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ORIGINAL ARTICLE

CME

Social Inequity, Place of Residence and All-Cause Premature Death in Argentina

Inequidad social, lugar de residencia y muerte prematura por cualquier causa en la Argentina

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ABSTRACT

Background: Although the relationship between premature death and socioeconomic status has been recently reported in Argentina, there are no analyses on the impact of this condition in different regions of the country.
Objective: The aim of this study was to describe the influence of socioeconomic status on the incidence of premature death rate in different provinces of Argentina, from 2000 to 2010.
Methods: An ecological model was used to evaluate standardized premature death rates ($\leq$74 years) during the period between 2000 and 2010. In addition, the relationship between socioeconomic status, measured in deciles of unmet basic needs at geographic departmental level, and premature death was examined. The units of analysis were the 512 Argentine departments and the 15 communes of the city of Buenos Aires.
Results: Socioeconomic status was significantly associated with premature death rate in Argentina during the study period. A linear gradient was observed between premature death and socioeconomic status in all provinces and regions. However, the slope index of inequality varied significantly between departments. While the absolute difference in standardized premature death rate between the extreme components of socioeconomic status was 10 deaths (range: 7.81-12.36) per 10,000 persons per year in all Argentina, in the city of Buenos Aires this difference was 61 deaths (range: 53-69). The Southern communes of Buenos Aires were the areas with the highest social and health inequalities of Argentina.
Conclusions: Although social inequity had a significant impact on premature death rate throughout Argentina during the study period, the city of Buenos Aires was the most unequal region.

Key words: Mortality - Vital Statistics - Social Class - Epidemiology - Argentina

RESUMEN

Introducción: Aunque recientemente se reportó la relación entre la muerte prematura y la condición socioeconómica en la Argentina, no existen análisis sobre el impacto que dicha condición tiene en distintas regiones del país.
Objetivo: Describir el impacto que la condición socioeconómica presentó sobre la incidencia de muerte prematura en las distintas provincias de la Argentina durante el período 2000-2010.
Material y métodos: Se utilizó un modelo ecológico, que evaluó las tasas estandarizadas de muerte prematura ($\leq$ 74 años) durante el período 2000-2010. Asimismo, se examinó la relación entre la condición socioeconómica medida en deciles de necesidades básicas insatisfechas por departamento geográfico y la muerte prematura. La unidad de análisis fueron los 512 departamentos de la Argentina y las 15 comunas de la ciudad de Buenos Aires.
Resultados: La condición socioeconómica estuvo significativamente asociada con la muerte prematura en la Argentina durante el período analizado. En todas las provincias y regiones se observó un gradiente lineal entre la muerte precoz y la condición socioeconómica. Sin embargo, la pendiente de desigualdad entre los componentes de la condición socioeconómica varió significativamente entre los distintos departamentos. Mientras que en toda la Argentina la diferencia absoluta en la tasa estandarizada de muerte prematura entre los componentes extremos de condición socioeconómica fue de 10 muertes (rango: 7,81-12,36) por cada 10.000 personas por año, en la ciudad de Buenos Aires esa diferencia fue de 61 muertes (rango: 53-69). Las comunas del sur de la ciudad de Buenos Aires fueron las zonas con mayor desigualdad social y sanitaria de la Argentina.
Conclusiones: Aunque la inequidad social tuvo un impacto significativo en la muerte prematura en todo el período en toda la Argentina, la ciudad de Buenos Aires se mostró como la región más desigual.

Palabras clave: Mortalidad - Estadísticas vitales - Clase social - Epidemiología - Argentina

Abbreviations

CABA	Autonomous City of Buenos Aires	**SII**	Slope index of inequality
ECLAC	Economic Commission for Latin America and the Caribbean	**INDEC**	National Institute of Statistics and Censuses
SES	Socioeconomic status	**RII**	Relative index of inequality
DEIS	Bureau of Vital Statistics and Health Information	**UBN**	Unmet basic needs

INTRODUCTION

Social inequity significantly impacts on population quality of life and life expectancy. (1) This concept can be ascribed to all populations whose life expectancy is not truncated by violence, war or hunger. Moreover, it is verifiable for societies with a high level of economic development as for those having poorer indicators. Argentina is not exempt from the association between economic and social deprivation and premature death. (2, 3) However, the impact that economic inequity generates on death at an early age among the different Argentine regions has not been sufficiently documented. This documentation should be relevant for health planning in order to, among other things, prioritize interventions in the most vulnerable population segments.

Despite Argentina reports a significant economic growth since the 2002 economic-financial crisis, the gap in health inequity has significantly increased. (4, 5) Many of these differences are avoidable with active State policies; however, it is necessary to document the most vulnerable regions and populations to prioritize the necessary works to be implemented.

The purpose of this study is to describe the socio-economic status (SES) impact on the incidence of premature death in the different provinces of Argentina during the 2000-2010 period.

METHODS

An ecological design study was performed to analyze standardized premature death rates by age and sex and their association with SES. Premature death was defined as that occurring before the age of 75.

Data were obtained from the records of all-cause deaths in Argentina in persons between 0 and 74 years, as well as the number and demographic composition of the 512 departments distributed in the 23 provinces of Argentina and 15 communes of the Autonomous City of Buenos Aires (CABA). The information from the National Institute of Statistics and Censuses (INDEC) derived from the 2001 and 2010 national population and household censuses was used to establish the number of persons between 0 and 74 years living in each Argentine department and CABA commune. The data takes into account the distribution by age and sex. The component method was used to calculate the population size during the intercensal period. (6)

The number of deaths by department and commune was based on the information provided by the Bureau of Vital Statistics and Health Information (DEIS) of the National Ministry of Health. This information is obtained by processing the death certificates of the Argentine departments in the period considered for the analysis. The cause of death is processed by DEIS with a validated specific algorithm, using the International Classification of Diseases, 10th Revision (ICD-10). The cause of death reported by the program is the "underlying cause", as recommended by the World Health Organization.

The direct standardization method was applied to calculate the rate of death standardized by age and sex (incidence density) at departmental and communal level using the 2010 Argentine population as standard population. The rates are reported on an annual basis of 10,000 residents.

A geographic measurement (departmental for the provinces and communal for CABA) of the degree of unmet basic needs (UBN) was used to qualify SES. These data are derived from INDEC integrated sources (2001 census) and the Economic Commission for Latin America and the Caribbean (ECLAC). Unmet basic needs originate from complex attributes including the following domains: income, educational level attained, housing conditions, degree of overcrowding and health conditions, as described in other sources. (9) Moreover, the information on social and economic conditions of CABA communes was characterized with information provided by the city government.

With these data, each Argentine department and CABA commune was classified with a percentage of UBN, representing the proportion of homes in each department and commune with UBN. All departments and communes were subsequently divided into deciles of UBN, quintile 1 corresponding to less UBN (less deprived departments).

Statistical analysis

Age and sex standardized rates are expressed as number of events per 10,000 persons per year and are reported for each UBN decile.

A Poisson multivariate regression model for randomized panel data was used for the analysis. These models are used when the estimator to be analyzed is a number of discrete events (as, for example, the annual number of deaths) and the dependent variable has Poisson distribution (mean similar to variance). Panel data also include an error term, and a second term which controls for non-observed time-invariant characteristics in the analysis unit. In this particular analysis, they include but are not limited to geographical, historical and socio-cultural variables of the department.

Additionally, some standardized measurements of health inequities were incorporated for this analysis. These metrics included the slope index of inequality (SII), the relative index of inequality (RII) and the limited RII. (10) The SII represents the slope of a linear regression model fitted by weighted least squares, with the rate of premature death as the dependent variable and the average relative rank of the different UBN deciles by department and commune as the independent variable. This average rank is called ridit and is by definition a variable comprised between 0 (lower limit of the socio-economic organization) and 1, representing the upper limit. The slope expresses the change in the rate of death when the independent variable (in this case UBN) is modified by one unit. The index can be interpreted as the difference of rates between the upper and lower limits of the social hierarchy corresponding to ridits 1 and 0.

The RII, defined by Kunst and Mackenback as the ratio between the estimated rate of ridit 0 and ridit 1, and consequently expressing the gradient between the extreme limits of the socioeconomic scale is also illustrated. (11)

STATA version 13.0 software package was used for data processing and analysis.

Ethical considerations

As the data analyzed are anonymous and public, the approval of an Ethics Committee was not necessary to perform the study.

RESULTS

Table 1 shows the population distribution across the different SES deciles from 2000 to 2010. It can be seen that the distribution was not substantially modified between those years, particularly among the most so-

cially and economically deprived deciles (from deciles 7 to 10), representing 17.6% of the population in 2000 and 17.7% in 2010.

The difference between the highest and lowest standardized rates (decile 10 minus decile 1) of premature death in Argentina ranged between 7.8 (in 2001) to 12.35 (in 2009) deaths per 10,000 persons per year, with an average value of 10.8 for all the 2000-2010 period.

Several metrics reflect this inequitable distribution of mortality according to SES. Thus, for example, the overall SII for Argentina is 9.181. Table 2 shows the SII for Argentina as a whole and for each province, as well as the RII and the Kunst and Mackenbach RII. The data show that both SII as the relative indexes are very heterogeneous among the different provinces of Argentina, reflecting the impact that social, material and economic deprivation have in each district. Specifically, CABA was the most inequitable district during the study period.

Table 3 shows the standardized rate of premature death for the different UBN deciles of the city of Buenos Aires. It can be seen that the differences between the extreme rates in decile 10 fluctuated between 89.08 and 68.68 deaths per 10,000 persons for 2000 and 2010, respectively, whereas in decile 1, it was between 20.57 and 15.95 per 10,000 persons for 2000 and 2010, respectively. The average rate during the 11 years considered in the study was 62 deaths per 10,000 persons per year.

Table 4 specifies the standardized rate of premature death per commune in the city of Buenos Aires.

The logarithm of the standardized rate of premature death per Argentine region shown in Figure 1 illustrates the gradient existing in all regions between SES and the rate of premature death. It also reveals that the slope of the relationship is far larger in CABA compared with any other region of Argentina, indicating that deprivation is more marked in this district.

DISCUSSION

The results of the present analysis show that the proportion of persons who live in departments with high levels of UBN remained stable from 2000 to 2010, and that as a consequence of population growth, the absolute number of persons in the most deprived departments increased. Moreover, data show that premature death has an unequal distribution according to departmental SES, the highest inequity was registered in CABA, and inequities were maintained during the entire study period.

Our results are consistent with other studies showing association between SES, measured with several indicators, and premature death, both among countries as within the same country. (12, 13)

Health inequity in large cities has been previously reported and associated to emergence and growth of poor neighborhoods. (5, 14, 15) Data from the present study extend these observations to the case of CABA and, in addition, allow quantifying the excess mortality related to SES and hence, the associated mortality load.

Another significant finding was that CABA, the district with the highest net income per inhabitant, had the uppermost inequity indexes of the country. (16) Although data from other studies show high inequity in other important cities, this information had not been reported for Argentina. (15, 17) Therefore, the effect of deprivation was more marked in CABA than in the rest of the regions or in the country considered as a whole (for each decile increase of UBN, standardized mortality increased more than in other regions).

Limitations

The study has limitations that should be considered when interpreting the results. It is an ecological study and as such, results are referred to the geographical observation unit and not to individuals. (18) Moreover, although the SES decile identified groups with

Table 1. Number of persons and percent population per decile of unmet basic needs in the years 2000 and 2010. Mean of unmet basic needs per decile

Decile of UBN	Year 2000		Year 2010		
	Persons	% population	Persons	% population	% UBN
1	2,987,114	8.7	3,156,030	8.2	5.1
2	4,603,797	13.4	4,892,195	12.6	6.9
3	6,177,916	18.0	6,729,324	17.4	8.4
4	4,345,840	12.6	4,956,450	12.8	10.3
5	6,201,849	18.0	7,462,460	19.3	13.3
6	4,019,159	11.7	4,662,571	12.0	16.5
7	2,104,158	6.1	2,395,119	6.2	20.0
8	1,677,249	4.9	1,931,250	5.0	22.4
9	1,152,503	3.4	1,281,027	3.3	26.6
10	1,115,623	3.2	1,248,547	3.2	35.0
	34,385,208	100	38,714,973	100	

UBN: Unmet basic needs

Jurisdiction	SII	RII	RII (1)	Limited RII
Argentina	-9.181	0.214	1.24	1.223
City of Buenos Aires	-31.034	0.811	2.363	2.124
Buenos Aires	-9.145	0.219	1.246	1.216
Chaco	-1.155	0.026	1.026	1.021
Chubut	-5.497	0.125	1.133	1.128
Córdoba	-8.051	0.199	1.22	1.152
Corrientes	-3.88	0.088	1.092	1.074
Entre Rios	-4.568	0.106	1.112	1.096
Formosa	-2.616	0.059	1.061	1.037
Jujuy	0.316	0.007	1.007	0.995
La Pampa	-7.164	0.174	1.19	1.181
La Rioja	-9.593	0.236	1.267	1.258
Mendoza	-10.192	0.25	1.286	1.249
Misiones	-0.129	0.003	1.003	1.002
Neuquén	-6.027	0.141	1.152	1.118
Río Negro	-4.95	0.119	1.127	1,115
Salta	-1.645	0.037	1.037	1.033
San Juan	-11.634	0.292	1.342	1.236
San Luis	-7.007	0.168	1.183	1.108
Santa Cruz	-7.71	0.186	1.205	1.108
Santa Fe	-7.4	0.178	1.196	1.172
Santiago del Estero	-3.298	0.075	1.078	1.063
Tucumán	-2.201	0.05	1.051	1.044

Table 2. Slope index of inequality for all Argentina and for each province, relative index of inequality and Kunst and Mackenbach relative index of inequality

SII: Slope index of inequality. RII: Relative index of inequality.

Table 3. Standardized rate of premature death per decile of unmet basic needs in the City of Buenos Aires

UBN	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	20.57	19.99	19.50	19.84	19.44	17.30	17.37	17.74	16.38	15.41	15.95
2	41.08	42.94	39.78	42.77	38.76	37.28	35.71	34.75	33.45	31.84	32.18
3	40.41	38.54	41.64	38.65	37.29	36.68	34.00	35.81	33.15	32.12	30.46
4	36.25	34.77	36.31	34.46	31.98	30.30	28.54	29.66	26.02	27.45	25.94
5	24.25	24.34	23.96	22.61	21.99	20.45	20.94	20.37	18.51	17.59	17.52
6	50.85	52.11	51.41	51.04	46.59	46.99	43.05	43.76	41.72	37.28	38.15
7	30.70	30.62	30.85	29.43	30.11	26.67	26.39	26.39	23.19	23.89	24.68
8	40.63	40.89	40.07	41.12	39.74	38.10	36.17	35.81	33.56	33.27	32.04
9	45.72	47.63	47.85	49.42	43.02	46.75	42.13	44.63	41.52	40.91	39.95
10	89.08	88.63	90.53	84.70	84.42	74.90	72.28	80.89	74.10	72.91	68.68

UBN: Unmet basic needs

different levels of premature death, absence of data from risk factors do not allow identifying the causes that have to be modified to reverse the situation, albeit an adverse distribution of numerous risk factors according to SES has been reported. (19)

between 2000 and 2010 these inequities were observed without attenuation despite the improved SES verified in the country in the same period. The implementation of measures among the most vulnerable groups of society should be a priority of public health efforts.

### CONCLUSIONS

The results of this analysis show marked inequities in premature death in Argentina and particularly in CABA, where

Conflicts of interest

None declared. (See authors´ conflicts of interest forms in the web / Supplementary Material)

Table 4. Standardized rate of premature death per commune of the City of Buenos Aires

Commune	Neighborhood	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
8	Lugano; Villa Soldati	89.08	88.63	90.53	84.70	84.42	74.90	72.28	80.89	74.10	72.91	68.68
3	Balvanera; San Cristóbal	50.85	52.11	51.41	51.04	46.59	46.99	43.05	43.76	41.72	37.28	38.15
10	Floresta; Versalles; Villa Luro	48.86	48.91	47.71	45.18	42.69	41.62	38.11	39.76	33.68	37.77	35.77
14	Palermo	46.67	48.56	42.46	47.41	42.54	41.81	40.33	37.36	37.47	33.86	35.77
4	Barracas	45.72	47.63	47.85	49.42	43.02	46.75	42.13	44.63	41.52	40.91	39.95
11	Devoto; Villa del Parque	40.41	38.54	41.64	38.65	37.29	36.68	34.00	35.81	33.15	32.12	30.46
1	Retiro; San Nicolás; San Telmo; Constitución	34.78	36.63	36.90	37.66	34.53	32.17	30.52	31.84	28.84	29.63	28.13
12	Saavedra; Villa Urquiza	34.78	36.63	36.90	37.66	34.53	32.17	30.52	31.84	28.84	29.63	28.13
9	Mataderos; Liniers	33.38	33.12	33.48	31.64	32.71	29.27	30.34	27.58	25.53	26.34	27.69
2	Recoleta	29.33	28.56	25.42	26.19	27.00	23.77	24.07	24.88	21.98	20.58	22.60
7	Flores	28.69	28.76	28.87	27.77	28.09	24.77	23.42	25.48	21.50	22.05	22.44
6	Caballito	24.70	21.77	25.74	24.61	22.14	19.87	19.77	20.30	19.00	18.03	16.89
5	Almagro; Boedo	24.30	23.58	25.25	21.13	22.06	20.34	21.27	20.54	18.26	16.89	16.51
15	V.Crespo; Ortúzar; Parque-Chas; Agronomía ; Chacarita	24.22	25.10	22.66	24.06	21.93	20.55	20.61	20.20	18.73	18.24	18.51
13	Núñez; Belgrano; Colegiales	14.80	14.32	15.51	15.69	14.43	13.08	12.87	13.08	12.55	11.93	11.61

Fig. 1. Logarithm of the standardized rate of premature death among the different regions of Argentina. ANE: Argentine Northeast. ANW: Argentine Northwest. CABA: Autonomous City of Buenos Aires. UBN: Unmet basic needs
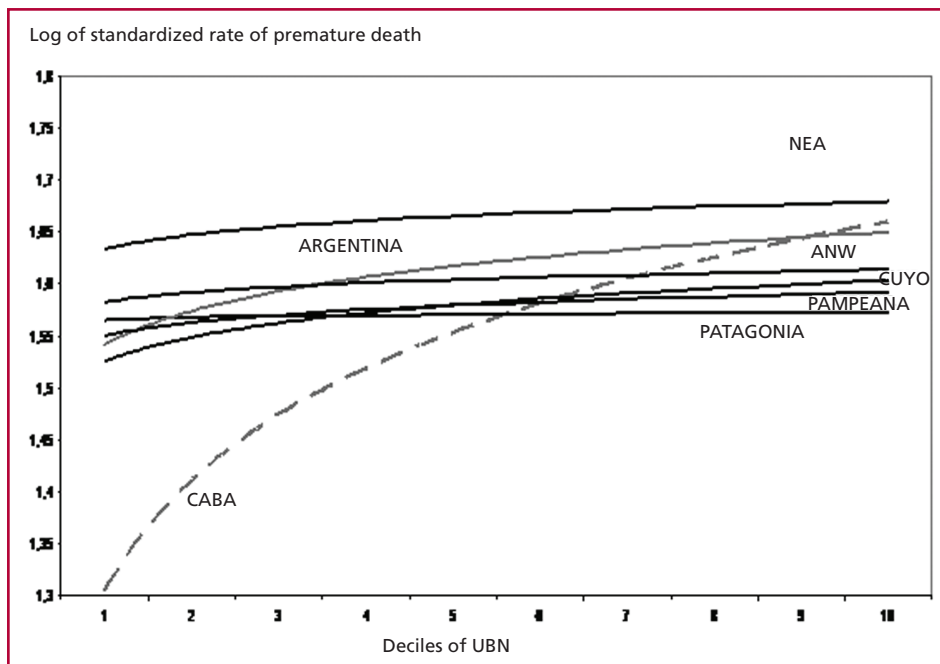
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