

Evolution of COVID-19 According to Vaccination Status in a Moroccan Cohort

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Abstract

Original Research Article

Introduction: Since the development of vaccines against the new emerging virus SARSCoV-2, which causes the coronavirus disease 2019 (COVID-19), several fundamental questions remain regarding the efficacy of these vaccines and their impact on the disease, its occurrence and its clinical course. In this sense, the study of the efficiency of the proposed vaccines has become an obligation in order to determine their true influence on COVID-19 in real clinical situation. **Materials and Methods:** This is a retrospective and prospective cohort study with descriptive and analytical cross-sectional aims conducted in the Avicenna hospital in Marrakech over a period of 50 days, between December 20, 2021 and February 10, 2022, among patients diagnosed as positive for SARS-CoV-2 infection confirmed by RT-PCR. Data collection was performed retrospectively and prospectively on medical records and by telephone calls of the patients diagnosed positive using a pre-established operating form. **Results:** 512 patients were included during the study period. The average age of the patients was 41 years with a slight male predominance (sex ratio M/F=1.37). 24.4% of our patients had at least one associated comorbidity, with diabetes and hypertension the most frequent comorbidities with a percentage of 15.2% and 9.8% respectively. - 75.8% of the patients included in our study were fully vaccinated against COVID-19, while 24.2% were partially or not vaccinated. The evolution was marked by the occurrence of severe COVID-19 in 3.9% of the cases combined, out of only 1.8% of the fully vaccinated cases developed a severe form compared to 10.5% of the partially or non-vaccinated patients. The analytical study of our results showed that vaccination status and clinical progression had a statistically significant relationship and that complete vaccination was a protective factor against the occurrence of severe COVID-19 disease, although the overall efficacy of complete vaccination against these forms was estimated at 84.4%. Vaccination efficacy was variable when patients were studied in subgroups according to sex, age group, associated comorbidities and vaccination schedule, suggesting the impact of different factors on vaccination efficacy and disease course. **Conclusion:** During this research, which is one of the first of its kind in Morocco, it was found that vaccination status is a powerful factor on the COVID-19 disease's evolution, although fully vaccinated individuals have a lower risk of developing a severe COVID-19 disease compared to the partially or unvaccinated population. This finding was consistent with all the literature studies described demonstrating a significant protection of full vaccination. Therefore vaccination remains a strong means for the control and prevention of COVID-19 disease and its severe forms, encouraging the continuation of initiated vaccination campaigns as well as the require of booster doses for well-defined populations.

Keywords: Covid 19, Evolution, Morocco, SARS Cov 2, Vaccination.

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INTRODUCTION

Since the development of vaccines against the new emerging virus SARS-CoV-2, several fundamental questions remain regarding the efficacy of these vaccines and their impact on the disease, its occurrence and its clinical course. In this sense, the study of the efficiency of the proposed vaccines has become an obligation in order to determine their real influence on COVID-19 in real clinical situation.

The objective of this work is essentially to identify and analyze the effectiveness and the real

impact of the vaccination against COVID-19 on the clinical evolution of this pathology.

MATERIALS AND METHODS

This is a retrospective cohort study with descriptive and analytical cross-sectional aims, conducted in the Avicenna military hospital in Marrakech over a period of 50 days, between December 20, 2021 and February 10, 2022, including patients diagnosed positive for SARS-CoV-2 infection confirmed by RT-PCR. Data collection was done retrospectively on medical records and by phone calls

of patients diagnosed positive using a pre-established operating form.

RESULTS

In this cohort, 512 patients were included during the study period. The mean age of the patients was 41 years with a male predominance (sex ratio M/F=1.37). 24.4% of the patients had at least one associated comorbidity, with diabetes and hypertension the most frequent comorbidities, with a percentage of 15.2% and 9.8% respectively. - 75.8% of the patients included in our study were completely vaccinated against COVID 19, while 24.2% of the cases were incompletely or not vaccinated. The evolution was marked by the occurrence of severe forms in 3.9% of the cases combined. However only 1.8% of the fully vaccinated cases developed a severe form, against 10.5% of the partially or non-vaccinated patients.

Analytical study of the results showed that vaccination status and clinical course had a statistically

significant relationship and that full vaccination was a protective factor against the occurrence of severe COVID-19 disease, although the overall efficacy of full vaccination against severe COVID-19 disease was estimated at 84.4%. Vaccination efficacy was variable when patients were studied in subgroups according to sex, age group, associated comorbidities and vaccination regimen, suggesting the impact of different factors on vaccination efficacy and disease course.

DISCUSSION

1-Vaccination status:

We note a predominance of fully vaccinated patients with a rate of about 75.8%, which represents the highest rate compared to the percentages reported in the literature (Table I). This can be explained by the availability of vaccination during the periods in which the studies were conducted, and thus evoking the success of the national vaccination campaign against coronavirus in Morocco.

Table I: Vaccination status and profile in comparison with the literature

Study (Year)	Country	Prevalent variant	Patients (n)	Vaccinal status	
				Fully vaccinated %	Partially /Not Vaccinated %
Butt <i>et al.</i> , (2020) [1]	Qatar	Alpha	912	50%	50%
Seo <i>et al.</i> , (2021) [2]	Japan	Delta	387	52.8%	47.2%
Butt <i>et al.</i> , (2021) [3]	Qatar	Beta	415	12%	88%
		Delta	415	21.1%	78.9%
Al Barhani <i>et al.</i> , (2022) [4]	KSA	Omicron	400	20%	80%
Butt <i>et al.</i> , (2021) [5]	Qatar	Omicron	3926	65.9%	34.1%
Our study (2022)	Morocco	Omicron	512	75.8%	24.2%

2-Evolution:

The evolution in our series was marked by the occurrence of severe or serious forms of COVID-19 disease in 3.9% of the patients included in our study, which agrees with the results of the series of Butt *et al.*, [5] with a percentage of 1.5%. In the other series the

rate of cases that had progressed to a severe or serious form of the disease was higher. This may reflect the impact of vaccination on the course of the disease as well as its variable efficacy on the different variants of SARS-CoV-2 and their suggested fluctuating clinical severity (Table II).

Table II: Clinical evolution profile compared to the literature

Study	Year	Country	Prevalent variant	Patients (n)	Evolution	
					Non-severe form %	Severe form %
Butt <i>et al.</i> , [1]	2020	Qatar	alpha	912	81.6%	18.4%
Seo <i>et al.</i> , [2]	2021	Japan	delta	387	85.8%	14.2%
Butt <i>et al.</i> , [4]	2021	Qatar	beta	415	80%	20%
			delta	415	72.7%	27.3%
Al Barhani <i>et al.</i> , [4]	2022	KSA	omicron	400	87.4%	12.6%
Butt <i>et al.</i> , [5]	2022	Qatar	omicron	3926	98.5%	1.5%
Our study	2022	Morocco	omicron	512	96.1%	3.9%

3-Correlation of vaccination status-evolution:

In our series, statistical analysis of the relationship between vaccination status and clinical course of COVID-19 disease was statistically significant ($p = 0.000 < 0.005$), while the Odds ratio was less than 1 (Odds ratio = $0.156 < 1$) evoking that full vaccination is a protective factor against the

occurrence and progression to severe or critical forms of the disease. These results are in perfect agreement with the data of the national and international literature, except for the study of Butt *et al.*, [5], where we note that this relationship was not significant for the Beta variant.

4- Vaccine efficacy:

4.1 Overall:

The efficacy of complete vaccination against the occurrence of severe and severe forms of COVID-19 disease was estimated to be 78.5% on average in all

the series investigated, which is slightly lower than the data of our study where the overall efficacy against these forms was 84.4% (CI 95%: 59.7 - 93.9%) (Table III).

Table III: Overall effectiveness of full vaccination compared to the literature

Study	YEAR	COUNTRY	Prevalent Variant	Patient(N)	Effectiveness	IC A 95%
Butt <i>et al.</i> , [1]	2020	Qatar	ALPHA	912	65%	45-78%
Butt <i>et al.</i> , [3]	2021	Qatar	BETA	415	NA	NA
			DELTA	415	98%	79 - 100%
Skowronski <i>et al.</i> , [6]	2021	Canada	DELTA	27439	98%	97 - 98%
Zhang <i>et al.</i> , [7]	2021	Maroc	DELTA	348190	88.5%	85.8 - 90.7%
Wu <i>et al.</i> , [8]	2021	China	DELTA	1467	82%	21 – 96%
Self <i>et al.</i> , [9]	2021	UAE	DIVERS	3689	71%	56 - 81%
Colie <i>et al.</i> , [10]	2021	South Africa	DELTA et OMICRON	133437	70%	62 – 76%
Butt <i>et al.</i> , [5]	2022	Qatar	OMICRON	3926	34%	10 – 52%
Smid <i>et al.</i> , [11]	2022	Tchèque republic	OMICRON	-	87%	84 – 88%
Martellucci <i>et al.</i> , [12]	2022	Italy	OMICRON	140035	75%	70 – 80%
Buchan <i>et al.</i> , [13]	2022	Canada	OMICRON	16087	95%	87 – 98%
Our Study	2022	Morocco	OMICRON	512	84.4%	59.7 – 93.9

In the study of Zhang *et al.*, [7], Wu *et al.*, [8], Šmíd *et al.*, [11] the efficacy of the vaccine was 88.5%, 82%, 87% respectively, this was comparable with the data of our series, while in those of Butt *et al.*, [3], Skowronski *et al.*, [6], Buchan *et al.*, [13] the efficacy was much higher than our results, while the estimated vaccine efficacy in the series of Butt *et al.*, [1], Self *et al.*, [9], Collie *et al.*, [9], Butt *et al.*, [5], Martellucci *et al.*, [12] was much lower than ours. This could be secondary to the nature of the sample, the type of vaccines introduced or the prevalent variant at the time of the study.

4.2. By gender:

Adjustment of vaccine efficacy against severe forms of the disease according to gender revealed in our series that the efficacy in males was 93.5%, higher compared to the general population, This is in contrast to the data observed in the study of Zhang *et al.*, [7], where the vaccine efficacy was more marked in females than males respectively 92.9% and 87.6% compared to the overall efficacy reported in the study 88.5%.

4.3. By age:

In our study, the calculation and analysis of the vaccine efficacy in the subgroups of age groups showed a decrease in the vaccine efficacy compared to the overall vaccine efficacy in patients of age over 60 years which was estimated to be 72.6%, while it was not statistically concluded in patients under 60 years. This finding is consistent with the data from the series of Zhang *et al.*, [7] which showed an adjusted efficacy of 53.3% in patients over 60 years of age, lower than that of the general population in the series 88.5%.

4.4. According to comorbidities:

In our series, the effectiveness of complete vaccination was variable according to the terrain and associated comorbidities. Complete vaccination was more effective in non-diabetic patients without associated lung disease for protection against severe forms of the disease than in the general population, although statistical calculation of the effectiveness of vaccination in patients with diabetes, heart disease or lung disease was not possible. These results are largely consistent with data from the cohort study of Tenforde *et al.*, [14] conducted in the United States, where vaccination was more effective in non-diabetic patients as well as in patients without associated heart disease or lung disease respectively 89.8%, 95.4%, 89% than in the general population included in the study 86.9%.

CONCLUSION

During this research, which is one of the first of its kind in Morocco, it was found that the vaccination status is a powerful factor on the evolutivity of COVID-19 disease, although fully vaccinated persons have a lower risk of developing a severe form compared to the partially or non-vaccinated population, this finding was consistent with all the literature studies described demonstrating a significant protection of full vaccination. Vaccination to date remains one of the most effective medical interventions for the prevention of COVID-19 and its severe forms, contributing significantly to the reduction of the burden of infectious disease and mortality in many countries, prompting the continuation of initiated vaccination campaigns, as well as the support of booster doses for specific populations.

REFERENCES

- Butt, A. A., Yan, P., Shaikh, O. S., & Mayr, F. B. (2021). Outcomes among patients with breakthrough SARS-CoV-2 infection after vaccination in a high-risk national population. *EClinicalMedicine*, *40*, 101117. doi:10.1016/j.eclinm.2021.101117.
- Seo, W. J., Kang, J., Kang, H. K., Park, S. H., Koo, H. K., Park, H. K., ... & Kang, J. (2022). Impact of prior vaccination on clinical outcomes of patients with COVID-19. *Emerging Microbes & Infections*, *11*(1), 1316-1324.
- Butt, A. A., Dargham, S. R., Chemaitelly, H., Al Khal, A., Tang, P., Hasan, M. R., ... & Abu-Raddad, L. J. (2022). Severity of illness in persons infected with the SARS-CoV-2 delta variant vs beta variant in Qatar. *JAMA internal medicine*, *182*(2), 197-205. doi: 10.1001/jamainternmed.2021.7949.
- AlBahrani, S., AlBarrak, A., Al-Musawi, T., AlGubaisi, N. A., Almalki, M., Hakami, F. H., ... & Al-Tawfiq, J. A. (2022). COVID-19 vaccine had a significant positive impact on patients with SARS-CoV-2 during the third (Omicron) wave in Saudi Arabia. *Journal of Infection and Public Health*, *15*(11), 1169-1174. doi: 10.1016/j.jiph.2022.09.005.
- Butt, A. A., Dargham, S. R., Tang, P., Chemaitelly, H., Hasan, M. R., Coyle, P. V., ... & Abu-Raddad, L. J. (2022). COVID-19 disease severity in persons infected with the Omicron variant compared with the Delta variant in Qatar. *Journal of global health*, *12*, 05032. doi: 10.7189/jogh.12.05032.
- Skowronski, D. M., Setayeshgar, S., Febriani, Y., Ouakki, M., Zou, M., Talbot, D., ... & De Serres, G. (2021). Two-dose SARS-CoV-2 vaccine effectiveness with mixed schedules and extended dosing intervals: test-negative design studies from British Columbia and Quebec, Canada. *MedRxiv*, 2021-10. doi: 10.1093/cid/ciac290.
- Zhang, Y., Belayachi, J., Yang, Y., Fu, Q., Rodewald, L., Li, H., ... & Yang, X. (2022). Real-world study of the effectiveness of BBIBP-CorV (Sinopharm) COVID-19 vaccine in the Kingdom of Morocco. *BMC Public Health*, *22*(1), 1584. doi: 10.1186/s12889-022-14016-9.
- Wu, D., Zhang, Y., Tang, L., Wang, F., Ye, Y., Ma, C., ... & Yin, Z. (2022). Effectiveness of inactivated COVID-19 vaccines against symptomatic, pneumonia, and severe disease caused by the delta variant: Real World Study and evidence—China, 2021. *China CDC weekly*, *4*(4), 57-65. doi: 10.46234/ccdcw2022.009.
- Self, W. H., Tenforde, M. W., Rhoads, J. P., Gaglani, M., Ginde, A. A., Douin, D. J., ... & Cass, C. (2021). Comparative effectiveness of Moderna, Pfizer-BioNTech, and Janssen (Johnson & Johnson) vaccines in preventing COVID-19 hospitalizations among adults without immunocompromising conditions—United States, March–August 2021. *Morbidity and Mortality Weekly Report*, *70*(38), 1337-1343. doi: 10.15585/mmwr.mm7038e1.
- Collie, S., Champion, J., Moultrie, H., Bekker, L. G., & Gray, G. (2022). Effectiveness of BNT162b2 vaccine against omicron variant in South Africa. *New England Journal of Medicine*, *386*(5), 494-496. doi: 10.1056/NEJMc2119270.
- Šmíd, M., Berec, L., Příbylová, L., Májek, O., Pavlík, T., Jarkovsky, J., Weiner, J., Barusová, T., & Trnka, J. (2022). Protection by Vaccines and Previous Infection against the Omicron Variant of Severe Acute Respiratory Syndrome Coronavirus 2. *J Infect Dis.*, *226*(8), 1385-1390. doi: 10.1093/infdis/jiac161.
- Acuti Martellucci, C., Flacco, M. E., Soldato, G., Di Martino, G., Carota, R., Caponetti, A., & Manzoli, L. (2022). Effectiveness of COVID-19 Vaccines in the General Population of an Italian Region before and during the Omicron Wave. *Vaccines*, *10*(5), 662. doi: 10.3390/vaccines10050662.
- Buchan, S. A., Chung, H., Brown, K. A., Austin, P. C., Fell, D. B., Gubbay, J. B., ... & Kwong, J. C. (2022). Estimated effectiveness of COVID-19 vaccines against Omicron or Delta symptomatic infection and severe outcomes. *JAMA network open*, *5*(9), e2232760-e2232760.
- Tenforde, M. W., Patel, M. M., Ginde, A. A., Douin, D. J., Talbot, H. K., Casey, J. D., ... & Self, W. H. (2021). Effectiveness of SARS-CoV-2 mRNA vaccines for preventing Covid-19 hospitalizations in the United States. *MedRxiv*. 2021.07.08.21259776.
- World Health Organization (WHO). Guidance for laboratories shipping specimens to WHO reference laboratories that provide confirmatory testing for COVID-19 virus. 2020.
- Hantz, S. (2020). Diagnostic biologique de l'infection à Sars-CoV-2 : stratégies et interprétation des résultats. *Rev Francoph Lab*, *2020*(526), 48-56.
- World Health Organization (WHO) WHO-convened Global Study of Origins of SARS-CoV-2: China Part. Joint WHO-China Study 14 January—10 February 2021. Joint Report; 2021.
- Organisation mondiale de la Santé. Suivi des variants du SARS-CoV-2. 2022.
- Ministère de la Santé et de la Protection Sociale du Maroc. Bulletin quotidien COVID-19 10-02-2022
- International Committee on Taxonomy of Viruses Executive Committee. (2020). The new scope of virus taxonomy: partitioning the virosphere into 15 hierarchical ranks. *Nat Microbiol*, *5*(5), 668-674. doi: 10.1038/s41564-020-0709-x.