

The COVID-19 vaccine acceptance in Jordan: a meta-analysis and review of the literature

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Abstract. - OBJECTIVE: The COVID-19 pandemic continues to impose a health and economic burden on the global population with millions of deaths linked to infection with the virus. Vaccination remains the most effective intervention to reduce infection, severity, and hospitalization for COVID-19. However, vaccine hesitancy has emerged as a global phenomenon facing the effective implementation of coronavirus vaccination programs. Several studies have been conducted in Jordan to examine vaccine acceptability. This study aims at calculating the pooled acceptance rate for the COVID-19 vaccine in Jordan.

MATERIALS AND METHODS: The Systematic Reviews and Meta-Analysis (PRISMA) guideline was adopted to conduct the present meta-analysis. The RevMan software was utilized to estimate the pooled acceptance rate and to construct the study Figures.

RESULTS: Data from 22 studies that fit the study inclusion criteria were included in the analysis. The total number of participants was 38,600. The pooled COVID-19 vaccine acceptance rate was estimated to be 39.89% [95%-CI: 33.52-46.27]. Subgroup analysis, according to the year of publication, showed a pooled COVID-19 vaccine acceptance rate of 36.70% [95%-CI: 29.27-44.12, $I^2=100\%$, $p<0.0001$] for 2021, and 48.90% [95%-CI: 40.21-57.65, $I^2=91.0\%$, $p<0.0001$] for 2022. This indicates about a 33% increase in vaccine acceptance through 2022.

CONCLUSIONS: The reported COVID-19 vaccine acceptance rate in Jordan is below expectations. While the acceptance rate has increased in 2022 compared to 2021, there is still a need for more efforts and awareness interventions to reach a convincing level of vaccination against COVID-19 in Jordan.

Key Words:

Vaccine, COVID-19, SARS-CoV-2, Acceptance, Hesitancy, Jordan.

Introduction

Coronavirus disease 2019 (COVID-19) appeared in November of 2019 and then spread rapidly throughout the world¹. In March 2020, the World

Health Organization (WHO) declared the disease a pandemic. The pandemic has caused a substantial worldwide health burden and claimed more than 6.3 million deaths by May 2022. Jordan is a developing country in the Middle East with a population of about 11 million. It is among the countries severely affected by COVID-19 with around 1.7 million cases of COVID-19 and nearly 14,000 deaths linked to direct infection with the virus².

One of the most adopted approaches to stop the pandemic has been the development of effective vaccines against the SARS-CoV-2 that caused COVID-19³. During the first quarter of 2021, several vaccines against the virus received emergency approval for human use by most countries of the world. These include BNT162b2, Spikevax, AZD1222, Sputnik V, CoronaVac, and others⁴. However, vaccination programs have faced hesitancy/refusal to take vaccinations by a good fraction of the public globally despite their availability⁵⁻⁷.

In Jordan, the government has provided free COVID-19 vaccination programs to the public⁸. In addition, the government has adopted the green pass strategy while travelling. In addition, the green pass was required to enter governmental places, shopping centers, educational institutions, hotels, restaurants, gyms, and others⁹. Despite governmental efforts to enhance vaccinations, only 46.6% of the population had received full doses of the vaccine as of May 2022, and vaccine hesitancy remains a major challenge in the country¹⁰⁻¹².

Acceptance of COVID-19 vaccines has been investigated globally and several reviews and meta-analyses have been conducted worldwide to better characterize the phenomenon of vaccine hesitancy¹³⁻¹⁷. In Jordan, different acceptance rates for COVID-19 vaccination have been reported by several previous studies¹⁸⁻²⁴. Reported acceptance rates ranged from 17% to 72%^{20,25}. The current meta-analysis aims at reporting the pooled rates of COVID-19 vaccine acceptance in Jordan. The study will provide feedback to government poli-

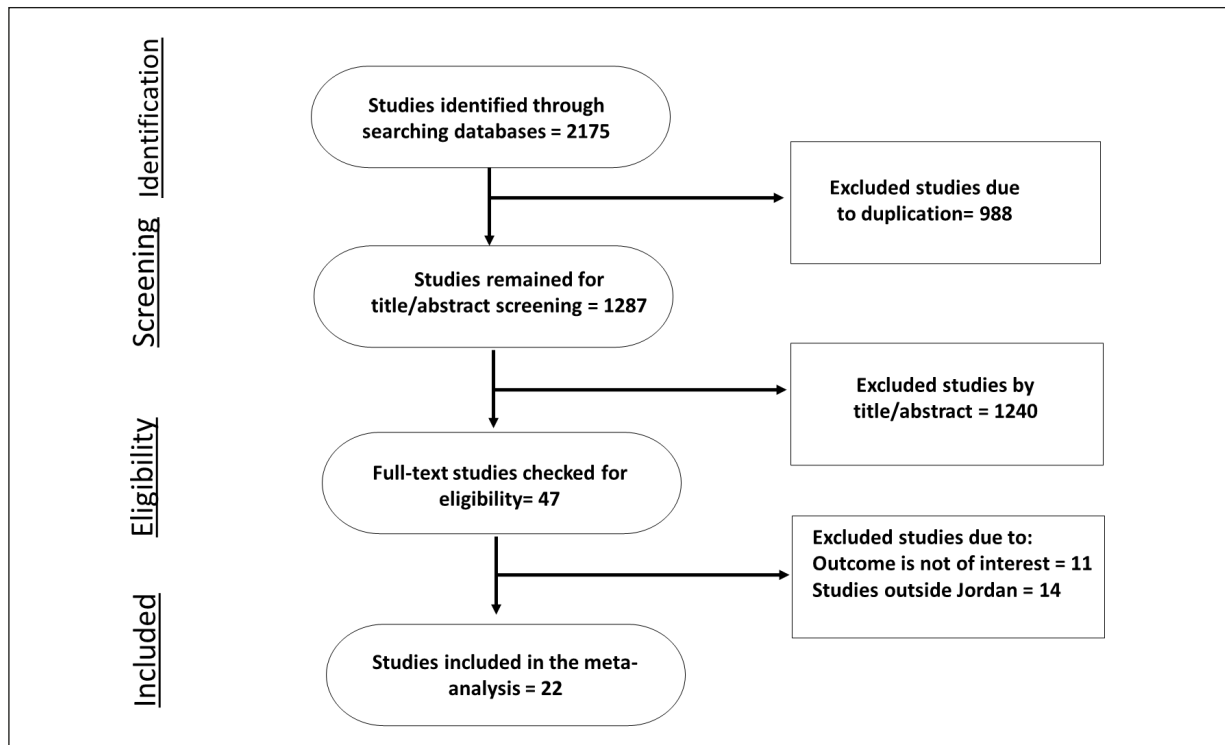


Figure 1. The flowchart of selection of eligible studies for COVID-19 vaccine acceptance meta-analysis study in Jordan.

cymakers to overcome vaccine hesitation and promote vaccination in the country.

Materials and Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline was used (Figure 1) to conduct the current systematic review/meta-analysis²⁶. The present meta-analysis/systemic review was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under identification number CRD42022326191.

Inclusion Criteria

Cross-sectional studies published in English that investigated COVID-19 vaccine acceptance/hesitancy in Jordan up to 20 April 2022 have been included in the present meta-analysis. These included articles conducted on the general public, women, healthcare workers, and university students. Exclusion criteria included review articles, qualitative studies, case studies, and articles for which the full text was not available.

Search Strategies

The following databases were used to search for eligible articles: PubMed, Scopus, Jordanian journals, Web of Science, Google Scholar, ScienceDirect, and EMBASE¹⁵. A combination of the following search keywords was used: COVID-19, SARS-CoV-2, coronavirus, vaccine, vaccination, acceptance, willingness, hesitancy, intention, Jordan, Jordanians¹⁷. Reference lists of selected articles for relevant studies were also searched¹⁵.

Study Setting

The current meta-analysis/systematic review included studies conducted in Jordan to examine the acceptance/hesitancy of COVID-19 vaccination and related determinants.

Measurement of Outcomes

The outcome of the present meta-analysis/systematic review was the rate of COVID-19 vaccine acceptance in Jordan. In included studies, participants were asked about their acceptance to take the COVID-19 vaccine when it would be available. Participants who answered

“yes” or “agree” were considered as “accept the vaccine”, while participants who answered “no”, or “disagree” were considered as “do not accept the vaccine”.

Data Extraction

Studies identified by searching the databases referenced in the “Search strategies” section above were exported to Endnote software. Using the command “find duplicate”, duplicate studies were filtered. The titles and abstracts of the endnote library were screened based on inclusion criteria. Two reviewers independently extracted the required data using a standard form. Discordance issues between the two reviewers were resolved by discussion and consensus. Eligible articles underwent a full-text review (Figure 1).

Strategy for Data Synthesis

The extracted data were loaded into Microsoft Excel and then imported into RevMan software (Review Manager Web, The Cochrane collaboration, Copenhagen) for further analysis. Meta-analysis was implemented for studies that provided the outcome and the determinant variables. Estimates of adjusted odds ratio with a 95% confidence interval (CI) were considered as the measure of association for factors. Heterogeneity between the studies was assessed with the I^2 statistics. Evidence of publication bias was assessed using the visual inspection of the asymmetry in funnel plots and Egger’s test. The model used in RevMan was the mean difference (IV, Random, 95% CI). Subgroup analysis according to the year of publication was used to assess possible causes of heterogeneity among study results.

Quality Assessment

Quality assessment of the studies included in the present meta-analysis was performed using the modified “Newcastle-Ottawa Scale” for cross-sectional studies²⁷. All included articles were rated as high or moderate quality.

Statistical Analysis

The acceptance rate of the COVID-19 vaccine among Jordanians was pooled using a random-effects model and the RevMan meta-analysis software²⁸. Heterogeneity analysis was performed by I^2 -statistics. In addition, publication bias was assessed using the funnel plot/Egger’s test²⁹. A p -value < 0.05 was used to indicate statistical significance.

Results

Different databases (PubMed, Scopus, Jordanian journals, Web of Science, Google Scholar, ScienceDirect, and EMBASE) and Jordanian journals were searched for articles related to the topic of the meta-analysis (Figure 1). A total of 2,175 articles were retrieved and transferred to the Endnote library. A total of 988 of those articles were excluded due to duplication. Additionally, 1,240 articles were excluded by screening titles/abstracts. The remaining 47 articles were selected for eligibility. After a full-text assessment, 22 out of 47 articles were included in the meta-analysis because they met the study inclusion criteria (Table I).

Included Studies

A total of 22 articles that examined Jordanian acceptance of COVID-19 vaccines were included. Sample sizes ranged from 7,020¹² to 131³⁰. The highest acceptance rate was 72.3%²⁰, while the lowest was 17.1%²⁵. The studies were conducted on the general public^{11,12,19,21,24,25,31-37}, healthcare workers^{30,38-40}, and students^{18,22}.

Publication Bias and Sensitivity Analysis

Two methods were used to assess publication bias (Egger’s test and funnel plot). Both methods indicated a lack of publication bias. The p -value of Egger’s test was > 0.05 and the funnel plot showed a symmetrical distribution of the meta-analysis articles (Figure 2). With respect to sensitivity analysis, the data showed that there was no effect of a particular study on the overall acceptance rate of the COVID-19 vaccine among Jordanians.

Meta-Analysis of COVID-19 Acceptance in Jordan

The 22 studies reported acceptance of the COVID-19 vaccine in Jordan and included 38,600 participants (Table I, Figure 3). The pooled COVID-19 vaccine acceptance rate in Jordan was calculated to be 39.89% [95%-CI: 33.52-46.27]. The model adopted for conducting the present meta-analysis was the random-effects model. This is due to the high observed heterogeneity ($I^2 = 99%$, $Z=12.26$, $p<0.00001$) of the studies included in the meta-analysis (Figure 3).

Subgroup Analysis

The included studies were analyzed according to the year of publication. The pooled COVID-19 vaccine acceptance rate among Jordanians was 36.70% [$n=33,696$, 95%-CI: 29.27-44.12, $I^2=100%$, $p<0.0001$) for the 2021 studies,

Table I. Summary of studies aimed to examine the acceptance of COVID-19 vaccine in Jordan.

Study	Sample size	Study population	Acceptance rate	Quality of the study
Abu Farha et al ²⁵	1,287	General population	35.8%	High
Abu Farha et al ³¹	833	General population	17.1%	Medium
Al-Mistarehi et al ³³	2,208	General population	30.4%	High
Aloweidi et al ³⁹	646	Hospital workers	35.0%	High
Al-Qerem and Jarab ³⁵	1,144	General population	36.8%	High
Al-Qerem et al ²³	1,897	Young adults	19.9	High
El-Elimat et al ¹⁹	3,100	General population	37.4%	High
Noushad et al ³⁰	131	Healthcare workers	53%	Medium
Qunaibi et al ³⁸	1,092	Healthcare workers	29%	High
Qunaibi et al ¹²	7,020	General population	38.5%	High
Sallam et al ¹¹	2,173	General population	28.4%	High
Sallam et al ¹⁸	1,106	University students	34.9%	High
Rababa'h et al ²¹	475	General population	48.8%	High
Tarifi et al ³⁷	3,728	General population	39.5	High
Zein et al ⁵⁴	3,735	General population	41.3%	High
Abu Hammour et al ³²	468	General population	45.9	Medium
Al-Qerem et al ³⁴	915	General population	44.6%	High
Al-Sagarat et al ²²	615	University students	39.6%	High
Al-Rawashdeh et al ²⁴	281	General population	39.9%	Medium
Alzoubi et al ³⁶	2,261	General population	58.2	High
Nusair et al ²⁰	3,121	General population	72.3%	High
Lataifeh et al ⁴⁰	364	Healthcare workers	64.1%	Medium

and 48.90% [n=4,904, 95%-CI: 40.21-57.65, I²=91.0%, p<0.0001) for the 2022 studies. Thus, the acceptance rate was boosted by approximately 33.2% in 2022.

Discussion

The COVID-19 pandemic continues to be a major health challenge for the world during 2022⁴¹. The pandemic has claimed hundreds of millions of cases and more than 6 million deaths directly related to infection. In a recent estimate by the World Health Organization (WHO), approximately 15 million deaths globally have been associated with the COVID-19 pandemic⁴². As a response to the pandemic, different vaccines have been developed and approved by the WHO and food and drug administration in most countries around the world⁴. However, vaccine hesitancy has emerged as a global phenomenon with higher hesitancy rates reported in developing countries compared to developed countries⁵⁻⁷.

In Jordan, vaccine uptake rates were still lower than expected with approximately 44% of the population receiving two doses of the vaccine as of May 2022. Therefore, the current systematic

review/meta-analysis was conducted to determine the acceptance rate of the COVID-19 vaccine in Jordan. The study followed the PRISMA guidelines and checklists and adopted standard procedures in identifying the included studies²⁶. According to the study results, the pooled COVID-19 vaccine acceptance rate in Jordan was calculated to be 39.89% [95%-CI: 33.52-46.27]. This indicates a high hesitancy rate (about 60%) for the COVID-19 vaccine in the country. Studies^{14,25,43-48} from the Middle East and North Africa have also reported high hesitancy rates. For example, the hesitancy rates were 31.5-57.4% in Egypt^{14,43}, 33-80% in Saudi Arabia^{44,45}, 41-81.5% in Lebanon^{25,46}, 43.8% in Iraq⁴⁷, and 42% in Tunisia⁴⁸. In a meta-analysis¹⁵ conducted in Africa, vaccine hesitancy was estimated to be around 50%. In Ethiopia, a meta-analysis¹³ involving 14 studies and a total of 6,373 people estimated a pooled hesitancy rate of about 44%. A pooled vaccine hesitancy rate of 38.2% was reported in low- and lower-middle-income developing countries¹⁴. However, relatively lower hesitancy rates have been reported in the developed world. For example, the reported vaccine hesitancy rate was 21.4% in Germany⁴⁹, 22% in the United States⁵⁰, 18% in the United Kingdom⁵¹, and 24%

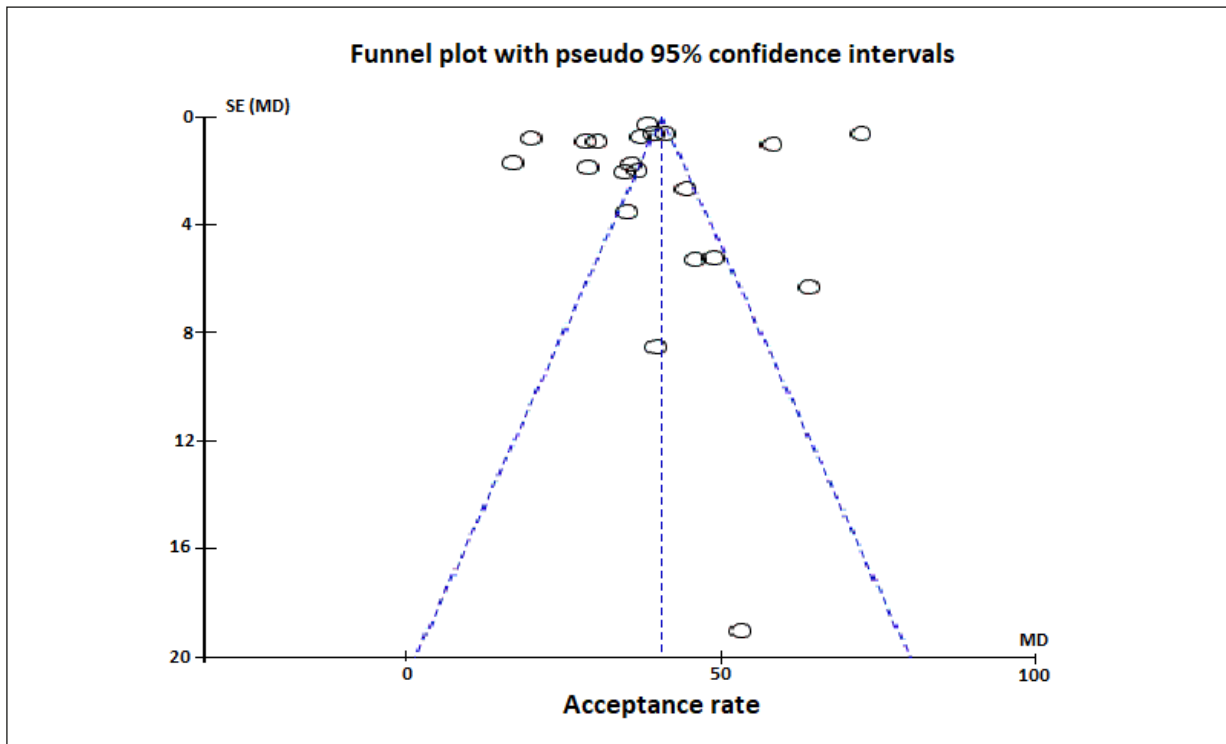


Figure 2. Funnel plot of included studies in the meta-analysis for estimation of publication bias.

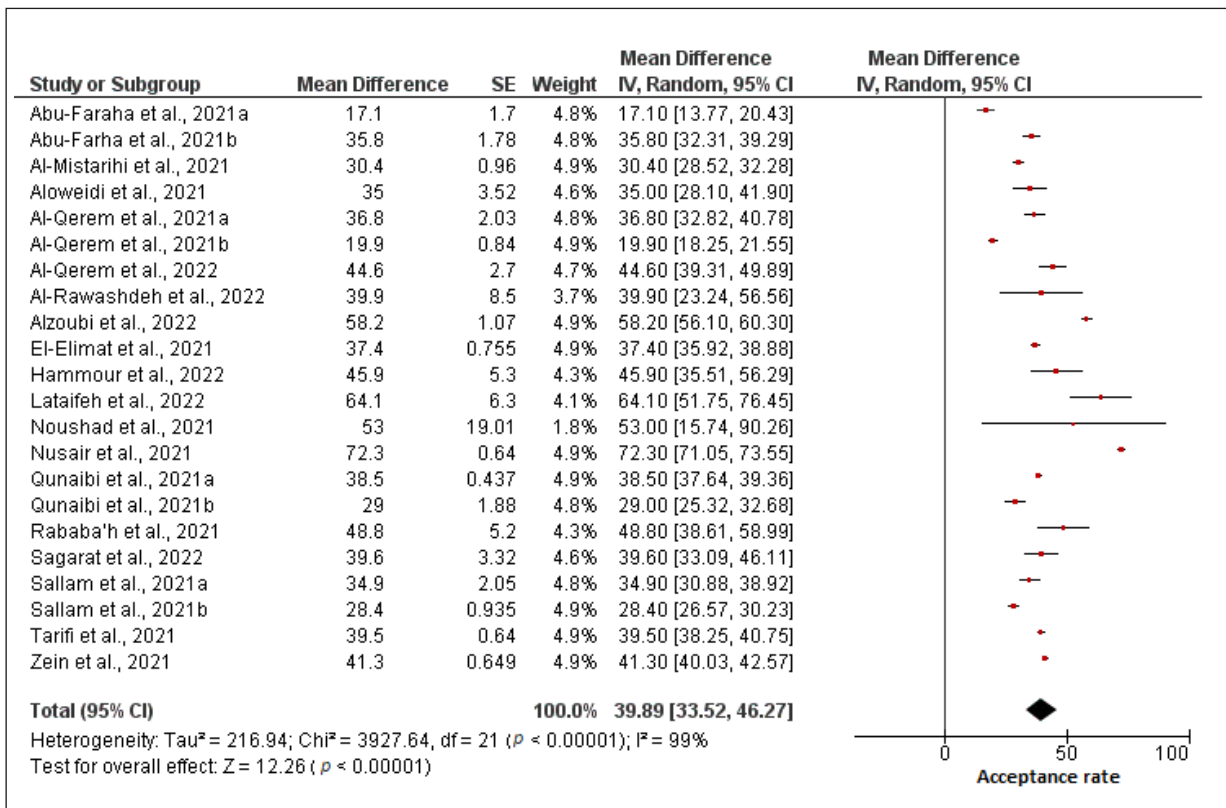


Figure 3. Forest plot showing studies that examined COVID-19 vaccine acceptance in Jordan. The pooled COVID-19 vaccine acceptance rate in Jordan was calculated to be 39.89% [95%-CI: 33.52-46.27].

in Canada⁵². Therefore, more efforts should be made to enhance vaccine acceptance in developing countries.

According to the present meta-analysis, vaccine acceptance has enhanced over time with an approximate 33% increase in vaccine acceptance during 2022 compared to 2021 year. A similar trend has been reported in other regions¹⁵. In Jordan, the government has adopted several strategies to overcome COVID-19 vaccine hesitancy and to enhance the public acceptance of the vaccine. These include improving the national immunization system by establishing an online registration stage, automated certification of vaccine doses, and utilization of an efficient COVID-19 vaccination monitoring system⁹. In addition, government efforts have been strengthened by recruiting the private health sector, medical school doctors and students, Royal Medical Services, and others in the COVID-19 campaign. This has been accomplished through the implementation of the “National Deployment and Vaccination Plan”. Moreover, the government has ensured the availability of vaccines through strong cooperation with the WHO (through the COVAX initiative), the pharmaceutical industry, and producing countries⁹, making mandatory COVID-19 vaccination for healthcare personnel, army personnel, governmental workers, academic/educational staff, public services personnel, and university students^{8,53}. Such efforts may be responsible for the observed increase in vaccine acceptance among the public in Jordan during the year 2022. However, there is still a need for more efforts and awareness interventions to reach a convincing level of vaccination against COVID-19 in Jordan.

Among the factors identified behind the COVID-19 hesitancy, there is the preference for natural immunity over vaccinations³¹, side effects and safety issues^{31,33,54}, the influence of social media³⁹, lack of trust^{35,36}, expected benefits^{34,40}, conspiracy beliefs^{11,18,19}, lack of knowledge about vaccines³⁸, and being infected with COVID-19³⁷. Interventions that consider such factors might significantly enhance vaccine acceptance rates in Jordan.

Limitations

Among the study limitations is that only articles published in the English language and the searched databases were included in the meta-analysis. Therefore, some related studies may be missed from the analysis.

Conclusions

The present meta-analysis reported a pool acceptance rate of COVID-19 of 39.89% in Jordan. The acceptance rate increased by about 33% in 2022 compared to 2021. However, the current reported acceptance rate is still lower than expected to end the current COVID-19 disease. More efforts and awareness interventions are needed to enhance vaccine acceptance in Jordan.

Conflict of Interest

The author has nothing to declare.

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Data Availability Statement

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

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