Consistently widening?: Evidence for fluctuating gaps in adult mortality by educational attainment in Argentina[1]

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Abstract:

The persistence of socioeconomic differences in mortality is a pressing public health matter. Several recent studies from around the world have observed that despite an overall decline in death rates during the 20th Century, socioeconomic disparities in morbidity and mortality persisted or even increased. However, there is little evidence on this issue from Latin America countries. Using data from the Argentinian Mortality Files and National Censuses for 1991, 2001, and 2010, this paper analyzes changes in educational differences in adult mortality in Argentina. Results show that educational differences in overall adult mortality were widest in the year 2001, which was characterized by a serious economic and social crisis. In contrast, somewhat narrower educational inequalities in mortality were found in both 1991 and 2010. The findings are relevant to research on social inequalities in mortality and to public policies aimed at reducing them.

Introduction and statement of the problem

The persistence of socioeconomic differences in mortality over time is a pressing public health matter. As pointed out by Williams (1990), during the last part of the 20th Century, several major changes occurred that were expected to drastically reduce, if not eliminate, socioeconomic differences in health: the decline of infectious diseases as major causes of death; the availability of adequate nutrition, housing, water, and waste disposal; and the expansion of health care systems. However, several studies have observed increasing socioeconomic differentials over time, which goes against the expectation of improving distributions of health across all population subgroups.

A large set of studies has specifically analyzed the phenomenon of widening socioeconomic differences in adult mortality. Most of these studies are from the United States (Feldman, Makuc et al. 1989; Pappas, Queen et al. 1993; Christenson and Johnson 1995; Preston and Elo 1995; Duleep 1998; Backlund, Sorlie et al. 1999; Rogers, Hummer et al. 2000; Molla, Madans et al. 2004; Hadden and Rockswold 2008; Meara, Richards et al. 2008; Cutler, Lange et al. 2010; Montez Karas, Hummer et al. 2011; Hummer and Lariscy 2011) and Europe (Marmot, Ryff et al. 1997; Shkolnikov, Leon et al. 1998; Bopp and Minder 2003; Murphy, Bobak et al. 2006; Clark and Royer 2010). Most of these

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studies have registered a widening gap in life expectancy and specific mortality rates between educational groups.

In Latin America, there is an important set of studies that focus on social inequalities in mortality, in a context of overall mortality decline (Arriaga and Davis 1969; Behm 1980; Palloni 1981; Chackiel 1990; Rofman 1994; Rosero-Bixby 1994; Grushka 1995; Cerqueira and PaesAntunes 1998; Paes-Sousa 2002; PaesAntunes 2002; Diez Roux et al. 2007; Belon et al. 2008; Renteria and Turra 2008, 2009). These studies all show a significant inverse relationship between socioeconomic status and mortality rates. However, mainly due to specific limitations in the available data, we know very little about the specific relation between educational attainment and adult mortality and changes across time. In Argentina, in fact, there is very little research on differential mortality among adults.

Most Latin America countries have been identified as being among the most unequal societies in the world (Reimers 1991; Frenk, Lozano and Bobadilla 1994; Altimir 1997; López and Perry 2008). While Argentina is not the most unequal country in the region, economic inequality is a relevant characteristic when compared with other middle income countries. In this context, the study of how social inequality shapes different life opportunities for Argentinean individuals takes on remarkable relevance.

There also other reasons why Argentina is an interesting case study for analyzing the relationship between educational attainment and adult mortality. The mortality decline in Argentina began earlier than other Latin American countries, at the end of the 19th century. With Chile and Uruguay, Argentina was in an advanced stage of its demographic transition in the first half of the 20th century, when other Latin American countries were only beginning this transition. During the 1950s and 1960s, Argentina had the second highest life expectancy at birth in Latin America, only lower than the life expectancy of Uruguay. At present, however, Argentina has the sixth best position in the region, below Cuba, Costa Rica, Panama, Uruguay, and Chile. Thus, the pace of decline in the Argentinean mortality rate over the last four decades has slowed compared with other developing countries in the region.

The period 1991-2010, the temporal frame of this paper, contains the Argentinean economic crisis in 2001-2002, the most severe economic debacle since 1929. Also during this period, educational reform was implemented in the country, in 1993, which produced a significant expansion of school enrollment and generated important changes in the composition of the educational groups

in Argentinean society. This acceleration in the expansion of school enrollment rates took place during a period of economic stagnation.

The selection of the adult population aged 25-64 for this study is based on three main reasons. First, there is not much research on mortality among the adult population in Latin America and especially so in Argentina. While infant mortality research is a common topic because of its implications for the social development of society, adult mortality has not received much attention. On the other hand, the population aged 65 years has been the focus of an increasing number of studies because of the phenomena of population aging in Argentina. Second, the study of mortality among the working-age population is important because of the economic and social consequences of those deaths for the whole society. At the same time, considering current life expectancy in Argentina, all of the deaths in this age range can clearly be classified as premature. Finally, there is a methodological issue related with the data sources in this dissertation. There are much higher percentages of missing cases for the variable educational attainment among the population aged 65 or more in comparison to the population aged 25-64.

This paper addresses two main questions: 1) How is the relationship between adult mortality and educational attainment unfolding across time in Argentina? 2) Are mortality differences across educational levels increasing, as they have in other countries?

The data used in this study come from the Mortality File for the years 1991, 2001 and 2010 and from the National Census from Argentina for the same years. Considering significant limitations in the available data, it is used a Multiple Imputation procedure for predicting the missing cases in the variable education in the Mortality File. The main measures used in this paper are Specific Mortality Rates by educational attainment, sex, age and region, and Mortality Ratios among educational groups.

The main objective of this paper is to analyze changes in educational differences in mortality between 1991 and 2010 in Argentina. More precisely, I focus the analysis on the relationship between educational attainment and specific levels of mortality among the working-aged adult population (25 to 64 years old) with data from the last three Argentinean Censuses (1991, 2001 and 2010).

Background

The widening of educational differentials in mortality levels has been consistently reported in the United States since the 1960s. In a classic longitudinal study of persons followed up from the U.S. 1960 Census, Kitagawa and Hauser found a graded inverse association between mortality and educational attainment, and that these associations were greater at ages 25-44 years and declined in strength with increasing age (Kitagawa and Hauser 1973). Similar results have been observed in subsequent studies that have focused on the study of this association with more sophisticated data.

The availability of datasets that link individuals included in probabilistic surveys with data from death certificates over a long period of time has generated a wide set of new questions in the study of mortality in general, and in the study of the relationship between mortality and educational attainment in particular.[3] Unfortunately, this kind of data set is not available in Argentina. However, research from the United States using this kind of dataset provides important background information for the current study. For instance, the work of Pappas and colleagues (1993) show how the inverse relation between mortality and education persisted in 1986 and was stronger than in 1960. Using data from the National Mortality Followback Survey and the National Health Interview Survey, the authors found that U.S. adults aged 25-64 with less than high school education are more than twice as likely to die each year as similarly aged adults with college education. Most recently, research using the National Longitudinal Mortality Study (NLMS) examined educational disparities in mortality levels and life expectancy in the 1980s and 1990s (Meara, Richards et al. 2008). The authors found rapidly rising life expectancy during this period; however, the mortality decline was very different for each educational group. Comparing the period 1981-88 with the period 1991-98, they found that life expectancy at age 25 increased 1.4 years for highly educated individuals but only 0.5 years for low educated individuals. During the 1990-2000 period, the widening of the gap was even more pronounced. Life expectancy at 25 increased 1.6 years for highly educated individuals but did not change at all for the low educated people (Meara, Richards et al. 2008).

In a study using the National Health Interview Survey Linked Mortality File, Montez and colleagues (2011) showed that educational differences in adult mortality risk increased between 1986

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[3]The National Health Interview Survey- Linked Mortality Data (NHIS-LMF), a dataset that connects information from a multi-stage probability cross-sectional survey (NHIS) with the death certificates using the Mortality Files, is one of the most used. The National Health and Nutrition Survey Epidemiological Follow-Up Study (NHEFS), the National Mortality Followback Survey (NMFS), and the National Longitudinal Mortality Survey (NLMS) are other examples of this type of data.

and 2006 for certain demographic subgroups, creating even larger disparities. The authors found that the widening educational gap was particularly pronounced among young white women.

These studies all show that despite an overall decline in death rates in the United States during the second half of the 20th Century, people with lower education still die at significantly higher rates than those with higher education. Furthermore, the disparity increased between 1960 and the end of the century. As noted by Rogers and colleagues, these trends have raised the awareness of the scientific and government communities that such gaps need to better understood and addressed (Rogers, Hummer et al. 2000).

A number of European countries also exhibit evidence of widening educational differentials in adult mortality (Marmot and McDowall 1986; Shkolnikov, Leon et al. 1998; Bopp and Minder 2003; Huisman, Kunst et al. 2004; Murphy, Bobak et al. 2006; Shkolnikov, Andreev et al. 2006).

Some of these studies show how the widening of this gap coincides or differs in different countries with very different economic and social conditions (Valkonen 1989; Valkonen 1993; Kunst and Mackenbach 1994; Sihvonen, Kunst et al. 1998; Mackenbach, Kunst et al. 1999; Huisman, Kunst et al. 2004; Shkolnikov, Andreev et al. 2006). For example, in one of the seminal works in this area, Valkonen (1989) compared educational differences in mortality in Denmark, Norway, Sweden, Finland, England and Wales and Hungary for the 1970-1980 period. The results showed that the decline of male mortality with increasing years of education was very similar in each of the six countries: the age-standardized death rates in the categories with the higher education were 40 to 60% lower than those for categories with the lower education. Male mortality diminished by 8 or 9% per one year of education in all countries. A less consistent picture was apparent for women, among whom the decline in mortality with each additional year of education varied from 2% in Hungary to 8% in England and Wales. Another large longitudinal study compared data from 9 countries: Netherlands, Sweden, Denmark, Norway, France, Italy, and the United States for the 1970-1982 period (Kunst and Mackenbach 1994). The authors reached a similar conclusion: among adult men the strength of association between educational attainment and mortality was similar across countries, and was of the same order as found by Valkonen in his earlier study. However, they also found some small differences across countries. Mortality inequalities by education were relatively small in the Netherlands, Sweden, Denmark, and Norway and about two times as large in the United States, France, and Italy. Finland and England and Wales occupied intermediate positions. Shkolnikov and colleagues (2006), analyzing educational differences in mortality in the Czech Republic, Estonia, and

Russia in the 1988-1989 and 1998-1999 periods, found similar differences in comparison to the western countries of Europe. However, while there was just a slight widening of educational differences in the Czech Republic, a dramatic widening of the educational gap was found in Estonia and Russia.

In sum, most of the studies analyzing educational differences in adult mortality in developed countries report a widening gap on educational differentials in adult mortality levels. This body of work constitutes a fundamental source of information for this research.

Previous research in Latin America

In Latin America, research on adult mortality is much less developed than it is in either the United States or Europe. Even more scarce is the analysis of the relationship between educational attainment and adult mortality. However, there is some evidence from studies on socioeconomic differentials, which tend to include education in a broader set of socioeconomic variables. In general, these studies show a significant inverse relationship between socioeconomic status and mortality rates (Rofman 1994; Rosero-Bixby 1994; Grushka 1996; Paes-Sousa 2002; Belon, Barros et al. 2008; Renteria and Turra 2008), and that there are significant differences in the relationship depending on the specific causes of death (Rosero-Bixby 1994; Grushka 1995; Paes Antunes 2002; Diez Roux, Green Franklin et al. 2007).

The limitations in the available data and the almost exclusive focus on infant and child mortality are the main reasons for the lack of research on adult mortality in Latin America (Chackiel 1990; Rofman 1994; Paz, Guzmán et al. 2004). The restricted information reported on death records has constrained the analysis of socioeconomic differentials in mortality using direct methods. Unfortunately, the application of specific surveys for overcoming these limitations, such as the mortality follow-up studies used in developed countries, is not common[4]. Moreover, the traditional sources of information, such as Vital Statistics data, are plagued by problems of data quality such as missing information on key variables, coverage problems, etc.[5] In addition to the data limitations, research on mortality in Latin America has largely focused on infants, mostly because of its use in

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[4] Promising research designs have being implemented in the last years. See, for example, Rosero-Bixby and Antich (2010).

[5] The evaluation of the quality of the available data and methods for overcoming its problems has been an important issue in the research on adult mortality in the region (Grushka 1996; Paes Antunes 2007; Piscoya-Díaz and Queiroz 2010).

international comparisons as a crude indicator of the status of the population and for its intrinsic importance for measuring human development.

There is also an incipient group of studies that try to overcome these data limitations using alternative sources of information and/or methodological designs that are of special relevance for this research (Rofman 1994; Grushka 1995; Renteria and Turra 2009).

Rofman (1994) estimated socioeconomic differentials in adult mortality in Argentina using data from the National Social Security System (*Administracion Nacional de Seguridad Social*), finding an important inverse correlation between mortality risk and income. Even though this study does not advance the analysis of the role of education attainment for mortality risk and used only the information of the population aged 65 or older, it was the first study in Argentina using individual data for estimating socioeconomic differentials in adult mortality. The author found that the mortality differences by income translated into 11.5 years in life expectancy at 20 years old, and 4.4 years at 65 years. Thus, life expectancy among individuals with high socioeconomic status is 20 to 25 percent higher than individuals with lower socioeconomic status (Rofman 1994).

An analysis of trends in adult mortality for the period 1980-1990 showed that adult mortality rates decreased approximately 14%, with a similar relative decline for men and women, and for each five-year age group from 15 to 65 years old (Grushka 1995). As stated by the author of this research, the analysis of mortality rates at the national level hides important differences between subpopulations. The analysis of mortality rates at the province level allows us to observe differences between subpopulations with very diverse ecological socioeconomic indicators (such as illiteracy rate, GDP per capita or urbanization rate). For example, for the year 1980, adult mortality levels across provinces oscillated between 2.5 and 4.7 by one thousand inhabitants among women, and from 4.5 to 7.4 among men. For the year 1990, the differences between adult mortality levels across provinces were considerably reduced, oscillating between 2.1 and 3.7 among women, and 4.5 to 6.5 among men (Grushka 1995).

The study of Renteria and Turra (2008) in Brazil is another of these studies trying to overcome data limitations and it is of special relevance to this study because it is, to my knowledge, the only research article in Latin America that has analyzed specifically the relation between adult mortality and education attainment. This research study combines information about the mother's survival and education of respondents from a nationally representative household survey collected in Brazil in 1996 (*Pesquisa de Padrões de Vida*) to examine how mortality among adult women varied

by level of education during the last few decades. Based on the traditional orphanhood method for adult mortality, the authors applied a methodological approach that allowed them to estimate female mortality rates by level of education at the individual level and analyze how these differentials vary by age and education simultaneously. The authors found that "…mortality is about three to four times higher among the lowest educational group compared to the highest one. The differences reduce slightly at higher ages, suggesting that protection or selection effects may also operate also among Brazilian women" (Renteria and Turra 2008: 12). Thus, this study from Brazil is consistent with the findings of studies in other regions showing the strong inverse association between adult mortality and education attainment (e.g., Hummer and Lariscy 2011).

In sum, the literature shows that, in Latin America, research on adult mortality has been largely neglected. The scarcity of studies analyzing socioeconomic differentials and the incipient group of studies trying to overcome data limitations with new data sources generally show that a strong inverse association exists between adult mortality and socioeconomic factors. To my knowledge, no study in Latin America has tried to analyze how the relation between education attainment and adult mortality unfolds with changes occurring in education levels. Neither have I found a research study in the region that used the information about education attainment on death certificates for analyzing educational differentials in adult mortality.

Why using educational attainment as the key variable?

The use of alternative socioeconomic status measures for analyzing socioeconomic differentials in adult mortality has been extensively debated (Kitagawa and Hauser 1973; Christenson and Johnson 1995; Backlund, Sorlie et al. 1996; Elo and Preston 1996; Hummer, Rogers et al. 1998; Smith, Hart et al. 1998; Duncan, Daly et al. 2002; Molla, Madans et al. 2004; Hummer and Lariscy 2011). As summarized by Hummer and colleagues (Hummer, Rogers et al. 1998), there is a group of studies that suggest that income is the optimal measure because it is used to purchase health care and preferred qualities of nutrition, transportation, exercise equipment, and housing (e.g., Adler, Boyce et al. 1994). On the other side, there is another group of studies that argue that education is the optimal measure because it is most often completed relatively early in adult life and usually remains constant through adulthood; is more relevant to study populations out of the work force (e.g., unemployed, retired, women in some regions); it generally has a higher response rate on surveys than income; it allows for easier international comparisons than does income (Valkonen 1993) and; it typically

precedes occupational status, income, and the accumulation of wealth in a causal sense (Hummer and Lariscy 2011). Occupation is used as the main indicator of socioeconomic status for analyzing socioeconomic differentials in adult mortality in many seminal European mortality studies (Antonovsky 1967); however, its use is limited for reaching groups such as the unemployed, service workers, and homemakers. Alternatively, occupation is useful when the analysis focuses of the mortality risk of different professions (Marmot and McDowall 1986; Marmot, Stansfeld et al. 1991; Duncan, Rumel et al. 1995; Sorlie, Backlund et al. 1995) or when the availability of educational and income data are limited (Cordeiro and Silva 2001).

In this paper, I use educational attainment as my indicator of socioeconomic status because I agree that it is the best socioeconomic measure for analyzing socioeconomic differentials in mortality, especially for adult mortality. Moreover, education is available in the Argentinean Mortality Files, while the variable income has much higher rates of missing data than educational attainment.

Data, Measures and Methods

The main objective of this paper is to analyze changes in educational differences in mortality between 1991 and 2010 in Argentina. The data used in this study come from the Mortality Files for the years 1991, 2001 and 2010 and from the National Censuses from Argentina for the same years.

Argentina's Mortality Files include data on all deaths occurring within Argentina for each year. Data are obtained from certificates filed for deaths taking place in each Province, including one record for each death occurring during the data year. Mortality Files are part of the National Vital Statistics System and are one of the most well utilized data sets for studying mortality patterns, especially because of their universal coverage and standardization. Mortality Files include information on basic socio-demographic factors of the deaths, generally reported by next of kin, and some characteristics of the situation of the death (such as place of death, manner of death, cause of death). This information is collected by the Department of Statistics of the Ministry of Health.

Even when various studies have examined the quality of vital statistics on death and ranked the coverage and the quality of the data in Argentina as one of the best in the region (Chackiel 1987; Jaspers-Faijer and Orellana 1994, 1996), the variable educational attainment presents a higher rate of

missing cases. For the year 2010, for example, the percentage of missing cases in the variable education for the population aged 25-64 years hovered around 30 percent.

Considering this limitation of the available data, it is used the technique of Multiple Imputation (Rubin 1996; Schafer and Graham 2002; Enders 2006; Graham 2009; Stata 2009). Multiple Imputation is a statistical technique for handling missing data which basically consists of the creation of multiples sets of plausible values through a series of multiple regression equations on the variable with missing cases, using the other variables in the file as predictors. In order to create imputed datasets with different estimates of the missing values, random perturbations are added (e.g., using a different number of predictors). In this phase, a pre-determined number of copies (e.g., 10 or 20) of the data are generated; each of which is imputed with different estimates of the missing values. In a second phase, the average of the estimated values is used as the predicted score of the missing value. The multiple set of imputations used to create the missing value also allows the calculation of the standard error related with each predicted value (Enders 2006:430). The final product is a completed data set which could be analyzed with standard statistical software. This technique is currently considered to be one of the best procedures available when working with missing data (Enders 2006:434).

The Multiple Imputation is a technique for overcoming important data limitations. It complements and incorporates new insights to the frequently used ecological approach. However, it could not substitute high quality data. In this sense, results need to be considered cautiously, like an exploratory approximation to social phenomena and an incentive for the efforts for improving for socioeconomic data in death certificates.

The main variables are mortality and educational attainment.

Mortality in this study is measured by age, sex, region, and educational attainment. Argentinean death certificates for 2010 for country residents who were age 25 to 64 at the time of their death provide the numerators of these death rates. The denominators are estimated from the 2010 Census.

Besides the use of specific mortality rates, the use of mortality ratios among educational groups offers a more eloquent view of the differences. The mortality ratios clarify the relative mortality differences between educational attainment groups for each age and sex group. In this case, the reference category for the ratios is the highest level of education.

The use of data from the Mortality Files for the numerator and data from the census for the denominator is a method that has a long history in the study of socioeconomic differentials in mortality levels and has been productively used in many countries (e.g., Kitagawa and Hauser 1973; Valkonen 1993; Christenson and Johnson 1995). This method has a number of potential problems due to possible numerator or denominator biases, but also due to the combination of different sources in which classification of educational level may differ between Census and Mortality Files (Vallin 1980; Shkolnikov et al. 1998). In the census the information comes from a declaration which is usually made by the individual, in the death certificate the declaration is always made by a third party. Additionally, in the specific case of educational attainment, several studies showed that third parties tend to overestimate the educational attainment of the deceased when completing the death certificate. This bias tends to be most severe when estimating mortality for educational groups at the extremes of the distribution (Shkolnikov et al. 1998). A conservative strategy adopted for some authors for dealing with this problem was to use aggregate educational categories (e.g., 3 categories) rather than an extensive category system of education or years of education (Marmot and McDowall 1986; Shkolnikov et al. 1998). In this study we do not have other alternative that using aggregate educational categories because this is the way that the data is registered in the Argentina's Mortality Files.

Years of education is categorized in three groupings: a) less than eight years of education (low level of education, up to Completed Primary School), b) eight to twelve years of education (intermediate level of education, up to Completed Secondary School), and c) thirteen years of education or more (high level of education, Completed or Uncompleted Superior Studies). The decedent data is answered by next of kin, and in some cases these relatives do not have complete information on some dimensions. For instance, knowing the highest education level attained for the decedent is difficult for some groups, especially when the decedent is very old.
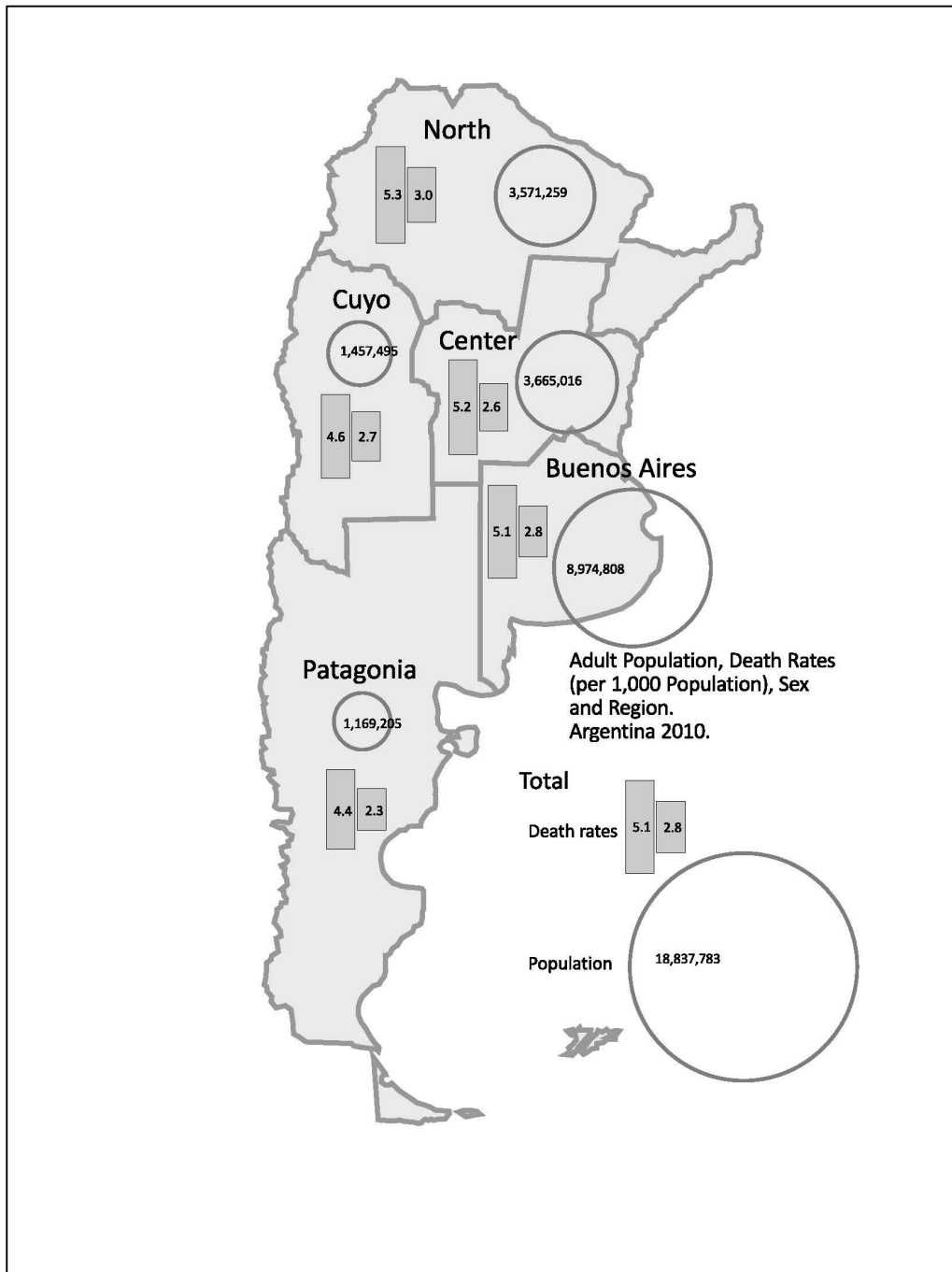
Sex is measured as male and female.

The variable age is categorized using five-year age groups.

The variable region is categorized in five groups: 1) Buenos Aires region, including the province of Buenos Aires and Buenos Aires city; 2) Center region, including the provinces of Córdoba, Entre Ríos, and Santa Fe; 3) Cuyo region, including the provinces of La Rioja, Mendoza, San Juan and San Luis; 4) North region, including the provinces Chaco, Corrientes, Formosa,

Misiones, Catamarca, Jujuy, and 5) Patagonia region, including the provinces of Santa Cruz, Chubut, Río Negro, La Pampa, Tierra del Fuego, and Neuquén.

Graph 1 Map of main regions in Argentina, adult population (25-64 years) and adult death rates by sex and region. Argentina, 2010.

North
5.3 3.0
3,571,259

Cuyo
1,457,495
4.6 2.7

Center
3,665,016
5.2 2.6

Buenos Aires
5.1 2.8
8,974,808

Patagonia
1,169,205
4.4 2.3

Adult Population, Death Rates (per 1,000 Population), Sex and Region. Argentina 2010.

Total

Death rates   5.1 2.8

Population   18,837,783

Hypothesis

The working hypothesis of this paper is that educational differences in overall adult mortality have increased over time between 1991 and 2010. There are no studies in Argentina to date that have analyzed the evolution of this relationship across time. Thus, this hypothesis is based on the results of studies from other countries.

Descriptive information

Table 1 describes the percentage distributions of the main variables of the study. It is easily observed that a continuing expansion of education occurred during the period 1991-2010 in Argentina: while just 14.1 percent of the population aged 25-64 had 13 or more years of education in 1991, this changed to 24 percent in 2010. The age structure of the adult population does not show significant variation across this time period, but there is some variation in the regional population distribution; indeed, there is a small relative decline in the more populated regions (Buenos Aires and Center) and greater relative growth in the less populated regions.

Table 1 Percentage Distributions for Deaths and Census Respondents 25-64 years in Argentina for 1991, 2001, and 2010.

	Deaths			Census Respondents		
	1991	2001	2010	1991	2001	2010
N	71,850	71,608	73,677	14,447,721	16,045,663	18,837,783
Education						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Less than 8 years	84.5	76.6	66.5	58.1	46.7	40.6
8 to 12 years	12.1	17.6	25.7	27.8	32.6	35.4
13 years or more	3.5	5.9	7.8	14.1	20.7	24.0
Age						
Total	100.0	100.0	100.0	100.0	100.0	100.0
25-29	4.1	4.7	4.7	15.9	16.8	16.5
30-34	4.2	4.8	5.0	15.3	15.5	16.5
35-39	5.8	5.7	5.5	14.7	13.2	14.0
40-44	8.3	7.7	7.0	13.6	13.8	12.9
45-49	11.2	11.6	10.2	11.7	11.8	11.0
50-54	15.2	16.6	15.3	10.3	11.3	11.2
55-59	21.4	21.4	22.5	9.4	9.6	9.5
60-64	29.8	27.5	29.8	9.0	8.1	8.3
Gender						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Male	65.8	65.4	63.6	48.8	48.5	48.6
Female	34.2	34.6	36.4	51.2	51.5	51.4
Region						
Total	100.0	100.0	100.0	100.0	100.0	100.0
Buenos Aires	50.3	50.5	47.9	50.2	48.2	47.6
Center	20.7	20.0	19.4	20.4	20.0	19.5
Cuyo	6.7	6.9	7.1	7.3	7.7	7.7
North	17.3	17.8	20.1	17.0	18.4	19.0
Patagonia	5.0	4.8	5.4	5.2	5.6	6.2

Sources: Elaborated by the author based upon Argentine National Censuses 1991, 2001 and 2010, and Argentine Mortality Files-Vital Statistics 1991, 2001, and 2010.

Educational Differentials in Adult Mortality across Time

To answer the question about how the relationship between adult mortality and educational attainment unfolding across time in Argentina, I analyze mortality ratios – specifically the ratio between the group with the lowest educational attainment to the group with the highest level of education, specific to sex and age.[6] The use of a relative measure like mortality ratios, even when it does not consider absolute differences in mortality, give us a good picture of social inequalities at death and it has been indicated as an appropriate measure for this kind of analysis (Houweling, Kunst et al. 2007). If the working hypothesis in this paper is supported, I expect to find larger mortality ratios in each census date compared with the previous one.

Any analysis of mortality differentials across time must take into account selection: the idea that the low educated group is becoming smaller across time and, presumably, more negatively selected. At the same time, the high educated group is becoming larger and, presumably, less positively selected. To understand how these selection processes are affecting changes in the disparities over time requires different statistical techniques which were not among the main objectives of this paper but show the way for future research. Nonetheless, given increasing proportions of the population with high levels of education in Argentina, it seems likely that, in and of itself, the selection process would result in narrower educational differences in mortality across time.

Table 2 presents the mortality ratios between the population subgroup with the highest educational attainment (13 years or more) and the population subgroup with the lowest educational attainment (up to 8 years of education) for three selected years: 1991, 2001, and 2010. The selection of these three specific years is based on the fact that censuses were conducted.

A first look at the results suggests no support for the working hypothesis, going against what has been found in other countries. The general adult mortality ratios –that is, all age groups as whole– have decreased for both sexes. It can be observed that, for males, the mortality ratios between extreme educational groups descends from 5.5 in 1991, to 5.4 in 2001 and to 4.8 in 2010. For females, we find an even more pronounced pattern, with the ratios declining from 6.6 in 1991, to 5.7

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[6] Specifying the ratio as the low educated group to the high educated group does not take into account inequalities in other portions of the educational distribution (e.g., the relation of the low educated group to the group with an intermediate level of education). However, the analysis of the data showed the complete distributions of these rate ratios tend to be graded with few exceptions.

in 2001, to 4.7 in 2010. Although this trend is clear, this first view of the data – taking all adult mortality ages together – conceals other specificities.

Turning to the specific age patterns, the mortality ratios for the youngest age group (25-29) seem to be increasing across time. This pattern is clear in the case of the male population: the ratio changes from 6.7 in 1991, to 6.9 in 2001, to 7.6 in 2010. In the case of the female population, the highest mortality ratio in 1991 (9.7) for ages 25-29 narrows in 2001 but becomes very high again in 2010 (7.5). Thus, while the general pattern shows a decline in the mortality ratios across time, the age-specific pattern for the youngest age group of males does not follow this general pattern. Nonetheless, not only are educational inequalities in this age group the highest among adults in each of the three periods – which is similar to what has been found in other countries – but educational inequalities in mortality are generally increasing over time for this age group as well.

Table 2 Death Rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: Argentina, 1991, 2001, and 2010.

Sex and Age		Deaths per 1,000 population				Mortality Ratios		
		1991	2001	2010		1991	2001	2010
Male		6.7	6.0	5.1		5.5	5.4	4.8
25-29		1.6	1.8	1.6		6.7	6.9	7.6
30-34		1.8	1.9	1.6		5.1	5.9	4.2
35-39		2.4	2.5	2.0		4.4	5.9	4.5
40-44		3.9	3.2	2.7		4.2	4.2	4.4
45-49		6.4	5.7	4.5		4.0	4.7	4.3
50-54		10.2	8.8	7.0		3.5	3.3	3.4
55-59		16.0	13.7	12.3		3.2	3.8	3.4
60-64		23.5	21.8	19.3		2.8	2.6	2.8
Female		3.3	3.0	2.8		6.6	5.7	4.7
25-29		0.9	0.7	0.6		9.7	6.4	7.5
30-34		1.0	0.9	0.8		5.0	5.3	4.1
35-39		1.5	1.3	1.1		6.0	6.5	3.6
40-44		2.2	1.8	1.6		4.4	3.9	3.7
45-49		3.2	3.2	2.8		3.4	4.5	3.7
50-54		4.7	4.5	3.8		3.3	2.6	2.8
55-59		7.0	6.5	6.4		2.4	3.5	3.2
60-64		10.3	9.6	9.4		2.4	2.0	2.4

Sources: Elaborated by the author based upon Argentine National Censuses 1991, 2001 and 2010, and Argentine Mortality Files-Vital Statistics1991, 2001, and 2010.

Besides this increase in educational inequalities for the 25-29 age group, there are two other interesting patterns to note in Table 2. First, mortality ratios seem to be higher in the year 2001 than in the other years. Looking at the 16 age-and-sex-groups, it can be observed that 8 of these groups exhibited the highest mortality ratios in the year 2001 (registering 3 cases with the highest mortality ratios in in the year 1991, 2 in the year 2010, and 3 cases where the pattern it is not so clear). In this sense, more than a declining or a rising trend in mortality ratios, I find a more complex trend. Indeed

the mortality ratios tend to be the highest in the year 2001, which is the year of the Argentinian economic crash and one of the most severe social crises in recent history.[7]
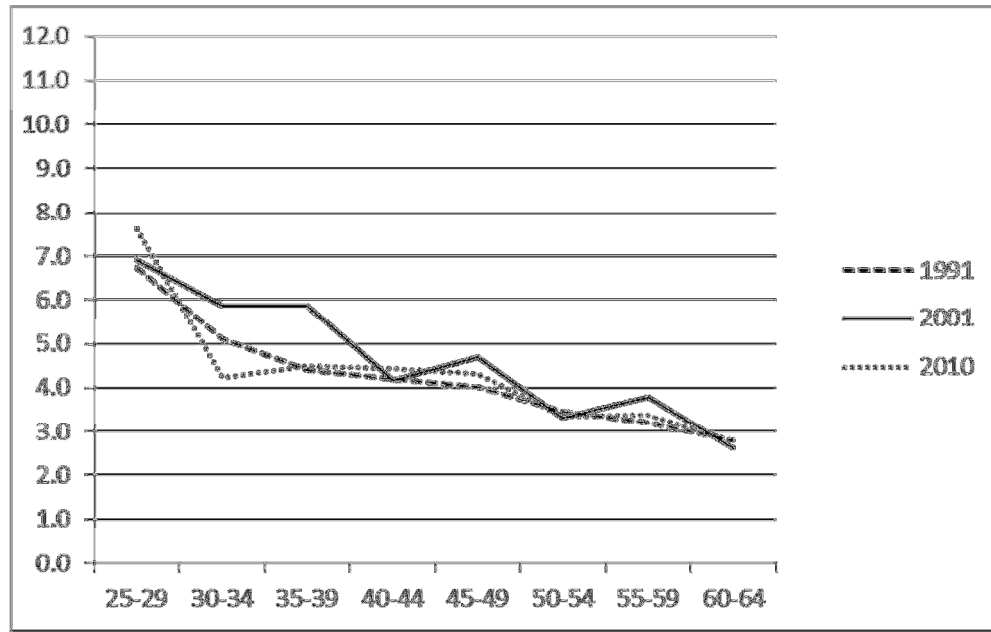
Second, educational inequalities in mortality among women tend to be significantly lower in the last period analyzed, with the exception of the youngest group. Although mortality ratios for both men and women tend to be the highest for both women and men, in the year 2010 we find the lowest female mortality ratios. Looking at the 8 female age groups, it can be observed that 4 of these groups exhibited the highest mortality ratios in the year 2001, 3 in the year 1991, and one case (ages 60-64) where the mortality ratio for 1991 equals the mortality ratio of 2010. The female mortality ratios tend to decrease substantially in the year 2010, reaching in all cases lower mortality ratios than the male population.

Graphs 2 and 3 display the mortality ratios between extreme educational groups for the three years under study, for men and women respectively. The dashed line represents the mortality ratios for the year 1991, the solid line those for the year 2001 and the dotted line those for 2010. As expected, the ratios for 2001 tend to be the highest on both graphs. In Graph 2, the ratios for 1991 and 2010 tend to be very close to one another, with the exception of the youngest age groups. For the female population, Graph 3, the ratios for 2010 tend to be lower than in either 1991 or 2001, especially in the intermediate ages. Meanwhile, the mortality ratios for the year 1991 are the highest for the youngest age group of 25-29.

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[7] 2001 was not a particularly bad year but the peak of a long-term process of gradual decline in economic and social indicators, since 1995 (Damill, Frenkel et al. 2003; Potter 2007).

Graph 2 Age-Specific Mortality Ratios by Educational Attainment across Time for the Adult Male
Population in Argentina

Graph 2 also illustrates that educational inequalities in mortality increase across time for men aged 25-29. Moreover, we find large gaps between years for men aged 30-34 and 35-39, where the dotted line (2010) is substantially lower in comparison to the solid line (2001). Clearly, educational inequalities in mortality have declined more significantly across time for men aged 30-34 and 35-39 than in the other age groups.

Graph 2 also shows that the dotted line (2010) is very close to the dashed line (1991), but that the solid line (2001) exhibits higher mortality ratios for almost all age groups. A comparison of the male mortality ratios in the year 1991 with those of the year 2010 finds a pattern which goes in the direction of the working hypothesis of this paper: male mortality ratios increase slightly over time. One exception is the 30-34 year age group, where the mortality ratios become smaller over time. However, the year 2001 shows a remarkable increase in educational inequalities in mortality among men, in contrast to the overall slightly increasing trend between the year 1991 and the year 2010. On the other side of the coin, the decline in educational inequalities in mortality between 2001 and 2010 is very significant.

Graph 3 Age-Specific Mortality Ratios by Educational Attainment across Time for the Adult Female
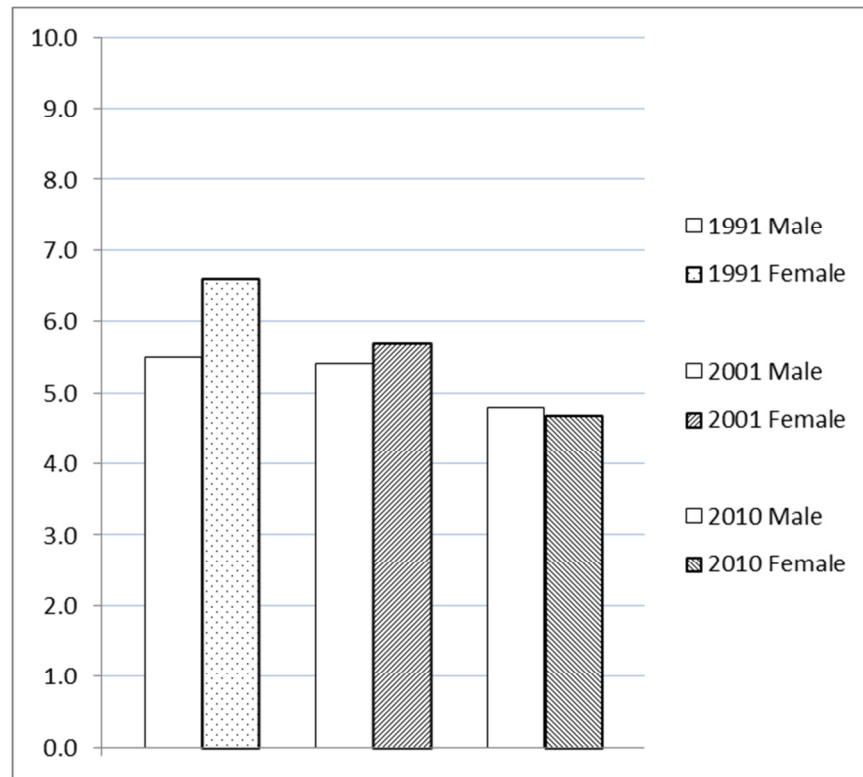   Population in Argentina
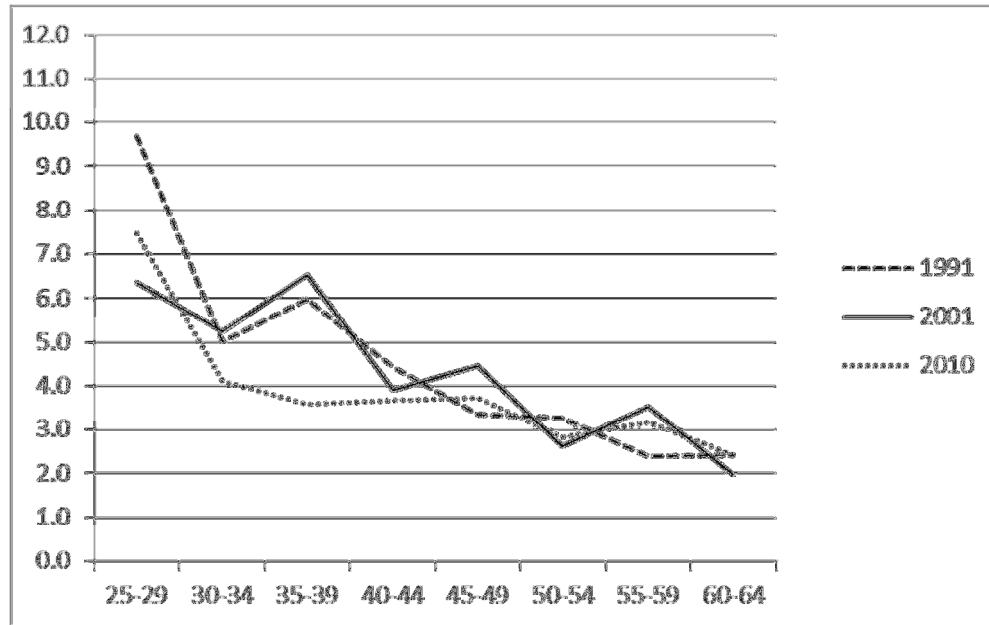
Graph 3 presents very high mortality ratios for the youngest female group, especially in the
year 2001. Similarly to what we observed among men, we find the largest gap between years for
women aged 35-39. This age group has also experienced the most pronounced decline in educational
inequalities in mortality across time.

Graph 3 for women also displays also a different pattern for changing inequalities than what
was shown for men in Graph 2. Educational inequalities among women were similarly high in the
years 1991 and 2001, but these mortality ratios descended abruptly in the period from 2001 to 2010,
with the exception of the youngest age group. This abrupt decline in the female educational
inequalities in death and the slight rise in male educational inequalities in death is reflected in the
inversion of the relation between sex and educational inequalities (as shown on Table 2). In 1991,
women generally had larger educational inequalities in death than men, especially in the young and

intermediate age groups. Meanwhile, in 2010, men have wider educational inequalities in mortality for almost all age groups. This reversal of the gender gap in educational differences in mortality is illustrated in Graph 4.

Graph 4 A Comparison of Mortality Ratios by Educational Attainment for Men and Women among the Adult Population in Argentina: 1991, 2001 and 2010.

More specifically Graph 4 shows[8] this changing of pattern in the relation between gender and educational inequalities in death. It can be observed that educational inequalities in death are wider for adult women in 1991, almost equal between men and women for the year 2001, and larger for men in 2010. An analysis of the regional differences, in the next section, provides some further insights into better understanding this change in the gendered patterning of educational differences in adult mortality.

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[8] This graph gives us only a rough view of the gender differences since all the age groups are included.

Regional Patterns of Educational Differentials in Adult Mortality across Time

How has the relationship between adult mortality and educational attainment unfolded across time in the different regions of Argentina?

The following graphs present the mortality ratios between extreme educational groups for 1991, 2001, and 2010 in the five regions. Graph 5 displays the information for the male population and Graph 6 displays the information for the female population.

Among males, it can be observed that in almost all regions the ratio in 2001 is larger than in either 1991 or 2010. One exception is in the Cuyo region, where the ratio in 1991 is the highest in almost every age group.

The Buenos Aires and Center regions present similar patterns, with the mortality ratios generally higher in 2001 than in either1991 or 2010. As mentioned earlier when describing the general trend for the country as a whole, these two regions are characterized by similar ratios in 1991 and 2010. Thus, the decline in the male mortality ratios in the period between 2001 and 2010 results in educational inequalities in death that are similar to those of the year 1991. Furthermore, these two regions (as well as in Patagonia) are characterized by very high mortality ratios in the youngest age group.

The Cuyo region presents a peculiar pattern, where we find higher mortality ratios in the year 1991 and lower ratios in 2010. In this region, male educational inequalities seem to decline substantially across time, again with the exception of the youngest age group where they have increased just as in the rest of the country (Graph 5).
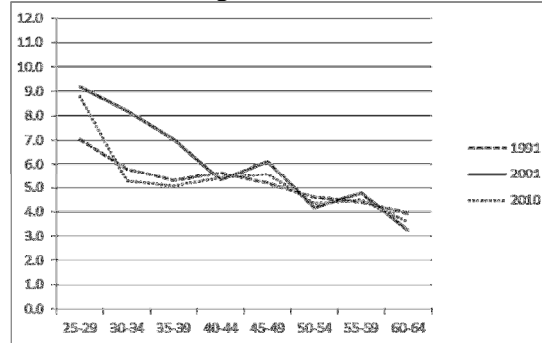
Graph 4 Age-Specific Mortality Ratios by Educational Attainment among the Adult Male Population
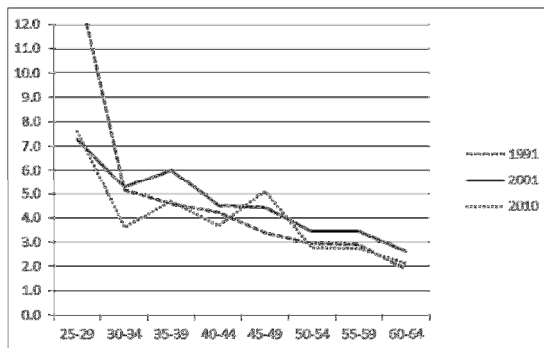   in Regions of Argentina: 1991, 2001, and 2010.
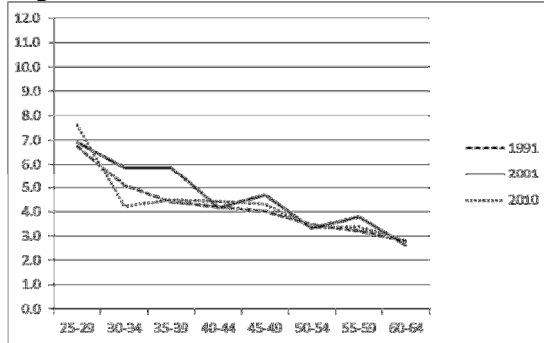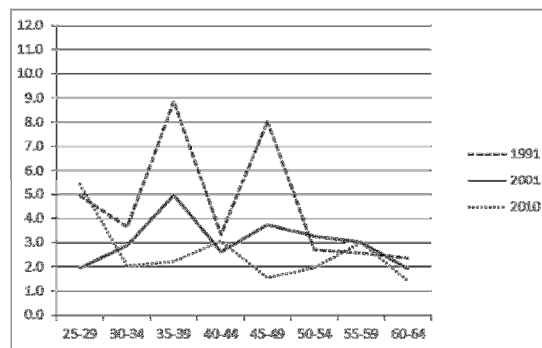
Argentina

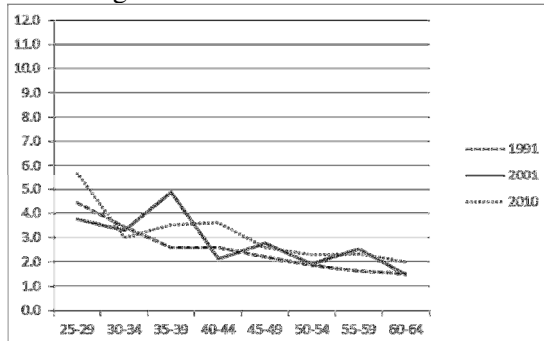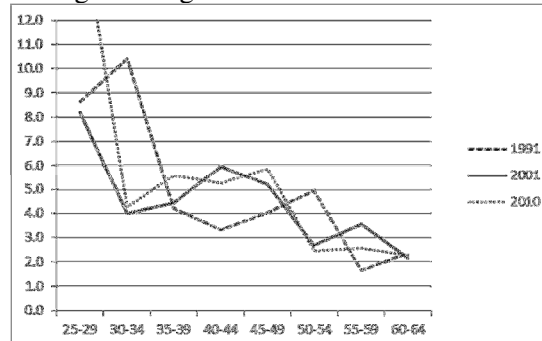Buenos Aires Region

Center Region

Cuyo Region

North Region

Patagonia Region

Sources: Elaborated by the author based upon Argentine National Census 1991, 2001 and 2010, and Argentine Mortality
Files-Vital Statistics1991, 2001 and 2010.

In the Patagonia region, we observe very high male mortality ratios in the youngest age group, similarly to what was found in the Buenos Aires and Center regions. However, there is not a specific year where the mortality ratios are higher than the other (none of the lines predominate). It can be also noticed that mortality ratios for the year 2001 are lower than the mortality ratios for the other years in almost all age groups, even though we have to approach these findings with caution because it could be a data artifact given the small population and small number of deaths for specific age groups in this particular region (Graph 5).

The North region presents lower educational inequalities in mortality than the other regions. However, it is important to notice that in this region the dotted line (2010) is over the other two lines for almost age groups, indicating an increasing trend over time (Graph 5).

For the female population, the pattern is very different. For the Buenos Aires, Center, Cuyo, and North regions, we observe higher mortality ratios in 1991 and 2001 than in 2010, the lines representing these years are very close to each other on the top of the graph. For the year 2010 we observe that at the intermediate ages the mortality ratios are lower than the other two years, meanwhile at the older ages the mortality ratios are close to those of 1991 and 2001 (Graph 6).

The mortality ratios for the youngest female group in 2010 are in general lower than those from 1991. In the case of Center, Cuyo, and North regions, the mortality ratios in the 25-29 age groups are lower than from those the years 1991 and 2001 (Graph 6). Different in comparison to what was found among men: the educational inequalities in death among women in this age group seem to be decreasing across time.

Graph 6 Age-Specific Mortality Ratios by Educational Attainment among the Adult Female
Population in Regions of Argentina: 1991, 2001, and 2010.
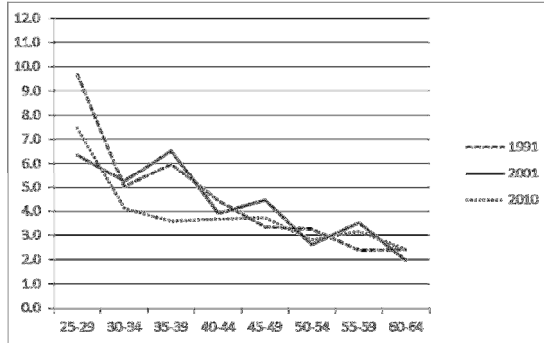
Argentina

Buenos Aires Region
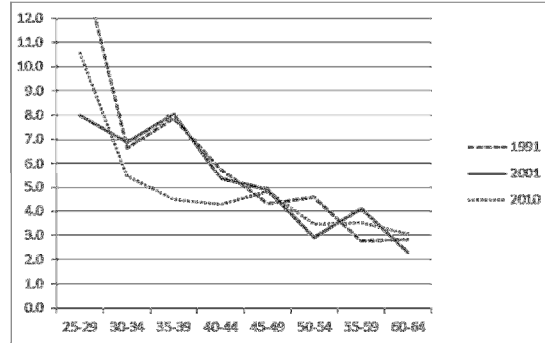
Center Region

Cuyo Region

North Region

Patagonia Region
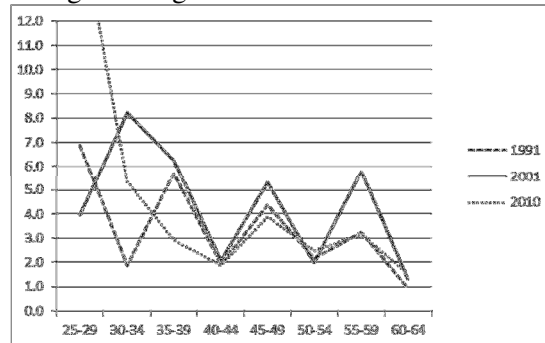
Sources: Elaborated by the author based upon Argentine National Census 1991, 2001 and 2010, and Argentine Mortality
Files-Vital Statistics1991, 2001 and 2010.

Graph 7 Age-Specific Mortality Ratios by Educational Attainment among the Adult Population in
Regions of Argentina: 1991, 2001 and 2010.

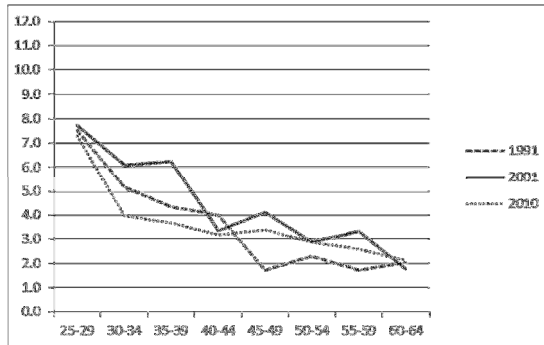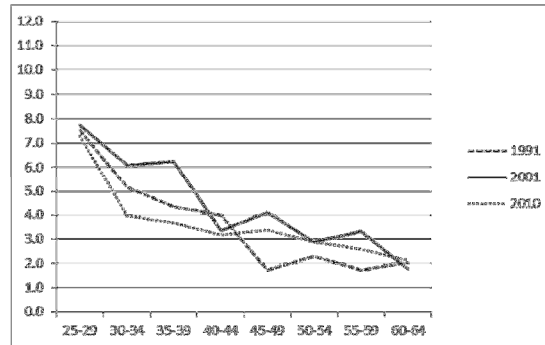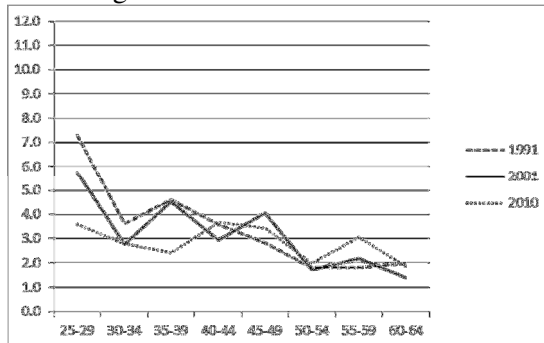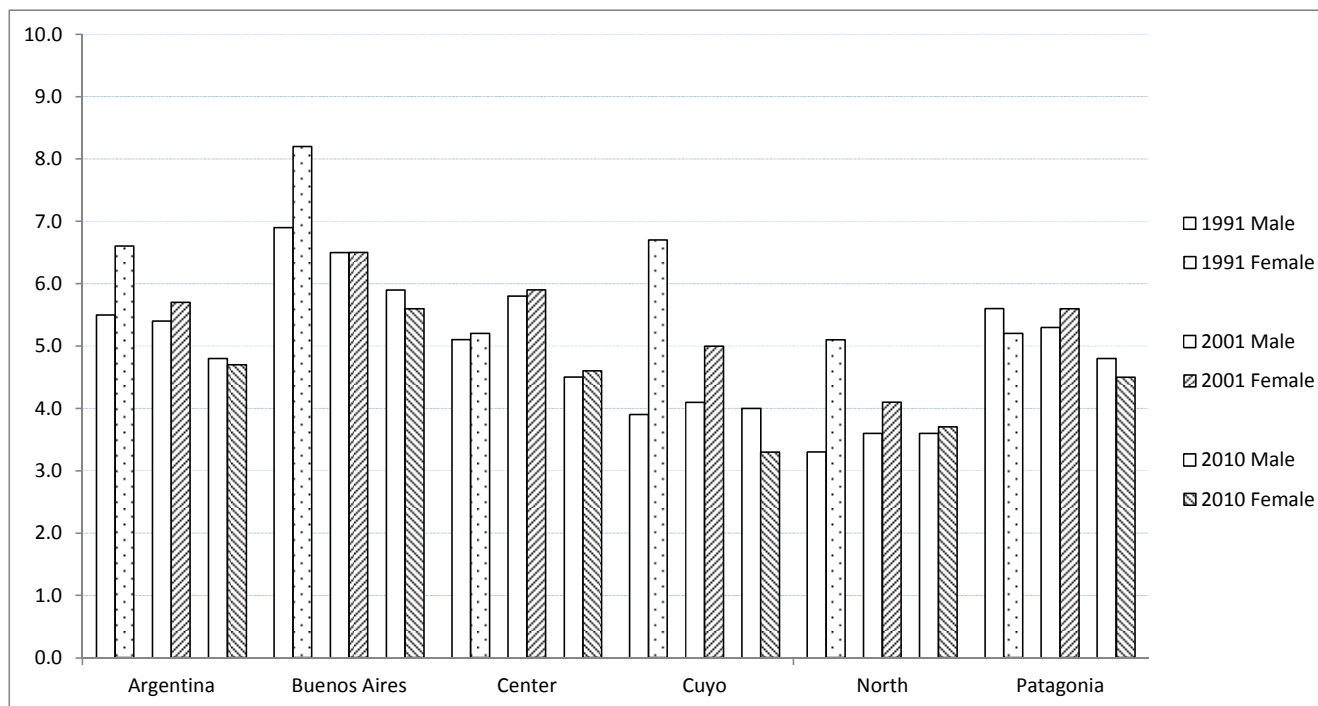*Sources:* Elaborated by the author based upon Argentine National Census 1991, 2001 and 2010, and Argentine
Mortality Files-Vital Statistics 1991, 2001 and 2010.

Conclusions

This paper addressed an important question for the study of the educational inequalities at death among adult population in Argentina: How has the relationship between educational attainment and adult mortality changed across time in Argentina?

Considering the lack of studies about this issue in Argentina, I developed a working hypothesis based on the outcomes of similar studies in other countries. The working hypothesis was that educational differences in overall adult mortality will increase over time during the period 1991-2010. Support for this working hypothesis would be found if mortality ratios between educational groups were larger in 2010 than in 1991 and 2001.

The results do not provide support for the working hypothesis. Instead, I found a more complex trend of mortality inequality, where the year 2001 generally shows the highest mortality ratios in comparison to either 1991 or 2010. This may be because the year 2001 was the peak of a long term process of gradual declining economic and social indicators for the country as a whole.

Support for the working hypothesis was found for the youngest age group of adults, 25-29 years, for both sexes. Moreover, educational inequalities in mortality among this age group are the highest among adults in all the periods. Further, mortality inequalities in this age group have also increased over time.

This paper also uncovered very different patterns by sex. Educational inequalities among women were reduced between 1991 and 2010, with the exception of the youngest group. Although the year 2001 was characterized by the largest mortality ratios for both men and women, the year 2010 was characterized by the lowest female mortality ratios. This decline in the female educational inequalities in death combined with a slight rise in the male educational inequalities in death generates the inversion of the relation between gender and educational inequalities. This inversion is similar to what has been found in the United States (Ross, Masters et al. 2012)

These outcomes could be interpreted at the light of the theory of resource substitution, which sustains that education benefits health most among people with fewer alternative resources (Mirowsky and Ross 2003; Ross, Masters et al. 2012). When applied to gender, "the resource substitution and human capital perspectives imply that education may be more important to women's health than to men's for the very reason that women have fewer socioeconomic resources of other kinds, such as power, authority, earnings, household income, and wealth" (Ross, Masters et al. 2012: 1160). In this sense, the generally increasing educational levels in Argentina during the

analyzed period could have a higher beneficial impact among women, who were in a more disadvantaged situation.

This paper answered relevant a key unanswered question in Argentina; however, the research was also hampered by data limitations. I used multiple imputation as an advanced technique for overcoming important data limitations, such as the 30% of death certificates that did not contain any information on educational attainment. However, multiple imputation cannot substitute for high quality data. Another important data limitation is the lack of available variables to explain why there are such large educational differences in mortality in Argentina. Focusing on the mortality files, besides the problems with the education variable, there is a lack of information on other socioeconomic variables such as employment status, occupation or nationality. Moreover, the analysis of underlying cause of death while also taking in account the other contributing causes of death is not possible in Argentina because public data on mortality files do not include this information.

Besides its scientific value, this analysis should also serve as an incentive toward improving socioeconomic data on death certificates, both in Argentina as well as across Latin America. An improvement of information on death certificates is required not only for testing classic hypotheses regarding social inequalities in mortality, but also to formulate new hypotheses and to answer more in-depth research questions on this issue.

The findings in this paper relate to relevant policy questions about health care and social inequalities in death. For example, even when the expected declining trend in mortality inequalities by education as age increased was observed in previous research (Manzelli 2014), educational inequalities at death among young adults are the highest among adults in all the periods and have also increased over time. How is the health system working with this population? What are the financial and social costs related with this very excess risk of death among young Argentinians?

References

Adler, N. E., T. Boyce, et al. (1994). "Socioeconomic status and health: The challenge of the gradient." American Psychologist **49**(1): 15-24.

Altimir, O. (1997). "Desigualdad, empleo y pobreza en América Latina: Efectos del ajuste y del cambio en el estilo de desarrollo." Desarrollo Económico **37**(145): 3-30.

Antonovsky, A. (1967). "Social Class, Life Expectancy and Overall Mortality." The Milbank Memorial Fund Quarterly **45**(2): 31-73.

Arriaga, E. E. and K. Davis (1969). "The Pattern of Mortality Change in Latin America." Demography **6**(3): 223-242.

Backlund, E., P. D. Sorlie, et al. (1996). "The shape of the relationship between income and mortality in the United States : Evidence from the National Longitudinal Mortality Study." Annals of Epidemiology **6**(1): 12-20.

Backlund, E., P. D. Sorlie, et al. (1999). "A comparison of the relationships of education and income with mortality: the national longitudinal mortality study." Social Science and Medicine **49**: 1373-1384.

Behm, H. (1980). "Socio-economic determinants of mortality in Latin America." Population Bulletin of the United Nations(13): 1-15.

Belon, A. P., M. B. A. d. Barros, et al. (2008). Diferenciais de esperança de vida segundo estratos socioeconômicos. XVI Encontro Nacional de Estudos Populacionais. Caixambu, Brasil.

Bopp, M. and C. E. Minder (2003). "Mortality by education in German speaking Switzerland, 1990-1997: results from the Swiss National Cohort." International Journal of Epidemiology **32**(3): 346-354.

Cerqueira, C. A. and N. Paes Antunes (1998). Mortalidade por Doenças Crônico-Degenerativas e Relações com Indicadores Socioeconômicos no Brasil. XI Encontro Nacional de Estudos Populacionais da ABEP. Caixambu, Brasil.

Clark, D. and H. Royer (2010). The Effect of Education on Adult Health and Mortality: Evidence from Britain. Working paper series. Stanford, National Bureau of Economic Research.

Cordeiro, R. and E. d. A. Silva (2001). "Desigualdade da sobrevivencia de trabalhadores de Botucatu, São Paulo, Brasil." Cadernos de Saúde Pública **17**(4): 925-931.

Cutler, D. M., F. Lange, et al. (2010). Explaining the Rise in Educational Gradients in Mortality. NBER Working Paper Series. Cambridge, National Bureau of Economic Research. **No. 15678**.

Chackiel, J. (1987). "La investigación sobre causas de muerte en la América Latina." Notas de Poblacion **15**(44): 9-30.

Chackiel, J. (1990). Studies of causes of death in Latin America: the current Situation and Future Perspectives. Measurement and Analysis of Mortality: New Approaches. J. Vallin, S. D'Souza and A. Palloni. Oxford, Clarendon Press.

Christenson, B. A. and N. E. Johnson (1995). "Educational Inequality in Adult Mortality: An Assessment with Death Certificate Data from Michigan." Demography **32**(2): 215-229.

Damill, M., R. Frenkel, et al. (2003). "Las cuentas públicas y la crisis de la convertibilidad en la Argentina." Desarrollo Económico **43**(170): 203-230.

Diez Roux, A., T. Green Franklin, et al. (2007). "Intraurban Variations in Adult Mortality in a Large Latin American City." Journal of Urban Health **84**(3): 319-333.

Duleep, H. O. (1998). "Has the US Mortality Differential by Socioeconomic Status Increased Over Time? ." American Journal of Public Health **88**(7): 125-125.

Duncan, B. B., D. Rumel, et al. (1995). "Social Inequality in Mortality in São Paulo State, Brazil." International Journal of Epidemiology **24**(2): 359.

Duncan, G. J., M. C. Daly, et al. (2002). "Optimal Indicators of Socioeconomic Status for Health Research." Am J Public Health **92**(7): 1151-1157.

Enders, C. K. (2006). "A Primer on the Use of Modern Missing-Data Methods in Psychosomatic Medicine Research." Psychosomatic Medicine **68**(3): 427-436.

Feldman, J. J., D. M. Makuc, et al. (1989). "National trends in educational differentials in mortality." Underline American Journal of Epidemiology **129**(5): 010-933.

Frenk, J., R. Lozano, et al. (1994). "La transición epidemiológica en América Latina." Notas de Población **22**(60): 79-101.

Graham, J. W. (2009). "Missing Data Analysis: Making It Work in the Real World." Annual review of psychology. **60**: 549.

Grushka, C. (1995). "Mortalidad adulta en Argentina. Tendencias recientes, causas y diferenciales." Notas de Población **61**: 111-145.

Hadden, W. C. and P. D. Rockswold (2008). "Increasing differential mortality by educational attainment in adults in the United States." International journal of health services : planning, administration, evaluation **38**(1): 47-61.

Houweling, T. A., A. E. Kunst, et al. (2007). "Using relative and absolute measures for monitoring health inequalities: experiences from cross-national analyses on maternal and child health." International Journal for Equity in Health(6).

Huisman, M., A. E. Kunst, et al. (2004). "Socioeconomic inequalities in mortality among elderly people in 11 European populations." J Epidemiol Community Health **58**(6): 468-475.

Hummer, R. and J. Lariscy (2011). Educational Attainment and Adult Mortality. International Handbook of Adult Mortality. R. G. Rogers and E. M. Crimmins, Springer Netherlands**:** 241-261.

Hummer, R. A., R. G. Rogers, et al. (1998). "Sociodemographic Differentials in Adult Mortality: A Review of Analytic Approaches." Population and Development Review **24**(3): 553-578.

Jaspers-Faijer, D. and H. Orellana (1994). "Evaluacion del uso de las estadisticas vitales para estudios de causas de muerte en America Latina." Notas de Poblacion **22**(60): 47-77.

Jaspers-Faijer, D. and H. Orellana (1996). Evaluation of vital statistics for the study of causes of death. Adult mortality in Latin America. I. Timaeus, J. Chackiel and L. T. Ruzicka. Oxford, U.K.; New York, Clarendon Press ; Oxford University Press**:** 45-68.

Kitagawa, E. M. and P. M. Hauser (1973). Differential mortality in the United States : a study in socioeconomic epidemiology. Cambridge, Mass., Harvard University Press.

Kunst, A. E. and J. P. Mackenbach (1994). "The Size of Mortality Differences Associated with Educational Level in Nine Industrialized Countries." American Journal of Public Health **84**(6): 932-937.

López, J. H. and G. Perry (2008). Inequality in Latin America : Determinants and Consequences. Washington, World Bank**:** 35.

Mackenbach, J. P., A. E. Kunst, et al. (1999). "Socioeconomic Inequalities in Mortality Among Women and Among Men: An International Study." American Journal of Public Health **89**(12): 1800-1806.

Manzelli, H., 2014. "Educational attainment and adult mortality differentials in Argentina", Revista Latinoamericana de Población, Año 8 (4): 129-163.

Marmot, M., C. D. Ryff, et al. (1997). "Social inequalities in health: Next questions and converging evidence." Social Science & Medicine **44**(6): 901-910.

Marmot, M. G. and M. E. McDowall (1986). "Mortality decline and widening social inequalities." Lancet **2**(8501): 274-6.

Marmot, M. G., S. Stansfeld, et al. (1991). "Health inequalities among British civil servants: the Whitehall II study." The Lancet **337**(8754): 1387-1393.

Meara, E. R., S. Richards, et al. (2008). "The Gap Gets Bigger: Changes In Mortality And Life Expectancy, By Education, 1981-2000." Health Affairs **27**(2): 350-360.

Mirowsky, J. and C. Ross (2003). Education, social status, and health. New Brunswick, NJ, Aldine Transaction.

Molla, M. T., J. H. Madans, et al. (2004). "Differentials in Adult Mortality and Activity Limitation by Years of Education in the United States at the End of the 1990s." Population and Development Review **30**(4): 625-646.

Montez, J. K., R. A. Hummer, et al. (2011). "Trends in the Educational Gradient of U.S. Adult Mortality From 1986 Through 2006 by Race, Gender, and Age Group." Research on Aging **33**(2): 145-171.

Murphy, M., M. Bobak, et al. (2006). "The Widening Gap in Mortality by Educational Level in the Russian Federation, 1980-2001." American Journal of Public Health **96**(7): 1293-1299.

Paes-Sousa, R. (2002). "Diferenciais intra-urbanos de mortalidade em Belo Horizonte, Minas Gerais, Brasil, 1994: revisitando o debate sobre transiçoes demográfica e epidemiológica." Cadernos de Saúde Pública **18**: 1411-1421.

Paes Antunes, N. (2002). Diverging regional trends in Brazilian Adult Mortality. IUSSP Committee on Emerging Health Threats: Determinants of Diverging Trends in Mortality. Rostock, Germany. **, :** 26.

Palloni, A. (1981). "Mortality in Latin America: Emerging Patterns." Population and Development Review **7**(4): 623-649.

Pappas, G., S. Queen, et al. (1993). "The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986." New England Journal of Medicine **329**(2): 103-9.

Paz, J., J. M. Guzmán, et al. (2004). América Latina y el Caribe: dinámica demográfica y políticas para aliviar la pobreza. Serie Poblacion y Desarrollo. Santiago de Chile, Centro Latinoamericano y Caribeño de Demografía (CELADE). **53**.

Piscoya-Díaz, M. and B. L. Queiroz (2010). "What do we know about adult mortality and data quality in Peru? Mortality coverage levels and trends from recent decades." Papeles de Población **16**: 219-241.

Potter, B. (2007). "Constricting contestation, coalitions, and purpose: the causes of neoliberal restructuring and its failures." Latin American Perspectives **34**(3): 3-24.

Preston, S. H. and I. T. Elo (1995). "Are Educational Differentials in Adult Mortality Increasing in the United States?" Journal of aging and health. **7**(4): 476.

Reimers, F. (1991). "The Impact of Economic Stabilization and Adjustment on Education in Latin America." Comparative Education Review **35**(2): 319-353.

Renteria, E. P. and C. M. Turra (2008). Desigualdade social na mortalidade no Brasil: diferenciais por escolaridade entre mulheres adultas. XVI Encontro da Asociacao Brasileira de Estudos Populacionais. Caxambu-MG, Brasil.

Renteria, E. P. and C. M. Turra (2009). Measuring educational differences in mortality among women living in highly unequal societies with defective data. The case of Brazil. Texto para discussão. Belo Horizonte:, UFMG/Cedeplar. **348**.

Rofman, R. (1994). "Diferenciales de mortalidad adulta en Argentina." <u>Notas de Población</u> **59**: 73-91.

Rogers, R. G., R. A. Hummer, et al. (2000). <u>Living and dying in the USA : behavioral, health, and social differentials of adult mortality</u>. San Diego, Academic Press.

Rosero-Bixby, L. (1994). "La disminución de la mortalidad de adultos en Costa Rica." <u>Notas de Población</u> **22**(60): 103-39.

Rosero-Bixby, L. and D. Antich (2010). "Estudio longitudinal de mortalidad de adultos costarricenses 1984-2007." <u>Población y Salud en Mesoamérica</u> **7**(2): 2-24.

Ross, C., R. Masters, et al. (2012). "Education and the Gender Gaps in Health and Mortality." <u>Demography</u> **49**(4): 1157-1183.

Rubin, D. B. (1996). "Multiple Imputation After 18+ Years." <u>Journal of the American Statistical Association</u> **91**(434): 473-489.

Schafer, J. L. and J. W. Graham (2002). "Missing data: our view of the state of the art." <u>Psychological methods</u> **7**(2): 147-77.

Schkolnik, S. and J. Chackiel (1998). "América Latina: la transición demográfica en sectores rezagados." <u>Notas de Población</u> **67/68**: 8-53.

Shkolnikov, V. M., E. M. Andreev, et al. (2006). "The changing relation between education and life expectancy in central and eastern Europe in the 1990s." <u>J Epidemiol Community Health</u> **60**(10): 875-881.

Shkolnikov, V. M., D. A. Leon, et al. (1998). "Educational level and adult mortality in Russia: An analysis of routine data 1979 to 1994." <u>Social Science & Medicine</u> **47**(3): 357-369.

Sihvonen, A.-P., A. E. Kunst, et al. (1998). "Socioeconomic inequalities in health expectancy in Finland and Norway in the late 1980s." <u>Social Science & Medicine</u> **47**(3): 303-315.

Smith, G. D., C. Hart, et al. (1998). "Education and occupational social class: which is the more important indicator of mortality risk?" <u>Journal of Epidemiology and Community Health</u> **52**: 153-160.

Sorlie, P. D., E. Backlund, et al. (1995). "US Mortality by Economic, Demographic, and Social Characteristics: The National Longitudinal Mortality Study." <u>American Journal of Public Health</u> **85**(7): 949-956.

Stata C. (2009). <u>Stata multiple-imputation reference manual release 11</u>. College Station, Tex, Stata Press.

Valkonen, T. (1989). Adult mortality and level of education: a comparison of six countries. <u>Health Inequalities in European Countries</u>. J. Fox. Gower, Gower, Aldershot**:** 142-162.

Valkonen, T. (1993). "Problems in the measurement and international comparison of socio-economic differences in mortality." <u>Social Science & Medicine</u> **36**(4): 409-418.

Vallin, J. (1980). "Socio-economic determinants of mortality in industrialized countries." <u>Population Bulletin of the United Nations</u>(13): 26-41.

Williams, D. R. (1990). "Socioeconomic Differentials in Health: A Review and Redirection." <u>Social Psychology Quarterly</u> **53**(2): 81-99.