PAN AMERICAN JOURNAL OF PUBLIC HEALTH 100 YEARS

Original research

Bolsa Família Program and deaths from oral cancer in Brazil: an ecological study

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Suggested citation Costa EM, Rocha NCS, Rocha TAH, Lima HLO, Vissoci JRN, Queiroz RCS, et al. Bolsa Família Program and deaths from oral cancer in Brazil: an ecological study. Rev Panam Salud Publica. 2022;46:e208. https://doi.org/10.26633/RPSP.2022.208

ABSTRACT

Objective. To assess the effect of coverage of the Bolsa Família Program (BFP) on oral cancer mortality rates in Brazil between 2005 and 2017, adjusting for health care coverage and socioeconomic characteristics of the Brazilian federative units.

Methods. This is an ecological study using annual data (2005–2017) from all the Brazilian federative units. The dependent variable for this study was the oral cancer mortality rate, standardized by gender and age using the direct standardization technique. BFP coverage was the main independent variable, calculated as the ratio of the number of BFP beneficiaries to those families that should potentially be entitled to this conditional cash transfer. Socioeconomic background and health care coverage were covariables. Choropleth maps were drawn, and space-time cube analysis was used to assess changes in the spatiotemporal distribution of BFP and oral cancer mortality rates. Mixed-effects linear regression analysis estimated the coefficients (β) and 95% confidence intervals (CI) for the association between BFP coverage and oral cancer mortality rates.

Results. BFP coverage trends increased and oral cancer mortality rate trends stabilized in Brazilian federative units, except for Maranhão, Goiás, and Minas Gerais, where the oral cancer mortality rates have increased. In the adjusted model, greater BFP coverage was associated with lower oral cancer mortality rates (β –2.10; 95% CI [–3.291, –0.919]).

Conclusions. Egalitarian strategies such as BFP can reduce the oral cancer mortality rate. We recommend the follow-up of families benefiting from conditional cash transfer program by oral health teams to reduce the oral cancer mortality rate.

Keywords Public assistance; social support; epidemiology; mortality; mouth neoplasms; Brazil.

Worldwide, an estimated 19.3 million new cancer cases and almost 10.0 million cancer deaths occurred in 2020. Of this total, 377 713 (2.0%) new cases and 177 757 (1.8%) deaths were from oral cancer (OC) (1). In the same year, Brazil had 9 839 (1.7%) new cases and 4 198 (1.6%) deaths due to OC (2). Oral cancer mortality rates (OCMR) in Brazil have shown a tendency to remain stable and have been influenced by the supply of, and access to, health care, due to the diagnosis of cancer at an advanced stage (3) and late treatment (4). Advanced clinical staging negatively affects the quality of life and survival of patients (3).

The National Policy on Oncologic Care establishes that, after diagnosis of cancer, treatment should be initiated within 60 days at the latest (5), and biopsy at the Center for Dental

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Specialties (acronym in Portuguese, CEO – Centros de Especialidades Odontológicas) is imperative (6). The high number of new cases and deaths from oral cancer has been maintained over the years, and one of the explanations for this may be related to the population's access to health services at the primary, secondary, and tertiary levels (7).

Poorer socioeconomic backgrounds have been associated with OCMR (8–10). On the other hand, income inequality has been not associated with oral cancer deaths by some authors (11) but has been positively associated in other studies (9, 10). The different approaches to the classification and analysis of these factors may result in discrepant results (8). Conditional cash transfer programs are an important strategy to reduce income inequities, as they may improve access to health care and health outcomes. However, to the best of our knowledge, there are no studies evaluating the association of the Brazilian conditional cash transfer program, the Bolsa Família Program (BFP), and OC deaths.

BFP is targeted at socioeconomically underprivileged families to help them lift themselves out of poverty and extreme poverty. The amount paid depends on household composition and monthly income per capita. In addition, payment is conditional on the families' compliance with some prerequisites (vaccination, prenatal care visits, school performance, etc.) and of the public authorities regarding the expansion of access of families to their basic social rights such as health, education, and social security (12). BFP has taken on an important role in the promotion of oral health (OH) among children (13, 14) and reduction of childhood mortality (15), suicide (16), and hospitalizations due to primary health care-sensitive conditions (17).

In 2021, BFP was replaced by the Auxílio Brasil Program (ABP). The monitoring of health actions related to the conditionalities of the ABP were only institutionally established from the Interministerial Ordinance No. 19/2022. The difference of the ABP in relation to the BFP is in the monitoring of conditionalities of this program, as it is linked to users assisted by the Primary Health Care (PHC), a strategy currently financed by Previne Brasil, which provides for transfers and the form of funding, not by the population enrolled in the territory but by users already registered in the Brazilian public health system (acronym in Portuguese, SUS – Sistema Único de Saúde). The period of receipt of the benefit in the current format is clear. The probability of a family benefiting from the ABP being monitored and having its health conditionalities fully implemented may decrease considerably, as other public policies that should dialogue with this program are being gradually defunded.

In this perspective, our hypothesis is that BFP managed to reduce OCMR over time, as it redresses socioeconomic inequalities and expands access to health care. The aim of this study is to assess the effect of BFP coverage on OCMR in Brazil between 2005 and 2017, adjusting for health care coverage and socioeconomic characteristics of the Brazilian federative units.

MATERIALS AND METHODS

Study design and ethical aspects

This is an ecological study based on annual secondary data obtained from Brazilian public domain databases from 2005 to 2017. Due to the use of public domain databases, review of this study by research ethics committee was not necessary, according to Resolution No. 510/2016 of the National Board of Health. The 27 Brazilian federative units were used as analytical units. We followed the STROBE statement.

Variables and databases

Outcome. Sex- and age-standardized OCMR was the dependent variable. Data on all the 67 008 OC deaths in Brazil were collected and classified according to the International Classification of Diseases (ICD-10), using codes C-00 through C-10 for years 2005 to 2017. The number of OC deaths was collected from data available in the Mortality Information System (acronym in Portuguese, SIM – Sistema de Informação de Mortalidade). Direct standardization was employed (18), which considers and removes the effects of related factors distribution of risk of death from oral and oropharyngeal cancer in the population. Sex and age data were obtained from the Brazilian Institute of Geography and Statistics (acronym in Portuguese, IBGE – Instituto Brasileiro de Geografia e Estatística), using 2003 and 2010 censuses. In those years in which censuses were not performed, intercensal estimates were used. For this study, we calculated the OCMR per 100 000 inhabitants.

Main exposition. Data on BFP and Cadastro Único (Single Registry) are available via a set of computer-based tools, built in partnership with the Information Assessment and Management Office (Sagi) (19). The BFP coverage was obtained from the ratio of BFP beneficiaries to those families that could be entitled to this cash transfer, with data aggregated by state and the Federal District. The monthly transfers consist of either a fixed or a variable amount ranging from R$ 77.00 to R$ 435.00. The amount to be transferred depended on the monthly per capita family income—up to R$ 70.00 (extreme poverty), or R$ 70.01 to R$ 140.00 (poverty)—as well as the household composition, with more resources going to families with pregnant women, nursing mothers, and containing children or adolescents (12).

Other variables. Other variables used were regarded as confounding factors. Socioeconomic variables were obtained from the IBGE and from the Brazilian National Household Survey (acronym in Portuguese, PNAD – Pesquisa Nacional por Amostra de Domicílios). Health coverage variables were extracted from the Primary Health Care Information System (acronym in Portuguese, SISAB – Sistema de Informação de Saúde da Atenção Básica), from the National Registry of Health Facilities (acronym in Portuguese, CNES – Cadastro Nacional de Estabelecimentos de Saúde), and from the Hospital Information System (acronym in Portuguese, SIH – Sistema de Informação Hospitalar).

IBGE manages sociodemographic data in Brazil and conducts PNAD on a regular, yearly basis. As of 2012, this household survey was called Continuous PNAD, collecting information on demographic and socioeconomic characteristics. These databases provide the Gini coefficient, the per capita gross domestic product (GDP), and the level of education. The Gini coefficient ranges from 0 to 1, where 0 represents perfect equality and 1 represents perfect inequality. Per capita GDP refers to the average aggregate value per person, denoted in national currency and at market prices, of final goods and services produced in a given geographic region in a given year. The level of education was self-reported and organized as a percentage of individuals with

12 years or more of schooling. These variables were obtained from the IBGE website (https://www.ibge.gov.br/).

The variables related to primary health care included in this study were: coverage of Family Health Strategy (FHS) teams, coverage of oral health teams in FHS, and coverage of Community Health Agents Strategy (CHAS). These data were obtained from the SUS management support website (https://sisab.saude.gov.br/).

CEO are health facilities registered in CNES. The number of CEO in operation in each federative unit over the years was collected from the dates on which administrative acts on registration, discontinuation, and dissolution of health facilities were published on the official Ministry of Health website. This criterion was used because of the lack of information on the number of CEO in public domain databases. Secondary health care coverage was calculated based on the ratio of the number of CEO to the resident population in each year.

The number of cancer beds available in SUS was collected from SIH data. SIH records all SUS-funded hospital services provided during hospitalizations. The ratio of cancer beds available in SUS to the resident population was the tertiary health care coverage variable. Owing to the low coverage observed for CEO and beds available in SUS, the value was multiplied by 1 000 000.

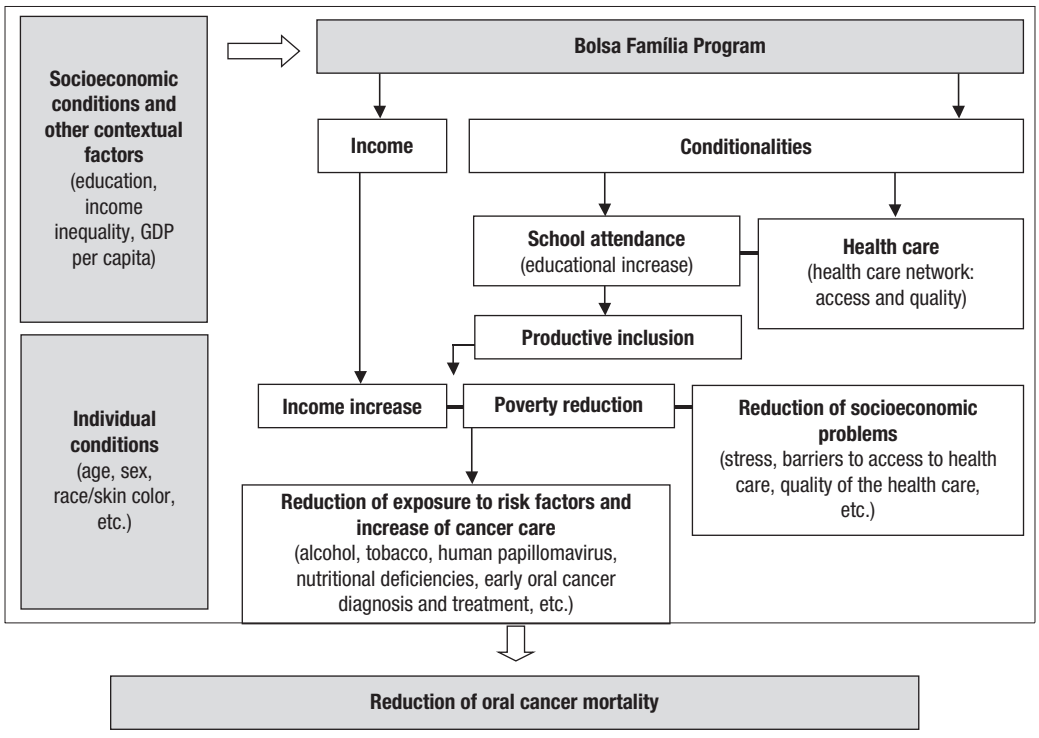
Theoretical model

The proposed theoretical model was constructed to analyze the association between BFP coverage and OCMR, adapted from Rasella et al. (20). A conditional cash transfer could affect oral cancer mortality through a variety of mechanisms. The long-term effects of the BFP can contribute to completing the intergenerational cycle of poverty by reducing school dropout rates and increasing the probability of entering the labor market. Besides, given its conditionalities, BFP has improved health care utilization, especially in PHC (21). There is also evidence about the effects of the conditional cash transfer on OH indicators; for example, reducing alcohol and tobacco consumption (22), improving child nutrition (23), reducing maternal (20) and infant (24) mortality, and increasing the likelihood of early cancer diagnosis in women (25, 26). Finally, the increased demand for health services could, in the long term, trigger improvements in the provision of services at points in the oral health care network, such as family health units, CEO, and hospitals (Figure 1).

Statistical analysis

Choropleth maps were produced to understand the distribution of OCMR and coverage of BFP in the federative units. Space-time cube analysis was used to check the spatiotemporal trends for both BFP and oral cancer. The space-time cube analysis of the rates was employed to assess the spatiotemporal distribution of OCM, considering Brazilian federative units as the unit of analysis and a time interval of one year. Then, an analysis of the emerging hotspots was conducted, which identifies the *p*-value for each location in the cube, categorizing the

FIGURE 1. Theoretical model on the mechanisms linking the Bolsa Família Program to the reduction of the oral cancer mortality rate



Source: Prepared by the authors based on Rasella D, Alves FJO, Rebouças P, de Jesus GS, Barreto ML, Campello T, et al. Long-term impact of a conditional cash transfer programme on maternal mortality: a nationwide analysis of Brazilian longitudinal data. BMC Med. 2021;19(1):127.

federative units into: hotspots, with a tendency to grow over the period studied; cold spots, with a tendency to decrease; or no pattern detected. Boxes were generated for the time units, considering the 99%, 95%, and 90% confidence intervals (27). The analyses were conducted in Arcgis Pro version 10.2 (Esri, Redlands, CA). The cartographic base of Brazil with borders for the federative units is publicly available online as a shapefile (PCH) on the IBGE website.

Some preliminary steps were performed for the analysis of the association between BFP and OCMR: Construction of the theoretical model; Evaluation of the normality of the distribution of OCMR and residues; OCMR natural logarithm transformation; Choice of the regression model, through the lowest values of the Akaike information criterion (AIC) and Bayesian information criterion (BIC) (parsimony criterion); and Evaluation of the variance inflation factor (VIF) between the model's adjustment variables.

The natural logarithm of OCMR was the strategy used to reduce these problems during the statistical analysis. In addition, this transformation can be used when a variable has non-negative values, being able to extend the values of the variable to the real line. Logarithmic transformation has been used and is popular in regression analysis and econometrics.

Nonlinear panel data models were tested, as the outcome originates from count data, but the fixed-effects linear regression model revealed smaller AIC and BIC estimates (560.806 and 601.309, respectively). As this was a serial study, in which variables were collected at different time points, mixed-effects linear regression analysis was adopted with a random intercept model to assess the association between BFP and OCMR. In this analysis the coefficient is fixed, but it allows including the random intercept effect (28). This model is more flexible and allows analyzing longitudinal data collected at different time points, including dependence, variance, and covariance matrix (28). Mixed-effects coefficients (β) and 95% confidence intervals (95% CI) were estimated.

Multicollinearity between the confounding variables was tested by the VIF. Illiteracy rate and income per capita were removed from the model because the VIF was higher than 5. Unadjusted and adjusted models for the association between BFP and OCMR were built. Variables with a *p*-value less than 0.10 remained in the final model as potential confounders. The analyses were performed using Stata version 14.0 (StataCorp, College Station, TX).

RESULTS

The BFP coverage was expanded over time. In 2005, Roraima and Rio Grande do Norte had a BFP coverage between 75% and 90%, while Amapá and Mato Grosso do Sul had ≤15%. In 2017, Maranhão, Piauí, Amazonas, Pará, Minas Gerais, Ceará, Alagoas, Sergipe, Pernambuco, Paraíba, Tocantins, Minas Gerais, Santa Catarina, and Paraná had a BFP coverage between 75% and 90%, while Amapá had 45% to 60% (Figure 2).

In 2005, OCMR showed a quite uneven distribution across Brazilian federative units, but the rates were higher in the South and Southeast and lower in the North. Between 2009 and 2012, the mortality rates were more evenly distributed and lower. In 2017, the states of Rio Grande do Sul, São Paulo, and Espírito Santo had the highest rates when compared to the other federative units (Figure 3).

A statistically significant tendency ($p < 0.05$) toward an increase in BFP coverage was observed across Brazilian federative units, except for Rio Grande do Norte and Roraima. Despite the increase in OCMR over the years, the uptrend was statistically significant only in Minas Gerais (99% CI), Goiás (95% CI), and Maranhão (95% CI) (Figure 4).

The analysis of the covariables between 2005 and 2017 showed that socioeconomic indicators improved and SUS health care coverage increased. The Gini coefficient decreased in all federative units, indicating a reduction in inequalities. The per capita GDP ranged from R$ 7 678.74 (Piauí) to R$ 40 201.42 (Distrito Federal). The largest increase in the rate of individuals with ≥12 years of schooling occurred in Distrito Federal (15.45%) and the lowest in Pará (4.1%). The expansion of FHS coverage ranged from 17.64% (Distrito Federal) to 73.79% in Maranhão, and of the FHS OH teams ranged from 4.76% (Distrito Federal) to 55.22% (Paraíba). CHAS coverage decreased in Amapá (–38.51%), Amazonas (–25.43%), Rio Grande do Norte (–1%), and Distrito Federal (–0.28%), but increased in the other federative units. The increase in the number of CEO per inhabitants ranged from 1.31% (Distrito Federal) to 20.55% (Paraíba). Finally, the number of cancer beds in SUS per 1 000 000 inhabitants decreased in Distrito Federal (–4.8%), Rio de Janeiro (–3.51%), Amapá (–3.22%), Piauí (–0.84%), Goiás (–0.18%), and Ceará (–0.05%), but it increased in the other federative units (Table 1).

After adjusting for Gini coefficient, per capita GDP, and schooling of more than 12 years, the larger BFP coverage was statistically associated with the lower OCMR after the transformation of the natural logarithm (β –2.10; 95% CI [–3.291, –0.919]) (Table 2).

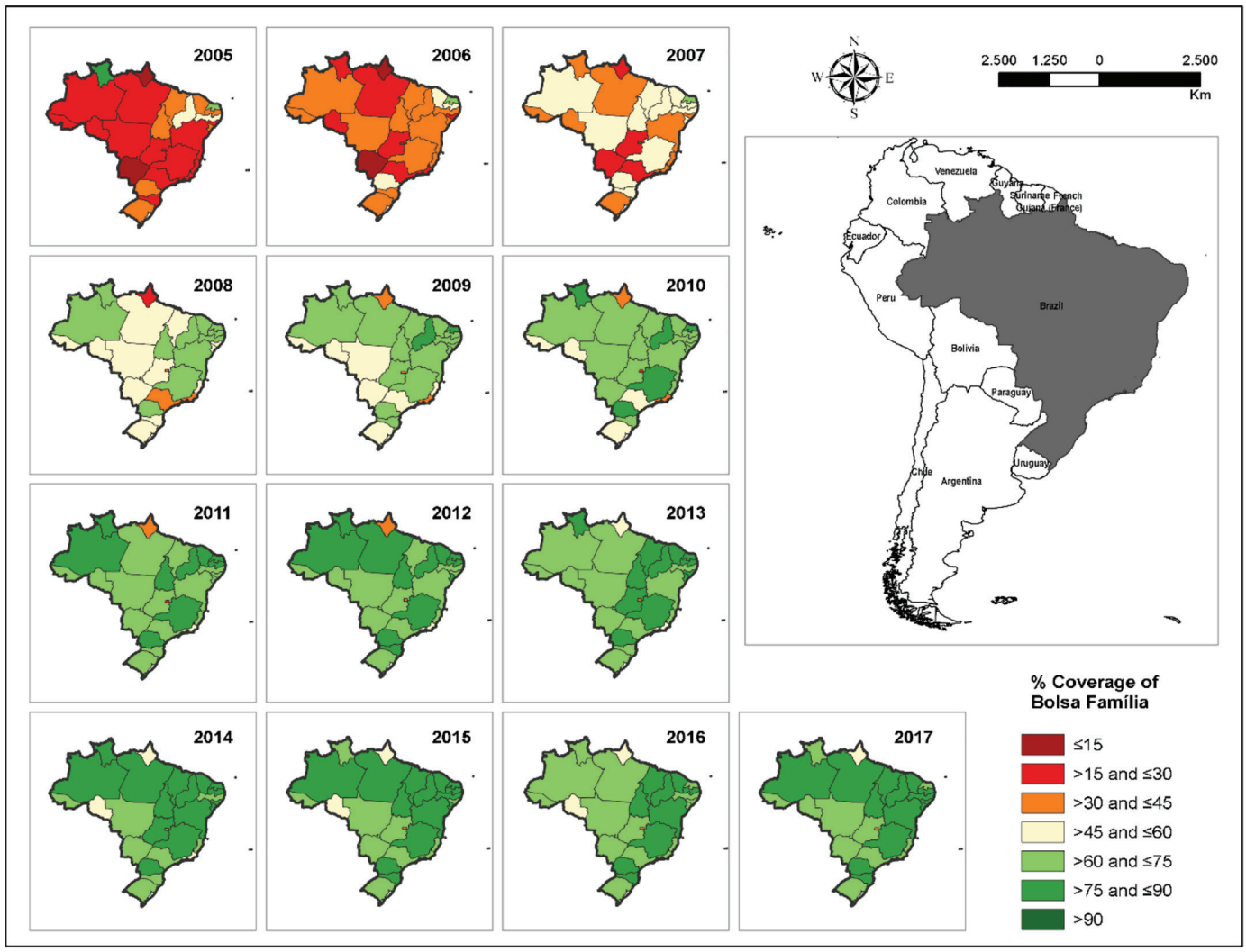
DISCUSSION

BFP coverage and OCMR increased in Brazilian federative units from 2005 to 2017. The larger BFP coverage was associated with the lower OCMR after natural logarithm transformation of this outcome and adjusting for confounding variables in the regression model.

Our finding is consistent with that of a previous study, in which women who were BFP beneficiaries had easier access to guidance and exams for the detection of cervical cancer at primary health care units (26). Larger BFP coverage seems to increase the access to early diagnosis of oral cancer and health care, given the essential conditions that have to be fulfilled for BFP cash transfer. This result shows that high and sustained coverage of conditional cash transfers can have long-term effects on OCMR in vulnerable populations, potentially contributing to the reduction of health inequalities, similar to what has already been demonstrated for maternal (20) and infant mortality (24), among other long-term beneficial effects of BFP (13, 21, 29).

Weak social cohesion brought about by income inequalities leads to low social capital and poor political participation, as there is smaller investment in human capital and in social support networks deemed essential for the health promotion and protection at the individual and collective levels (30). The association between BFP coverage and the reduction in OCMR is possibly due to the larger acquisition of worldly goods, improvements in food safety, and broader access to education and to health care, including early diagnosis and treatment of the disease.

FIGURE 2. Spatiotemporal distribution of the coverage of the Bolsa Família Program, by federative unit, Brazil, 2005–2017



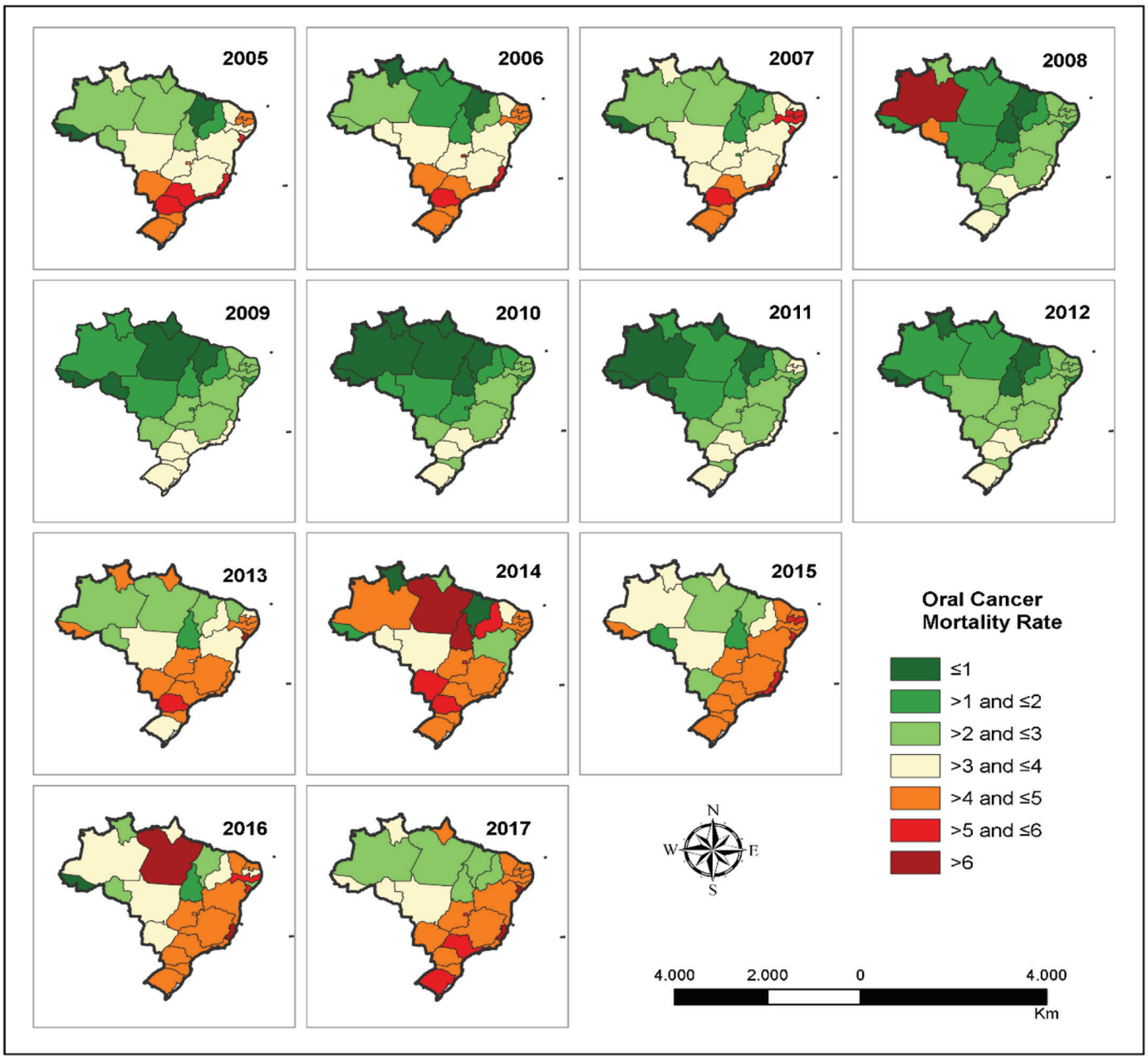
Source: Prepared by the authors based on data available in Sagi (2005–2017).

This cash transfer strategy could have a compensatory effect that favors equity, improving other socioeconomic indicators traditionally associated with OCMR. The findings of our research are consistent with those of other studies in which better education (31), a higher human development index (32), and higher income per capita (8) have already been associated with lower OCMR. Socially underprivileged groups may be more vulnerable to behavioral risk factors such as alcohol consumption and smoking (22), and nutritional deficiencies (23), and they may also have poor access to health care (13, 21). For such reasons, it should be paramount that BFP is preserved. The context under which the ABP was implemented does not favor the long-term reduction of OCMR, since new teams from the Family Health Support Nucleus (acronym in Portuguese, NASF – Núcleo de Apoio à Saúde da Família), until then responsible for matrix support, have not been accredited, and many OH teams were disconnected after Conditional Amendment No. 95/2016, and activities related to OH promotion and prevention of adverse oral conditions showed a decrease due to the COVID-19 pandemic.

Some secondary results of the study are also discussed. The maps show an uptrend for oral cancer mortality in three Brazilian federative units: Minas Gerais, Goiás, and Maranhão. Differences in mortality rate trends may be related to underreporting of the disease and limited use of secondary data (33). This finding corroborates the results of another study, in which oral cancer mortality remained stable in Brazil and increased in the Northeastern region (33). Even after the implementation of the National Policy on Oncologic Care and consolidation of the National Policy on Oral Health, OCMR trends remain stable, probably as a result of difficult access to OH care and diagnosis and beginning treatment at an advanced stage (7). The stable trend in OCMR in these states may be related to the improvement in disease reporting over time (34).

BFP coverage tended to increase in Brazil as a whole, except for Roraima and Rio Grande do Norte. This finding indicates the reduction in health inequalities, as cash transfers are conditional on compliance with certain actions on education, health, nutrition, and social services. Even though this issue is not

FIGURE 3. Spatiotemporal distribution of the oral cancer mortality rate, by federative unit, Brazil, 2005–2017



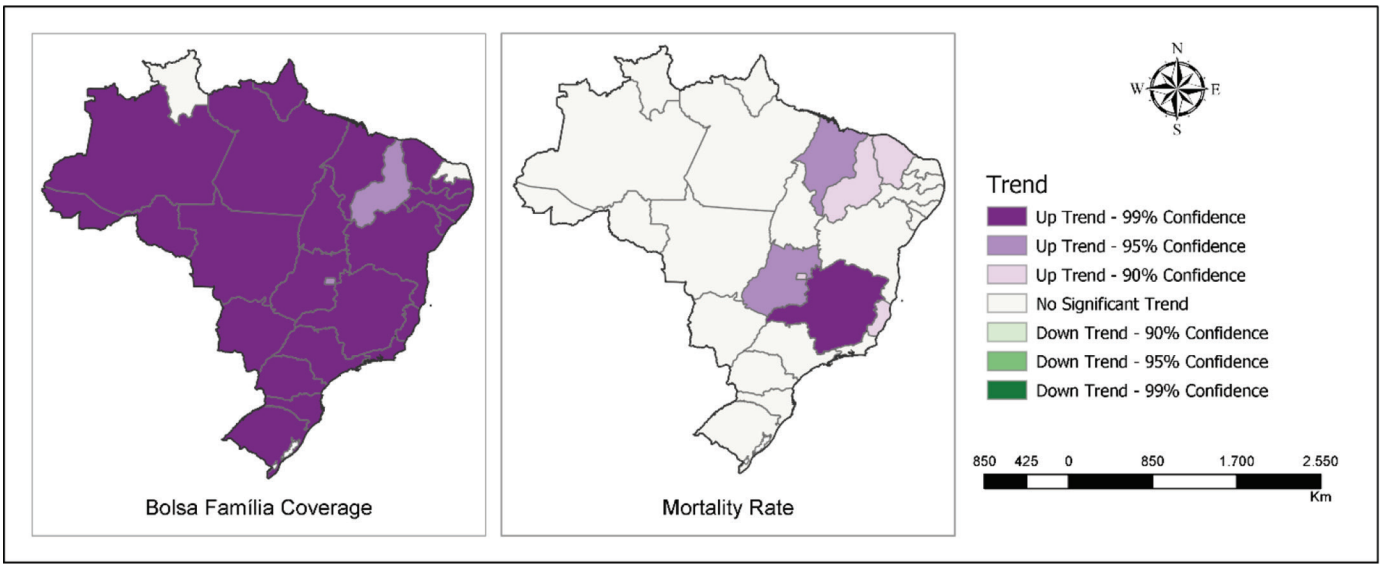
Source: Prepared by the authors based on data available in the Mortality Information System (2005–2017).

discussed in dentistry, a study indicates that inclusion of OH care in SUS as an essential condition for BFP eligibility could be important for the prevention of adverse oral outcomes (14). Authors have also drawn attention to the need to increase the supply of OH services to this share of the population, given their social vulnerability (13, 35).

There are some limitations such as possible underreporting of OC deaths. However, there is evidence on the suitability of the SIM, which has been improving over time, representing a useful and valid monitoring system in Brazil (34). The data obtained from Brazilian federative units do not take into account the impact of social inequality on the intrastate and local levels or lower aggregation levels. However, there is a relatively small number of deaths from OC, and therefore aggregation at a higher level (e.g., federative unit) is recommended. Also, we have not found studies in which OCMR trends were assessed by federative unit, not even in the most recent studies carried out in this century. The better understanding of such trend contributes to the implementation of promotion and prevention strategies specifically targeted at the outcome.

The discontinuity of some indicators used in the analyses hinders comparisons in a longer period. Moreover, longitudinal data, in which measures are repeated, generate dependence between the annual observations and correlated errors. These

FIGURE 4. Trends of Bolsa Família Program coverage and oral cancer mortality rate, by federative unit, Brazil, 2005–2017



Source: Prepared by the authors based on data available in Sagi and the Mortality Information System (2005–2017).

TABLE 1. Differences on the socioeconomic and health coverage variables (in SUS), by federative units, Brazil, 2005–2017[a]

Federative unit	Gini coeff.	GDP per capita (R$)	≥12 years of schooling[b]	FHS (%)	OHT in FHS (%)	CHAS (%)	CEO[c]	Cancer beds in SUS[d]
Rondônia	–0.12	13 681.23	8.05	42.52	18.27	1.46	4.32	24.16
Acre	–0.09	10 869.49	9.90	36.19	33.50	16.88	2.41	19.21
Manaus	–0.17	15 918.30	11.45	45.41	29.39	–25.43	3.19	1.25
Roraima	–0.08	13 019.01	11.75	52.50	25.72	17.32	3.82	2.50
Pará	–0.14	12 099.75	4.10	43.23	29.26	10.02	3.86	6.86
Amapá	–0.09	12 422.78	11.15	60.45	22.32	–38.51	2.01	–3.22
Tocantins	–0.13	12 913.15	9.95	59.70	47.74	6.76	3.73	10.67
Maranhão	–0.04	7 841.25	5.60	73.79	50.63	14.51	4.11	2.24
Piauí	–0.11	7 678.74	7.25	48.17	46.23	20.65	8.64	–0.84
Ceará	–0.15	9 350.98	5.75	40.28	38.80	11.17	8.53	–0.05
Rio Grande do Norte	–0.12	11 963.56	5.65	56.77	41.36	–1.00	7.98	23.61
Paraíba	–0.11	9 123.02	6.25	62.45	55.22	23.63	20.55	1.35
Pernambuco	–0.16	11 877.64	7.75	38.50	46.52	11.11	6.36	10.48
Alagoas	–0.18	8 524.27	5.25	18.76	32.24	5.92	7.11	10.85
Sergipe	–0.11	12 363.45	5.40	37.29	39.28	17.52	5.24	1.94
Bahia	–0.11	10 018.27	7.80	62.49	45.41	11.31	4.79	8.10
Minas Gerais	–0.12	18 022.74	8.70	53.27	34.69	36.93	4.49	3.04
Espírito Santo	–0.11	22 978.71	9.45	38.69	17.63	14.86	2.73	13.16
Rio de Janeiro	–0.08	28 551.06	9.50	45.67	24.67	41.70	3.35	–3.51
São Paulo	–0.10	27 668.47	9.95	30.27	13.65	26.06	4.03	4.63
Paraná	–0.12	23 036.26	9.75	41.23	25.61	19.02	4.26	14.29
Santa Catarina	–0.14	24 203.51	11.05	54.33	27.56	28.03	6.47	7.30
Rio Grande do Sul	–0.11	21 626.62	7.90	47.96	25.11	28.44	2.53	4.53
Mato Grosso	–0.14	21 266.84	9.40	52.70	33.56	27.81	5.89	8.39
Mato Grosso do Sul	–0.10	22 069.88	9.85	42.97	50.05	27.58	4.48	0.07
Goiás	–0.13	18 224.06	10.35	36.76	19.14	12.50	4.66	–0.18
Distrito Federal	–0.05	40 201.42	15.45	17.64	4.76	–0.28	1.31	–4.80
BRAZIL	–0.11	16 970.78	8.76	45.76	32.10	14.03	5.17	6.09

Notes: SUS, Brazilian public health system; GDP, gross domestic product; FHS, Family Health Strategy; OHT, oral health teams; CHAS, Community Health Agents Strategy; CEO, dental specialties centers.
[a] Positive values show an increase between 2005 and 2017, whereas negative values show a decrease.
[b] Rate of the population with 12 or more years of schooling.
[c] Number of CEO per 1 000 000 inhabitants.
[d] Number of cancer beds available in SUS per 1 000 000 inhabitants.
Source: Prepared by the authors using data available from the information systems (2005–2017).

TABLE 2. Unadjusted and adjusted analyses of Bolsa Família Program coverage and oral cancer mortality rate in Brazil, 2005–2017

	Oral cancer mortality rate									
	Unadjusted analysis					Adjusted analysis[a]				
	Fixed effect			Random effect		Fixed effect			Random effect	
	β	95%CI	*P*	β	Residual	β	95%CI	*P*	β	Residual
BFP coverage	–0.004	–0.008 to 0.016	0.531	0.778	1.848	–2.10	–3.291 to –0.919	<0.001	1.067	0.916

Notes: BFP, Bolsa Família Program; β, regressor; 95% CI, 95% confidence interval; *P*, *p*-value, based on linear regression of mixed effects.
[a] Adjusted for the Gini coefficient, GDP per capita, percentage of individuals with 12 years or more of schooling, Family Health Strategy, oral health teams, Community Health Agents Strategy, number of dental specialties centers (CEO) per 1 000 000 inhabitants, and number of cancer beds available in the Brazilian public health system (SUS) per 1 000 000 inhabitants.
Source: Prepared by the authors using data available from the information systems (2005–2017).

assumptions require modeling the data covariance matrix, which could not be obtained with conventional regression analyses. Mixed-effects linear regression was used to minimize the standard error estimates of the coefficients and it is more appropriate for data included at different time points. This technique allows relaxing of some assumptions of conventional linear regression, such as independence and normality of residuals (28). Nevertheless, we decided to use the log transformation of the outcome, generating residuals with normal distribution and, in both analyses—with and without log transformation—associations between BFP and OCMR were similar.

We identified as a limitation of this study the non-inclusion of variables such as alcohol and cigarette use, obesity, and physical activity. However, these risk factors associated with noncommunicable chronic conditions such as cancer are available on Vigitel only for the capitals of Brazilian states, and the greatest detailing of health-related issues in household surveys occurred from 2013 onwards with the National Health Survey (PNS). It is important to remember that the unit of analysis of this article is the federative unit and that the period from 2005 to 2017 was included to study the association between BFP and mortality from oral cancer, therefore differences in the unit of analysis and differences in temporality between our article and the beginning of the PNS did not allow the inclusion of these variables. There are limitations, but the concomitant inclusion of socioeconomic, PHC-related variables, CEO coverage, and coverage of cancer beds available in SUS can be considered a strength of this article.

Possible limitations concerning the criteria for the selection of BFP beneficiaries, in addition to errors while filling in registration forms, lack of information on family earnings and/or frequent changes in the earnings of some families, may generate biases regarding BFP coverage estimation (19). However, we used the official national validated databases. Although death registrations significantly improved in Brazil, enhancing the validity of mortality rate estimates, inferences at the individual level should be made with caution due to ecological fallacy.

Some strengths of the study include the use of population data from several years and both age and sex standardization of OCMR, allowing us to compare data at different time points and among different locations. The association estimates were adjusted for contextual socioeconomic variables in a mixed-effects linear regression analysis, thus dealing with the confounding bias. Previous studies have addressed only some specific federative units, assessing a smaller number of cases and years. Other studies have investigated the association between BFP and some other OH indicators (13, 14), but none of them has assessed the OCMR outcome.

The BFP coverage increased and the mortality trends for OCMR showed a stable behavior during the study period, in most of the federative units. Larger BFP coverage was associated with lower OCMR. Egalitarian strategies such as BFP can reduce the inequitable distribution of OCMR. We recommend the follow-up by OH teams of families benefiting from the Auxílio Brasil Program to promote health and prevent unfavorable OH outcomes such as OC. Reducing socioeconomic inequalities, through conditional cash transfer programs, is fundamental for the development and monitoring of comprehensive strategies to prevent deaths from OC in Brazil and in low- and middle-income countries.

Author contributions. EMC and EBAFT contributed to the conception of the study, data collection and analysis, and article writing process. NCS contributed to data analysis. TAHR, HLOL, JRNV, and RCSQ contributed to the study design. All authors reviewed and approved the final version.

Acknowledgments. We thank the Ministry of Health and the Graduate Program in Public Health at the Federal University of Maranhão.

Conflict of interest. None declared.

Funding. This work was supported by the Brazilian Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior–CAPES: finance code 001); the National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico–CNPq: research productivity grant – processes 306592/2018-5 and 308917/2021-9); and the Foundation for Support to Research and Scientific and Technological Development of Maranhão (Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão–FAPEMA).

Disclaimer. Authors hold sole responsibility for the views expressed in the manuscript, which may not necessarily reflect the opinion or policy of the *RPSP/PAJPH* and/or those of the Pan American Health Organization (PAHO).

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Manuscript submitted on 3 May 2022. Revised version accepted for publication on 25 August 2022.

Programa Bolsa Família y muertes por cáncer de la cavidad bucal en Brasil: estudio ecológico

RESUMEN

Objetivo. Evaluar el efecto de la cobertura del Programa Bolsa Família (BFP) en las tasas de mortalidad por cáncer de la cavidad bucal en Brasil entre el 2005 y el 2017, ajustadas por cobertura de atención de salud y características socioeconómicas de las unidades federativas brasileñas.

Métodos. Este es un estudio ecológico con datos anuales (2005-2017) de todas las unidades federativas brasileñas. La variable dependiente de este estudio fue la tasa de mortalidad por cáncer de la cavidad bucal, estandarizada por sexo y edad mediante la técnica de estandarización directa. La cobertura del BFP fue la principal variable independiente, calculada como la relación entre el número de beneficiarios del BFP y las familias que podrían tener el derecho a recibir esta transferencia monetaria condicionada. Los antecedentes socioeconómicos y la cobertura de atención de salud fueron covariables. Se trazaron mapas coropléticos y se realizó un análisis con cubos espaciotemporales para evaluar los cambios en la distribución espaciotemporal del BFP y las tasas de mortalidad por cáncer de la cavidad bucal. El análisis de regresión lineal de efectos mixtos calculó los coeficientes (β) y los intervalos de confianza (IC) del 95% para la relación entre la cobertura del BFP y las tasas de mortalidad por cáncer de la cavidad bucal.

Resultados. Las tendencias de cobertura del BFP aumentaron y las tendencias de la tasa de mortalidad por cáncer de la cavidad bucal se estabilizaron en las unidades federativas brasileñas, excepto en Maranhão, Goiás y Minas Gerais, donde estas tasas aumentaron. En el modelo ajustado, una mayor cobertura del BFP se asoció con tasas más bajas de mortalidad por cáncer de la cavidad bucal (β –2,10; IC del 95% [–3,291, –0,919]).

Conclusiones. Las estrategias igualitarias como el BFP pueden reducir la tasa de mortalidad por cáncer de la cavidad bucal. Recomendamos el seguimiento por parte de los equipos de salud bucodental de las familias que se benefician del programa de transferencias monetarias condicionadas para reducir la tasa de mortalidad por cáncer de la cavidad bucal.

Palabras clave Asistencia pública; apoyo social; epidemiología; mortalidad; neoplasias de la boca; Brasil.

Programa Bolsa Família e mortes por câncer bucal no Brasil: um estudo ecológico

RESUMO

Objetivo. Avaliar o efeito da cobertura do Programa Bolsa Família (PBF) sobre as taxas de mortalidade por câncer bucal no Brasil entre 2005 e 2017, com ajuste para a cobertura de saúde e as características socioeconômicas das unidades federativas brasileiras.

Métodos. Este é um estudo ecológico com base em dados anuais (2005-2017) de todas as unidades federativas brasileiras. A variável dependente foi a taxa de mortalidade por câncer bucal, padronizada por sexo e idade pela técnica de padronização direta. A cobertura do PBF foi a principal variável independente, calculada como a razão entre o número de beneficiários do PBF e de famílias que deveriam ter direito a essa transferência condicionada de renda. O contexto socioeconômico e a cobertura de saúde foram covariáveis. Elaboraram-se mapas coropléticos e usou-se a análise de cubo espaço-temporal para avaliar variações da distribuição espaço-temporal do PBF e das taxas de mortalidade por câncer bucal. A análise por regressão linear de efeitos mistos estimou os coeficientes (β) e intervalos de confiança (IC) de 95% da associação entre cobertura do PBF e taxas de mortalidade por câncer bucal.

Resultados. Houve aumento da tendência de cobertura do PBF e estabilização da tendência da taxa de mortalidade por câncer bucal nas unidades federativas brasileiras, com exceção dos estados de Maranhão, Goiás e Minas Gerais, onde as taxas de mortalidade por câncer bucal aumentaram. No modelo ajustado, a maior cobertura do PBF foi associada a menores taxas de mortalidade por câncer bucal (β -2,10; IC 95% [-3,291, -0,919]).

Conclusões. Estratégias igualitárias como o PBF podem reduzir a taxa de mortalidade por câncer bucal. Recomendamos o acompanhamento das famílias beneficiadas por programas de transferência condicionada de renda por equipes de saúde bucal para reduzir a taxa de mortalidade por esse câncer.

Palavras-chave Assistência pública; apoio social; epidemiologia; mortalidade; neoplasias bucais; Brasil.