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Social inequalities in cervical cancer mortality in the Autonomous City of Buenos Aires, 1999-2003 and 2004-2006

Desigualdades sociales en la mortalidad por cáncer de cuello de útero en la Ciudad Autónoma de Buenos Aires, 1999-2003 y 2004-2006

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ABSTRACT The aim of this study was to describe the spatial distribution of cervical cancer mortality in the Autonomous City of Buenos Aires during the period 1999-2003 and its relationship to the socioeconomic conditions of the population, as well as to compare the distribution during this period with that of the triennium 2004-2006. This ecological study used electoral districts as the unit of analysis. The selected socioeconomic indicators were educational deficit, lack of health insurance and the Material Deprivation of Households Index (*Índice de Privación Material de Hogares*), taken from the National Population and Housing Census (*Censo Nacional de Población, Hogares y Viviendas*) of 2001. The stratification of the city into areas according to these conditions and the analysis of standardized mortality ratios showed an increased risk of dying from cervical cancer associated with worse socioeconomic conditions. The stratification and death risks demonstrated a clear spatial pattern, with the south of the city presenting the highest death risks, and the northern and central areas presenting the lowest risks.
KEY WORDS Mortality; Uterine Cervical Neoplasms; Health Inequalities; Ecological Studies; Argentina.

RESUMEN El objetivo del trabajo fue describir la distribución espacial de la mortalidad por cáncer de cuello de útero en la Ciudad Autónoma de Buenos Aires en el período 1999-2003 y su relación con condiciones socioeconómicas de la población y cotejar esa distribución con la observada en el trienio 2004-2006. Se utilizó un diseño de estudio ecológico cuya unidad de análisis fueron las circunscripciones electorales. Los indicadores socioeconómicos seleccionados fueron déficit de instrucción, ausencia de cobertura de salud e Índice de Privación Material de Hogares, provenientes del Censo Nacional de Población, Hogares y Viviendas 2001. La estratificación de la ciudad en áreas según dichas condiciones y el análisis de las razones de mortalidad estandarizadas mostraron que el riesgo de morir por esta causa aumentó a medida que empeoraron las condiciones socioeconómicas de la ciudad. Se evidenció una clara espacialidad en la estratificación y los riesgos de mortalidad. La zona sur presentó los mayores riesgos, mientras que en la zona norte-centro se registraron los menores.
PALABRAS CLAVES Mortalidad; Cáncer de Cuello Uterino; Desigualdades en la Salud; Estudios Ecológicos, Argentina.

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INTRODUCTION

Cancer is currently one of the leading causes of disease and death among the population. Although cervical cancer can be cured and is largely preventable, it is the second most frequent malignant tumor and the second cause of cancer-related death in women worldwide (1). In the year 2000 alone, with 76,000 new cases and 30,000 deaths reported, Latin America accounted for 16% of cervical cancer incidence and 13% of deaths worldwide. Argentina, with an incidence of 14.2 per 100,000 women and a mortality rate of 7.6 per 100,000, registered some of the best numbers in the region, although its standardized rates were well above those of developed countries (2).

In Argentina, cancer is the main cause of death for women between the ages of 35 and 64, and cervical cancer is the second most frequent cause of death after breast cancer (1). Statistics show that 5.5% of deaths caused by cervical cancer registered in Argentina between the years 2003 and 2005 affected women who resided in the Autonomous City of Buenos Aires (1). In the city, cancer of the uterus in its three classifications – cervix uteri, corpus uteri and part unspecified – is the fourth most common type after breast, colon, and lung cancers (3). Despite its low frequency, mortality caused by cervical cancer in the City of Buenos Aires from 2002 to 2006 increased with respect to the previous five-year period (4).

This city is characterized as having the most favorable health and socioeconomic indicators in the country (5,6), but the known limitations of indicator averages serve to mask contrasting situations. The concept of inequality carries the underlying notion of citizenship, which acknowledges that all individuals have equal rights. Analyzing inequalities means studying health differences among different populations or attributing their variability to other dimensions such as socioeconomic status (7). Several studies (8-15) have focused on socioeconomic variables as factors associated with cervical cancer. The International Agency for Research on Cancer (IARC) considers education, income, and occupation as socioeconomic factors. Other studies that analyze inequalities in health also include education level as a relevant measure (17,18), following Kunst and Mackenbach's recommendation of including *occupation, income,* and *education* as variables for measuring socioeconomic inequalities (19).

Ecological studies are generally recommended for the analysis of inequalities (7). In such cases, the geographical area grants the advantage of combining information obtained from different sources, allowing for the analysis of health inequalities (7).

In the City of Buenos Aires, the existence of a cervical cancer prevention program suggests that there is a certain degree of social awareness about the problems derived from gynecological cancer in women (20). The inequalities observed with respect to mortality rates suggest that State initiatives in the creation of social policy focused on this problem have been insufficient, given that – as many authors argue – social policy should be aimed at eradicating (or at least diminishing) inequalities in health (17).

In light of these considerations, the aim of this study was to describe the spatial distribution of cervical cancer mortality in the City of Buenos Aires for the 1999-2003 period and its relationship to socioeconomic conditions, as well as to compare the distribution during this period with that of the 2004-2006 period. This was intended to generate knowledge that can be used in the definition and implementation of health policies aimed at diminishing the number of avoidable deaths. It also intended to serve as a starting point for the assessment of the impact of implemented actions and to monitor the development over time of this health-disease issue in the City of Buenos Aires.

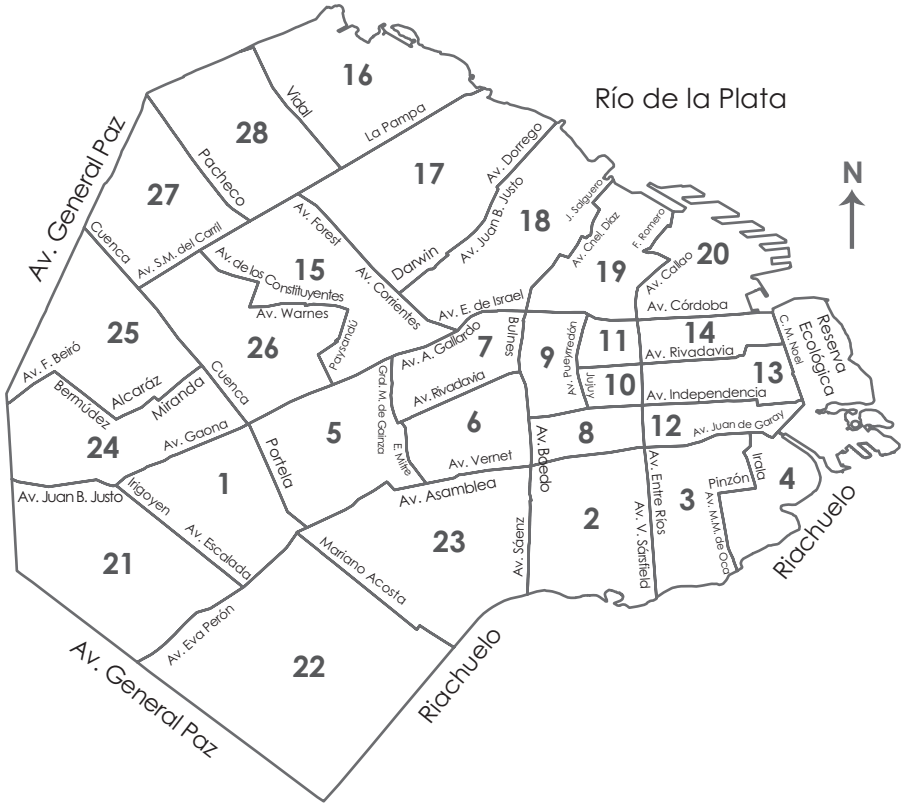
MATERIALS AND METHODS

Study Design

This study was conducted using an ecological study design, with the electoral districts of the City of Buenos Aires as the units of analysis (Figure 1).

Variables and Sources

The information for all variables studied was obtained from secondary data sources. The dependent variable was cervical cancer mortality. The Statistics and Health Information Department



1. Vélez Sársfield	8. San Cristóbal Norte	15. San Bernardo	22. Villa Lugano
2. San Cristóbal Sud	9. Balvanera Oeste	16. Belgrano	23. Cristo Obrero
3. Santa Lucía	10. Balvanera Sud	17. Palermo	24. Versalles
4. San Juan Evangelista	11. Balvanera Norte	18. Las Heras	25. San Luis Gonzaga
5. Flores	12. Concepción	19. Pilar	26. San José
6. San Carlos Sud	13. Montserrat	20. Socorro	27. Nuestra Sra. del Carmen
7. San Carlos Norte	14. San Nicolás	21. San Vicente de Paul	28. Saavedra

Figure 1. City of Buenos Aires, electoral districts, 2004.

Source: Own elaboration based on data from the Department of Statistics and Censuses of the Buenos Aires City Government [Dirección General de Estadísticas y Censos del Gobierno de la Ciudad de Buenos Aires] (21).

(DEIS) [*Dirección de Estadísticas e Información de Salud*] of the Ministry of Health provided the information on the number of deaths caused by malignant tumors of the uterus by age group for residents of the City of Buenos Aires. In accordance with the cause of death classification listed in the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), cancer of the uterus includes the following categories: *malignant neoplasm of cervix uteri* (C53), *malignant neoplasm of corpus uteri* (C54), and *malignant neoplasm of uterus, part unspecified* (C55). This study included deaths in women over age 30 for the 1999-2003 and

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2004-2006 periods. It should be clarified that individuals under the age of 30 were excluded from this study because cervical cancer-related deaths for this age group are infrequent (only 5 were reported throughout the entire period considered).

Given that 42% of deaths caused by malignant neoplasm of the uterus reported in the City of Buenos Aires during the period under review were classified as *malignant neoplasm of uterus, part unspecified* (C55), they had to be reassigned. This reassignment was done in accordance with the methodology used by the National Program for the Prevention of Cervical Cancer (1), and consisted in reassigning the total number of deaths initially classified as *malignant neoplasm of uterus, part unspecified* to *malignant neoplasm of cervix uteri* (C53) or *malignant neoplasm of corpus uteri* (C54) based on the proportions that each of those categories represented in the overall number of deaths for each age group. This methodology was applied across all electoral districts. In cases where a specific age group did not register any cases of death, unspecified deaths were reassigned based on the relative weight that cervix and corpus deaths had for that age group in the City of Buenos Aires. This methodology was also used to reassign the cases for which the electoral district was not specified.

The independent variable related to socioeconomic conditions of the different areas of the City of Buenos Aires was considered based on the dimensions of *poverty*, *education*, and *health coverage*. The source of information for this variable was the 2001 National Population and Housing Census [*Censo Nacional de Población, Hogares y Viviendas*] (5). Poverty was measured through the Household Material Deprivation Index (IPMH) [*Índice de Privación Material de Hogares*], which makes a fundamental distinction between households that are deprived of material resources and those that are not. Three types of household material deprivation were distinguished as follows: the first type includes households with insufficient economic conditions and is defined as *economic deprivation*; the second refers to inadequate housing conditions and is defined as *housing deprivation*; and the third includes households or individuals that suffer both of the previously mentioned types of depravation (22). The operational definition used for each electoral district was the percentage of individuals presenting any type of deprivation (housing, economic, or both).

Educational level was assessed through an analysis of the percentage of individuals over the age of 15 who presented an educational deficit in each electoral district. This indicator was developed based on the definition outlined by the National Institute of Statistics and Censuses (INDEC) [*Instituto Nacional de Estadística y Censos*] for highest educational level achieved, and it represented the population over the age of 15 with an educational level below that which would be expected for their age, according to the formal education system. Therefore, this accounts for the total population over the age of 15 with no formal schooling, with incomplete elementary school, and with elementary school as the highest level of education.

Lastly, health covergae was understood as affiliation to any of the following healthcare systems: health insurance plans (system of mandatory affiliation for formally contracted workers) or private health care through private insurance providers or mutual associations. Therefore, the indicator *population without coverage* includes all individuals who are not covered by a medical insurance plan, private insurance provider, or mutual association (22). Its operational definition was the percentage of the population without coverage in each electoral district.

Data Analysis

The presence of inequalities in cervical cancer mortality was evaluated using a graphic representation of standardized mortality ratios (SMR) for cervical cancer by electoral district. In order to calculate the SMR, the standard used was cervical cancer mortality by age group in the City of Buenos Aires for the five-year period under review (1999-2003). The numerator represented the total number of deaths caused by cervical cancer in the City of Buenos Aires for each age group, obtained by totaling the number of cases in each electoral district after the aforementioned adjustments. The denominator was the estimated population of the City of Buenos Aires by age group midway through the period considered, multiplied by 5. Estimates

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for the studied population were made by the Department of Statistics and Censuses (DGEyC) [*Dirección General de Estadística y Censos*] of the City of Buenos Aires and were provided by the DEIS for use in this study.

Similarly, 95% confidence intervals were based on the Poisson distribution in order to contemplate SMR variability (23). The graphic representation consisted of placing SMRs for each electoral district in thematic maps of the City of Buenos Aires. The type of map selected was a *choropleth map*, in which values of the variable were represented in intervals, each with a different shade (24). Five intervals based on quintiles were defined for this study, such that the central interval showed the electoral districts with an SMR close to 100 (and therefore a mortality rate similar to that of the City of Buenos Aires). This allowed for the identification of electoral districts with SMRs in the upper and lower intervals as those showing higher and lower risk of cervical cancer mortality with respect to the city in general. In order to represent these intervals in black and white, grayscale and cross-hatching were used. The central interval was represented in light gray (almost white), and higher and lower intervals were represented in progressively darker shades of gray. It should be noted that the grays representing lower intervals were distinguished using cross-hatching.

A similar graphic was used to describe the selected socioeconomic indicators. These were represented as quartiles using a sequential scale of gray.

The analysis of socioeconomic inequalities in cervical cancer mortality was carried out using two methods. First, correlation was considered through scatter plots and Pearson product-moment correlation coefficients for each of the socioeconomic variables and the SMR of each electoral district.

Second, the city was divided into four internally homogenous areas with different socioeconomic conditions and the differences in mortality were compared. This was advantageous as it allowed for a reduction of SMR variability due to the greater number of cases considered in the calculation.

The stratification of electoral districts was carried out using a summary index constructed from one of the hierarchization tools of the EPIDAT software called the Health Need Index, which is made up of a set of selected indicators. For each geographical unit the value of the indicators was standardized using Z scores, and the Health Need Index for each geographical unit was calculated as the sum of Z scores for each indicator (25). The three aforementioned socioeconomic indicators were used to generate the index used in this study, and the results obtained were grouped by the natural breaks method, which, according to a cluster detection algorithm, serves to partition the total range of values in such a way that the lowest possible dispersion among the values of each group is achieved (26).

Upon grouping the electoral districts according to this summary index, the city was stratified into four areas with the following differences in socioeconomic conditions:

- Area A had the lowest value, that is, more favorable socioeconomic conditions; it was composed of electoral districts 19, 18, 17, 16, 7, and 6.
- Area B was comprised of electoral districts 28, 27, 25, 20, 15, 14, 11, and 5.
- Area C was comprised of electoral districts 26, 24, 21, 13, 12, 10, 9, 8, and 1.
- Area D showed the worst socioeconomic conditions, and it was composed of electoral districts 23, 22, 4, 3, and 2.

In order to conclude the study, the spatial distribution of cervical cancer mortality in the City of Buenos Aires from 1999-2003 was compared with the spatial distribution for the 2004-2006 period, both by electoral district and socioeconomic area. The data processing of the number of deaths and the standardization for the 2004-2006 period were carried out using the same methodology for both periods.

The collected data was processed with Microsoft Office, R 2.11.1 statistical software (27), and EPIDAT 3.1. (25). Maps were designed with R 2.11.1 (27).

The data and the methodology applied did not include the identification information of individuals in the study population, in compliance with statistical confidentiality norms outlined in Act No.17622.

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RESULTS

In the two periods under review, the SMRs presented variations across electoral districts; however, almost none of the variations showed statistical significance (Table 1).

For the five-year period 1999-2003, the SMRs in electoral districts 28, 26, 23, 14, 13, 4, 3, and 2 were over 100, indicating a higher risk of cervical cancer death than the City of Buenos Aires as a whole. Electoral district 16 registered an SMR of 100, and thus exhibited a risk equal to that of the city in general. In the remaining electoral districts, the SMRs did not reach 100 and the risk of cervical cancer death was lower than that of the city as a whole (Figure 2).

The selected socioeconomic indicators showed that on average 26.2% of the population of the City of Buenos Aires had no health coverage, with a median of 26.9% and ranging from 12.7% in District 19 to 51.3% in District 22 (Figure 3). One quarter of the city's population over age 15 (25.1%) showed educational deficits, close to the value of the median (24.6%). The electoral district with the lowest educational deficit was District 19

Table 1. Quantity of observed and expected deaths caused by cervical cancer, standardized mortality ratios and confidence intervals, by electoral district and period. Autonomous City of Buenos Aires, 1999-2003 and 2004-2006.

Electoral district	Period 1999-2003				Period 2004-2006			
	OD	ED	SMR	95% CI	OD	ED	SMR	95% CI
1	11	16	66.11	31.29; 115.88	6	10	60.24	22.11; 131.12
2	19	12	162.29	96.09; 252.64	11	7	153.29	75.38; 270.19
3	17	11	151.14	85.51; 238.85	10	7	139.67	65.47; 260.81
4	12	8	151.38	76.93; 267.53	11	7	153.57	75.97; 272.30
5	23	28	81.45	50.45; 120.61	14	17	83.80	44.86; 137.67
6	21	22	99.01	59.98; 148.12	10	13	74.40	33.69; 134.21
7	23	24	97.88	61.64; 145.91	11	14	77.06	37.89; 135.82
8	6	10	58.00	19.86; 128.74	6	6	101.53	37.26; 220.98
9	12	15	82.97	41.78; 141.23	13	9	140.88	74.70; 239.89
10	8	8	99.20	39.65; 191.17	5	5	109.53	33.55; 241.14
11	7	8	86.57	34.45; 176.52	9	5	174.79	74.22; 322.37
12	7	8	91.33	35.31; 180.93	5	5	102.07	33.14; 238.21
13	14	7	181.87	97.92; 307.22	3	5	64.07	13.21; 187.23
14	9	5	161.03	70.82; 307.57	2	3	69.47	7.21; 215.11
15	19	19	97.26	57.59; 151.41	11	12	94.85	46.68; 167.33
16	22	22	100.29	62.14; 150.13	16	14	117.78	66.72; 189.54
17	19	32	59.31	34.65; 91.11	19	20	95.54	56.07; 147.43
18	25	31	79.49	50.68; 116.63	11	19	55.32	26.60; 98.50
19	21	31	68.35	42.17; 104.13	7	19	38.61	14.68; 75.25
20	6	12	51.16	17.89; 106.10	8	8	100.52	41.05; 197.92
21	14	19	75.95	40.28; 123.61	12	12	101.08	50.77; 176.54
22	21	22	96.53	59.62; 147.23	21	14	147.96	90.05; 224.96
23	23	18	124.35	78.12; 186.78	8	11	70.74	30.04; 137.10
24	14	16	86.06	47.03; 144.32	14	10	142.00	77.63; 238.26
25	13	18	72.88	38.80; 124.62	10	11	95.78	44.45; 170.46
26	24	19	125.41	80.13; 186.09	7	12	60.04	24.14; 123.71
27	7	15	46.88	18.26; 93.58	9	9	92.97	40.57; 176.20
28	24	21	111.64	70.08; 164.29	9	13	71.23	31.45; 130.55
Unspecified	38	-	-	-	16	-	-	-
Total	478	-	-	-	295	-	-	-

Source: Own elaboration based on data from the Department of Statistics and Health Information, Ministry of Health.

OD: Observed Deaths. ED: Expected deaths. SMR: Standardized Mortality Ratio, per 100 women. 95% CI: 95% Confidence Interval.

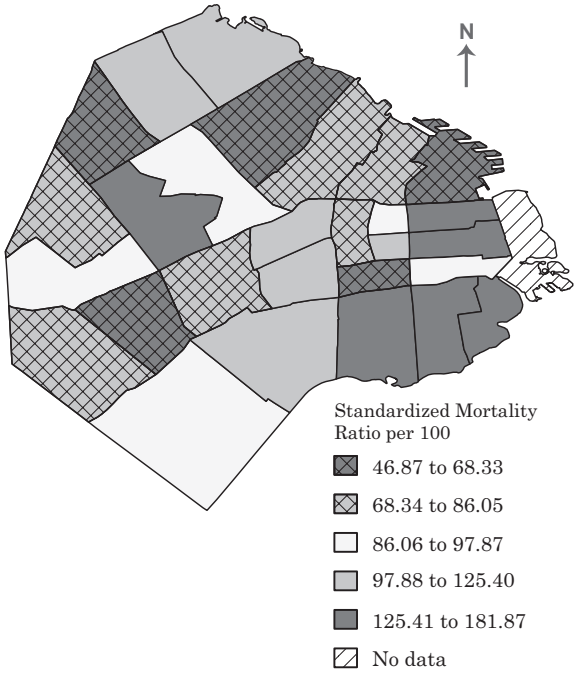

Figure 2. Standardized cervical cancer mortality ratio by electoral district. City of Buenos Aires, 1999-2003.

Source: Own elaboration based on data from the Department of Statistics and Health information, Ministry of Health.

with 11.8%, while District 22 registered a value of 43.1% for this indicator. Material deprivation affected 14.5% of the population of the City of Buenos Aires, although the median was below that figure (11.6%). The electoral district with the lowest percentage of individuals experiencing material depravation was District 16, with a value of 7.2%, while in District 22 this condition affected 39.9% of the population (Figure 3).

The correlation test showed a certain degree of correlation and statistical significance for percentages of educational deficit (0.40, 95%CI [0.04; 0.68]) and lack of health insurance (0.46, 95%CI [0.10; 0.71]). However, the relationship

Table 2. Standardized cervical cancer mortality ratios by area of socioeconomic stratification and period. City of Buenos Aires, 1999-2003 and 2004-2006..

Area of the City of Buenos Aires	Period 1999-2003		Period 2004-2006	
	SMR	95% CI	SMR	95% CI
A	81.55	68.16; 96.67	74.35	58.33; 93.25
B	84.24	69.00; 101.64	93.06	72.70; 116.81
C	92.62	75.81; 111.27	97.80	75.79; 122.61
D	129.80	104.38; 159.17	129.48	98.74; 166.18

Source: Own elaboration based on data from the Department of Statistics and Health information, Ministry of Health and the National Institute of Statistic and Census (INDEC, from the Spanish Instituto Nacional de Estadísticas y Censos).

SMR: Standardized Mortality Ratio, by 100. 95% CI: 95% Confidence Interval.

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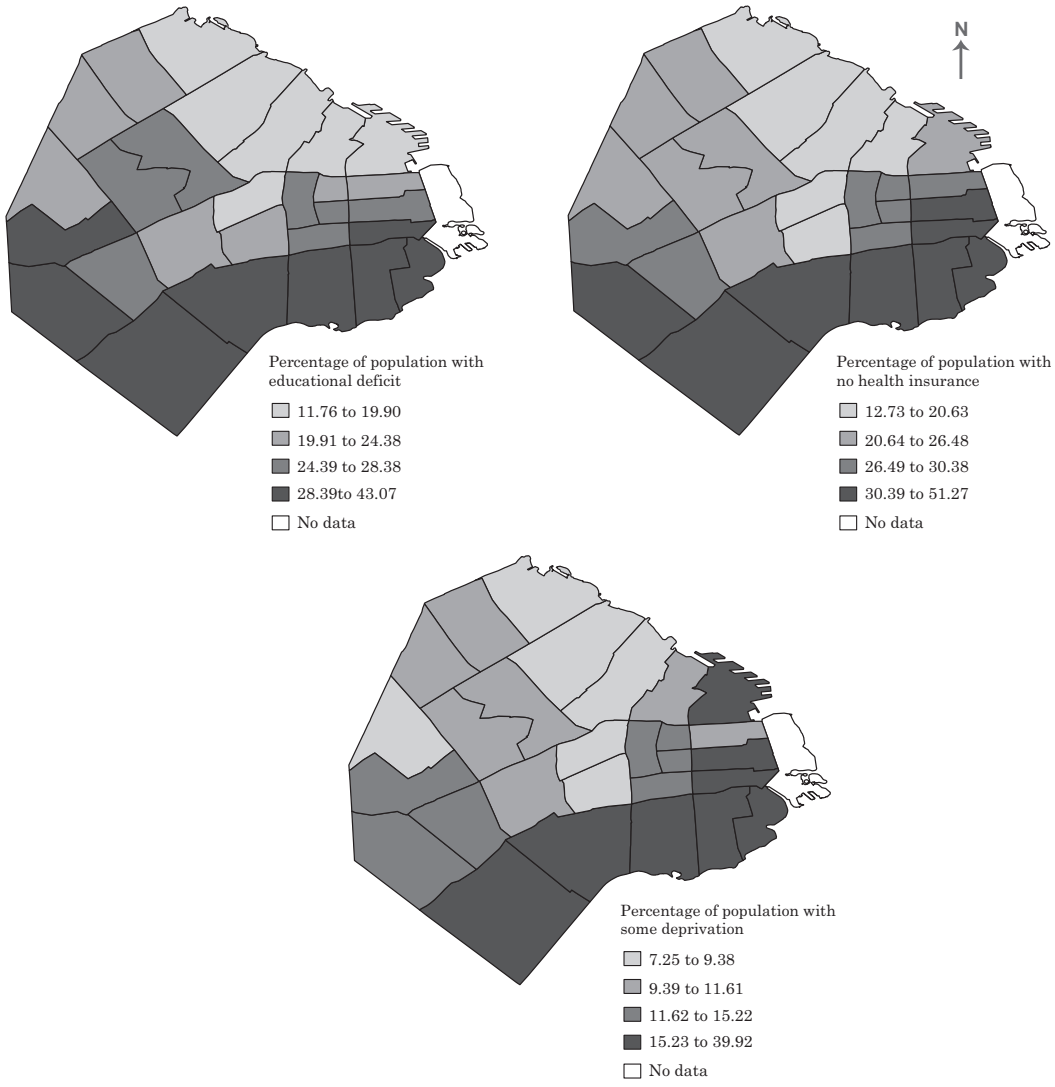

Figure 3. Percentage of population with educational deficits, lack of health insurance and some type of material deprivation (economic, housing, or both), by electoral district. City of Buenos Aires, 2001.

Source: Own elaboration based on data from of the 2001 National Population and Housing Census [*Censo Nacional de Población, Hogares y Viviendas*], conducted by the National Institute of Statistics and Censuses (INDEC) [*Instituto Nacional de Estadística y Censos*].

between the SMR and percentage of population experiencing material deprivation displayed low levels of correlation, with insignificant values from a statistical standpoint (0.36, 95%CI [-0.02; 0.64]).

The results of the stratification of the city into areas according to the summary index may be observed in Figure 4. SMRs from 1999-2003 for each area showed that excess mortality caused by cervical cancer increased as socioeconomic conditions worsened (Table 2). Area A registered the lowest ratio and displayed a 20% lower risk of death by cervical cancer than the City of Buenos Aires as a whole. However, Area D (with an SMR over 100) showed the highest risk of death by cervical cancer, 30% higher than that of the city in general. Both SMRs were significant from a statistical standpoint (Table 2).

The distribution of SMRs within each of four areas was variable. None of the electoral districts of Area A registered an SMR over 100, while in

Area D four out of its five electoral districts showed an SMR over 100. In intermediate areas (B and C) there were electoral districts with high SMRs, but the majority of districts registered a ratio below 100 (Figure 5).

The SMRs of the electoral districts in the 2004-2006 period also registered variations. Districts 5, 4, 3, 2, and 1 replicated the SMRs registered in the 1999-2003 period (Table 1, Figure 6). Of these, Districts 4, 3, and 2 showed a repetition of the excess risk of death by cervical cancer, while Districts 5 and 1 again showed standardized mortality ratios below 100 and a lower risk than the city as a whole (Table 1, Figure 6)

In this three-year period, the SMRs of the four areas of the city once again showed increases from Area A to Area D (Table 2). Area D was the only case in which an SMR over 100 was registered, although it presented no statistical significance. Area A registered for the second time a statistically significant SMR below 100 (Table 2).

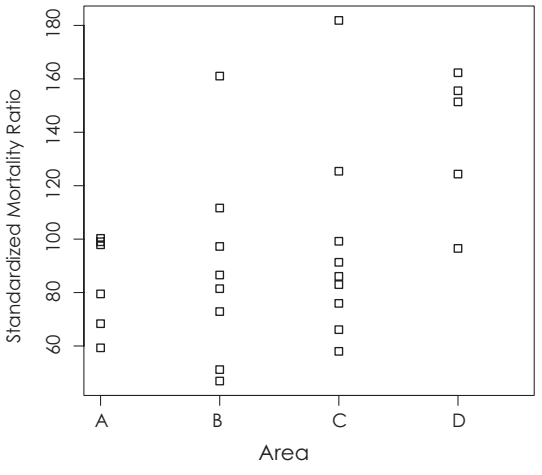

Figure 5. Scatterplot representing cervical cancer standardized mortality ratios in each electoral district, by area of socioeconomic stratification. City of Buenos Aires, 1999-2003.

Source: Own elaboration based on data from the Department of Statistics and Health information, Ministry of Health.

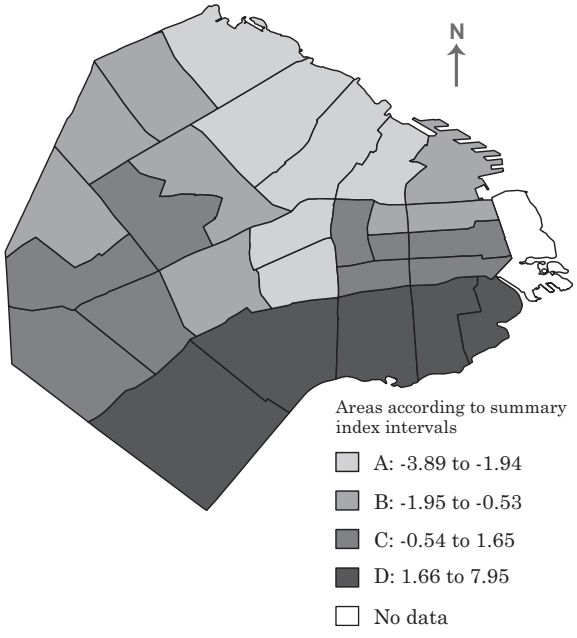

Figure 4. Stratification areas of electoral districts, by summary index of socioeconomic conditions. City of Buenos Aires, 2001.

Source: Own elaboration based on data from of the 2001 National Population and Housing Census [*Censo Nacional de Población, Hogares y Viviendas*], conducted by the National Institute of Statistics and Censuses (INDEC) [*Instituto Nacional de Estadística y Censos*].

DISCUSSION

Upon analyzing the results of risk of death due to cervical cancer, it can be concluded that the variation in mortality for this type of cancer is associated with the variation of selected socioeconomic indicators in the City of Buenos Aires. Nonetheless, it was not possible to establish a direct relationship given that there was notable heterogeneity in the intermediate areas, both in cervical cancer mortality and socioeconomic indicators, and therefore in the summary index. The fact that selected socioeconomic indicators describe only some aspects of living conditions makes it forseeable that the diversity found within electoral districts would remain when grouping larger geographical areas, although with greater moderation. Similarly, it is necessary to take into account that when the number of deaths is small, the variability of registered standardized mortality ratios is greater (29), which could weaken the association with socioeconomic variables. The incorporation of other socioeconomic indicators and the use of other statistical methodologies (smoothing) could strengthen the analysis of this information.

The inequalities observed have persisted over time given that the same areas registered higher and lower mortality in the 2004-2006 period,

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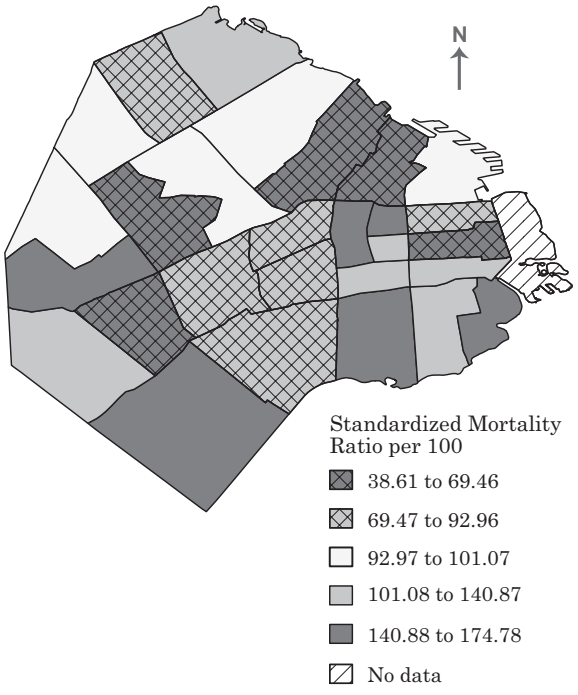

Figure 6. Standardized cervical cancer mortality ratios by electoral district. City of Buenos Aires, 2004-2006.

Source: Own elaboration based on data from the Department of Statistics and Health information, Ministry of Health.

although the only one that demonstrated statistical significance was the area with the most favorable socioeconomic conditions. The shorter time period may have conditioned this limitation as it yielded a lower number of cases and a greater range in the confidence intervals, diminishing statistical significance (29).

The characteristics outlined in this study are consistent with the literature, in that high cervical cancer mortality rates can be expected in areas of low socioeconomic development (11,16). Lack of material resources in households defined one of the indicators used in this analysis (30), and it showed the lowest correlation with cervical cancer mortality across electoral districts (r=0.36) and a non-linear relationship on the scatterplot. Other studies affirm that with respect to the magnitude of inequalities, the indicator utilized has more impact on results than the method of measurement (31). Moreover, it should be recalled that this is a complex indicator that takes into account variables at the household and individual level, which may reduce the explanatory capacity of the relationship (7). Lack of health insurance – another variable used to explain socioeconomic inequalities in cervical cancer mortality – registered the highest correlation (r=0.46). Although both relationships present great heterogeneity, groups of electoral districts can be identified at both extremes, displaying greater or lesser risk of mortality with respect to the city average.

Educational level is a frequently used variable for studying living conditions and health inequalities (17), as it is directly related to preventive health behaviors. This is consistent with multiple studies that describe how low educational levels in women constitute a factor associated with the development of cervical cancer (8,9). Similarly, in this and other studies educational level has been used as a group level variable to describe the context in which people live (12,14,15,32,33). Although correlation was not high (r=40), electoral districts with higher rates of educational deficit registered a higher risk of cervical cancer mortality. Similar studies have assessed the distribution of cervical cancer mortality and its association with various socioeconomic variables (12,14,16). They all agree on the aspects of educational level and territorial heterogeneity in cervical cancer mortality rates (12,14), as well as the impact of socioeconomic inequalities in mortality caused by this type of cancer (12,13).

The territorial heterogeneity of socioeconomic variables in the City of Buenos Aires has been described in a study on multiple indicators of living conditions applied to another territorial and governmental subdivision: the Management and Participation Centers [*Centros de Gestión y Participación*] (34). In that study, despite the diversity of situations among the different geographical units, a certain regularity in the distribution of indicators allowed for the definition of areas as more or less favorable in terms of living conditions. That study considered a wider spectrum of variables, which likely contributed to the construction of areas with greater levels of homogeneity. The absence of this characteristic in our research could account for certain observations with respect to the persistence of heterogeneity in some areas, as previously mentioned.

By dividing the City of Buenos Aires into four areas, a clear spatiality was shown, in part coinciding with that of the aforementioned study (34).

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Given the previous discussion, it is not surprising that this spatial representation existed in areas with extreme socioeconomic conditions, in such a way that the areas with the most and least favorable conditions were made up of neighboring districts. Area A included the northern and central electoral districts while Area D was composed of the southern districts. The two remaining areas (B and C) did not show the same consistency and were alternately composed of eastern and western electoral districts of the city. The heterogeneity of these areas was accompanied by a noticeable variability in cervical cancer mortality. Both areas included electoral districts with varying standardized mortality ratios (that is, below, equal to, and over 100). However, both the northern and central areas on one hand and the southern area on the other displayed more homogeneous mortality ratios, to the extent that no electoral district in Area A registered an SMR over 100, whereas all but one of the electoral districts in Area D registered standardized mortality ratios over 100.

Among the limitations of this study, it should be considered that electoral districts are large geographical units. As divisions defined by governments for administrative purposes, they often have little to do with expressions of the social identity and organization of their inhabitants, and from a spatial standpoint they are often internally diverse.

Exploring mortality through ecological studies introduces the advantage of eliminating the need for social variables from death certificates. Although these documents do collect data on social variables for individuals – including highest level of education completed, employment status, occupation, and health insurance – they are often poorly defined and lacking in quality (7). Ecological studies surpass this difficulty by describing the context with information from other sources. In this type of study, the unit of analysis is a group of individuals, and therefore variables attempt to describe group characteristics, understood as a description of the group construct and not as a substitute for individual data (35). The group of individuals can be defined territorially, as in a neighborhood for instance; or it can correspond to institutions such as health centers, schools, and other organizations (36). If the goal of an epidemiological study is to obtain information at the individual level, employing this type of design can be interpreted as a limitation, mainly because conclusions are made from aggregate data, which if used to explain phenomena at the individual level would constitute an ecological fallacy (37). However, the goal of this study was not to explain the phenomenon of cervical cancer mortality at the individual level, but to explain the existing inequalities among electoral districts and socioeconomic areas of the City of Buenos Aires. Furthermore, related to this point, the sociologistic fallacy must be discussed (38,39). This refers to the limitation of explaining phenomena at the group level without including individual variables that would be crucial to understanding the problem in question.

The use of mortality statistics can bring about difficulties in some cases given that both the percentage of deaths by *neoplasm of uterus, part unspecified* as well as the number of deaths with no specified cause may modify the situation and lead us to erroneous conclusions (13). In both cases, errors in the reporting of basic cause of death may conceal deaths caused by cervical cancer. The City of Buenos Aires is one of the jurisdictions that displays an elevated number of cervical cancer deaths in which the tumor site is not specified (1), which has been confirmed in this study. Although methods have been proposed to overcome this difficulty, such as the acceptance of the estimate that 70% of these deaths are cervix-related cases, or the reassignment of deaths according to their specific proportions by age group – recommended by the International Agency For Research on Cancer (IARC) (1) and applied in this study – it is clear that this limitation does not allow for the clear and certain assessment of cervical cancer mortality. Therefore, it is essential to improve death certificate data collection, which may be undervalued in some cases due to misinformation or disinterest. Improvements in the reporting of deaths and better quality information will contribute to a better understanding of this and other causes of death.

Considering our initial comments on the areas of the city where there is excess risk of cervical cancer mortality, it can be concluded that it is necessary to plan and implement diagnoses, treatments, and follow-ups in the southern area of the city, as well as to implement strategies that may facilitate the access of all women to these services.

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