ORIGINAL ARTICLE

Health promotion and prevention actions in the Brazilian Unified Health System (SUS): evaluation of the temporal trend and impact of the COVID-19 pandemic

Ações de promoção e prevenção em saúde no Sistema Único de Saúde (SUS): avaliação da tendência temporal e do impacto da pandemia da COVID-19

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ABSTRACT

Objective: To evaluate health promotion and prevention in the Brazilian Unified Health System (SUS) between 2008 and 2022. **Method**: An epidemiological study was conducted, with an ecological approach, as a time series. APPS-related data available in the Outpatient Information System of the SUS (SIA/SUS) over the last 15 years were used, normalized to every 100,000 Brazilian residents, characterizing the incidence. COVID-19 pre- and post-pandemic periods were outlined to verify its impact on productivity. The data were analyzed with a significance level of 5%. **Result**: Between 2008 and 2022, 6,933,081,931 APPS were carried out in the SUS. The most frequent modality was home visits (56.3%), and the most common health professionals were health and endemic agents (59.8%). For the entire study period, the incidence was 3,407,327 APPS *per* 100,000 Brazilian residents, with an annual median of 281,999. Furthermore, there was a significant decreasing trend over the last 15 years (p <0.001), whose annual percentage change was estimated at -6.7%. Disregarding COVID-19 pandemic years, the trend remained to decrease (p = 0.028). At last, when comparing it to the pre-pandemic period, the incidence of APPS were 32% lower in the first, 26% lower in the second, and 21% lower in the third year after the COVID-19 pandemic onset (p <0.001). **Conclusion**: It was possible to conclude that APPS in the SUS have reduced in the last 15 years.

RESUMO

Objetivo: Avaliar as ações de promoção e prevenção em saúde (APPS) realizadas no Sistema Único de Saúde (SUS) entre 2008 e 2022. **Método:** Foi conduzido um estudo epidemiológico, com abordagem ecológica, do tipo série temporal. Foram utilizados os dados relativos às APPS no Sistema de Informações Ambulatoriais do SUS (SIA/SUS) nos últimos 15 anos, normalizada a cada 100.000 residentes brasileiros, caracterizando a incidência. Foram delineados períodos pré e pós-pandemia da COVID-19 para verificar o seu impacto na produtividade. Os dados foram analisados com nível de significância de 5%. **Resultado:** Entre 2008 e 2022, 6.933.081.931 APPS foram realizadas no SUS. A

modalidade mais frequente foram as visitas domiciliares (56,3%) e os profissionais da saúde mais comuns foram os agentes de saúde e endemias (59,8%). Para todo o período, a incidência foi de 3.407.327 APPS a cada 100.000 residentes brasileiros, com mediana anual de 281.999. Ademais, houve uma tendência de redução ao longo dos últimos 15 anos (p <0,001), cuja variação percentual anual foi estimada em -6,7%. Desconsiderando o período da pandemia da COVID-19, a tendência permaneceu decrescente (p = 0,028). Por fim, ao compará-la com o período pré-pandemia, a incidência de APPS foi 32% menor no primeiro, 26% menor no segundo e 21% menor no terceiro ano após o início da pandemia da COVID-19 (p <0,001). **Conclusão:** Foi possível concluir que as APPS no SUS reduziram nos últimos 15 anos.

INTRODUCTION

The Unified Health System (Sistema Único de Saúde, SUS) is a fundamental pillar in the public health landscape of Brazil. Established by the 1988 Constitution, the SUS is an initiative aimed at ensuring universal, comprehensive, and equitable access to healthcare[1]. Its structure is organized in a decentralized manner, encompassing the federal government, states, municipalities, and the Federal District to promote health actions and services. The SUS covers everything from primary care to high-complexity procedures, including consultations, exams, procedures, surgeries, and health prevention and promotion actions (HPPA). Additionally, it is important to consider that the SUS plays a crucial role in reducing inequalities and promoting equity in access to health services, making it an essential instrument for improving the living conditions of the Brazilian population[2,3].

Within the SUS, HPPA work towards building a healthier society (habits and lifestyles) and reducing the burden of diseases. Health promotion aims to empower individuals to improve their control over their own health by addressing social, environmental, and economic determinants[4]. This involves encouraging healthy lifestyles, promoting health education, and creating environments conducive to well-being. On the other hand, prevention actions aim to prevent the occurrence of diseases by identifying and mitigating risk factors, whether through vaccination, screening tests, nutritional guidance, or lifestyle changes, among other examples[3,5]. Such strategies not only contribute to individual health but also result in significant impacts on population health, reducing disease incidence and alleviating pressure on health systems asthe SUS[4,5].

In the context of non-communicable chronic diseases (NCDs) such as diabetes, hypertension, cardiovascular diseases, and cancer, HPPA are crucial for the population, as these conditions often have roots in behavioral and environmental factors (e.g., poor diet, lack of physical activity, smoking, and excessive alcohol consumption).

Promoting healthy habits and preventing risky behaviors can thus be effective in reducing the incidence of these diseases, improving their management, and enhancing the population's quality of life. Investing in educational programs, awareness campaigns, and public policies that promote healthy lifestyles (HPPA) not only benefits individuals but also contributes to the long-term sustainability of health systems[6,7].

However, despite the relevance of HPPA within the SUS, to the best of our knowledge, there is no national investigation exploring this topic from a productivity perspective. This gap in the literature becomes even more pertinent when considering the COVID-19 pandemic. The epidemiological outbreak began in late 2019 in Wuhan, China, when a novel coronavirus, SARS-CoV-2, was identified as the causative agent of severe respiratory disease.

The disease rapidly spread globally and was declared a pandemic by the World Health Organization (WHO) in March 2020. Faced with the rapid spread of the virus and the exponential increase in cases, health authorities worldwide prioritized urgent and emergency sanitary measures to contain the virus's spread, such as lockdowns, social distancing, mask mandates, and large-scale vaccination campaigns[8,9].

Thus, the prioritization of emergency actions aimed to reduce the immediate impact of the COVID-19 pandemic and prevent the collapse of health systems like the SUS. However, this approach resulted in the postponement or interruption of elective actions, including HPPA. Routine exams, preventive consultations, and programs promoting healthy habits were delayed to prioritize resources and efforts in the direct fight against COVID-19. This decision, although understandable given the health crisis, highlighted the need to find a balance between the immediate response to the pandemic and the maintenance of HPPA, which are essential for the long-term health of the population[8,10]. However, there is also no national investigation examining the impact of the COVID-19 pandemic on productivity related to HPPA within the SUS to date.

Therefore, given the presented scenario, it is possible to question the development of HPPA in the SUS in recent years, particularly after the onset of the COVID-19 pandemic. Thus, the objective of this study was to evaluate health promotion and prevention actions conducted within the SUS between 2008 and 2022, exploring the temporal trend and the impact of the COVID-19 pandemic.

The alternative hypotheses were: (1) there was a significant increasing trend in HPPA in the SUS over the past 15 years, and (2) the COVID-19 pandemic significantly reduced the development of HPPA in the SUS.

METHODS

Study design

An ecological, longitudinal, retrospective, and quantitative epidemiological study was conducted, characterized as a continuous time series analysis[11]. The approach was

delineated to evaluate SUS-related data across the entire Brazilian territory (all macro-regions and the Federal District). The period was established from 2008 to 2022 (n = 15) because of the availability of data relevant to the objective. To address the impact of the COVID-19 pandemic, a pre-pandemic period was outlined as a control (April 2019 to March 2020). The COVID-19 pandemic period was outlined into the first year (April 2020 to March 2021), the second year (April 2021 to March 2022), and the third year (April 2022 to March 2023), similar to other investigations[12,13].

Data source

To evaluate HPPA, the selected data source was the Outpatient Information System (SIA/SUS), provided and managed by the Department of Informatics of the SUS (DATASUS; Ministry of Health - Brazil). The procedures categorized as HPPA were recorded in the SIA/SUS through outpatient productivity bulletins (BPAs) filled out by health services linked to the SUS[14], without restriction on the type of health service or the executing professional.

Variables

The primary variable of the study was the annual incidence of HPPA in the SUS from 2008 to 2022.

To correct for the influence of demographic transitions, the annual and monthly counts were normalized by the population projection in Brazil for each year, as estimated and provided by the Brazilian Institute of Geography and Statistics (IBGE), considering the incidence of HPPA *per* 100,000 residents[15]. As secondary variables, the study considered the macro-region, modality, complexity, and executing professionals of HPPA in the SUS.

Data acquisition

Data collection was based on similar procedures in the SIA/SUS as described in a previous approach.[16] Access to SIA/SUS was conducted via the TabNet tool provided by DATASUS. In this tool, the options "*Assistência à Saúde*" (Healthcare), "*Produção Ambulatorial*" (Outpatient productivity) and "*Por local de atendimento - a partir de 2008*" (By place of service - from 2008 onwards) were selected. The geographical scope was set to Brazil, and filters related to the group of procedures (HPPA) and the period were adjusted according to the study design. The content was adjusted for approved outpatient productivity.

Data analysis

In the statistical analysis of the data, the alpha (α) value was set to 0.05 for all operations, with any p-value below this threshold considered statistically significant. Analyses were conducted using the statistical packages JAMOVI (version 2.3.15, Sydney, Australia) and PAST (version 4.03, Oslo, Norway). The annual quantity of HPPA per 100,000 residents was described using the median (measure of central tendency) and interquartile range (IQR, measure of dispersion), as well as absolute (f) and relative (fr) frequencies. The data distribution was verified using the Q-Q plot. The incidences in the pre- and post-COVID-19 pandemic periods were

compared using a generalized[17,18] (APC) through Prais-Winsten regression analysis. Annual Percent Change The hypothesis of first-order serial autocorrelation was observed following the Durbin-Watson test (DW statistic = 0.403, p-value <0.001)[19]. Therefore, the temporal trend was estimated using the linear model employing negative binomial regression.

Ethical aspects

The study was conducted using SIA/SUS data that were fully available in open access, characterizing public domain information and thus exempting the need for ethical evaluation according to Resolution 510/2016 of the National Health Council - Ministry of Health of Brazil[20]. Therefore, no information used allows for the identification of users or professionals of the SUS related to the HPPA developed during the evaluated period.

RESULTS

In the past 15 years, between 2008 and 2022, 54,822,972,601 outpatient procedures were performed in the SUS, with 6,933,081,931 (12.6%) being HPPA. Table 1 presents the frequency in relation to macroregion, HPPA modality, complexity, and executing professionals. It was observed that the Southeast macroregion had the highest gross percentage, home visits were the most frequent modality, low complexity was the most common, and health/endemic agents were the main executors of HPPA in the SUS between 2008 and 2022. For the entire period, the incidence was 3,407,327 HPPA *per* 100,000 Brazilian residents.

Table 2 presents the descriptive analysis and the temporal trend of the annual incidence of HPPA in the SUS per 100,000 Brazilian residents. It was observed that there was a decreasing trend in HPPA over the last 15 years. In a secondary analysis, removing the interval between 2020 and 2022 due to the COVID-19 pandemic (n = 12, 2008-2019), the temporal trend remained significantly decreasing (p-value = 0.028). The lowest annual incidence was observed in the second year after the onset of the COVID-19 pandemic, while the highest was observed in the middle third of the time series. Ultimately, model adjustment indicated that 66.7% of the variance related to the annual incidence of HPPA was explained by temporal variation as a regressor. Figure 1 visually presents the variation in the annual incidence of HPPA in the SUS over the past 15 years in Brazil.
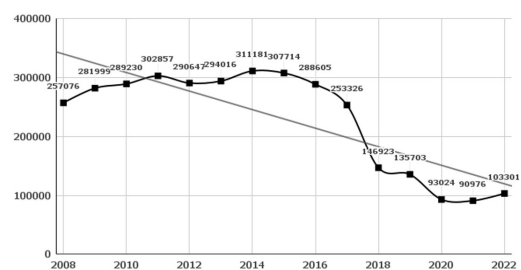

Figure 1 – Annual incidence of health promotion and prevention actions in the Unified Health System of Brazil per 100,000 residents between 2008 and 2022.

Table 1 – Characteristics of health promotion and prevention actions in the Unified Health System between 2008 and 2022 (2023).

Variable	n	%
Macro-region		
North	607,693,929	8.8
Northeast	2,045,627,400	29.5
Southeast	2,806,294,292	40.5
South	944,165,961	13.6
Central-West	529,241,827	7.6
Not reported	58,522	<0.1
Modality		
Health education	655,589,143	9.5
Oral health	1,317,497,391	19.0
Home visits	3,902,642,017	56.3
Food and nutrition	740,872,053	10.7
PICs	1,290,530	<0.1
Sanitary surveillance	313,537,892	4.5
Occupational surveillance	1,652,905	<0.1
Complexity		
Low	6,558,152,168	94.6
Medium	61,391,554	0.9
Not applicable	313,538,209	4.5
Occupation		
Physicians	76,761,898	1.1
Dental surgeons	1,183,186,735	17.1
Pharmacists	12,910,453	0.2
Nurses	324,456,449	4.7
Physiotherapists	29,427,723	0.4
Occupational therapists	3,103,853	<0.1
Nutricionistas	116,140,467	1.7
Speech therapists	5,459,723	0.1
Psychologists	17,052,200	0.2
Physical educators	28,753,544	0.4
Social workers	18,494,849	0.3
Health/Endemic agents	4,148,441,990	59.8
Oral health technicians and assistants	189,136,580	2.7
Nursing technicians and assistants	681,587,574	9.8
Others	98,167,893	1.4

PICs: integrative and complementary practices.

Table 3 presents the monthly incidence rate ratios of HPPA in the SUS between the pre-pandemic period and the subsequent years following the onset of the COVID-19 pandemic. The monthly incidence in all years after the onset of the COVID-19 pandemic was significantly

Table 2 – Descriptive analysis and temporal trend of the annual incidence of health promotion and prevention actions in the Unified Health System *per* 100,000 Brazilian residents, from 2008 to 2022 (2023).

Variable	Health promotion and prevention actions
Annual incidence (median)	281,999
IQR	158,313
Minimum (year)	90,976 (2021)
Minimum (year)	311,181 (2014)
β_1	-0.030 [-0.021, -0.056]
R^2	0.667
p-value	<0.001*
Trend	Decreasing
APC (%)	-6.7 [-4.7, -12.1]

β_1: angular coefficient. R^2: coefficient of determination. APC: Annual Percent Change. [ ]: 95% confidence interval. IQR: interquartile range. *: *p*-value <0.05 (statistically significant difference).

lower than that in the pre-pandemic period (control), with reductions estimated at -32% (95% CI = -26%, -38%) in the first year, -26% (95% CI = -19%, -32%) in the second year, and -21% (95% CI = -14%, -28%) in the third year. The monthly incidence in each period per 100,000 residents, considering the median and interquartile range, was respectively 11,351 (2,982), 7,425 (1,018), 7,927 (1,185), and 8,573 (779).

DISCUSSION

This study evaluated health promotion and prevention actions carried out in the SUS between 2008 and 2022, exploring temporal trends and the impact of the COVID-19 pandemic. The first alternative hypothesis was rejected, as there was a significant decreasing trend in HPPA in the SUS over the last 15 years, while the second hypothesis was accepted, as the COVID-19 pandemic significantly reduced the implementation of HPPA in the SUS.

It is noticeable that the distribution among the macroregions approximates the population density, with a higher concentration of residents in the Southeast and Northeast regions of Brazil[15]. On the other hand, concerning home visits as the most frequent modality, the execution of HPPA in the family setting and the assessment of environmental characteristics in which individuals are immersed are highlighted. Home visits represent a potential for HPPA in the SUS, enabling mid-level and higher-level professionals to develop such actions in a person-centered and family-centered manner, taking into account their social, cultural, and economic reality in that environment/territory[21,22].

However, the results indicate that mid-level professionals, health agents, and endemic agents were the most active in terms of productivity in HPPA in the SUS over the last 15 years. This outcome is in line with the inclusion of these professionals in Primary Care, according

Table 3 – Monthly incidence ratios of health promotion and prevention actions in the Unified Health System between the pre-pandemic period and the subsequent years following the onset of the COVID-19 pandemic (2023).

Periods	Incidence ratio	Limits		p-value
		Lower	Upper	
Reference		Pre-pandemic interval		
Intercept	8,558	8,296	8,830	<0.001*
First year	0.68	0.62	0.74	<0.001*
Second year	0.74	0.68	0.81	<0.001*
Third year	0.79	0.72	0.86	<0.001*

to the current National Primary Care Policy (PNAB) in Brazil, in which home visits are part of their duties and involve HPPA. Nonetheless despite their higher activity, there is evidence indicating low territorial coverage related to these professionals, which may result in reduced home visits and negatively impact the resolution of Primary Care[23,24]. Corroborating this perspective, the results indicate the predominance of low-complexity HPPA, corresponding to Primary Care.

In addition, the observed decreasing temporal trend over the last 15 years, even after removing the years related to the COVID-19 pandemic, is a negative outcome for the SUS. Firstly, it is important to consider the barriers faced in the management of healthcare services in recent years, especially budgetary constraints and the persistence of socioeconomic inequalities in different territories, which certainly negatively impact health actions as a whole, including HPPA[2,25]. From another perspective, it adds the viewpoint that SUS managers have regarding the development of HPPA in their healthcare services, considering the cost-benefit for illness in the territory, especially in those where socioeconomic inequalities significantly modify the health-disease process and act as a vulnerability factor[3,26].

Secondarily, it is important to acknowledge the impact of the COVID-19 pandemic on this outcome. Although a decreasing temporal trend has been observed over the last 15 years, the SARS-CoV-2 outbreak has negatively contributed to this outcome. The healthcare efforts implemented by Primary Care resulted in the prioritization of diagnostic and care actions for the disease, mobilizing healthcare professionals from their original duties[27,28]. Considering that HPPA often develop in services or in the field (in loco), such as home visits[21,22], this outcome was expected.

Nevertheless, such impact persisted even after the end of the COVID-19 pandemic, following mass immunization of the population, as the third year evaluated was lower than the pre-pandemic period in terms of monthly incidence. Thus, it is noteworthy that the repercussions of the pandemic context experienced will still reverberate in the SUS in the coming years. The evidence points to new challenges related to management, human resources, and healthcare flows in the post-COVID-19 pandemic era. Therefore, this outcome may corroborate with this perspective by indicating that HPPA did not return to their immediate pre-pandemic parameter[29,30]. However, it is valid to consider that the decreasing trend in incidence was already observed in the pre-pandemic period, which should also be taken into account to understand this delayed impact without dissociating it from the overall context of HPPA in the SUS.

CONCLUSION

The analysis of available data on HPPA in the SUS led to the conclusion that there was a significant reduction over the past 15 years, as well as an immediate and delayed impact of the COVID-19 pandemic, considering the period between the first and third years after its onset.

Therefore, it is reasonable to develop new investigations to understand the changes in healthcare flows and the planning of actions in SUS healthcare services, identifying factors that modified the incidence of HPPA. Additionally, it is important to investigate the impact of such reduction on population health indicators, especially those related to preventable diseases or the exacerbation of existing ones.

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