RESEARCH

VACCINATION ANALYSIS AND MONITORING GROUP (GAMOV): QUALIFYING COVID-19 VACCINATION INDICATORS IN THE STATE OF MINAS GERAIS, BRAZIL

GRUPO DE ANÁLISE E MONITORAMENTO DA VACINAÇÃO (GAMOV): QUALIFICANDO OS INDICADORES DE VACINAÇÃO CONTRA COVID-19 NO ESTADO DE MINAS GERAIS, BRASIL

GRUPO DE ANÁLISIS Y MONITOREO DE LA VACUNACIÓN (GAMOV): CALIFICANDO LOS INDICADORES DE VACUNACIÓN CONTRA LA COVID-19 EN EL ESTADO DE MINAS GERAIS, BRASIL.

Janaina Fonseca Almeida Souza[1]
Thales Philipe Rodrigues da Silva[1]
Tércia Moreira Ribeiro da Silva[1]
Adriana Coelho Soares[2]
Hellen Flávia Ribeiro dos Santos[2]
Daiany Suellen Conceição Genuíno[2]
Guilherme Amaral Bernardino[3]
Fernanda Penido Matozinhos[1]

[1]Universidade Federal de Minas Gerais – UFMG, Escola de Enfermagem – EE, Departamento de Enfermagem Materno Infantil e Saúde Coletiva. Belo Horizonte, MG – Brasil.

[2]Secretaria de Estado de Saúde de Minas Gerais – SES/MG, Subsecretaria de Vigilância em Saúde – SUBVS, Superintendência de Vigilância Epidemiológica – SVE. Belo Horizonte, MG – Brasil.

[3]Secretaria de Estado de Saúde de Minas Gerais – SES/MG, Assessoria de Tecnologia da Informação (ATI), Núcleo de Inteligência e Governança de Dados. Belo Horizonte, MG – Brasil.

Corresponding Author: Fernanda Penido Matozinhos

E-mail: nandapenido@hotmail.com

Authors' Contributions:

Conceptualization: Janaina F. A. Souza; Thales P. R. da Silva; Fernanda P. Matozinhos*; Data Collection:* Janaina F. A. Souza; Thales P. R. da Silva; Hellen F. R. dos Santos; Daiany S. C. Genuíno; *Investigation:* Janaina F. A. Souza; Thales P. R. da Silva; Hellen F. R. dos Santos; Daiany S. C. Genuíno; *Methodology: J*anaina F. A. Souza; Thales P. R. da Silva; Hellen F. R. dos Santos; Daiany S. C. Genuíno; Fernanda P. Matozinhos; *Project Management:* Fernanda P. Matozinhos*; Statistical Analysis:* Janaina F. A. Souza; Thales P. R. da Silva; Guilherme A. Bernardino; Fernanda P. Matozinhos; *Supervision:* Janaina F. A. Souza; Fernanda P. Matozinhos; Validation: Janaina F. A. Souza; Thales P. R. da Silva; Tércia M. R. da Silva; Adriana C. Soares; Hellen F. R. dos Santos; Daiany S. C. Genuíno; Guilherme A. Bernardino; Fernanda P. Matozinhos; *Visualization:* Janaina F. A. Souza; Thales P. R. da Silva; Tércia M. R. da Silva; Adriana C. Soares; Hellen F. R. dos Santos; Daiany S. C. Genuíno; Guilherme A. Bernardino; Fernanda P. Matozinhos; *Writing – Original Draft Preparation:* Janaina F. A. Souza; Thales P. R. da Silva; Tércia M. R. da Silva; Adriana C. Soares; Hellen F. R. dos Santos; Daiany S. C. Genuíno; Guilherme A. Bernardino; Fernanda P. Matozinhos. *Writing – Review and Editing:* Janaina F. A. Souza; Thales P. R. da Silva; Tércia M. R. da Silva; Adriana C. Soares; Hellen F. R. dos Santos; Daiany S. C. Genuíno; Guilherme A. Bernardino; Fernanda P. Matozinhos.

Funding: No funding.

Submitted on: 29/01/2024

Approved on: 28/05/2025

Responsible Editors:

Alexandra Dias Moreira

Luciana Regina Ferreira da Mata

ABSTRACT

Objective: to analyze the COVID-19 vaccination indicators (vaccinawtion coverage, mortality rate, and risk classification of municipalities) monitored by the Vaccination Analysis and Monitoring Group (GAMOV) in the state of Minas Gerais, Brazil, and to report the experience of this strategy. **Methods**: this is a cross-sectional documentary and epidemiological study, utilizing data on vaccination coverage, COVID-19 deaths, and risk classification of municipalities according to the alert level by the Regional Health Management/Superintendence (GRS/SRS), considering the period from January 18, 2021 (before the implementation of GAMOV) to March 31, 2022 (after the implementation of GAMOV). For quantitative analyses, the Kolmogorov, Friedman, and Sidak post-tests were employed, depending on the variable studied. **Results**: astatistically significant increase in vaccination coverage was observed one month and eight months after the implementation of GAMOV. Regarding the mortality rate, an indicator of the impact of vaccination, it was found that the GRS/SRS of Ituiutaba, Leopoldina, and Passos had the highest values in all evaluated periods. Additionally, deaths decreased over time. As for the risk classification of municipalities, the low alert level showed differences especially between July 30, 2021, and February 2022, between July 30, 2021, and March 2022, and between July 1, 2021, and March 2022, with the number of GRS/SRS in the Low Alert Level being higher in the more recent periods. **Conclusions**: the results demonstrated that GAMOV was one of the main contributors to the advancement of COVID-19 vaccination in the state of Minas Gerais, Brazil.
Keywords: Immunization Programs; Vaccination; COVID-19 Vaccines; Vaccination Coverage; COVID-19; SARS-CoV-2; Management Indicators; Planning.

RESUMO

Objetivo: coanalisar os indicadores de vacinação contra a COVID-19 (cobertura vacinal, taxa de mortalidade e classificação de risco dos municípios) monitorados pelo Grupo de Análise e Monitoramento da Vacinação (GAMOV) no estado de Minas Gerais, Brasil, e relatar a experiência dessa estratégia. Métodos: trata-se de um estudo documental e epidemiológico transversal, utilizando dados de cobertura vacinal, óbitos por COVID-19 e classificação de risco dos municípios conforme o grau de alerta por Gerência/Superintendência Regional de Saúde (GRS/SRS), considerando o período de 18 de janeiro de 2021 (anterior à implantação do GAMOV) a 31 de março de 2022 (posterior à implantação do GAMOV). Para as análises quantitativas, foram empregados os testes de Kolmogorov, Friedman e o pós-teste de Sidak, conforme a variável estudada. Resultados: verificou-se aumento estatisticamente significativo das coberturas vacinais um mês e oito meses após a implantação do GAMOV. Em relação à taxa de mortalidade, indicador do impacto da vacinação, observou-se que as GRS/SRS de Ituiutaba, Leopoldina e Passos apresentaram os maiores valores em todos os períodos avaliados. Ademais, os óbitos diminuíram ao longo do tempo. Quanto à classificação de risco dos municípios, o grau de alerta baixo demonstrou diferenças especialmente entre 30 de julho de 2021 e fevereiro de 2022, entre 30 de julho de 2021 e março de 2022 e entre 1º de julho de 2021 e março de 2022, sendo que o quantitativo de GRS/SRS em Grau de Alerta Baixo foi maior nos períodos mais recentes. Conclusões: os resultados demonstraram que o GAMOV foi um dos principais responsáveis pelo avanço da vacinação contra a COVID-19 no estado de Minas Gerais, Brasil.
Palavras-chave: Programas de Imunização; Vacinação; Vacinas contra COVID-19; Cobertura Vacinal; COVID-19; SARS-CoV-2; Indicadores de Gestão; Planejamento.

RESUMEN

Objetivo: analizar los indicadores de vacunación contra la COVID-19 (cobertura vacunal, tasa de mortalidad y clasificación de riesgo de los municipios) monitoreados por el Grupo de Análisis y Monitoreo de la Vacunación (GAMOV) en el estado de Minas Gerais, Brasil, y reportar la experiencia de esta estrategia. Métodos: estudio documental y epidemiológico transversal con datos sobre cobertura vacunal, muertes por COVID-19 y clasificación de riesgo de los municipios según el grado de alerta por Gerencia/Superintendencia Regional de Salud (GRS/SRS), considerando el período del 18 de enero de 2021 (antes de la implementación del GAMOV) al 31 de marzo de 2022 (tras la implementación del GAMOV). Para los análisis cuantitativos se emplearon las pruebas de Kolmogorov, Friedman y el postest de Sidak, de acuerdo con cada variable estudiada. Resultados: se observó un aumento estadísticamente significativo en las coberturas vacunales a 1 mes y a 8 meses después de la implementación del GAMOV. En cuanto a la tasa de mortalidad, que representa un indicador del impacto de la vacunación, se constató que las GRS/SRS Ituiutaba, Leopoldina y Passos presentaron los valores más altos en todos los períodos analizados. Además, las muertes disminuyeron a lo largo del tiempo. En relación con

la clasificación de riesgo de los municipios, el grado de alerta bajo mostró diferencias especialmente entre el 30 de julio de 2021 y febrero de 2022, entre el 30 de julio de 2021 y marzo de 2022, y entre el 1 de julio de 2021 y marzo de 2022 (la cantidad de GRS/SRS en Grado de Alerta Bajo fue mayor en el segundo momento). Conclusiones: los resultados demostraron que GAMOV fue uno de los principales responsables del avance de la vacunación contra la COVID-19 en el estado de Minas Gerais, Brasil.
Palabras clave: Programas de Inmunización; Vacunación; Vacunas contra la COVID-19; Cobertura de Vacunación; COVID-19; SARS-CoV-2; Indicadores de Gestión; Planificación.

INTRODUCTION

The pandemic caused by the new SARS-wCoV-2 virus, the etiological agent of COVID-19, declared by the World Health Organization (WHO) on March 11, 2020, accelerated the production of knowledge in the globalized world and changed the perspective on health[1]. The uncertainties regarding the mode of transmission, the speed of dissemination, and the high mortality rates among the most vulnerable groups became significant challenges in combating the pandemic[1].

While safe and effective vaccines were not available to the population, non-pharmacological measures were globally established to contain the circulation of the virus and reduce its transmission[2]. Among these measures, the following stand out: use of masks, social distancing, hand hygiene, ventilation of environments, widespread COVID-19 testing, lockdowns, and border closures[2].

With the approval and acquisition of the first vaccines against COVID-19 in 2021, the Ministry of Health of Brazil developed the National Plan for the Operationalization of Vaccination against COVID-19 (PNOV), with the aim of guiding states and municipalities during the COVID-19 Vaccination Campaign[3]. However, this plan was criticized by the academic community due to the limited detail provided for the implementation of the operationalization strategies[4].

In Brazil, even after the start of vaccination on January 18, 2021, the public health crisis persisted due to the lack of federal political support, resulting in the disorganization of vaccination strategies at the state and municipal levels[5]. Additionally, there was an exacerbation of the public health crisis, a decrease in the population's adherence to non-pharmacological containment measures and the blocking of SARS-CoV-2 transmission, as well as a delayed vaccination campaign that reached only 22.8% of the target population with two doses or a single dose and 52.9% with the first dose of the vaccine in the first six months of the campaign[1]. Notably, in November 2020, European countries with over 80% of their population vaccinated began to report a significant increase in cases, especially with the arrival of the Delta variant, highlighting the importance of vaccination against COVID-19 for reducing the number of cases and deaths from the disease in Brazil[1].

In this context, the state of Minas Gerais, one of the most populous in the country, with approximately 20.5 million inhabitants distributed across 853 municipalities[6], also faced operational and logistical difficulties in executing the COVID-19 Vaccination Campaign. Thus, the Vaccination Analysis and Monitoring Group in the State of Minas Gerais (GAMOV) was established, with the main objective of conducting regionalized and decentralized analysis and monitoring of COVID-19 vaccination. Since its implementation on July 1, 2021, GAMOV has monitored the doses administered, the registration, vaccination coverage against COVID-19, and the mortality rate from the disease, aiming to assess the impact of immunization actions on the reduction of deaths.

This monitoring was carried out in conjunction with the State Situation Room, using a methodology that classified municipalities into maximum and minimum alert levels based on the results of the indicators. Based on the analysis and monitoring of the data, strategies were proposed to enable the achievement of vaccination coverage goals against COVID-19 in Minas Gerais, prioritizing municipalities classified as being at maximum alert.

Thus, the objective of this study was to analyze the vaccination indicators against COVID-19 monitored by GAMOV-MG, as well as to report the experiences of the group that can be replicated in other contexts. The hypothesis of this study is that GAMOV contributed to the advancement of vaccination against COVID-19 in the state of Minas Gerais, Brazil, especially by promoting integration and governance among the central state level, the regional level, and the municipalities.

METHOD

This is a cross-sectional documentary and epidemiological study that used data on vaccination coverage and deaths from COVID-19, as well as the classification of municipalities according to their alert level, by Regional Health Management/Superintendence (GRS/SRS) of the state of Minas Gerais, Brazil, from January 18, 2021, to March 31, 2022.

Scenario

Minas Gerais is a Brazilian state composed of 853 municipalities, distributed over a territory of 586,513.984 km², with an estimated population of 20,539,989

inhabitants for the year 2022[7]. The state is divided into 19 Regional Health Superintendencies (SRS) and nine Regional Health Managements (GRS). The division between GRS and SRS constitutes a management approach proposed by the Health Regionalization Master Plan[6]. Among the responsibilities of these territorial units are implementing state health policies, assisting in the organization of services, coordinating, evaluating, and monitoring health actions, among other functions, according to Decree No. 47,769 of November 29, 2019, which regulates the organization of the State Health Secretariat of Minas Gerais (SES/MG)[6].

Variables

In this study, the following variables were considered: vaccination coverage, deaths per 100,000 inhabitants (over the last 28 days), and alert level (classified as maximum and minimum) in the GRS/SRS, made available in four distinct periods. These periods correspond to times before and after the implementation of GAMOV: January 18 to July 1, 2021 (before implementation); January 18 to July 30, 2021 (one month after implementation); January 18, 2021, to February 28, 2022 (eight months after implementation); and January 18, 2021, to March 31, 2022 (nine months after implementation). These periods were selected randomly, according to the availability of data and the updating of information. It is noteworthy that the milestone for the implementation of GAMOV was July 1, 2021.

Vaccination Coverage

For the calculation of vaccination coverage in the population over 12 years old, the sum of the doses administered was performed: Dose 1 (D1), Dose 2 (D2), or Single Doses (SD), divided by the corresponding population. At the beginning of the Vaccination Campaign, this information was communicated daily by the municipalities to the State Situation Room. Since the Ministry of Health's Information System did not provide real-time data on the doses administered, the state created a parallel measurement method, in partnership with the municipalities, through a questionnaire that also fed into the "State Vaccination Meter". It was only in May 2022 that it became possible to migrate the data from the analyses to the Official System (OpenDataSUS).

Mortality Rate

For the calculation of the mortality rate, the totality of deaths with a final classification of COVID-19, recorded in the Information System of Epidemiological Surveillance of Influenza in the last 28 days, was divided by the total estimated population during the period.

Alert Level

This analysis tool classified the municipalities of the state based on immunization indicators, such as data completeness in the official information system, number of doses administered, and overall coverage of D1, D2, and Single Doses (SD). Using interquartile ranges, municipalities with performance significantly different from the state median were identified.

Based on these indicators, the results obtained from each of them, and the parameters considered appropriate for the moment, an analysis of the measures in the territories was conducted. The total sum of points resulted in a final index, termed "alert level," where the highest score indicated greater risk (maximum alert) and the lowest score indicated lower risk (minimum alert).

Data Analysis

The quantitative variables were submitted to the Shapiro-Wilk test, which indicated that the data were not normally distributed; therefore, non-parametric tests were applied. The significance level adopted for all analyses was 5%. The analyses were performed using Stata® software, version 16.0.

Vaccination Coverage

For the analysis of vaccination coverage in the population over 12 years old, regarding doses D1, D2, and Single Doses (SD), the Kolmogorov-Smirnov test was applied, comparing the observed coverage percentage with the reference vaccination goal of 90%. The null hypothesis states that the coverage is equal to the expected value (90%), while the alternative hypothesis assumes that the coverage is different from this value. Although a vaccination coverage above the 90% target does not represent a problem, coverage below this indicates a failure in immunizing the target population.

Mortality Rate

The Friedman test (non-parametric paired data) was used, followed by the Sidak post-test, to verify the existence of statistical differences in the temporal analysis of the mortality rate (number of deaths per 100,000 inhabitants) over the last 28 days.

Research Ethics Committee

This study was conducted using publicly available data, which did not allow for the individual identification of participants. Therefore, approval from the Research Ethics Committee was not required.

RESULTS

The GAMOV, linked to the Superintendency of Epidemiological Surveillance/SES-MG, was formally established through Deliberation CIB-SUS/MG No. 3,437, dated July 11, 2021.

The internal regulations, developed after the establishment of the Group, covered its nature, purpose, composition, coordination, competencies, organization, operation, activities, and expected products. A central GAMOV was implemented along with 28 regional GAMOVs, one in each GRS/SRS. Representatives from the areas of Epidemiological Surveillance, Sanitary Surveillance, State Situation Room, Immunization Coordination, Primary Health Care, Social Communication, and the Council of Municipal Health Secretaries (COSEMS) participated in this group. Municipal managers and regional supporters were also represented in the group, based on prior indications made by COSEMS.

GAMOV had a work routine with well-defined processes, holding meetings every other week at the central level and monthly meetings at the regional level. During the year 2021, these meetings occurred weekly due to the various challenges posed by the National Vaccination Campaign against COVID-19. At each central GAMOV meeting, a technical report was provided, containing updated results of the monitored indicators, as well as alert points for the GRS/SRS and their municipalities, thus serving as a resource for the meetings and discussions of the regional GAMOVs. The technical reports also facilitated the simplification of communication processes between the regional/municipal levels and the central level.

Initially, regarding the coverage data for the first dose (D1), the tests indicated a progressive increase over the analyzed periods, with statistical significance observed before the implementation of the GAMOV and in the first month. As for the coverage of the second dose (D2) and the single dose (SD), the increase was significant before implementation, one month, eight months, and nine months after the implementation of the GAMOV (Table 1).

Regarding COVID-19 deaths in Minas Gerais, Figure 1 shows variability among the GRS/SRS across the four analyzed periods. The GRS Ituiutaba, GRS Leopoldina, and SRS Passos exhibited the highest rates in all evaluated periods. Furthermore, the mortality rate showed a reduction over time.

The deaths that occurred in the periods one month and nine months after the implementation of the GAMOV were statistically equal (p = 0.347). Similarly, there was no significant difference between eight months and nine months after the implementation of the GAMOV (p = 0.068). When comparing February 2022 with July 30, 2021, a higher number of deaths was observed in the second period. Comparing March 2022 with July 1, 2021, a higher number of deaths was also noted in the second period.

When comparing the period prior to the implementation of the GAMOV with the following month, the mortality from COVID-19 was significantly higher before the implementation of the Group (p = 0.037).

Regarding the minimum alert level (which was expected for the municipalities), the differences occurred between: July 30, 2021, and February 2022; July 30, 2021, and March 2022; and July 1, 2021, and March 2022. The number of GRS/SRS at the minimum alert

Table 1 – Median COVID-19 vaccination coverage according to the period of GAMOV's operation, Minas Gerais, 2021 and 2022.

	COVID-19 Vaccination coverage							
	D1 (Before)	D2; SD (Before)	D1 (1 month)	D2; SD(1 month)	D1 (8 months)	D2; SD (8 months)	D1(9 months)	D2; SD (9 months)
Median	35,16	13,37	61,29	24,74	85,59	80,20	87,28	81,98
p value	<0,001*	<0,001*	<0,001*	<0,001*	0,517	<0,001*	0,400	0,022*

Observations: * Statistically significant values.
D1, D2 and SD: doses 1, 2, and single, respectively.

Figure 1 – COVID-19 mortality rate according to GRS/SRS and monitoring period of GAMOV - Minas Gerais, 2021 and 2022.
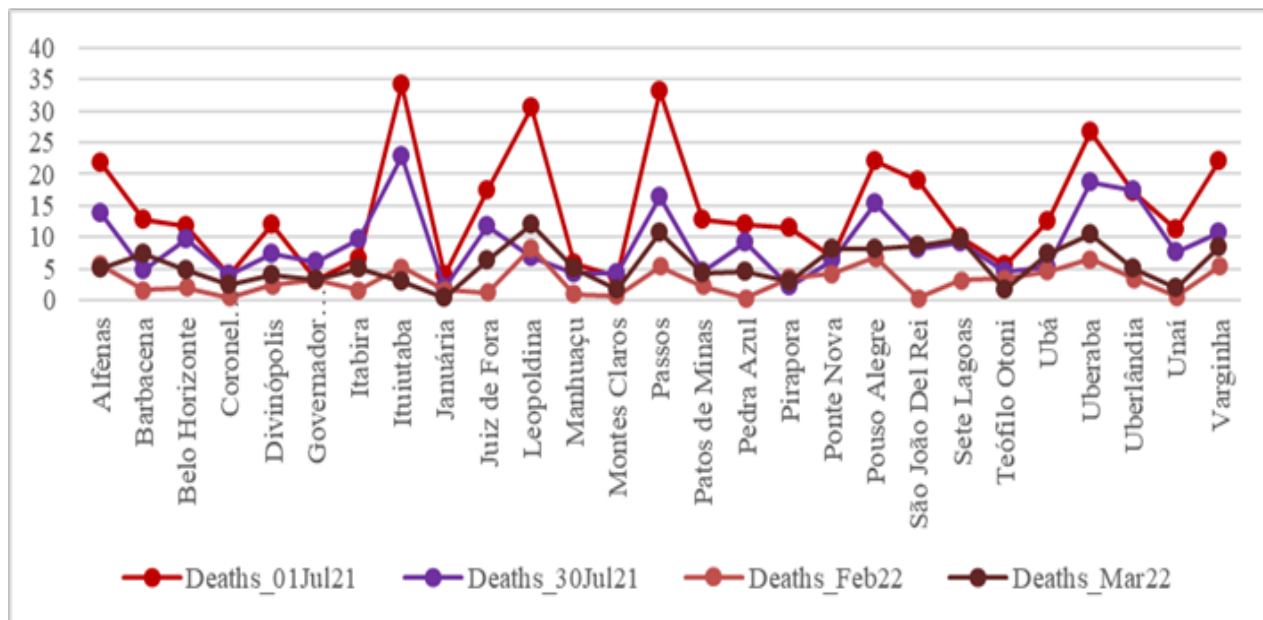

level was higher in the second moment for all the periods compared (Figure 2).

Overall, in the year 2022, the minimum alert level prevailed in the state of Minas Gerais and was demonstrated to be stable. The GRS Pirapora, SRS Teófilo Otoni, and GRS Unaí stood out for having the highest number of municipalities at the minimum alert level this year, especially in the month of March (Figure 2).

DISCUSSION

This study evaluated the vaccination coverage against COVID-19, the mortality rate, and the alert level of municipalities in Minas Gerais, considering the periods before and after the implementation of the GAMOV. A progressive increase in vaccination coverage for D1, D2, and SD was observed throughout the analyzed periods, as well as a reduction in mortality rates, despite the significant variability among the GRS/SRS. The assessment of the

Figure 2 – Minimum alert level according to GRS/SRS and monitoring period of GAMOV - Minas Gerais, 2021 and 2022.
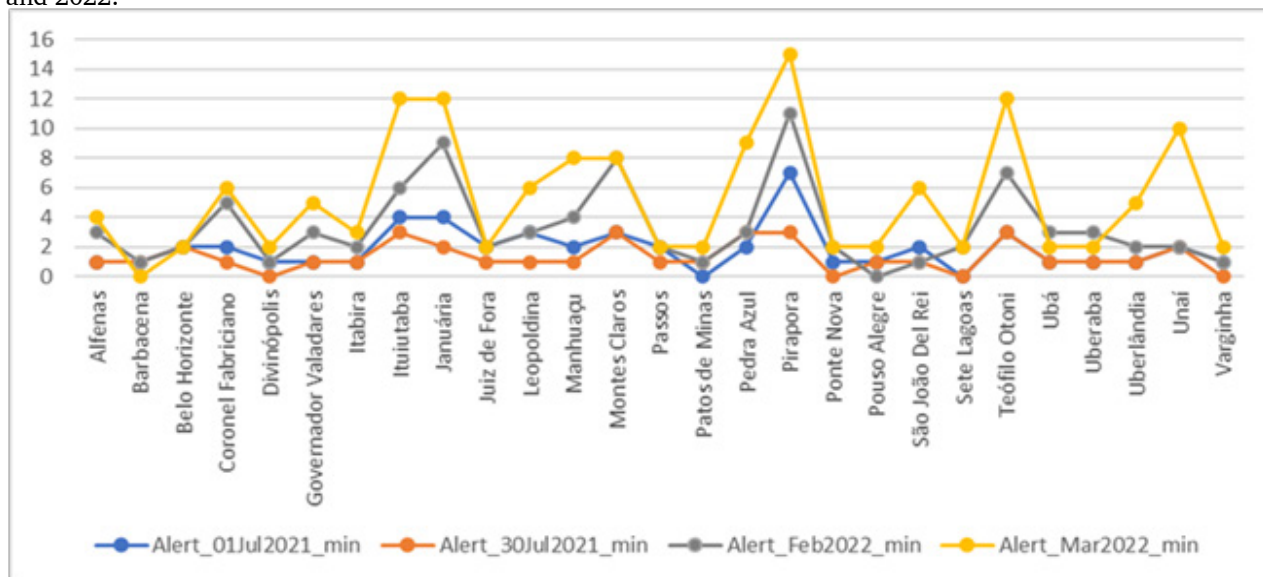
alert level, which allowed for the classification of the risk of COVID-19 transmission, highlighted an increase in the number of GRS/SRS at the minimum alert level after the implementation of the GAMOV, which is consistent with the improvement of the Public Health Emergency scenario in the state.

Studies conducted in various countries have shown that vaccination against COVID-19 is associated with a reduction in mortality rates[8-11]. States and municipalities faced numerous difficulties at the beginning of the vaccination campaign, particularly due to the low visibility of scientific evidence and the loss of prominence of the National Immunization Program in guiding actions[1]. Considering this scenario and the complexity of health regionalization in the vast territory of Minas Gerais, the GAMOV, as an integrated group of decision-makers, played a crucial role in improving the logistics of vaccine distribution, disease surveillance, and immunization processes in the state.

The establishment of a culture of routine data use is essential to inform the planning, design, and improvement of the quality of immunization services. The incremental and continuous use of indicators provides a sustainable and ascendable approach to achieving vaccination coverage goals. The indicators need to be evaluated with partners, not just by the professionals directly involved in immunization actions. This strategy allows for greater transparency and accountability among stakeholders[12].

WHO recommends Immunization Programs to: implement evidence-based interventions that demonstrate improvements; continuously measure performance; act on data and adopt an interactive approach to quality improvement; promote a culture that reduces harm to patients; focus on quality to enable the prevention, detection, and response to vaccine-related threats; provide infrastructure for quality immunization learning; and facilitate knowledge management to enhance immunization services within broader health services and systems[12].

WHO recommendations highlight that the systematic monitoring of the immunization process by the GAMOV, involving various key stakeholders at the state, regional, and municipal levels, promoted discussions in a regionalized and decentralized manner. Thus, decision-making, guided by assertiveness, was particularly enhanced by the direct participation of municipalities, whose understanding of the local reality contributed to the improvement of the alert level during the pandemic response.

Among the various challenges for structuring effective vaccination campaigns, the definition and location of the target population emerge as central points to be discussed. Only the correct identification of the target audience allows for the estimation of the necessary resources and the costs associated with conducting health campaigns[13]. In Brazil, the pandemic coincided with the period of updating the 2010 census, hindering its regular course. As a result, there was no availability of primary population data until mid-2024, leaving Brazil without an updated and accurate picture of the demographic reality for nearly 15 years. Without reliable estimates of population quantities and their spatial distribution, actions based on population denominators were compromised. Furthermore, the PNOV faced difficulties in implementing the evaluative axes, which required updated information about the distribution of the target population and the sizing of the effort needed for the eligible population[13].

The municipalities of Minas Gerais also faced significant difficulties in obtaining accurate calculations of population denominators, particularly due to the lack of an updated census. This challenging scenario, experienced by the SES/MG, required the active participation of the GAMOV for state and municipal organization, especially regarding the definition of quantities and the logistics of distributing doses of immunobiological throughout the territory, in accordance with government guidelines.

Since the beginning of the COVID-19 Vaccination Campaign, one of the main responsibilities of the GAMOV has been to assist in the equitable distribution of doses, respecting the priority groups recommended by the PNOV, based primarily on knowledge of the territory and other available tools for calculating the population denominator in the municipalities.

The classification of municipalities into alert levels, adopted by SES/MG, also enabled the prioritization of support at the state and regional levels, with direct interventions carried out in municipalities that had the highest alert levels and faced greater difficulties in the operationalization of the vaccination campaign. A study conducted in Brazilian municipalities, through a comparison between the period before and after the National Vaccination Movement (starting in 2023), reinforced the importance of risk classification for diagnosing and prioritizing actions aimed at increasing vaccination coverage[14].

In a pandemic context marked by factors such as denialism, fake news, and the anti-vaccine movement, which have spread globally, it is essential to discuss equity in access to healthcare services and in the acquisition and distribution of vaccines[15]. Health indicators, in turn, are fundamental tools for assessing the performance of healthcare services actions, serving as important instruments for planning. The information derived from

health indicators provides an indispensable foundation for evaluating the actions carried out by the system[16].

Planning, programming, monitoring, and evaluation — i.e., the set of activities carried out in the daily work of the GAMOV — were essential tools for integrating Health Surveillance and Primary Care in the state of Minas Gerais during the COVID-19 vaccination campaign. The systematic and coordinated work facilitated the reorganization of work processes, aiming to improve the quality of life of the population in Minas Gerais. By valuing diverse knowledge through discussions based on health situation analysis, the GAMOV promoted integration among sectors related to Immunization, also within municipal territories, enhancing the achievement of vaccination campaign objectives and reducing the likelihood of unforeseen events.

This study presented some limitations, such as the fact that the doses of COVID-19 vaccines administered were reported directly by the municipalities to the State Situation Room at the beginning of the vaccination campaign, rather than by the official system of the Ministry of Health, which began operating only in May 2022. However, the State Situation Room actively worked on ensuring record compliance and data quality. Furthermore, the other data were obtained from secondary sources, derived from the official information systems of the Ministry of Health. The time periods established for analyzing the indicators post-implementation of the GAMOV were defined based on the availability of data passed directly from the municipalities to the state.

CONCLUSIONS

Despite the short time since the implementation of the GAMOV, by July 2021, the results were already satisfactory. There was an observed increase in vaccination coverage over time, as well as an increase in the number of doses administered. Additionally, a significant decrease in the COVID-19 mortality rate was also identified. These results highlight that this group played a fundamental role in advancing COVID-19 vaccination in the state of Minas Gerais. Beyond the COVID-19 Vaccination Campaign, the implementation of analysis and monitoring groups for vaccination is seen as a strategy that can be used to improve routine vaccination coverage, which has been especially impacted by the COVID-19 pandemic.

The GAMOV represented an innovative governance strategy, capable of contributing to the integrated discussion among the various actors involved in vaccination, with the active participation of municipalities in regional and state-level discussions. Furthermore, the strategy proved to be sustainable in the long term, as it promoted changes in work processes and is perfectly applicable to the monitoring of other routine vaccines in the National Vaccination Calendar.

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