancing for symptomatic individuals, even after the pandemic, to prevent the virus from circulating[30].

The research findings highlight the importance of vaccination against COVID-19 in the elderly population, showing that the introduction of vaccines has directly impacted reducing mortality rates from the disease. Increased vaccination coverage was essential to achieving this control, and adherence to vaccination remains an indispensable strategy for maintaining disease control.

Study limitations

It should be noted that this study's limitations may be related to the completeness of the data reported and recorded in public access databases.

Contributions to practice

Knowing the research results is of the utmost importance since the benefits of vaccination against COVID-19 in the elderly have been proven. The research makes it possible to go against the anti-science and anti-vaccine movement through statistical data and various studies cited in the article. So, it is possible to clarify and encourage the vaccination of the elderly against COVID-19, signaling the relevance of adherence to booster doses so that this population remains protected.

Conclusion

There was a positive impact, with a significant reduction in the annual mortality rate of the disease among the elderly population after vaccination began. This concerned the analysis of the number of doses and the manufacturers of the COVID-19 vaccines and their impact on mortality, in other words, death or cure.

In this sense, the vaccines have proven effective, and encouraging booster doses promotes prolonged immunization for this population and contributes to controlling future disease outbreaks.

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Authors' contribution

Conception and design, analysis and interpretation of data, manuscript drafting, or relevant critical revision of the intellectual content. Responsibility for all aspects of the text in ensuring the accuracy and integrity of any part of the manuscript: Silva CC, Uehara SCSA. Final approval of the version to be published: Silva CC, Magno GD, Uehara SCSA.

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