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Article

Municipal public spending and the manager's gender

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Abstract

The objective of this study was to evaluate the influence of female leadership on the level of expenditures allocated to health, education, and social assistance in the state with the most advanced history of female participation, Rio Grande do Norte. The research focused on this state because it is one of the most representative, possessing the highest proportion of female mayors. All expenditures were analyzed on a per capita basis. Among the main results is the confirmation that during periods administered by women, there is an increase of approximately 6.9% in health spending. The opposite trend was found for education expenditures, with per capita spending being 6.3% lower during female-led administrations. Expenditure on social assistance did not show a significant relationship. In addition to these findings, the study found a relationship between spending on health, education, and social assistance and the political cycle; all expenditures were higher in municipal pre-election years and lower in the election year itself. Regarding health spending, this study confirms previous research stating that women tend to focus more on well-being-oriented outcomes rather than economic ones.

Keywords: public spending, mayors' gender, political cycle.

Gasto público municipal e o gênero do gestor

Resumo

O objetivo deste estudo foi avaliar a influência do perfil feminino na gestão do nível de despesas destinadas às áreas da saúde, educação e assistência social no estado com o histórico mais avançado de participação feminina, o Rio Grande do Norte. A pesquisa focou esse estado por ser um dos mais representativos, que possui a maior proporção

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de prefeitas. Todos os gastos foram tratados na base per capita. Entre os principais resultados está a confirmação de que, em períodos administrados por mulheres, há um aumento de aproximadamente 6,9% em gastos com saúde. A tendência oposta foi encontrada para gastos com educação, sendo tais gastos per capita 6,3% menores em períodos administrados por mulheres. Gastos com assistência social não apresentaram relação significativa. Além desses resultados, o estudo encontrou relação entre os gastos com saúde, educação e assistência social e o ciclo político, e todos foram maiores em anos pré-eleição municipal e inferiores no ano da eleição. Considerando os gastos com saúde, este estudo confirma pesquisas que afirmam que mulheres tendem a focar mais em resultados voltados para o bem-estar do que em resultados econômicos.
Palavras-chave: gastos públicos, gênero dos prefeitos, ciclo político.

Gasto público municipal y el género del gestor

Resumen

El objetivo de este estudio fue evaluar la influencia del perfil femenino en la gestión sobre el nivel de gastos destinados a las áreas de salud, educación y asistencia social en el estado con el historial más avanzado de participación femenina, Rio Grande do Norte. La investigación se centró en este estado por ser uno de los más representativos y el que posee la mayor proporción de alcaldesas. Todos los gastos fueron tratados sobre una base per cápita. Entre los principales resultados se encuentra la confirmación de que, en los periodos administrados por mujeres, hay un aumento de aproximadamente el 6,9% en los gastos de salud. La tendencia opuesta se encontró para los gastos en educación, siendo dichos gastos per cápita un 6,3% menores en periodos administrados por mujeres. Los gastos en asistencia social no presentaron una relación significativa. Además de estos resultados, el estudio encontró una relación entre los gastos en salud, educación y asistencia social y el ciclo político, observándose que todos fueron mayores en los años preelectorales municipales e inferiores en el año de la elección. Considerando los gastos en salud, este estudio confirma investigaciones que afirman que las mujeres tienden a enfocarse más en resultados orientados al bienestar que en resultados económicos.
Palabras clave: gastos públicos, género de los alcaldes, ciclo político.

1. INTRODUCTION

A substantial body of research in psychology, sociology, and management has documented differences in managerial performance when the manager's gender is treated as an explanatory variable for outcomes (Buss et al., 2025; Gonçalves et al., 2019). Beyond gender, other personal characteristics of managers have also been examined, including age (Pereira & Saes, 2022; Sprenger et al., 2017) and education level (Araújo et al., 2021; Pereira & Saes, 2022).

In the public sector, recent studies examine, beyond gender, other qualitative characteristics of managers and their impact on outcomes (Arvate et al., 2018). Gender and education had limited effects, whereas age significantly influenced the use of organizational management tools, as observed by George et al. (2019) in their study of senior public managers across 18 European countries. The presence of women in government across 18 Latin American countries was associated with improvements in indicators such as political stability, absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption (Turrent, 2019). Arvate et al. (2018) and Cabaleiro and Buch (2025) focus specifically on female public management and its association with improved outcomes in the context of political appointments and municipal budgetary policy.

In Brazil, Pereira and Saes (2022) found that male mayors did not improve fiscal indicators, although their municipalities performed well on the Basic Education Development Index (IDEB). Conversely, states with poorer overall results tend to have higher percentages of elected female mayors. Regarding public spending, female mayors allocate more per capita in total expenditure, as well as specifically within health and education (Cabaleiro & Buch, 2025; Lautenschlage, 2017). However, this diverges from Araújo et al. (2021) and Sell et al. (2020), neither of whom identified such a spending

relationship, though Sell et al. (2020) did observe that age influences managerial performance. Finally, Bruce et al. (2022) evaluated female mayors during the COVID-19 pandemic and concluded they were more effective, achieving lower average rates of hospitalizations and deaths.

Health and education spending are among the government functions that absorb the largest share of public resources each year. Both are subject to a constitutional spending floor that administrators must observe. Article 212 of the 1988 Constitution of the Federative Republic of Brazil stipulates that "the federal government shall allocate annually no less than 18%, and the states, the federal district, and the municipalities no less than 25%, of the revenue resulting from taxes [...]" (Constituição da República Federativa do Brasil de 1988, 1988).

Female administrators are frequently associated with higher social spending. According to Lautenschlage (2017), female governors in Brazil and female mayors in Santa Catarina spend more than their male counterparts. Park (2014) observed a similar pattern in California, focusing on social welfare. More recently, Buss et al. (2025) confirmed that female-led municipal administrations tend to prioritize social issues, corroborating the findings of Arvate et al. (2018). Together, these studies suggest that a manager's gender influences resource allocation, pointing to a female tendency to strengthen social assistance and welfare policy. In addition, Bruce et al. (2022) find that female administrators tend to respond more effectively to crisis scenarios and prioritize health and social assistance in their response.

Within the broader landscape of women's participation in public administration, Rio Grande do Norte stands out for several notable political milestones. According to the 2024 municipal election results (Tribunal Superior Eleitoral [TSE], 2024a), among states with more than 100 municipalities, Rio Grande do Norte recorded the highest share of women elected to head the executive branch, at 25.1%. This contrasts sharply with Mato Grosso and Minas Gerais, where fewer than 10% of municipalities elected female mayors. Rio Grande do Norte has a long tradition of leading, albeit with persistent disparities, in women's presence at the helm of municipal government: according to TSE data, Alzira Soriano became the first woman elected to lead a municipality in Brazil in 1928, winning the election in the city of Lajes, RN (TSE, 2024b). As a result, the state exhibits more representative female leadership at the municipal level, even though the broader national picture remains highly uneven.

Despite the existing body of research, the persistent under-representation of women in municipal leadership roles leaves ample scope for empirical studies in Brazil examining the influence of gender on budget allocation. The literature indicates that female leadership is associated with greater attention to socially oriented policy areas, a finding that warrants further empirical investigation. Accordingly, the objective of this study is to assess the influence of female leadership on spending levels in health, education, and social assistance in Rio Grande do Norte, the state with the most advanced track record of female participation in local government.

The personal characteristics of municipal leaders are among the most prominent themes in the literature on budget allocation (Arvate et al., 2018; Cabaleiro & Buch, 2025; Huang & Villadsen, 2023), particularly regarding how resources are allocated across health, education, and social assistance. According to Arvate et al. (2018), municipal government offers a particularly fertile setting for this line of research because local leaders have the most direct contact with the population's needs. This study therefore seeks to extend this body of research to Brazil, building on a substantial international literature on the influence of gender in management, including Esarey and Schwindt-Bayer (2019), George et al. (2019), Janahi et al. (2021), Park (2014), and Turrent (2019).

Cabaleiro and Buch (2025) argue that a greater number of women elected to government office tends to affect local and neighboring public policy. The assumption is that, given women's typical alignment with social agendas, spending on welfare initiatives tends to be higher under their leadership. This commitment to social investment is likewise emphasized by Buss et al. (2025), who reaffirm that women prioritize social protection initiatives. These dynamics may take on particular characteristics in the Brazilian context, especially in Rio Grande do Norte, which, among states with more than 100 municipalities, has the highest proportion of women leading local governments. Focusing on this single state also helps mitigate potential endogeneity concerns, since regional and cultural factors are more homogeneous when examining one state with a comparatively balanced set of municipalities, an approach that differs from that of Arvate et al. (2018).

2. LITERATURE REVIEW

2.1 Manager Gender and Performance

There is a well-established notion in organizational settings that men and women exhibit different personality traits and leadership styles, which in turn affect performance. This notion has been studied across fields such as psychology, sociology, and management, with results revealing divergent findings (Gonçalves et al., 2019; Rodríguez-López et al., 2023). Along these lines, studies point to differences in values between men and women, suggesting that ethical behavior in decision-making may also be shaped by gender (Betz et al., 1989).

Regarding differences in leadership style, gender is among the most frequently studied demographic attributes, according to Huang and Villadsen (2023). Paustian-Underdahl et al. (2024) note that female leaders often develop a highly effective profile by combining communal and agentic characteristics. In other words, women in leadership positions demonstrate a stronger orientation toward developing individuals and teams, along with a strong capacity to execute planned strategies. These authors further observe that male managers tend to exhibit more passive, less effective behaviors, placing heavy emphasis on situational analysis while devoting comparatively little attention to execution and control. These findings are corroborated by Bruce et al. (2022), who found that female mayors in Brazil responded more effectively and achieved better outcomes during the COVID-19 health crisis.

This more communal profile is associated with lower levels of corruption in female-led administrations (Esarey & Schwindt-Bayer, 2018). Studies such as those by Paweenawat (2018) and Salari and Noghanibehambari (2021) report a negative correlation between the number of women in government and observed levels of corruption. However, more recent empirical research indicates that gender alone is insufficient to affect corruption levels in government (Esarey & Schwindt-Bayer, 2018); rather, gender matters when it interacts with other elements, such as institutional (Mazigh et al., 2023) and cultural (Debski et al., 2018; DiRienzo, 2019) factors.

The relationship between gender and fiscal outcomes remains underexplored in Brazil, where only 12% of mayors elected in 2020 were women. Candido et al. (2023) identify the unequal division of domestic labor as the principal barrier to female representation, as household responsibilities are prioritized over the added burden of administrative duties. Arvate et al. (2018), however, note that greater female presence in leadership roles encourages new women leaders to pursue positions of political representation.

George et al. (2019) found that gender and education level had a limited effect on the adoption of management best practices. Turrent (2019) observed that the presence of women in parliaments and in the offices of House speakers improved governance indicators, including political stability, absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Nonetheless, the profile typically associated with female representation remains closely tied to the distribution of social welfare and to a preference for public spending and investment in social policy areas (Cabaleiro & Buch, 2025; Park, 2014).

In Brazil, Pereira and Saes (2022) found that male mayors did not improve fiscal indicators, yet performed better on the Basic Education Development Index (IDEB), which in turn was lower in states with a higher proportion of elected women. Lautenschlage (2017) found that female mayors increase per capita spending on health and education. Araújo et al. (2021), by contrast, found a relationship between the manager's age and management outcomes, but no relationship with gender.

2.2 Spending on Health, Education, and Social Assistance

The Brazilian federal model, consolidated by the 1988 Constitution, promotes the decentralization of public policy by assigning specific responsibilities to the federal government, states, and municipalities. Most of these duties fall primarily to local governments, with health and education representing the areas that demand the greatest attention from public administrators (Melo et al., 2015). Because these are high-priority areas requiring substantial financial resources, managerial efficiency is critical to the sustainability of public entities (Buljan et al., 2019).

In health care, the decentralization mandated by the Constitution governs the operation of the Unified Health System (SUS). The division of responsibilities among levels of government places the obligation to ensure full access to primary health care on municipalities, which in turn allows for greater oversight and public scrutiny (Sousa & Andrade, 2020). Constitutional Amendment No. 29 of 2000 establishes minimum expenditure thresholds for subnational entities: a minimum of 12% for states and the Federal District, and a minimum of 15% for municipalities, of revenue collected from taxes and federal transfers.

In 2020, health spending across the three levels of government reached 4.83% of national GDP. Although still below private health expenditure, public per capita spending has grown in recent years. This pattern indicates that public health spending in Brazil is expanding at a rate that outpaces overall economic growth (Araújo et al., 2022). However, relative to international benchmarks among countries with universal health systems, such as Germany, Sweden, the United Kingdom, Spain, and France, this share of GDP is considered low: in those countries, health spending reached 8% of GDP in 2014 (Mazon et al., 2021).

Education is another area that demands attention regarding the efficiency of public resource management and allocation (Buljan et al., 2019). Article 212 of the 1988 Federal Constitution stipulates that "the federal government shall allocate annually no less than 18%, and states, the Federal District, and municipalities no less than 25%, of the revenue resulting from taxes [...]" (Constituição da República Federativa do Brasil de 1988, 1988). Compulsory public education comprises elementary education, which falls primarily under municipal responsibility, and high school, which is overseen by the states and the Federal District.

As in health care, these minimum thresholds are not always observed by administrators, leading to irregularities in the management of public accounts. Azambuja et al. (2018) note that many mayors have had their accounts rejected by external oversight bodies for failing to meet these minimum thresholds (Mendes et al., 2020). Although the Constitution establishes education as a right for all and a duty of the state, this is not universally realized in Brazil, as social, economic, and regional factors continue to hinder full access to education (Mendes et al., 2020).

Pozza et al. (2022) note that education is a critical priority in Brazil: given the population's high levels of poverty and social inequality, it is essential that the government fulfill its obligation. Public spending on education in Brazil stands at approximately 5.6% of GDP, above the OECD average of 4.4% but below that of countries such as Belgium, Finland, Iceland, Norway, and Sweden, which allocate between 5.7% and 5.8% of GDP to education (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira [INEP], 2020). Within South America, Argentina, Brazil, Colombia, and Peru show similar levels of education spending, while Bolivia and Paraguay spend at higher levels (Marín-Velásquez et al., 2020).

Social assistance, subdivided into support for the elderly, people with disabilities, children and adolescents, and community-based assistance under Portaria No. 42/1999 of the Ministry of Budget and Management, likewise requires the annual allocation of substantial resources (Pozza et al., 2022), reflecting the ongoing need for government support to meet basic human needs. Notably, female administrators have been associated worldwide with public spending that skews more heavily toward social priorities (Lautenschlage, 2017).

Park (2014) reinforces this pattern in a study examining how gender representation affects redistributive choices at the local and state levels in California between 2001 and 2010, finding, among other results, that counties led by women have higher average social welfare spending. The study also finds that welfare-oriented policy is more closely associated with administrations affiliated with the U.S. Democratic Party, which the author characterizes as center-left. By contrast, in a study of female mayors in Spanish cities, Cabaleiro and Buch (2025) find reduced non-social spending alongside increased spending on health, education, and, in particular, social assistance. These authors identify party ideology as an important factor in Spanish municipalities, with non-social spending lower in cities governed by right-wing parties.

DiRienzo (2019) argues that, owing to a less self-interested orientation, women's concerns about public spending center less on economic outcomes, such as deficits and surpluses, and more on general well-being. Given the constitutional spending floors established for municipal health and education expenditures, it is therefore reasonable to expect that female-led administrations would meet these thresholds more consistently than their male counterparts and may also be more inclined to spend more overall (Arvate et al., 2018).

3. METHOD

The study population comprised 167 municipalities in the state of Rio Grande do Norte (RN) over the 2017–2022 period. In the 2020 municipal elections, the average share of female mayors elected in Brazil was only about 12%; in RN, by contrast, the figure was nearly 23%, second only to Roraima, which comprises 15 municipalities (TSE, 2020). As RN is the state with the highest proportion of

elected women among those with more than one hundred municipalities, focusing on this state increases the number of available observations. Restricting the analysis to a single state also helps mitigate potential endogeneity concerns (Cabaleiro & Buch, 2025; Debski et al., 2018; Park, 2014). Data were drawn from the Brazilian Superior Electoral Court (TSE), the Public Sector Accounting and Tax Information System (SICONFI), and the Brazilian Institute of Geography and Statistics (IBGE). Financial variables were deflated using the General Market Price Index (IGP-M), calculated by the Fundação Getulio Vargas (FGV).

Spending on health, education, and social assistance was classified using the functional-programmatic classification under Portaria No. 42/1999 of the Ministry of Budget and Management, based on expenditure by function. Total revenue was used in accordance with the classification guidelines set out in the Manual of Accounting Applied to the Public Sector (Secretaria de Tesouro Nacional [STN], 2024).

TABLE 1 RESEARCH VARIABLES

Variable	Type	Meaning	References
1. Health 2. Education 3. Social Assistance	Dependent	Logarithm of per capita expenditure	Lautenschlage (2017); Marin-Velásquez et al. (2020); Pereira & Saes (2022); Pozza et al. (2022); Scheeffer et al. (2020)
Gender	Independent	Dummy (0 if male; 1 if female)	Gonçalves et al. (2019); Janahi et al. (2021); Mazigh et al. (2023); Salari & Noghanibehambari (2021)
Age		Age	Pereira & Saes (2022); Sprenger et al. (2017); Sell et al. (2020)
High school		Dummy (1 if manager has up to high school education; 0 otherwise)	Araújo et al. (2021); Lautenschlage (2017); Pereira & Saes (2022); Sell et al. (2020)
Higher education		Dummy (1 if manager has higher education; 0 otherwise)	

(Continue)

Variable	Type	Meaning	References
Reelected	Political control	dummy (1 = second term; 0 = first term)	Azambuja et al. (2018); Araújo et al. (2021)
Year_Preceding		dummy (1 = year preceding the election; 0 = otherwise)	Rogoff (1987); Kyriacou et al. (2021); Gonçalves et al. (2017)
Election_Year		dummy (1 = election year; 0 = otherwise)	
Ideology		dummy (1 = mayor's party is left-wing; 0 = otherwise)	Bolognesi et al. (2023); Cabaleiro & Buch (2025)
GDP per capita	Socioeconomic control	GDP per capita	Martins et al. (2020)
Population		Population	Martins et al. (2020)
Size		dummy (1 = municipality among the 25% most populous; 0 = otherwise)	Martins et al. (2020)
ΔRevenue		Percentage change in total annual revenue	Almeida-Santos et al. (2018); Martins et al. (2020)
COVID-19		dummy (1 = COVID-19 pandemic year (2020–2022); 0 = otherwise)	Poiatti & Pedroso (2023); Servo et al. (2020)

Source: Elaborated by the authors.

The estimated models are multiple linear regressions based on short, balanced panel data, following Fávero and Belfiore's (2017) classification; the general model equation is given by:

Equation 1

$$Y_{it}^{*} = \beta_0 + \beta_1\, Gênero_{it} + \beta_2\, Idade_{it} + \beta_3 EscolaridadeEM_{it} + \beta_4\, EscolaridadeES_{it} + \beta_5 Reeleito_{it} + \beta_6\, Ano_Pre_t + \beta_7\, Ano_Ele_t + \beta_8 \ln(PIB_{it}) + \beta_9 \ln(POP_{it}) + \beta_{10} Var_Rec_{it} + \beta_{11} COVID19_t + \varepsilon_{it}$$

Based on Equation 1, three separate models were estimated, one for each expenditure function (Y_{it}^{*} = {saúde, educação e assistência social}). In addition to this baseline specification, four further regression models were estimated: (i) including the variable "mayor's political party ideology," to assess whether public spending varies by party orientation (Model 2); (ii) including the interaction between ideology and gender to assess whether female mayors from left-leaning parties exhibit a different spending structure (Model 3); (iii) including the interaction with *ln(POP)* to assess whether female mayors in larger municipalities exhibit a distinct spending structure (Model 4); and (iv) including the interaction with a municipality-size dummy variable instead of *ln(POP)* to verify whether, among the largest 25% of municipalities, female mayors exhibit a spending structure distinct from that of their counterparts (Model 5).

Following the assumptions underlying the ordinary least squares (OLS) estimator, as set out by Gujarati and Porter (2011) and Fávero and Belfiore (2017), the models were tested for: normality of residuals (Shapiro-Wilk test); multicollinearity (VIF); serial autocorrelation (Durbin-Watson and Breusch-Godfrey tests); and heteroskedasticity (Breusch-Godfrey test). Only the VIF results across models were within acceptable limits, with the highest coefficient equal to 3.93, below the threshold that Fávero and Belfiore (2017) identifies as indicative of a multicollinearity problem. None of the estimated models satisfied the residual normality assumption; however, given a sample of 813 observations, this assumption can be relaxed under the Central Limit Theorem, whereby, for large samples ($n \to \infty$), the distribution of estimated parameters converges in probability to a normal distribution. The assumptions of serial autocorrelation and heteroskedasticity were not satisfied. Standard errors consistent with heteroskedasticity and autocorrelation (HAC) were estimated using the Newey-West estimator. All analyses were conducted using R software.

4. RESULTS

4.1 Descriptive Statistics

This study analyzed a sample of 166 municipalities in the state of Rio Grande do Norte over the 2017–2022 period. This state was selected for the representativeness of its municipalities: among states with more than one hundred municipalities, it has the highest proportion of cities governed by women. Table 2 presents descriptive statistics for the data to aid interpretation of the variables, including per capita spending on health, education, and social assistance. Additional variables used in the study are described as potential influences on per capita spending on the variables of interest.

TABLE 2 DESCRIPTIVE STATISTICS

	Mean	Standard deviation	Min.	1st Q	Median	3rdQ	Max.
Health*	969.84	500.22	156.09	670.21	848.35	1103.06	4365.01
Education*	1048.23	455.88	19.78	768.00	958.04	1190.21	4206.60
Social assistance*	160.32	145.01	8.19	80.46	115.2	179.32	1475.99
Female**	0.25		0				1
Age	47.12	11.31	21	39	47	56	83
Elementary education**	0.07		0				1
High school**	0.32		0				1
Higher education**	0.60		0				1
Reelected	0.24		0				1
Population	21453	75698	1712	4541	8245	14326	896708
GDP*	16498.01	17797.37	6535.76	9604.36	11795.21	15980.72	204407.50
ΔRevenue	0.11	0.17	-0.65	0.04	0.1	0.16	3.1

Notes: *BRL (reals) per inhabitant, without logarithmic transformation; **dummy variable.

Source: Research data.

Women accounted for 25% of the municipal leadership observations (municipality × year). Despite this gender disparity, Rio Grande do Norte has the highest share of female mayors among Brazilian states with more than one hundred municipalities. Most observations correspond to mayors serving their first term, with only 24% serving a second term. Table 2 also highlights the skewed nature of the per capita spending data (health, education, and social assistance), population, and per capita GDP. These variables generally resemble a log-normal distribution, which justifies using the natural logarithm.

At the extremes, the municipality of Guamaré stands out as the highest in average per capita spending on health, education, and social assistance in Rio Grande do Norte; throughout the analysis period, it was led by male mayors. São Gonçalo do Amarante, also administered by men throughout the period, recorded the lowest average per capita spending on health and social assistance, at BRL 477.00 and BRL 30.30, respectively. The lowest average per capita spending on education, BRL 445 per inhabitant, was recorded in Mossoró, which was led by a female mayor from 2017 to 2020.

Average health spending over the period was approximately BRL 970 per inhabitant, with a median of around BRL 850 per inhabitant. Relative to average (median) per capita GDP, this spending amounts to 5.9% (7.2%) of GDP. Notably, in 2020, health spending across the three levels of government reached 4.83% of GDP (Araújo et al., 2022). Compared with spending in countries with universal health systems, this share of Brazilian GDP is considered low, as those countries reached 8% of GDP in 2014 (Mazon et al., 2021).

For education, spending averages about 6.4% of GDP, with a median of 8.1%. Public spending on education in Brazil stands at around 5.6% of GDP, above the OECD average of 4.4% but below that of developed countries such as Belgium, Finland, Iceland, Norway, and Sweden (INEP, 2020). It is similar to that of South American countries such as Argentina, Colombia, and Peru (Marín-Velásquez et al., 2020).

Social assistance spending is lower than that allocated to health and education, averaging 0.97% of GDP annually over the period, with a median of 0.98% of municipal GDP. Despite this comparatively low share, social assistance still requires substantial annual public resources, given Brazil's high proportion of low-income population (Pozza et al., 2022).

4.2 Correlation Matrix

A municipality's expenditure structure tends to reflect competition among budgetary functions, since total expenditure (100%) is composed of a fixed set of allocations. At the same time, some alignment across per capita expenditures is expected, as municipalities with larger overall budgets tend to allocate more to each function. When population size is taken into account, spending is relatively lower: Table 3 shows that spending on health, education, and social assistance is negatively related to population size.

TABLE 3 CORRELATIONS

	Health	Education	Assistance	Age	ln,POP	ln,GDP	ΔRevenue
Health		0.56***	0.74***	-0.16***	-0.64***	0.22***	0.24***
Education	0.64***		0.62***	-0.07	-0.58***	0.14***	0.15***
Assistance	0.77***	0.66***		-0.12***	-0.75***	0.07	0.09*
Age	-0.15***	-0.06	-0.09**		0.18***	0.12***	-0.03
ln,POP	-0.10**	-0.28***	-0.22***	0.15***		0.24***	-0.01
ln,GDP	0.41***	0.43***	0.39***	0.04	0.06		0.14***
ΔRevenue	0.16***	0.09**	0.05	-0.07*	-0.02	0.06	

Notes: The lower triangle shows Pearson correlation, and the upper triangle shows Spearman correlation; *, **, *** indicate significance at 10%, 5%, and 1%, respectively.

Source: Elaborated by the authors.

As shown in Table 3, none of the correlation coefficients among the independent variables is high, with all values below 0.5, indicating no evidence of multicollinearity among the predictors (Fávero & Belfiore, 2017). Low correlations, however, do not imply that the variables are independent (Gujarati & Porter, 2011). By contrast, the strongest associations observed are among the health, education, and social assistance variables themselves, with coefficients ranging from 0.56 to 0.77. These correlations are unsurprising given municipalities' expenditure structures, particularly the minimum spending levels mandated by constitutional provisions. The remaining correlations were too low to support inferences about linear association, with the exception of municipal wealth (ln_GDP) and per capita spending on health, education, and social assistance, all of which were around 0.40, indicating a moderate relationship.

4.3 Model Estimation

This study used the models described above to investigate potential relationships between the structure of public spending on health, education, and social assistance and the gender of municipal mayors. Beyond this core relationship, the analysis also considered marginal effects, including municipality size, the electoral cycle, and revenue growth, among other control variables. The data are structured as a panel with variation across both time and individual units.

TABLE 4 HEALTH EXPENDITURE MODELS

Dependent variable: log(pc.Health)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
Female	0.069*	0.071*	0.068*	0.070	0.110**
	(0.038)	(0.038)	(0.037)	(0.468)	(0.045)
Ideology		0.085	0.074	0.074	-0.012
		(0.064)	(0.066)	(0.067)	(0.064)
Female × Ideology			0.055	0.054	0.235
			(0.155)	(0.152)	(0.178)
log(POP)	-0.239***	-0.239***	-0.239***	-0.239***	
	(0.039)	(0.037)	(0.037)	(0.035)	
Female × log(POP)				-0.0003	
				(0.053)	
Size					-0.336***
					(0.042)
Female × Size					-0.086
					(0.093)
Age	-0.003*	-0.003*	-0.003*	-0.003*	-0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Highschool education	-0.054	-0.055	-0.055	-0.055	-0.098
	(0.082)	(0.083)	(0.083)	(0.083)	(0.098)
Higher education	-0.038	-0.040	-0.041	-0.041	-0.128
	(0.086)	(0.086)	(0.086)	(0.086)	(0.099)
Reelected	0.079**	0.078**	0.078**	0.078**	0.108**
	(0.038)	(0.037)	(0.037)	(0.037)	(0.044)
Year preceding the election	0.100***	0.100***	0.100***	0.100***	0.104***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Election year	-0.065***	-0.065***	-0.066***	-0.066***	-0.063***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.023)
log(GDP)	0.330***	0.332***	0.332***	0.332***	0.338***
	(0.055)	(0.055)	(0.055)	(0.055)	(0.061)
ΔRevenue	0.121	0.125	0.126	0.126	0.121
	(0.103)	(0.104)	(0.104)	(0.104)	(0.113)

(Continue)

Dependent variable: log(pc.Health)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
Pandemic	0.350***	0.350***	0.350***	0.350***	0.356***
	(0.029)	(0.030)	(0.030)	(0.030)	(0.033)
Intercept	5.798***	5.786***	5.782***	5.781***	3.762***
	(0.609)	(0.599)	(0.599)	(0.598)	(0.582)
Observations	813	813	813	813	813
R^2	0.635	0.638	0.638	0.638	0.488
Adjusted R^2	0.630	0.633	0.632	0.632	0.479
F	126.676***	117.556***	108.471***	100.597***	54.374***
	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)

Notes: *, **, *** 10%, 5%, and 1% significance levels, respectively.

Source: Elaborated by the authors.

The results indicate that per capita health spending is positively and significantly associated with female-led municipal governments in Rio Grande do Norte. The exception is Model 4, which includes an interaction between gender and population and shows a non-significant direct coefficient. On average, ceteris paribus, female-led administrations spend between 6.8% and 11% more per capita on health than their male-led counterparts. This pattern aligns with Park (2014) and DiRienzo (2019) for female administrators but contrasts with Cabaleiro and Buch (2025), who found a negative relationship in their study of Spain. Overall, the models show strong explanatory power, with adjusted R^2 values above 60% in the first four models. The proportion of variance explained is significantly greater than the unexplained variance (F-test), confirming that all models are statistically significant.

Within the sample analyzed, most female administrators lead medium- and large-sized municipalities. Interaction terms were included in Models 4 and 5. Model 4 tests the interaction between the log of population and female leadership; in this specification, the direct effect of gender on spending disappears. Model 5 instead uses a large-municipality dummy (the top 25% by size), which increases the direct effect. In both models, the interaction term itself is not significant, suggesting no interdependence between population size and gender in explaining health spending.

Several determinants of health spending were also examined. Ideology and education level were not significant, whereas age had a negative effect (a 0.3% reduction per year). Reelected mayors spent 7.8% more. A cyclical pattern emerged: an average 10% increase in years preceding elections and a 6.5% decrease in the election year. As expected, the COVID-19 pandemic increased health spending by 35%. These findings emphasize the role of biographical, political, and contextual factors in shaping the allocation of municipal public resources.

The second stage of the analysis examined the determinants of education spending, treated as the natural logarithm of per capita expenditure. The results of these models are reported in Table 5. These models yield an adjusted R^2 of approximately 50%, except for Model 5, which is 27%. The results are similarly consistent, as confirmed by the F-test. Standard errors were adjusted, resulting in wider confidence intervals.

TABLE 5 EDUCATION SPENDING MODELS

Dependent variable: log(pc.Education)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
Female	-0.066**	-0.066**	-0.063**	0.144	-0.031
	(0.033)	(0.033)	(0.032)	(0.313)	(0.047)
Ideology		-0.012	-0.002	-0.004	-0.090
		(0.044)	(0.039)	(0.039)	(0.063)
Female × Ideology			-0.052	-0.062	0.149
			(0.168)	(0.168)	(0.206)
log(POP)	-0.249***	-0.249***	-0.250***	-0.246***	
	(0.014)	(0.015)	(0.015)	(0.015)	
Female × log(POP)				-0.023	
				(0.034)	
Size					-0.337***
					(0.051)
Female × Size					0.002
					(0.143)
Age	0.001	0.001	0.001	0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
High school education	0.049	0.049	0.048	0.048	0.002
	(0.095)	(0.095)	(0.095)	(0.095)	(0.115)
Higher education	0.093	0.093	0.094	0.093	-0.005
	(0.100)	(0.100)	(0.100)	(0.100)	(0.124)
Reelected	0.009	0.009	0.009	0.008	0.041
	(0.031)	(0.031)	(0.031)	(0.031)	(0.043)
Year preceding the election	0.040***	0.040***	0.040***	0.040***	0.046***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Election year	-0.117***	-0.117***	-0.116***	-0.116***	-0.112***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.033)
log(GDP)	0.319***	0.319***	0.320***	0.320***	0.318***
	(0.046)	(0.047)	(0.047)	(0.047)	(0.060)
ΔRevenue	0.113	0.112	0.112	0.113	0.109
	(0.109)	(0.109)	(0.109)	(0.109)	(0.118)

(Continue)

Dependent variable: log(pc.Education)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
Pandemic	0.039*	0.039*	0.039	0.038	0.045*
	(0.024)	(0.024)	(0.024)	(0.024)	(0.027)
Intercept	5.986***	5.988***	5.991***	5.940***	3.970***
	(0.438)	(0.440)	(0.438)	(0.462)	(0.614)
Observations	813	813	813	813	813
R^2	0.507	0.507	0.507	0.508	0.282
Adjusted R^2	0.500	0.499	0.499	0.499	0.270
F	74.814***	68.515***	63.222***	58.760***	22.431***
	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)

Notes: *, **, *** 10%, 5%, and 1% significance levels, respectively.

Source: Elaborated by the authors.

Regarding the effect of the mayor's gender on education spending, only Models 1 through 3 show a significant relationship, and in all three cases the relationship is negative. The evidence therefore indicates that municipalities led by women allocate, on average, about 6.5% less per capita to education. This finding runs counter to the positive relationship found for health spending, echoing the pattern highlighted by Park (2014) and DiRienzo (2019). Much of the literature associates the female leadership profile with a caregiving orientation, which may lead female administrators to devote greater attention to health. This is because health spending yields more immediate outcomes and a broader generational reach than education spending, which is typically associated with children and adolescents.

Buss et al. (2025) describe a budgetary trade-off in which leaders prioritize the most urgent and universal needs, which helps explain the opposite signs observed in the health and education models. The results reported by Pereira and Saes (2022) align with those of the present study: they found that educational performance, as measured by IDEB scores, was lower in states with a higher proportion of female mayors, as in RN. None of the tested interaction terms were significant, suggesting that although female mayors are more heavily concentrated in larger municipalities, this concentration does not alter the underlying structure of education spending.

Municipal governments in Rio Grande do Norte also showed a cyclical pattern in education spending: an average 4% increase in years preceding elections and an 11.6% decrease in election years, consistent with electoral planning. Neither reelection status nor party ideology was significant for education spending. Structural factors, however, did matter: municipality size had a negative effect (a 2.5% reduction in per capita spending for every 10% increase in population), while wealth (GDP per capita) had a positive effect, with municipalities that were 10% wealthier spending, on average, 3.2% more per capita.

The behavior of per capita social assistance spending was the third pattern examined in this study. The models in Table 6 are all statistically significant and show strong explanatory power (adjusted R^2 above 50% in four of the five models). As with health and education spending, larger municipalities

invest less per capita in social assistance, while wealthier municipalities, i.e., those with higher GDP per capita, invest more. Periods affected by the COVID-19 pandemic were also associated with, on average, 7.2% higher social assistance spending.

TABLE 6 SOCIAL ASSISTANCE EXPENDITURE MODELS

Dependent variable log(pc.Assistance)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
Female	0.072	0.073	0.073	0.223	0.161*
	(0.078)	(0.078)	(0.081)	(0.628)	(0.088)
Ideology		0.039	0.039	0.038	-0.134
		(0.070)	(0.083)	(0.083)	(0.089)
Female × Ideology			-0.0004	-0.007	0.333*
			(0.156)	(0.158)	(0.200)
log(POP)	-0.468***	-0.468***	-0.468***	-0.465***	
	(0.051)	(0.050)	(0.050)	(0.049)	
Female × log(POP)				-0.017	
				(0.073)	
Size					-0.741***
					(0.078)
Female × Size					-0.281*
					(0.164)
Age	0.001	0.001	0.001	0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Highschool education	-0.089	-0.089	-0.089	-0.089	-0.172
	(0.118)	(0.119)	(0.119)	(0.119)	(0.149)
Higher education	-0.082	-0.083	-0.083	-0.083	-0.232
	(0.127)	(0.127)	(0.127)	(0.127)	(0.157)
Reelected	0.111*	0.110*	0.110*	0.110*	0.163**
	(0.059)	(0.059)	(0.059)	(0.059)	(0.082)
Year preceding the election	0.032	0.032	0.032	0.032	0.034
	(0.020)	(0.020)	(0.020)	(0.021)	(0.022)
Election year	-0.010	-0.010	-0.010	-0.010	-0.004
	(0.029)	(0.029)	(0.029)	(0.029)	(0.033)

(Continue)

Dependent variable log(pc.Assistance)	Mod.1	Mod.2	Mod.3	Mod.4	Mod.5
log(GDP)	0.516***	0.517***	0.517***	0.517***	0.554***
	(0.078)	(0.078)	(0.078)	(0.079)	(0.090)
ΔRevenue	-0.013	-0.011	-0.011	-0.010	-0.027
	(0.091)	(0.091)	(0.091)	(0.092)	(0.106)
Pandemic	0.072*	0.072*	0.072*	0.072*	0.077*
	(0.039)	(0.039)	(0.040)	(0.040)	(0.045)
Intercept	4.174***	4.168***	4.168***	4.131***	-0.053
	(0.824)	(0.823)	(0.821)	(0.850)	(0.868)
Observations	813	813	813	813	813
R^2	0.596	0.597	0.597	0.597	0.415
Adjusted R^2	0.591	0.590	0.590	0.590	0.405
F	107.540***	98.568***	90.872***	84.309***	40.482***
	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)	(p=0.000)

Notes: *, **, *** 10%, 5%, and 1% significance levels, respectively.

Source: Elaborated by the authors.

Among the variables describing the administrator's profile, only the second-term variable was significant, with reelected mayors spending 11% more on average. Party ideology, electoral cycle, education level, and age were not significant. The same was true of the mayor's gender, whose coefficient was positive and significant only in the model using the alternative size proxy. In that case, the size dummy contributes relatively little to the model's overall explanatory power, shifting greater weight and relevance to the gender variable. In the remaining models, a positive but non-significant relationship is observed between female leadership and the structure of social assistance spending. This is consistent with the literature, which associates the female leadership profile more closely with caregiving than with infrastructure expansion, as noted by Park (2014) and DiRienzo (2019). Nonetheless, the absence of a statistically significant effect here contrasts with Cabaleiro and Buch (2025), who found a negative relationship in Spanish municipalities.

Overall, the study yields three key findings, broadly consistent with the arguments of Brollo and Troiano (2016) and DiRienzo (2019): women tend to prioritize outcomes oriented toward social well-being, particularly in health. Female-led administrations in Rio Grande do Norte increase per capita health spending, a sector that serves the entire population across generations, classes, and age groups, through the Unified Health System (SUS). This finding aligns with the better COVID-19 outcomes documented by Bruce et al. (2022). By contrast, education spending shows a negative relationship with the mayors' gender across all specifications, consistent with Pereira and Saes (2022), who found weaker learning outcomes in states with a higher proportion of female mayors. Buss et al. (2025) note that women tend to prioritize caregiving, and that health, being more universally accessible and more immediate in its returns, takes precedence under a budgetary trade-off; this helps explain the

positive association with health spending alongside the negative association with education spending, reflecting a relative prioritization of the former. Social assistance spending, by contrast, shows no statistically significant relationship with gender.

5. CONCLUSION

The objective of this study was to assess how female leadership influences spending on health, education, and social assistance in Rio Grande do Norte, the state with the longest history of female participation in local government, from 2017 to 2022. The analysis examined per capita spending, treating gender, age, and education level as variables of interest, and included political and socioeconomic controls grounded in national and international literature.

Consistent with theoretical expectations, the manager's personal characteristics were significantly associated with variation in spending on health, education, and social assistance. Gender showed a significant relationship with both health and education spending: the relationship was positive for health, indicating that female mayors spend more per capita on health than their male counterparts, and negative for education. This pattern aligns with the literature, which finds that female administrators tend to prioritize social well-being, which helps explain the positive relationship with health spending, a sector that serves the entire population across generations and yields more immediate results. This finding highlights the influence of gender on budgetary structure. Education, by contrast, showed a negative relationship, possibly because it represents a less generationally inclusive investment whose returns are realized over the longer term. Social assistance spending, meanwhile, showed no significant gender-based disparity, which may be attributable to this category's relatively small share of total municipal expenditure in the sample analyzed.

The models also controlled for other individual-level factors, including the manager's education level and age, as well as structural municipal characteristics (size and GDP per capita) and adverse events, such as the COVID-19 pandemic. The pandemic significantly affected both health and social assistance spending, increasing per capita health expenditure by more than 30%. The political cycle was associated with higher spending in pre-election years and lower spending in election years. Party ideology showed no statistically significant effect.

Given the persistently low share of women leading municipal governments, focusing on a single state was justified by Rio Grande do Norte's status as the state with the highest proportion of female mayors relative to its total number of municipalities. Future research should nonetheless examine the evolution of women's leadership in municipal government over time, along with corresponding changes in spending structures, to identify potential shifts in spending and investment execution patterns.

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RESEARCH DATA AVAILABILITY

The dataset supporting the results of this study is not publicly available.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

ARTIFICIAL INTELLIGENCE USAGE

The Google Gemini artificial intelligence tool was used to assist in developing R software scripts for executing the statistical procedures.

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