

THE IMPACT OF IMMUNIZATION AGAINST COVID-19 IN RIBEIRÃO PRETO-SP

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Abstract: In December 2019 in Wuhan, China, a new type of coronavirus emerged, named by the World Health Organization as SARS-CoV-2, causing the disease COVID-19. In a short time, this virus spread and caused the biggest pandemic of the 21st century. Due to this pandemic scenario, numerous researches were carried out on SARS-CoV-2, concluding that this virus is an enveloped RNA virus with a genome consisting of a single-stranded positive-sense RNA molecule. Work was carried out on the development of vaccines against COVID-19, with the Coronavac, AstraZeneca/Oxford, Pfizer/Biontech and Janssen vaccines being approved in Brazil. However, a portion of the population questions how these vaccines work and whether there really are more benefits than harm to their application. This article aims to analyze the impact of vaccination coverage against COVID-19 on the number of infected people, hospitalizations and deaths due to SARS-CoV-2 in the population of Ribeirão Preto-SP, in order to verify whether there has been a reduction in these variants. This article is an ecological study and to carry it out data from epidemiological bulletins available at the Municipal Health Department of the city of Ribeirão Preto were used, which contained information on the variants analyzed and on vaccination coverage. Epidemiological bulletins from January 2020 to July 2022 were analyzed. The study showed that at the beginning of the COVID-19 pandemic the disease had a high death rate, with the average in 2020 and 2021 being 2.5% and 2.7%, respectively, while in 2022 this rate was 0.7%. Regarding hospitalization, in 2020 the highest rate was 23.7%, and in 2022 the highest rate was 1.7%. Comparing data in the period before and after vaccination of the population, it is noted that immunization against COVID-19 contributed to reducing hospitalization and death rates, being effective in individual

and collective health. However, vaccination did not show any effect on reducing the transmissibility of the virus.

Keywords: COVID-19; Vaccination; Ribeirão Preto

INTRODUCTION

In December 2019 in Wuhan, China, a new coronavirus emerged, called SARS-CoV-2, which causes the disease COVID-19, an acute respiratory infection. In a short time, this virus spread globally, causing the biggest pandemic of the 21st century. As of 02/08/2022, 578 million infected people and 6.4 million deaths have been recorded, according to "Our World in Data". Due to this pandemic scenario, numerous researches have been carried out on COVID-19, concluding that this virus is an enveloped RNA virus with a genome consisting of a single-stranded positive-sense RNA molecule. Its life cycle involves several viral proteins to enter the target cell. To achieve this, the Spike protein (S) binds to cellular receptors for angiotensin-converting enzyme 2 (Eca2) and this complex is translocated to endosomes. In endosomes, there is fusion between the envelope and the cell membrane. After this, the viral RNA is released, the which will undergo replication, translation, synthesis and release of new viral particles. With this knowledge, it is possible to work on the development of vaccines against COVID-19, with the Coronavac, AstraZeneca/Oxford, Pfizer/ vaccines being approved in Brazil. Biontech and Janssen. However, a portion of the population questions whether there really are more benefits than harm in its application and, many, fail to get vaccinated, which is a risk to individual and collective health. For this reason, this study aims to analyze the impact of vaccination coverage against COVID-19 on the number of infected people, hospitalizations and deaths due to SARS-CoV-2 in the population of Ribeirão

Preto-SP, in order to verify whether there was a reduction in these variants.

GOAL

The present study aims to analyze the impact of vaccination coverage against COVID-19 on the number of infected people, hospitalizations and deaths due to SARS-CoV-2 in the population of Ribeirão Preto-SP.

MATERIAL AND METHODS

An ecological study was carried out based on data made available in the epidemiological bulletins of the Municipal Health Department of Ribeirão Preto - SP, which reported weekly the number of individuals infected by the SARS-CoV-2 virus, deaths and hospitalizations due to COVID-19. In such bulletins, there is no distinction between the individual's race, sex, age and clinical status.

This municipal body also contains data on vaccination coverage against Covid-19, which informs which doses were administered, the number of individuals vaccinated and the total percentage of the population that received the vaccine, only distinguishing the age group. All epidemiological bulletins from January 2020 to June 2022 were verified, with no exclusion for accounting. The analysis of the bulletins took place from March 2022 to August 2022. From them, the total numbers of hospitalizations, deaths and infections were extracted in each month of the years evaluated. Regarding vaccination coverage, public data was scarce for a more detailed analysis of the evolution of vaccine applications in the municipality's population. With this data, authorial tables were constructed that compared the epidemiological profile of the number of infected people, hospitalizations and deaths in the years 2020, 2021 and 2022 of the entire population of Ribeirão Preto, making the behavior of the numbers of these variants visible. In this study, variables

absent in epidemiological bulletins, such as the patient's clinical status and comorbidities present simultaneously with SARS-Cov-2 infection, were not considered.

In the present study, the hospitalization rate and death rate due to Covid-19 per month were calculated (TABLE 1):

Indicator	Calculation	Data source
Death rate in the month	Number of confirmed deaths in the month Number of infected people confirmed in the month	Ribeirão Preto Municipal Health Department
Hospitalization rate per month	Total number of hospitalized patients in the month Number of infected people confirmed in the month	Municipal Department of Health of Ribeirão Preto

TABLE 1 - Indicators used in the study

DEVELOPMENT

After collecting data from epidemiological bulletins made available by the Municipal Health Department of Ribeirão Preto, from March 2020 to July 2022, it was observed that notifications of Covid-19 infection began on 03/16/2020, with the first case confirmed on 03/21/2020. As of 06/22/2022, 43,669 cases of Covid-19 were registered in the city of Ribeirão Preto. Table 3 records the number of cases per month in the years 2020, 2021 and 2022. Note that the highest number of confirmed cases occurred in January 2022, totaling 24,240. It is important to highlight that on 11/26/2021, a new variant of the SARS-CoV-2 virus was detected in South Africa, the omicron (B.1.1.529), which has a higher contamination speed than SARS-CoV-21. In January, this strain was predominant in the world, and during this period in Brazil it was responsible for the increase in the number of infected people, interrupting the decline in the number of deaths from the disease. According to the SARS-CoV-2 Variant Alert Network, in the 3rd epidemiological week of 2022 (16

to 22/01) the omicron already accounted for 99.7% of positive samples sequenced in the state of São Paulo.

Initially, countless people who became infected with Covid-19 needed to be hospitalized due to complications from Covid-19. At the beginning of the pandemic in Ribeirão Preto, in March 2020, 12.5% of those infected required hospitalization and 23.7% in April, as shown in table 3. During this period there were no vaccines available. Compared to the year 2022, in January, only 0.33% of those infected were hospitalized, a period in which 91% of the population of Ribeirão Preto received the 1st dose, 80% received the 2nd dose or single dose and 48% received the 3rd dose. Table 1 records the highest number of patients admitted in the months of 2020, 2021 and 2022.

Month of notifications	2020	2021	2022
January	0	132	81
February	0	130	112
March	11	250	26
April	53	255	9
May	120	247	21
June	166	279	50
July	182	186	-
August	139	124	-
September	108	75	-
October	80	52	-
November	37	30	-
December	59	15	-

Table 1 - Total number of hospitalizations for Covid-19 in patients residing in Ribeirão Preto in the years 2020, 2021 and 2022.

Source: own elaboration. Data source: SIVEP-Gripe, 2022.

In relation to the number of deaths confirmed by Covid-19, as of 06/30/2022, 3372 deaths were recorded, with the highest number occurring in 2021 (1992), which is also the year of higher lethality (2.7%). Table 2 records this information.

	2020	2021	2022
Month of symptom onset	Deaths	Deaths	Deaths
January	0	174	181
February	0	212	69
March	2	402	10
April	11	290	5
May	66	393	26
June	209	188	44
July	245	160	-
August	176	74	-
September	136	55	-
October	62	21	-
November	37	12	-
December	101	11	-
Total	1.045	1.992	335

Table 2 - Cases of confirmed deaths from Covid-19 by month and year of onset of symptoms, in patients residing in Ribeirão Preto/SP, 2020, 2021 and 2022.

Source: own elaboration. Data source: SIVEP and Municipal Health System DVE/DEVISA/SMS-RP, 2022.

Finally, analyzing vaccination coverage against Covid-19, it was observed that vaccinations in Ribeirão Preto began on 01/19/2021, initially for health professionals and, subsequently, organizing applications of vaccines by age group and risk groups. As of 07/27/2022, there are 635,872 people vaccinated with the first dose (94% of the total population), 573,999 vaccinated with the second dose (85% of the total population), 407,860 vaccinated with the third dose (66% of the total population) and 151,422 vaccinated with the fourth dose (51% of the total population). Image 1 records this information.

With these data in view, it is possible to analyze the effect of vaccination against Covid-19 on the population of Ribeirão Preto, whether there was a decrease in the number of infections, deaths and hospitalizations. To this end, the number of people infected by Covid-19, the percentage of infected

COVID-19 vaccine coverage in Ribeirão Preto

Update: July 27/2022
Grand total: 1,769,417

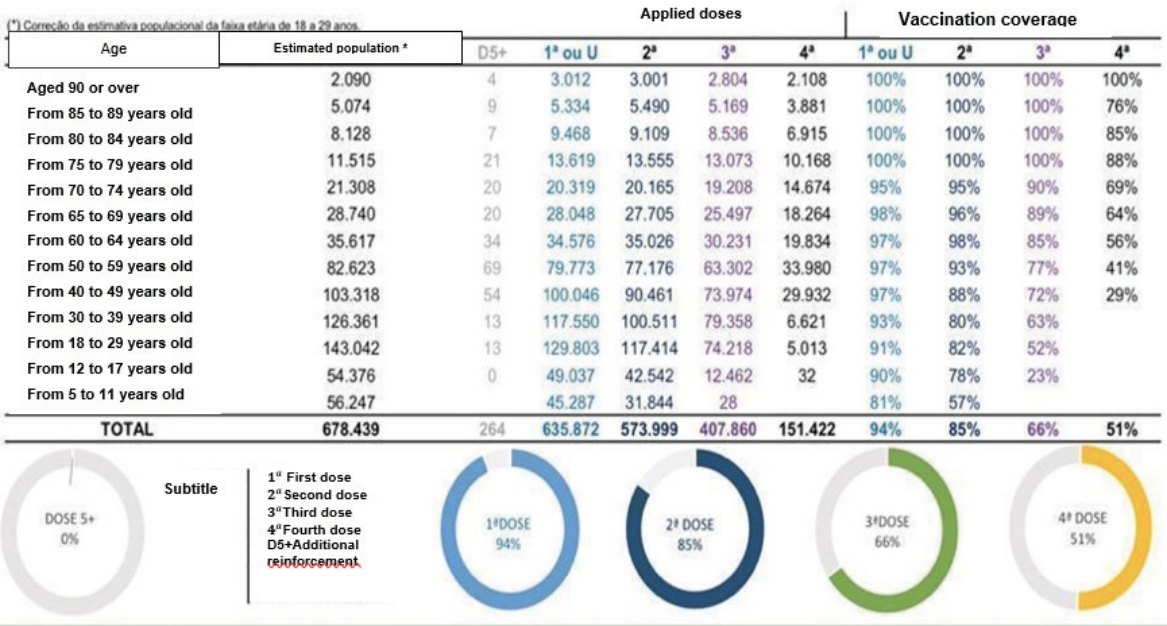
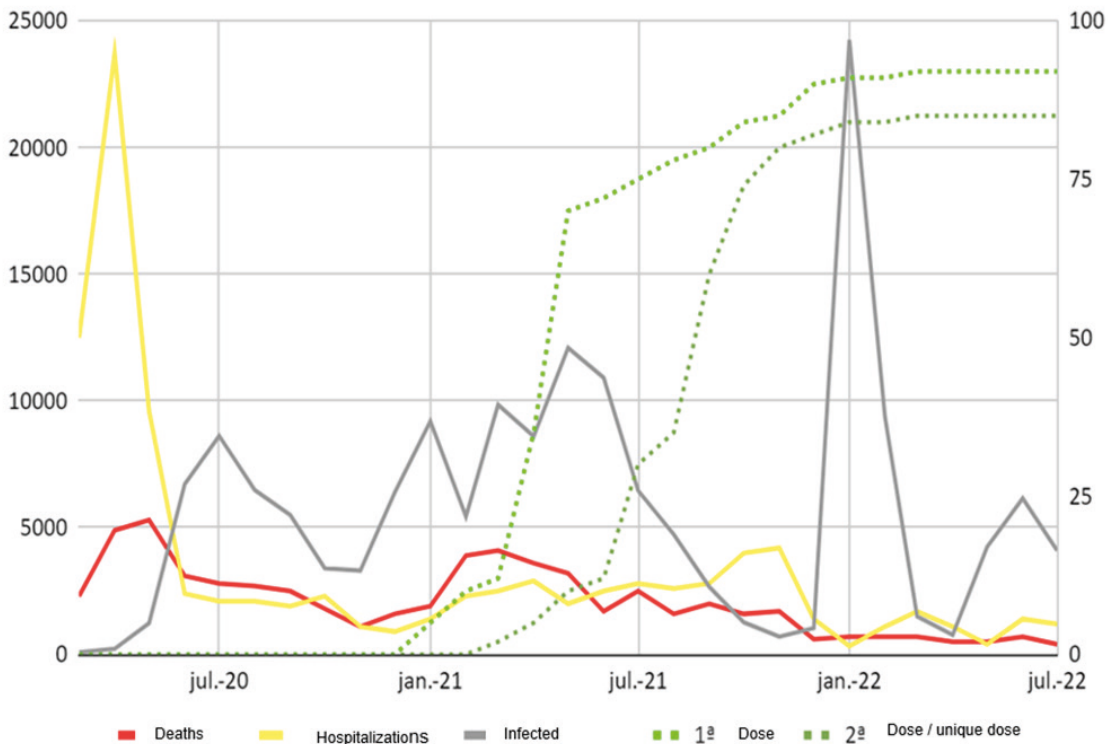


Image 1 - Vaccination coverage against Covid-19

Month of the event	2020			2021			2022		
	Infected	Rate of hospitalizations	Rate of deaths	Infected	Rate of hospitalizations	Rate of deaths	Infected	Rate of hospitalizations	Rate of deaths
January	-	-	-	9.197	1,4	1,9	24.240	0,33	0,7
February	-	-	-	5.441	2,3	3,9	9.368	1,1	0,7
March	88	12,5	2,3	9.849	2,5	4,1	1.501	1,7	0,7
April	223	23,7	4,9	8.603	2,9	3,6	770	1,1	0,5
May	1.238	9,6	5,3	12.099	2	3,2	4.241	0,4	0,5
June	6.717	2,4	3,1	10.917	2,5	1,7	3.549	1,4	0,3
July	8.625	2,1	2,8	6.462	2,8	2,5	-	-	-
August	6.490	2,1	2,7	4.738	2,6	1,6	-	-	-
September	5.498	1,9	2,5	2.665	2,8	2	-	-	-
October	3.400	2,3	1,8	1.269	4	1,6	-	-	-
November	3.309	1,1	1,1	703	4,2	1,7	-	-	-
December	6.389	0,9	1,6	1.039	1,4	0,6	-	-	-
TOTAL	41.977	-	2,5	72.982	-	2,7	50.724	-	0,7

TABLE 3 – Comparison of infected numbers, hospitalization rate and death rate in the years 2020, 2021 and 2022.

Source: own elaboration. Data source: SIVEP and Municipal Health System DVE/DEVISA/SMS-RP, 2022.



GRAPH 1 – BEHAVIOR CURVE OF THE NUMBERS OF DEATHS, INFECTED, ADMISSIONS DUE TO COVID-19 IN THE YEARS 2020, 2021 AND 2022 AND APPLICATION OF THE FIRST AND SECOND DOSE

individuals who needed to be hospitalized (hospitalization rate) and the percentage of infected people who died (death rate) were compared during the years 2020, 2021 and 2022, which is visible in table 3.

CONCLUSION

Observing the number of infected people, it is noted that vaccination did not interfere in reducing the transmissibility of the disease, since even with vaccination, the numbers of infected people remained high, this fact is due to the omicron variant. Regarding the hospitalization rate, the years 2020 and 2021 remained with high rates. In 2020, the highest hospitalization rate was 23.7 (April) and in 2021, 4.2 (November). In 2022 this value reduced, for example in January 2022 the hospitalization rate was only 0.33, and the highest rate was 1.7 (March).

Finally, in relation to the death rate, it is noted that this value was also high in the years 2020 and 2021, with the average death rate in those years being 2.5 and 2.7, respectively. In 2020, the highest death rate was 5.3 (May) and in 2021, 4.1 (March). while in 2022 the average rate reduced to 0.7%.

Therefore, it is noted that vaccination coverage against Covid-19 reduced the rate of hospitalization and deaths, which is why vaccination is beneficial for both individual and collective health.

With graph 1 in view, it is possible to visualize the falling behavior of variants, hospitalizations and deaths due to Covid-19, as vaccination coverage against the virus increases. However, this scenario does not occur for the number of infected people, due to the virus variants that appeared during the pandemic.

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