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The Relationship between Adult Mortality and Educational Attainment in Argentina

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Dedication

To my family.

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The Relationship between Adult Mortality and Educational Attainment in Argentina

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Abstract: The study of the relationship between socioeconomic characteristics and mortality patterns has been a traditional research focus in demography, representing one of the core areas of the discipline. In Latin America, there is an important set of studies that show a significant inverse relationship between socioeconomic status and mortality rates. However, mainly due to limitations in the available data, we know very little about the specific relation between educational attainment and adult mortality. This inverse relationship between educational attainment and mortality rates provides just the tip of the iceberg for a large set of questions: How wide are educational differences in overall adult mortality in Argentina? Does the association between educational attainment and adult mortality vary by age group, gender and region? Are there unique adult mortality patterns by education among specific causes of death? Has the adult mortality differential by education attainment widened or narrowed as education attainment increased between 1991 and 2010? The main objective of this research was to describe and analyze the relationship between educational attainment and adult mortality patterns during the 1991-2010 period in Argentina. The data used in this study come from the Argentinian Mortality Files for the period 1991-2010 and from the 1991, 2001 and 2010 Argentinian Censuses. Results show a clear gradient in the specific mortality rates according to educational groups, for both sexes and for all age groups. The existence and direction of this relationship was as expected; however, the magnitude of educational differences was much higher than what has been found in other countries. The data also exhibited a clear declining trend in mortality inequalities by education as age increased. Educational differences in overall adult mortality did not display an increasing pattern over time. The year 2001, which was characterized by serious economic and social crisis in the country, displayed the highest educational inequalities in mortality in comparison to either 1991 or 2010. The findings of this dissertation are relevant to policy questions about health care and social inequalities in death.

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CHAPTER 1: Introduction and Statement of the Problem

The study of the relationship between socioeconomic characteristics and mortality patterns has been a traditional research focus in demography, representing one of the core areas of the discipline. The classic studies of socioeconomic differentials in mortality have focused on how occupational status, income, and educational attainment are associated with mortality levels and causes of death for specific groups in the population. The analysis of these relationships has gained important scientific relevance in the social sciences in general and in demography in particular because it is directly linked with the crucial matter about how social stratification shapes different life opportunities for individuals (Hummer and Lariscy 2011). Furthermore, the study of socioeconomic differences in mortality has relevance for the designing of public policies oriented to deal with social inequalities.

An increasing number of academic studies, particularly in the United States, have documented a widening gap in life expectancy and specific mortality rates between socioeconomic groups, which goes against the expectation of an improving distribution of health across all population subgroups (Feldman, Makuc et al. 1989; Pappas, Queen et al. 1993; Adler, Boyce et al. 1994; Kunst and Mackenbach 1994; Preston and Elo 1995; Backlund, Sorlie et al. 1996; Backlund, Sorlie et al. 1999; Lauderdale 2001; Meara, Richards et al. 2008). A widening gap in mortality rates between groups was also found when using educational attainment as the indicator of socioeconomic status in a context of rising education levels across the population (Preston and Elo 1995; Hummer, Rogers et al. 1998; Molla, Madans et al. 2004). These findings suggest that although U.S. society is characterized by a more highly educated population than ever before, in relative terms, there are wider disparities in mortality rates across population groups than in the past.

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 Paes Antunes 1998; Paes-Sousa 2002; Paes Antunes 2002; Diez Roux, Green Franklin et al. 2007; Belon, Barros et al. 2008; Renteria and Turra 2008). 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 how the relationship between education attainment and adult mortality changes as education levels increase across time. In Argentina, in fact, there is very little research on differential mortality among adults.

The main objective of this dissertation is to describe and analyze the relationship between educational attainment and adult mortality patterns during the 1991-2010 period in Argentina. More precisely, I will focus the analysis on the relationship between educational attainment and specific levels of mortality and specific causes of death among the working-aged adult population (25 to 64 years old) during the 1991-2010 period in Argentina. To accomplish this objective, this research uses a quantitative design using data from the Argentinian Mortality Files for the period 1991-2010 and from the 1991, 2001 and 2010 Argentinian Censuses.

The selection of the adult population aged 25-64 for this study is based on three 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.

Latin American countries have been identified as being among the most unequal societies in the world (Reimers 1991; Frenk, Lozano et al. 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.

Moreover, the period 1991-2010, the temporal frame of this dissertation, 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 specific questions I aim to answer in this research study are: 1) How wide are educational differences in overall adult mortality in Argentina? 2) Does the association between educational attainment and adult mortality vary by age group, gender and region – as has been found in other countries? 3) Are there unique adult mortality patterns by education among specific causes of death and, if so, how do such cause-specific patterns compare to those found in other countries? 4) Has the adult mortality differential by education attainment widened or narrowed as education attainment increased between 1991 and 2010?

This dissertation first presents a summary of the demographic context in Argentina, as well as the major changes in educational attainment that have occurred during the last few several decades. Second, it introduces a review of the scientific literature for understanding the relationship between educational attainment and adult mortality levels. Third, it introduces my research objectives and the hypotheses to be tested. Next, I explain the data and methodology used in this research. The sixth, seventh and eighth chapters present the results of the research. Finally, this dissertation ends with a chapter focused on the conclusions of this research.

CHAPTER 2: Socio-demographic Context

In this section, I present a concise summary of the demographic dynamics in Latin America and focus more specifically on the contemporary mortality decline in Argentina. I continue with a review of some economic patterns in the region, where I illustrate some key characteristics of the social and economic context in Argentina for the period 1991-2010. Then, I present information about educational expansion in Argentina, concentrating on changes during the 1991-2010 period.

2.1. DEMOGRAPHIC BACKGROUND

During the second half of the 20th century, life expectancy at birth in Latin America increased from 52 years to 70 years. This was the second fastest increase in life expectancy in the world, behind several Asian countries (Chackiel 2004). Studies that have focused on the demographic and epidemiologic transition in Latin America agree with the idea that it is more accurate to talk about different or diverse transitions rather than talk about one transition (Palloni 1981; Chackiel 1990; Palloni 1990; Frenk, Lozano et al. 1994; Chackiel 2004; Guzmán, Rodríguez et al. 2006). Regarding the epidemiological transition, Frenk and colleagues proposed a typology of mortality profiles in Latin American countries, considering mortality patterns of change, the timing of the transition, and the pace and direction of these changes. In this typology, Argentina is part of the group of countries with an advanced mortality profile (together with Uruguay, Chile, Cuba, and Costa Rica). The other two groups in this typology are countries with a mixed mortality profile (e.g., Venezuela, Brazil, Colombia, Mexico, Dominican Republic, and Ecuador), and countries with an incipient mortality profile (e.g., Peru and El Salvador) (Frenk, Lozano et al. 1994).

Besides this heterogeneity in mortality profiles across Latin American countries, several authors have called attention to the heterogeneity of the demographic and epidemiologic transitions across socioeconomic groups (Zavala de Cosío 1995; Schkolnik and Chackiel 1998; Chackiel and Schkolnik 2004). As explained by Frenk and colleagues (1994), Latin-America has the dubious merit of having the most unequal economic distribution in the world. This highly unequal economic distribution affects mortality patterns in such a way that some authors have emphasized that the differences between socioeconomic groups cannot be reduced to "socioeconomic differentials." Instead, there are multiple and unequal simultaneous demographic transitions occurring in the Latin American context, leading to wide disparities in adult mortality across socioeconomic groups (Paes-Sousa 2002).

Life expectancy at birth in Argentina is currently estimated to be 76.13 years (INDEC 2010), a relatively high figure compared with the life expectancy in South America as a whole of 73 years (Population Reference Bureau 2010). However, the pace of decline in the Argentinean mortality rate over the last four decades has slowed compared with other developing countries (Grushka 1995).

The mortality decline in Argentina began at the end of the 19thCentury.[1] Estimates showed an increase in life expectancy at birth from 33 years for the period 1869-1895 to 40 years for the period 1895-1914. Life expectancy reached 61 years in 1947 and 66 years in 1960 (Somoza 1971). Unique in comparison to most Latin American countries, the most important increase in life expectancy in Argentina was registered at the end of the 19th century, during the 1895-1914 period. During the 1950s and 1960s, Argentina had the second highest life expectancy

[1] In contrast with the predictions from demographic transition theory that fertility and mortality are high in traditional and low in modern societies, and that a demographic transition takes place from one to other, in Argentina the decline of mortality and fertility has been practically simultaneous (Pantelides 1983 and 2001).

at birth in Latin America, only lower than the life expectancy of Uruguay. At present, Argentina has the sixth highest life expectancy level in the region, below Cuba, Costa Rica, Panama, Uruguay, and Chile. At the same time, the Argentinian GDP per capita is one of the highest in Latin America (PRB 2010). Thus, Argentina seems to have plenty of room for improvement with regard to life expectancy.

Comparisons across countries hide the heterogeneity that is present within each country. In the case of Argentina, heterogeneity in mortality levels across regions is wide. For example, in 2001, life expectancy at birth in Buenos Aires city was 75.91 (71.8 for men and 79.4 for women); meanwhile life expectancy at birth in the province of Formosa was just 70.8 (68.5 for men and 73.4 for women) (INDEC 2007). As noted by Frenk and colleagues (1994), the definition of development includes the universality of benefits and progress. The unique situation in Latin America is characterized by both the magnitude of these inequalities as well as by the growing differences among extreme social groups within a number of countries in the region, including Argentina (Frenk, Lozano et al. 1994).

2.2. ECONOMIC DEVELOPMENT

Most Latin American countries are characterized by a high level of economic inequality. Even during the period of rapid economic growth in the region after the Second Word War, economic polarization increased (Altimir 1997). The institutions and policies that were dominant during the so-called Import Substitution Industrialization model of growth started being dismantled during the 1970s. These economic and social transformations were supported and promoted by military regimes that interrupted democratic governments. In the case of Argentina, these transformations took place under a dictatorship regime during the period 1976-1983. Both

poverty and inequality worsened substantially in the 1980s (Beccaria 1991; Altimir 1997; Korzeniewicz and Smith 2000). During this period, most Latin American countries were hit with the so-called “debt crisis”. As stated by the Economic Commission for Latin America, the 1980s was a “lost decade”, evidenced by an overall decrease of 9.8% in the regional GDP (Cerrutti and Bertoncello 2003).

During the 1990s, a new set of economic policies was put in practice. These policies were recommended by multilateral institutions and supranational development agencies under the so-called "Washington Consensus" (Korzeniewicz and Smith 2000). Although there was significant variation in the way countries implemented these policies, most of them were oriented to a financial liberalization of the economy and incorporation of the region into the new global economy (Damill, Frenkel et al. 2003; Potter 2007). Structural adjustment policies were adopted that included currency devaluation, public spending cuts, elimination of price controls, trade liberalization, market deregulation, and privatization of public services and enterprises. During the first half of the decade several Latin American countries experienced a significant increase in per capita GDP. However, the regional economic performance worsened during the second half of the 1990s. For the region as a whole, 1990s income inequality and poverty increased (Altimir and Beccaria 2001; Cerrutti and Bertoncello 2003; Frenkel and Ros 2004; Potter 2007). Indeed, a severe economic crisis occurred in the region in this period; for example, the economic crisis hit Mexico in 1994-1995 and Brazil in 1998. Argentina went through an unprecedented economic and social crisis at the beginning of 2002, when GDP, employment, and wages plummeted (Beccaria, Esquivel et al. 2005). However deep, the crisis did not impede the recovery that started as early as in the second half of 2002, particularly in terms of employment creation. In most years of the proposed period under analysis for this dissertation (1991-2010), Argentina has been

undergoing a process of persistently increasing inequality. At the same during this period, education expansion continued, as detailed in the next section (Tedesco and Tenti Fanfani 2001).

2.3. EDUCATIONAL ATTAINMENT

Latin American countries experienced substantial educational expansion over the course of the 20th century (Reimers 2006; Torche 2010). In the case of Argentina, compulsory primary school attendance for ages 6-14 was established in 1884. This expansion resulted in major increases in literacy, as noted here: "Following this legislation, the illiteracy rate for persons 14 and older dropped from 77.4 percent in 1869 to 13.6 percent in 1947, albeit with considerable regional variation…" (Parrado 1998: 349).

Tedesco and Tenti Fanfani (2001) proposed three main stages in the process of educational expansion in Latin America: 1) a first stage during the end of the 19th century, when education systems were created and developed, with early development in particular in Argentina, Chile, and Uruguay; 2) a second stage during the 1960s when education reforms emphasized links between education, economic development and human capital and; 3) a third stage during the 1990s when new education reforms emphasized links between education, economic growth and democratic citizenship. In the case of Argentina, the second stage was not fully achieved mainly because of the interruption of democratic governments and the "debt crisis." As noted by Reimers (1991), these political and economic problems disproportionally impacted the education system. Thus, the education reform in Argentina that occurred over the past 20 years was an

important change. During this period, the acceleration in the expansion of school enrollment rates coincided with stagnation in economic growth[2].

Elementary school enrollment rates have traditionally been high, and particularly close to 100 percent since the mid 1980s. In 1960, the elementary school enrollment was already high in Argentina (82.6 percent). This rate showed an appreciable increase in the 1990-2000 period, starting out from 72.7 percent in 1991, and reaching 99.8 percent at the end of the 20th century (Parrado 1998; Tedesco and Tenti Fanfani 2001).

The proportion of 14-17 year olds that attended high school in Argentina has risen more or less continuously from about 65 percent in 1975 to 89 percent in 1998. High school graduation rates among 20-23 year olds oscillated around 40 percent between 1975 and 1990, but climbed to over 50 percent in recent years. After 1992, there was a clear jump in high school graduation rates as well as in college enrollment that has been associated by some authors to the huge increase in unemployment that happened at the same time[3] (Parrado 1998).

The gross tertiary enrollment rate reached almost 40 percent in Argentina during the 1990s, a higher rate than those observed in most Latin American countries (Cossa 2000). A factor that greatly contributes to high rates of college enrollment is that public education is virtually free in terms of tuition, even at the college level in Argentina.

In sum, during the 1991-2010 period Argentina showed a continuing decline in mortality rates in a context of an advanced mortality profile (Frenk, Lozano et al. 1994), a process of

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[2] These recent educational changes (1990-2010) have relatively little impact in the population of this research because most of the adults in my analysis completed school prior to the 1990s and 2000s, although it has an impact on the population aged 25-30 in 2001 and on the population aged 25-35 in 2010.

[3]This situation supports the hypothesis of a substitution effect, which suggests that "a decline in the opportunity cost of education in a context of growing unemployment and declining wages fosters the demand for education" (Torche 2010).

persistently increasing inequality in most part of the analyzed period, and a continuing expansion of education.

CHAPTER 3: Literature Review

3.1. SOCIOECONOMIC DIFFERENTIALS IN ADULT MORTALITY

An important body of knowledge has been constructed in demography and public health on the linkage between socioeconomic characteristics and mortality levels. The persistent and recurrent interest in this topic resides in that it expresses one of the most clearly evident manifestations of social inequality. As stated by Antonovsky in 1967, "Death is the final lot of all living beings. But, as the tragic experience of the Titanic passengers dramatically illustrates, the time at which one dies is related to one's class" (Antonovsky 1967: 31).

Studies from many countries around the world have shown a strong and inverse relationship between socioeconomic status and mortality rates. That is, individuals with lower socioeconomic status have higher mortality and morbidity rates than individuals with higher socioeconomic status. In the case of the United States, the pioneering work of Kitagawa and Hauser (1973) provided extensive evidence of the existence of differential mortality by socioeconomic status over the period 1930-60. In the fourth chapter of their book, dedicated to the analysis of socioeconomic differentials in Chicago using data from The Chicago Area Study, the authors found that for both men and women the lowest socioeconomic class had a mortality rate that was approximately 60 percent higher than the rate of the highest class and that this inequality seemed to be stable over the time period. Subsequent numerous studies showed this strong and inverse relationship, whether measured by socioeconomic status as a whole, or by the different components of socioeconomic status (educational attainment, income or occupation) (Duleep 1989; Feldman, Makuc et al. 1989; Pappas, Queen et al. 1993; Preston and Taubman 1994; Christenson and Johnson 1995; Backlund, Sorlie et al. 1996; Elo and Preston 1996; Marmot, Ryff et al. 1997; Backlund, Sorlie et al. 1999; Rogers, Hummer et al. 2000). Similar

patterns of mortality inequality have been found in other developed regions or countries like Israel (Jaffe, Neumark et al. 2008), Canada (Mustard, Derksen et al. 1997; Ross, Wolfson et al. 2000), and Europe (Kunst and Mackenbach 1994; Mackenbach, Kunst et al. 1997; Sihvonen, Kunst et al. 1998; Bopp and Minder 2003; Huisman, Kunst et al. 2004; Elo, Martikainen et al. 2006; Geyer, Hemstrom et al. 2006; Clark and Royer 2010; Madsen, Andersen et al. 2010), where the unexpected increase in mortality levels in Russia in the last two decades has gained special attention (Chen, Wittgenstein et al. 1996; Cockerham 1997; Shkolnikov, Leon et al. 1998; Murphy, Bobak et al. 2006; Shkolnikov, Andreev et al. 2006).

To a lesser extent, some of these studies have analyzed the relationship between socioeconomic status and cause-specific mortality (Kitagawa and Hauser 1973; Wrigley and Nam 1987; Pappas, Queen et al. 1993; Nam, Hummer et al. 1994; Link and Phelan 1995; Howard, Anderson et al. 2000; Rogers, Hummer et al. 2000; Phelan, Link et al. 2004; Geyer, Hemstrom et al. 2006). The study of differentials in mortality by cause of death allows for the analyses of associations that take particular magnitude and, in some cases, direction, compared to overall mortality. Even when socioeconomic status is associated with each of the 14 major cause-of-death categories in the International Classification of Diseases (Link and Phelan 1995), the analysis of the relationship between socioeconomic status and cause-specific mortality provides particularities related to the epidemiologic transition of each region. For example, using data from the National Longitudinal Mortality Study, which followed Current Population Survey respondents for nine years, Phelan and colleagues (2004) found that mortality from causes of death that are more preventable were more strongly related to socioeconomic status than mortality from causes that are less preventable. These findings held across gender and racial/ethnic groups.

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, U.S. socioeconomic disparities in morbidity and mortality persisted or even increased. In the last two decades, several studies have observed increasing socioeconomic differentials over time, which goes against the expectation of improving distributions of health across all population subgroups (Pappas, Queen et al. 1993; Preston and Elo 1995; Duleep 1998; Molla, Madans et al. 2004; Singh and Siahpush 2006; Hadden and Rockswold 2008; Montez Karas, Hummer et al. 2010). For example, 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 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.

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 research, 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.

3.2. PREVIOUS RESEARCH ON EDUCATIONAL ATTAINMENT AND ADULT MORTALITY FROM THE UNITED STATES AND EUROPE

There is a growing body of literature that has specifically analyzed the phenomenon of widening educational differences in adult mortality. This body of work constitutes a fundamental source of information for this research. 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. 2010; Hummer and Lariscy 2011) or Europe (Marmot, Ryff et al. 1997; Shkolnikov, Leon et al. 1998; Bopp and Minder 2003; Murphy, Bobak et al. 2006; Clark and Royer 2010).

The widening of educational differentials in mortality levels has been consistently reported in the United States since the 1960s. As mentioned before, 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.[4] 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

[4]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 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).

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). The documentation and analysis of this widening gap in developed countries different than the United States is of relevance for the current research. But there are also two characteristics of these studies that make them of particular importance for this dissertation: the

comparative perspective and the use of more restricted data sets in comparison to those from the United States.

In the first place, 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.

Second, some of the European studies give us significant methodological insights because they use more restricted data than has been used in the more recent studies from the United States. That is, these studies take advantage of classical demographic techniques in a context of limited data. The studies of Shkolnikov (Shkolnikov, Leon et al. 1998; Shkolnikov, Andreev et al. 2006) in Russia and Eastern Europe are good examples of this. In their comparative analysis of the evolution of the relationship between educational attainment and life expectancy in Eastern Europe during the 1990s, Shkolnikov and colleagues calculated life tables using three educational categories: university, secondary, and less than secondary education. Then the authors decomposed the changes in life expectancy into contributions of population composition and within-category mortality (Shkolnikov, Andreev et al. 2006). In a previous work, Shkolnikov and colleagues used cross-sectional data on mortality from Russian Censuses and mortality files and analyzed mortality gradients by length of education (Shkolnikov, Leon et al. 1998).

Gender differences in the relationship between mortality and educational attainment have been analyzed by some of the studies in both the United States and Europe. Findings on this issue have not been consistent. For instance, Preston and Elo (1995), using the National Longitudinal Mortality Study in the United States, found that education-related differences had widened for adult men in the comparison with the results obtained by Kitagawa and Hauser using data from 1960. However, the education-related differences had narrowed for adult women. Pappas and colleagues found, though, that these education-related differences had widened for both sexes, but

to a lesser degree for women than for men (Pappas, Queen et al. 1993). Other researchers also found that the relationship between mortality and educational attainment is stronger for men than for women (Feldman, Makuc et al. 1989; Backlund, Sorlie et al. 1996). Research by Zajacova and colleagues (Zajacova 2006; Zajacova and Hummer 2009) precisely focuses on whether the effect of education on mortality for U.S. adults differs by gender. Using information from the National Health and Nutrition Examination Survey (NHANES I), Zajacova did not find statistically significant gender differences in the relationship between educational attainment and all-cause mortality, or for mortality by cause of death. In a subsequent study with a much larger data set, Zajacova and Hummer (2009) found somewhat larger educational differences in mortality for U.S. men compared to U.S. women (see also Ross, Masters et al. 2012).

3.3. PREVIOUS RESEARCH ON ADULT MORTALITY 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[5]. 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.[6] In addition to the data limitations, research on mortality in Latin America has largely focused on infants, mostly because of its use in international comparisons as a crude indicator of the status of the population and for its intrinsic importance for measuring human development. An important body of knowledge on infant mortality has been developed in the region, often using specific surveys that complement traditional sources such as Vital Statistics (Breilh 1983; Bronfman and Tuiran 1984; Saad 1985; Bronfman 1992; Bähr and Wehrhahn 1993; Bronfman 2000; Sastry 2004). These studies have showed that socioeconomic factors are responsible for most of the observed differences in infant mortality. Several authors have suggested that this differential effect can be extended to the adult population (Paz, Guzmán et al. 2004), and a great portion of what we know today about socioeconomic differentials in adult mortality comes from these studies on infant mortality. However, as noted by Rofman (1994), this assumption lacks robust empirical support.

The majority of the studies in the region dealing with the relationship between educational attainment and adult mortality are subsumed in a wider set of investigations focused on socioeconomic differentials in adult mortality levels. In these studies, the variable education is

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

[6] 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).

included in a broader set of socioeconomic variables and their focus tends to be on the relationship between adult mortality and economic development (Curto de Casas 1993; Orihuela-Egoavil 1993; Rosero-Bixby 1994; Grushka 1995; Cerqueira and Paes Antunes 1998; Duarte, Schneider et al. 2002; Messias 2003; Ishitani, Franco et al. 2006; Diez Roux, Green Franklin et al. 2007; Belon, Barros et al. 2008). With few exceptions, these studies are based on indirect approaches, where deaths are compiled at a specific ecological level (e.g., states, municipalities, or census tracts of residence of the deceased person) and then deaths and the population for each geographical area are allocated as a unit to one of several educational groups, on the basis of an educational index for each geographic area.

Studies that have analyzed the relationship between mortality levels and socioeconomic factors in Latin America using these methods show that there is a strong and inverse association between socioeconomic factors (e.g., income, GDP per capita, urbanization, illiteracy rates, percent of homes with inadequate sanitation, etc.) and adult mortality rates. For example, Messias (2003) found that income disparities (using the Gini coefficient) and illiteracy rates were negatively associated with life expectancy in Brazil. A simple linear regression between life expectancy and the illiteracy rate showed a 2.2 year decrease in life expectancy for each 10-unit increase in the illiteracy rate. A multiple linear regression including GDP per capita, illiteracy rate, and the Gini coefficient showed that the inclusion of illiteracy rates in the regression model removed the effect of income disparities (Messias 2003). A similar finding was presented by Belon and colleagues (2008) for the population of Campinas, Brazil for the year 2005. The authors found that the difference in life expectancy between extreme socioeconomic groups was about 4 years (76.9 for those individuals in the highest socioeconomic status versus 72.5 for those individual in the lowest socioeconomic status), with the largest difference among men (Belon, Barros et al. 2008).

Concerning Argentina, 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).

However, even when the association between socioeconomic factors and adult mortality seems straightforward in the region, the association between the pace of decline in adult mortality and changes in economic development are not so direct. In a seminal research study on adult mortality in Costa Rica, stagnation in the adult mortality decline was observed in a period of strong economic growth and health spending (1960-1970); moreover, an increase in the pace of adult mortality decline was observed during a period of stagnation in economic development (1980-1990) (Rosero-Bixby 1994). In his research, Grushka showed that the 14 percent decline in adult mortality rates during the 1980-1990 period in Argentina occurred during a period of economic decline, calling attention to the apparent lack of association between economic crisis and adult mortality (Grushka 1995).

Studies that analyzed the relationship between causes of death in adult mortality and socioeconomic factors in Latin America show that there are significant differences in the

relationship depending on the specific cause of death and that the effect of this relationship varies considerably by age and sex (Rosero-Bixby 1994; Grushka 1995; Paes-Sousa 2002; Paes Antunes 2002; Ishitani, Franco et al. 2006; Di Cesare 2007; Diez Roux, Green Franklin et al. 2007; Pessoa Cesse 2007; Wilson, Regidor et al. 2007; Nogueira, Ribeiro et al. 2009). For example, the association between neoplasm mortality and socioeconomic factors tends to be positive; whereas the association between transmittable disease mortality and socioeconomic factors tends to be negative. These patterns should be understood in light of the transformations in the Latin American mortality profile throughout its epidemiological transition, which have shown a growing tendency for neoplasms as a cause of death compared to infectious and parasitic diseases. As proposed by the epidemiologic transition, improvement in the social conditions of the population reduce the incidence of diseases related to underdevelopment affecting mainly the younger population and increases the incidence of chronic-degenerative diseases affecting mainly the older population (Frenk, Lozano et al. 1994). In this sense, these studies find higher neoplasm mortality in geographic areas with better education levels. Furthermore, some of these studies show important variability in the effect of the relationship by age and sex. For instance, through a multiple regression analysis using the 1980 and 1991 Brazilian Censuses, Paes Antunes (2002) finds a significant positive association between education, measured as the illiteracy rate among the 15 year-old population, and neoplasm mortality and external cause mortality. That is, there is a higher death risk for these causes in states with better education. Similarly, Rosero-Bixby (1994) finds that the positive correlation between adult mortality in Costa Rican counties and their socioeconomic and health status was especially substantial for cardiovascular diseases and diabetes. In Argentina, Grushka (1995) found that the association between mortality levels and socioeconomic factors is significant for women but not for men. Through a decomposition of this relation by cause of death, the author shows that the negative correlation between neoplasm

mortality and urbanization (used as an indicator of economic development) is the reason for this unexpected difference between men and women in the significance of the association (Grushka 1995). Besides specific differences, these studies in Latin America call attention to the relevance of analyzing socioeconomic differences in cause-specific mortality as well as overall mortality.

The limitations in the available data do not prevent some researchers from analyzing socioeconomic differentials in adult mortality at the individual level. Following the research tradition of studies developed mainly in Europe (Antonovsky 1967), some researchers explore socioeconomic differentials using the occupation registered on death certificates. For example, Duncan and colleagues (1995) analyzed occupational differentials in mortality for men aged 15-64 years old in the State of Sao Paulo, Brazil, by linking data from Mortality Files and Censuses. In this study, they found that mortality rates were 3.8 times greater for men in the lower occupational category compared to the men in the higher occupational category. In a similar study, but applying a methodological design which included a longitudinal analysis on a probabilistic sample, Cordeiro and Silva (2001) found that in the region of Botucatu, Sao Paulo, Brazil, the death risk increases consistently for people with lower specialized occupations; they lose up to 12 years in life expectancy compared to workers with highly specialized occupations. Even when these studies provide evidence on the strength of the association between socioeconomic factors and adult mortality, they do not provide us with information about the relationship with other socioeconomic factors and have the limitations related to the use of occupation as the exclusive variable for measuring socioeconomic status. For example, they have the restriction of analyzing only the part of the population that is economically active, making it difficult for the analysis of female populations in some specific regions and periods.

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; 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).

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 my research as well 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. The literature also shows that the association between socioeconomic factors and mortality risk shows different directions and magnitudes depending on the cause of death, age and sex group, and time period analyzed. 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.

CHAPTER 4: Purpose, Specific Aims and Hypotheses of the Research

The **purpose** of this research is to describe and analyze the relationship between educational attainment and adult mortality during the 1991-2010 period in Argentina. More precisely, I focus my analysis on the relation between educational attainment and levels of mortality and specific causes of death among the adult working-aged population (25 to 64 years old) during the past 20 years in Argentina. I also focus on age, gender and region differences in the education-mortality relationship.

This purpose is more descriptive than explanatory in nature. While largely descriptive, it is of substantial importance because it aims to show the extent of inequality in a treasured resource – life itself – during a period of rapid development and change in Argentina. It will be conducted using a quantitative design and contains the following two **specific objectives**:

1) Describe and analyze the specific mortality levels and the specific underlying causes of death, and the relationship of these indicators with educational attainment during the 1991-2010 period in Argentina.

2) Analyze the relation between the changes occurring in the specific mortality levels and the changes occurring in educational attainment across the 1991-2010 period in Argentina. This will be done for both all-cause mortality as well for specific underlying causes of death.

4.1. HYPOTHESES

As mentioned in the literature review section, several studies have corroborated the inverse association between socioeconomic status and adult mortality and, to a lesser extent, the

persistence of this relationship over time. In the last two decades, new questions have emerged from the analysis of this relationship in developed countries[7]: do socioeconomic differences in adult mortality vary between males and females? Do these socioeconomic differences in mortality diminish with age? Have these persistent socioeconomic differences increased or declined over time? Does this increase or decrease behave in the same way and at the same pace for males and females (or at different ages or among different regions)?

In Argentina, the limitations in the available data and the relatively greater importance assigned to other demographic phenomena, such as infant mortality, account for a lack of research in this area. Thus, most of the hypotheses to be tested in this study are oriented to describe and document the structure of the relationship between educational attainment and adult mortality in Argentina.

In this research, I will test the following hypotheses:

Hypothesis 1: Educational attainment has an inverse and strong relationship with overall adult mortality levels. Overall, I expect to find that people with higher levels of education will exhibit lower levels of adult mortality as many international studies have shown.

Hypothesis 2: The relationship between educational attainment and overall adult mortality will vary by gender, region and age group, as has been found in other countries. This second hypothesis has three corollary hypotheses:

[7] As noted by Hummer and colleagues (Hummer et al. 1998), new datasets, such as those data linkages between health surveys and mortality files, have been one of the most important elements for the emergence of these new interests in adult mortality.

Corollary hypothesis 2.1: Educational differences in adult mortality will vary between males and females. I expect to find evidence of this relationship among both sexes, with a stronger relationship for males. Grushka (1995) found that the association between mortality levels and socioeconomic factors is significant for women but not for men in Argentina, but he did not have specific information on educational attainment and mortality levels. Existing international literature on the topic does not offer a consistent pattern (Koskinen and Martelin 1994; Zajacova 2006; Zajacova and Hummer 2009).

Corollary hypothesis 2.2: Educational differences in adult mortality will vary by age group. We expect to find smaller educational differences in mortality at older ages.

Corollary hypothesis 2.3: Educational differences in adult mortality will vary by region. I expect to find a stronger association in regions with greater socioeconomic inequalities (North and Cuyo) than in regions with lower socioeconomic inequalities (Buenos Aires, Center and Patagonia).

Hypothesis 3: The relationship between educational attainment and mortality risk will vary significantly for different causes of death. Following similar previous research in Latin America, I expect to find a positive relationship between neoplasm mortality and educational attainment, and a negative relationship between educational attainment and transmittable disease mortality and external causes of death. I also expect to find variation in these relationships by age group,

gender and region – similar to the strength and direction described in the second hypothesis for overall mortality.

Hypothesis 4: Educational differences in overall adult mortality will increase over time during the period 1991-2010. There are no studies in Argentina that have analyzed the evolution of this relationship across time. Thus, this hypothesis is based on the outcomes of studies in other countries.

CHAPTER 5: Data, Measures and Methods

5. 1. DATA

The data used in this study come from the Mortality Files of the Vital Statistics System for the years 1991, 2001 and 2010 and from the 1991, 2001 and 2010 Argentinian Censuses.

Mortality Numerator Files

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 characteristics of the decedents, generally reported by next of kin, and some characteristics of the situation of the death (such as place of death, manner of death, and cause of death). This information is collected by the Department of Statistics of the Ministry of Health. For this research project, I use the annual Mortality Files for the years 1991, 2001 and 2010.

Various studies have examined the quality of vital statistics data in Latin America (Chackiel 1987; Jaspers-Faijer and Orellana 1994; Jaspers-Faijer and Orellana 1996). The coverage and the quality of the data in Argentina is one of the best in the region. For the latter years of the 20th Century, the percentage of deaths with medical certification was 99.3 percent and cases with ill-defined causes of death or with "no information" on cause of death was less than 5 percent (Jaspers-Faijer and Orellana 1996). However, the variable education attainment presents a higher rate of missing cases. In the period 1991-2010, the percentage of missing cases

for the education variable among decedents aged 25-64 years hovered around 30 percent, reaching a maximum of 38 percent in the year 2001.

Considering this limitation of the available data, I use the technique of multiple imputation to fill in the missing education information (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 multiple 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). The final product is a completed data set that can 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).

Census Denominator Files

The other main source of information that is used in this research is the Argentinean Population and Housing Census data for the years 1991, 2001 and 2010, provided by the Instituto Nacional de Estadística y Censos (INDEC), the national statistical agency of Argentina. The Argentinean Census is carried out approximately each ten years by the INDEC. The complete population is enumerated for the national territory at the moment the census is taken. The

coverage was 98.94 percent for the 1991 census and 97.25 percent for the 2001 and 2010 censuses. The percentage of missing cases for the education variable was 1% for the 1991 census and 0% for the 2001 and 2010 censuses.

Census microdata for the year 2001 and 2010 were processed using the software Redatam, developed by the Latin and Caribbean Demographic Centre (CELADE) and verified with published tabulations from INDEC. For the 1991 Census, there is no publicly available database. In this case, data were obtained using published tabulations from INDEC.

5.2. MEASURES

The main variables of the study are mortality and educational attainment.

Mortality in this study is measured by age, sex, region, education, and cause-specific death rates. Argentinean death certificates for 1991, 2001 and 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 census data for the same years.

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, Leon et al. 1998). In the census, the information comes from a declaration which is usually made by the individual, while the death certificate report of

education 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, Leon et al. 1998). A conservative strategy adopted by 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, Leon et al. 1998).

In this research, I do not have any alternatives for measuring educational categories because educational attainment is recorded in a three-category manner in Argentina's Mortality Files. Thus, I use education as a three category variable: No education up to primary graduate (up to 7 years of school), some secondary up to secondary graduate (8 years up to 12), and post-secondary education (13 and more). The educational level of decedents is answered by the next of kin; in some cases, these relatives do not have complete information on education. For instance, knowing the highest education level attained for the decedent is difficult for some groups, especially when the decedent is very old.

There are eight five-year-age groups used in the study: 25-29; 30-34; 35-39; 40-44; 45-49; 50-54; 55-59; and 60-64. When analyzing data by cause of death, I use ten-year-age-groups because of sparse data in some age-cause specific cells.

Sex is measured as male or female.

I work with five main regions of Argentina:

1) Buenos Aires region, including the city of Buenos Aires and the province Buenos Aires.

2) Center region, including the provinces of Córdoba, Entre Ríos, and Santa Fe.

3) North region, including the provinces Chaco, Corrientes, Formosa, Misiones, Catamarca, Jujuy, Salta, Santiago del Estero and Tucumán.

4) Cuyo region, including the provinces of La Rioja, Mendoza, San Juan and San Luis.

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

The underlying cause of death is measured using the ninth revision of the International Classification of Diseases (WHO 2004). The ICD-9, published by the World Health Organization, provides codes to classify diseases. This classification has eighteen main categories defining groups of diseases. Here, I group the causes into: Certain infectious and parasitic diseases; Neoplasms; Diseases of the circulatory system; Diseases of the respiratory system; Diseases of the digestive system; Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified; External causes; and all other causes.

Table 5.1 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 5.1 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.

5.3. METHODS

Following the methodological strategy used by other authors (Kitagawa and Hauser 1973; Molla, Madans et al. 2004), I calculate death rates (per 1,000 persons) for each age group for each of the three categories of educational attainment. I examine similarities and differences in death rates between the three different educational groups by age group, sex, region, and cause of death.

I also use mortality ratios to compare rates across educational attainment groups. The mortality ratios express the relative mortality differences between educational attainment groups for each age group, sex, and region. In all the tables presented here, the reference category for the ratios is the highest level of education (Molla, Madans et al. 2004).

To analyze educational differences in mortality by cause of death, I calculate cause-specific mortality rates (per 1,000 population) by sex and age group, specified for each educational group. Considering the limitations in the number of cases when examining cause-specific mortality, this part of the analysis uses 10-year age groups instead of 5-year age groups. The analysis of educational differences in cause-specific mortality also uses mortality ratios for the different sexes, age groups, and regions.

CHAPTER 6: Education Attainment and Adult Mortality Differentials in Argentina

6.1. INTRODUCTION

This chapter addresses the first specific aim of this dissertation. That is, I describe the relationship of mortality to educational attainment in Argentina for the year 2010. As mentioned before, the scientific literature from countries all over the world has shown a strong and inverse relationship between socioeconomic status and mortality rates. More recently, many of these studies have focused on educational differences in adult mortality rates (Feldman, Makuc et al. 1989; Pappas, Queen et al. 1993; Christenson and Johnson 1995; Preston and Elo 1995; Marmot, Ryff et al. 1997; Duleep 1998; Shkolnikov, Leon et al. 1998; Backlund, Sorlie et al. 1999; Rogers, Hummer et al. 2000; Bopp and Minder 2003; Molla, Madans et al. 2004; Murphy, Bobak et al. 2006; Hadden and Rockswold 2008; Meara, Richards et al. 2008; Clark and Royer 2010; Cutler, Lange et al. 2010; Montez Karas, Hummer et al. 2010; Hummer and Lariscy 2011). This inverse relationship between educational attainment and mortality rates provides just the tip of the iceberg for a large set of questions: Does the association between education and adult mortality vary by age group? Does this association vary by sex, or by geographical region?

There are two main hypotheses that guide the following analysis. The first is that educational attainment has an inverse and strong relationship with overall adult mortality levels. This leading hypothesis is rooted in the demographic tradition that focuses on the study of mortality and its determinants. As many international studies have shown, this first hypothesis expects to find that people with higher levels of education exhibit lower levels of adult mortality than people with low levels of education. As mentioned before, in Latin America, the study of adult mortality is scarce and there is a lack of knowledge regarding the relationship between

educational attainment and adult mortality in Latin America more generally and in Argentina more specifically.

The second hypothesis guiding this analysis is that the relationship between educational attainment and overall adult mortality varies by gender, region and age group. The evidence from other studies, mainly from the United States, shows that there are such variations, but the shape that these variations take has specific characteristics, and not always in the expected direction. This second hypothesis has three corollary hypotheses related with the three mentioned moderating variables. First, I expect that educational differences in mortality will vary by age; specifically, I expect that among older adults, relative educational differences in mortality rates will be smaller than among younger adults. This age pattern has been found in some research in the United States from the 1960s but is different from US findings in more recent periods (Hummer and Lariscy 2011; Molla 2004). Second, I expect that educational differences in adult mortality will vary when comparing males and females. This corollary hypothesis looks to find evidence of this relationship among both sexes, with a stronger relationship for males. Grushka (1995) found that the association between mortality and socioeconomic factors was significant for women but not for men in Argentina, but he did not have specific information on educational differences in adult mortality. Existing international literature on the topic does not offer a consistent answer (Koskinen and Martelin 1994; Zajacova 2006; Zajacova and Hummer 2009). Third, I expect that educational differences in adult mortality will vary by region, related to the relevant socioeconomic differences across regions in Argentina. Following this idea, I expect to find a stronger association between educational attainment and adult mortality in regions with lower educational levels (North and Cuyo) than in regions with higher educational levels (Buenos Aires, Centro, and Patagonia).

This chapter first presents an analysis of educational differentials in adult mortality in general. Second, it focuses on educational differentials in adult mortality by age. The third and fourth sections of this chapter are dedicated to the analysis of educational differentials in adult mortality by sex and by geographical region, respectively. The fifth section closes with a summary of the findings.

6.2. EDUCATIONAL DIFFERENTIALS IN MORTALITY AMONG ADULTS IN ARGENTINA

How do overall adult mortality patterns in Argentina interrelate with educational attainment? The traditional way to approaching this question is to analyze the specific mortality levels (e.g., using death rates and/or life expectancy at particular ages) for each educational group. Support for the first hypothesis arises if I find lower mortality rates among more highly educated Argentinean adults.

Following the documentation strategy of Molla et al. (2004), Table 6.1 displays death rates (per 1,000 persons) for each age group by years of completed school. The variable age is categorized using five-year age groups. 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). Moreover, the use of mortality ratios among educational groups offers a more eloquent view of the differences. This information is presented in the last three columns of Table 1, similar to Molla et al. (2004). 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.

Table 6.1 Death rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: Argentina, 2010.

Sex and Age	Population	Deaths	Deaths per 1,000 population				Mortality Ratio		
				Years of school completed			Years of school completed		
			Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	9,154,273	46,872	5.1	8.2	3.5	1.7	4.8	2.1	1.0
25-29	1,542,414	2,432	1.6	3.4	1.2	0.5	7.6	2.6	1.0
30-34	1,523,234	2,413	1.6	2.4	1.3	0.6	4.2	2.3	1.0
35-39	1,297,569	2,582	2.0	3.1	1.5	0.7	4.5	2.2	1.0
40-44	1,180,645	3,191	2.7	3.9	2.3	0.9	4.4	2.6	1.0
45-49	1,005,734	4,554	4.5	6.8	3.4	1.6	4.3	2.2	1.0
50-54	1,013,357	7,057	7.0	8.9	6.1	2.7	3.4	2.3	1.0
55-59	863,230	10,624	12.3	16.3	9.7	4.8	3.4	2.0	1.0
60-64	728,090	14,019	19.3	23.0	16.4	8.3	2.8	2.0	1.0
Female	9,683,510	26,805	2.8	4.6	2.1	1.0	4.7	2.2	1.0
25-29	1,570,933	995	0.6	1.6	0.5	0.2	7.5	2.3	1.0
30-34	1,582,914	1,273	0.8	1.3	0.7	0.3	4.1	2.3	1.0
35-39	1,348,409	1,507	1.1	1.7	1.0	0.5	3.6	2.1	1.0
40-44	1,246,204	1,965	1.6	2.3	1.5	0.6	3.7	2.4	1.0
45-49	1,061,582	2,958	2.8	4.2	2.5	1.1	3.7	2.2	1.0
50-54	1,095,770	4,205	3.8	5.0	3.4	1.8	2.8	1.9	1.0
55-59	933,434	5,968	6.4	8.8	5.1	2.8	3.2	1.9	1.0
60-64	844,264	7,934	9.4	11.3	7.6	4.7	2.4	1.6	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

The findings show a clear gradient in the age-specific mortality rates according to educational attainment. For both sexes and for all age groups, the lower the educational level, the higher the mortality rate. In concordance with the first hypothesis, then, there is a strong and inverse relationship between educational attainment and adult mortality rates in Argentina.

The central panel of Table 6.1 shows that deaths rates are much higher for the population with low education levels than for the rest. For example, for the oldest male group (60-64), the death rate among men with thirteen years or more of education is 8.3 per 1,000 while the death rate among men in the same age group but with low education (less than eight years) is 23.0 per 1,000. This pattern is consistent throughout Table 1, accompanied by the expected rise of death rates at higher ages and by lower death rates for women compared with men.

We can gain a clearer perspective of these mortality differences using the mortality rate ratios that appear in the right panel of Table 6.1. For example, men aged 25 to 29 years old with low education have seven times the rate of dying than men in the same age group but with higher education (13 years or more). Similarly, women in the same 25-29 age group with low education have a mortality rate that is 7.5 times higher than highly educated women in that age group. Thus, the data are clearly supportive of the first hypothesis. Moreover, even though this pattern was expected between our key variables, the magnitude of these ratios is higher than what has been found in similar studies in other countries, such as the United States.

Table 6.1 also shows also other interesting patterns. First, the differences between educational groups tend to be similar for both men and women for the first three age groups, but more pronounced among men than women in the older age groups. Second, relative educational differences in mortality rates tend to smaller among older adults. This basic information provides

initial evidence for the first and second corollary hypotheses mentioned above. These hypotheses are analyzed in more detail in the next two sections below.

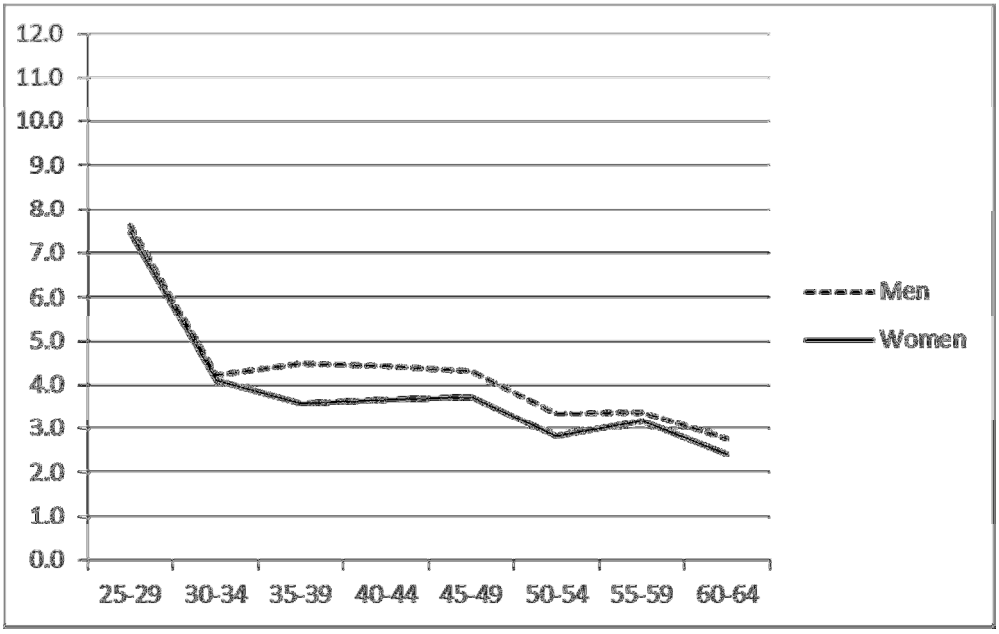
Educational differentials in mortality by age

Several studies have found that relative educational differences in mortality rates tend to be smaller among older adults than younger adults. This age pattern is found in different countries. In the case of the United States, this pattern was first demonstrated in the 1960s but is very strong in more recent periods (Hummer and Lariscy 2011; Molla et al. 2004).

As mentioned before, there are no studies in Argentina on this specific topic, and similar research on adult mortality in Latin America is scarce. Considering this lack of local information, the first corollary hypothesis is formulated based on the findings of previous research in other countries. This hypothesis suggests that mortality inequalities by education will be smaller among older adults than among younger adults.

Graph 6.1 displays mortality ratios comparing the groups with less than 8 years of education to the groups with 13 years or more of education, based on data from Argentina for the year 2010. This indicator expresses the ratio of the mortality rate for the low educated group divided by the death rate of the high-educated group; it can be interpreted as a proxy of educational inequality in mortality. Age groups are presented on the x-axis and the mortality ratios between the lowest and highest educational groups are presented on the y-axis. The solid line represents the mortality ratios for women while the dotted line represents the mortality ratios for men.

Graph 6.1 Mortality Ratios by educational attainment among the adult population, by age group and sex: Argentina, 2010.



Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistics2010.

Graph 6.1 shows a generally declining pattern of mortality inequalities by education as age ascends. The younger group has much higher mortality ratios than the other age groups. This is true for both sexes. The mortality ratio between women with the lowest education and women with the highest education is more than 7 for the youngest age group. This mortality ratio is reduced to approximately 2 for the older adults[8]. Similarly, the younger adult men with low education have 7.6 times the rate of dying than their peers with high education. For the older men, this mortality ratio is reduced to about three. These general patterns provide support for the first corollary hypothesis.

[8]As mentioned by other authors, because the mortality rates are high in older adults, "even small mortality differences by educational attainment in older adulthood are meaningful because of the heavy of concentration of deaths in older ages" (Hummer and Hernandez 2013: 5).

In addition to the generally smaller mortality ratios among older adults, there are some peculiarities in the age-based patterns. For example, the educational inequalities exhibit a decline for women up to the 35-39 age group; at that point, the mortality ratio between the less educated and the more educated women is equal to 4.5. The dotted line for men also shows a declining ratio up to the 30-34 age group, after which the ratio remains stable for the 35-39, 40-44, and 45-49 groups at about 4.5. At age group 50-54, there are important declines in educational inequalities in death for both men and women. Seemingly, it is in this age group where the force of mortality begins to have an important impact: less educated men and women have 2.5 times the rate of mortality than their more educated pairs. In the older age groups analyzed, we find the smallest educational inequalities, in concordance with the first corollary hypothesis. Nonetheless, less educated men and women in the oldest age groups still exhibit between 2 and 3 times the rate of death compared to their high educated peers; thus, there are very wide educational inequalities in every age group between 25 and 64.

Educational differentials in mortality by sex

The data from Table 6.1 also show that educational inequalities in death are larger for men than for women. This pattern is in agreement with the proposed third corollary hypothesis and differs with what has been found by Grushka (1995),[9] who demonstrated a significant

[9] It has to be considered that Grushka used extended indicators of socioeconomic status, not focusing exclusively on educational attainment, and with data from 1980 to 1991. Furthermore, there are also two main points that limits the reach of this apparent contradictory finding. First, a history analysis showed that there is an inversion in the patterns in the year 2001. Up to this year, the educational inequalities in death were larger for women than for women (see Chapter 8 in this dissertation). Second, using exclusively educational attainment as the key variable differs theoretically to using a set of socioeconomic indicators. In this sense, 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). In this sense, the generally increasing educational levels in Argentina across time could have a higher beneficial impact among women, who were in a more disadvantaged situation.

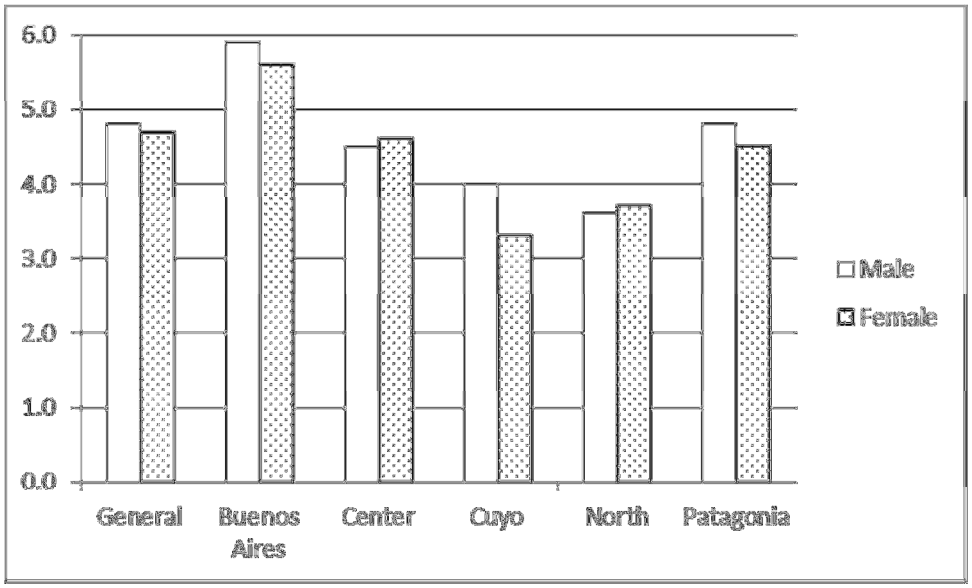
association between mortality and socioeconomic factors in Argentina but only for women and not for men.

At almost every age group, men are characterized by larger educational inequalities in death than women. Among younger adults, where the educational inequalities in death are the highest, the differences between genders are very small. It is at the 35-39 age group where these differences increase in a significant way: the mortality ratio for men is 4.5, while the mortality ratio for women is 3.6. The smaller educational inequalities in death in the oldest age groups are accompanied by a decline in the gender differences in educational inequalities as well. Overall, though, it is clear that low educated men in Argentina are characterized by the highest death rates during adulthood – rates that are generally 3 to 5 times higher than highly educated men. Low educated Argentinian women are also characterized by very high mortality relative to highly-educated women, with the ratios generally in the 2 to 5 range.

Educational differentials in mortality by region

Regional differences in mortality inequalities by education are not consistent with the third corollary hypothesis: that regions with larger percentages with low education (North and Cuyo) will have the smallest educational inequalities. Graph 6.2 presents the adult mortality rate ratios for educational attainment by sex for each region. These ratios are based on data for all adult ages 25-64.

Graph 6.2 Mortality Ratios by educational attainment among the adult population, by sex and region: Argentina, 2010.



Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistics2010.

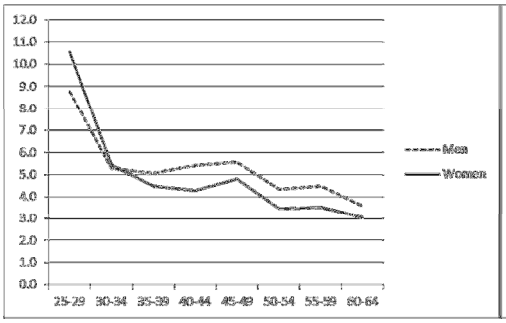
First, it is important to note that every region is characterized by wide educational differences in adult mortality; the ratios comparing the lowest educated individuals with the highest educated individuals are in the 3 to 6 range. Second, it can also be observed that the Buenos Aires, Center and Patagonia regions display higher educational inequalities in death than the other regions. In the case of the Buenos Aires region, the adult male population with low education has almost six times the rate of death than the adult male population with a high education level. For the female population of this region, the mortality ratios are slightly lower than the male population, but higher than the male and female populations in the other regions.

Beyond the Buenos Aires region, the next largest ratios are in the Patagonia and Center regions, each with a mortality ratio by educational attainment that is higher than 4 for both sexes. The North and Cuyo regions present smaller mortality ratios by educational attainment, each of which is lower than 4.0. Nonetheless, these are still very wide mortality differences by educational attainment.

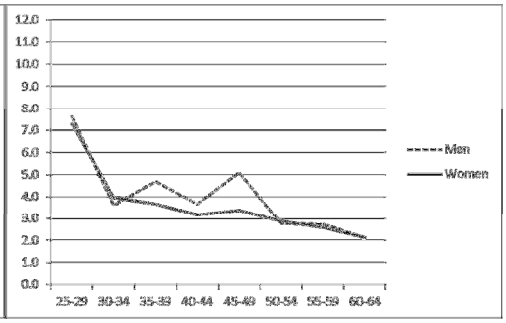
Graph 6.2 also shows that the Cuyo region is characterized by larger gender differences in educational inequalities in mortality, and that the Center and North regions show a particularity: the female population has similar educational inequalities in death than the male population. However, this last finding requires a deeper analysis that considers the specificities by age.

Graph 6.3 Mortality Ratios by educational attainment among the adult population, by age group, sex and region: Argentina, 2010.

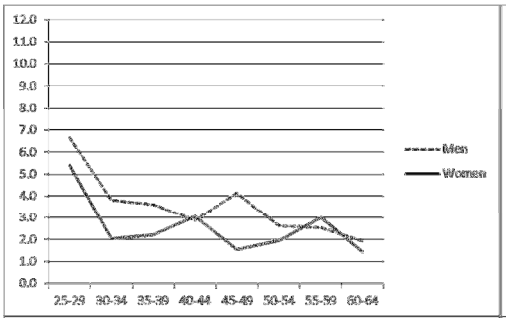
Buenos Aires Region



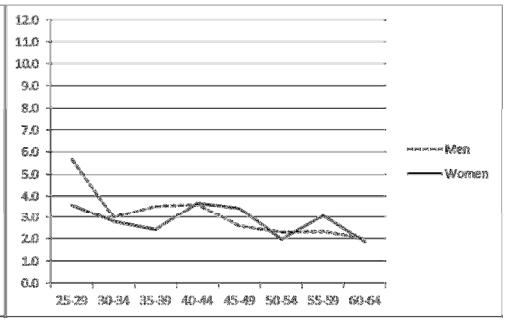
Center Region



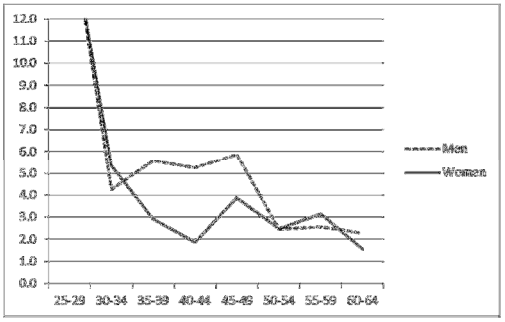
Cuyo Region



North Region



Patagonia Region



Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistics2010.

Graph 6.3 presents the mortality ratios for educational attainment, by sex and age, for the five regions. All of the regions exhibit higher educational differences in mortality at the youngest

ages, a decline in these mortality ratios as age increases, and generally stronger educational inequalities in death for men than for women. However, there are two unique patterns across regions. First, the patterns in the Buenos Aires and Center regions exhibit great inequality at the young ages and, considering their population weights in the country, they largely determine the national patterns presented in Graph 6.1. The Patagonia region also presents extreme mortality differentials by education among young adults.

There are other particularities in this group of regions that merit special attention. Contrary to what was found in the other regions, in Buenos Aires the female population at 25-29 years presents higher mortality ratios than the male population (10.7 and 9.6, respectively). This relation quickly reverses in the next age group (30-34), taking the traditional form where educational inequalities in death are stronger in the male population than in the female population. The Center region also does not show a gender difference in educational inequalities in death in the first age group but, similar to Buenos Aires, larger gender differences are found in the intermediate age groups (35-39, 40-44, 45-49).

Patagonia presents very high mortality ratios for the first age group for both men and women, even though we have to approach this finding with caution because it could be a data artifact given the small population and small number of deaths for specific age groups in this region (see Table 6 in the Annex). There are other strange patterns in this region: the cross-over in the 30-34 age group, the contrasting pattern of ascending differences for men and descending differences for women in the 35-39 and 40-44 age groups, and the cross-over in the 55-59 age group. The limitations of the available data do not allow us to go deeper in these issues. Again, though, this region has only a small number of deaths in some age groups.

The Cuyo and North regions show a different pattern characterized by lower educational inequalities in death across all age groups. Although the youngest age groups are characterized by the largest mortality ratios (roughly 6.0 in both regions), the declining pattern with age is not as pronounced as it is in the other three regions.

Conclusions

This chapter addressed the first and second specific questions of this dissertation. First, how are overall adult mortality patterns in Argentina differentiated by education level? Second, does the association between education and adult mortality vary by age group, gender and region as has been found in other countries? Hypotheses based on previous research, largely from the United States, were developed to guide the analysis.

The first hypothesis focused on the inverse relationship between educational attainment and overall adult mortality. The analysis for this hypothesis was based on death rates and mortality ratios by educational attainment. We found a clear gradient in the specific mortality rates according to educational group, for both sexes and for all age groups. The existence and direction of this relationship was as expected; however, the magnitude of educational differences was much higher than what has been found in other countries. It is clear, then, that educational attainment very strongly differentiates mortality rates among Argentinean adults.

Several corollary hypotheses were formed around the second general hypothesis of this dissertation. These corollary hypotheses guided the analysis of educational differences in mortality specific to gender, age group, and region among adults in Argentina. Again, we used age-specific mortality rates and rate ratios by educational attainment to examine these patterns.

The first corollary hypothesis regarding age differences was confirmed; the data exhibited a clear declining trend in mortality inequalities by education as age increased. In particular, the younger age groups had much higher mortality ratios than the older age groups.

We had also found evidence consistent with our second corollary hypothesis. Educational inequalities in death are stronger for men than for women. However, there were some exceptions to this overall pattern in some age groups. In general, though, gender differences in educational gradients in mortality were larger at younger ages when educational inequalities are the highest and smaller at older ages when educational inequalities are smaller. Clearly, young low educated men appear to exhibit the highest relative mortality disadvantages in Argentina.

Our third corollary hypothesis expected to find larger educational inequalities in mortality in regions with lower educational levels (North and Cuyo) than in regions with higher educational levels (Buenos Aires, Center, and Patagonia). However, the data indicated exactly the opposite. Instead, the North and Cuyo regions exhibited the smallest educational inequalities in death. On the other hand, the Buenos Aires, Center, and Patagonia regions presented very high mortality ratios between the lowest and highest educational groups.

Analyses of cause-specific educational inequalities in mortality (third hypothesis) and changes in mortality inequalities by education across an extended period of time (fourth hypothesis) are the subjects of the forthcoming seventh and the eighth chapters, respectively.

CHAPTER 7: Educational Inequalities in Cause-Specific Mortality

The study of mortality patterns through the analysis of underlying causes of death is a classic approach in demography, epidemiology and public health[10]. The main conceptual insights of the theory of the epidemiological transition (Omran 1971) relies on the analysis of changing mortality patterns due to changes in the social, economic, and medical conditions that unfold in different historical periods. Those studies dedicated to the analysis of socio-demographic differentials in mortality distinctively focus on how these changing patterns differ across different social groups.

Several studies have found that educational differentials in mortality vary across causes of death (Kitagawa and Hauser 1973; Wrigley and Nam 1987; Pappas, Queen et al. 1993; Nam, Hummer et al. 1994; Link and Phelan 1995; Howard, Anderson et al. 2000; Rogers, Hummer et al. 2000; Phelan, Link et al. 2004; Geyer, Hemstrom et al. 2006). For example, Phelan and colleagues (2004) found that U.S. mortality from causes of death that are more preventable were more strongly related to socioeconomic status than mortality from causes that are less preventable. These findings held across gender and racial/ethnic groups. In this sense, deaths that are more closely linked to social and behavioral risk factors (e.g., lung cancer, respiratory diseases, homicide, and accidents) are associated with wide educational differentials in mortality rates while causes less amenable to human control (such a cancers other than lung cancer) are more weakly associated with educational attainment (Hummer and Hernández 2013: 6).

[10]Since 1980, some authors have emphasized the relevance of studying the underlying cause of death but taking also in account the other contributing causes of death that are present on death certificates (Wrigley and Nam 1987; Rosenberg 1989; Nam, Hummer and Rogers 1994). Unfortunately, this analysis is not possible for Argentina because public data on mortality files do not include contributing causes of death.

Similarly, studies that analyzed the relationship between causes of adult mortality and socioeconomic factors in Latin America found that there are significant differences in the relationship depending on the specific cause of death and that the effect of this relationship varies considerably by age and sex (Rosero-Bixby 1994; Grushka 1995; Paes-Sousa 2002; Paes Antunes 2002; Ishitani, Franco et al. 2006; Di Cesare 2007; Diez Roux, Green Franklin et al. 2007; Pessoa Cesse 2007; Wilson, Regidor et al. 2007; Nogueira, Ribeiro et al. 2009). For example, the association between neoplasm mortality and socioeconomic factors tends to be positive, whereas the association between transmittable disease mortality and socioeconomic factors tends to be negative. These patterns should be understood in light of the transformations in the Latin American mortality profile throughout its epidemiological transition. That is, cancer (neoplasms) and heart disease are increasing as causes of death while infectious and parasitic diseases are decreasing. As proposed by the epidemiologic transition, improvement in the social conditions of the population reduce the incidence of diseases related to underdevelopment affecting mainly the younger population and increase the incidence of chronic-degenerative diseases affecting mainly the older population (Frenk, Lozano et al. 1994). In this sense, these studies tend to find higher neoplasm and heart disease mortality in geographic areas with better education levels. Furthermore, some of these studies show important variability in the effect of the relationship by age and sex. In Argentina, Grushka (1995) found that the association between mortality levels and socioeconomic factors is significant for women but not for men. Through a specific analysis by cause of death, the author shows that the negative correlation between neoplasm mortality and urbanization (used as an indicator of economic development) is the reason for this unexpected difference between men and women in the significance of the association (Grushka 1995). Besides specific differences, these studies in Latin America call attention to the relevance of socioeconomic differentials for analyzing each cause of death separately.

In this chapter I address the second part of the first specific aim of my dissertation, that is: to describe and analyze the mortality levels for specific underlying causes of death, and the relationship of these mortality levels with educational attainment during the 1991-2010 period in Argentina. Specifically, in this chapter, I focus on understanding educational differences in underlying cause of death patterns in Argentina.

The working hypothesis of this chapter is that the relationship between educational attainment and mortality risk will vary significantly for different causes of death. Following evidence from the previously mentioned studies, I expect to find a positive relationship between educational attainment and neoplasm mortality, and negative relationships between educational attainment and transmittable disease mortality and external causes of death. I also expect to find variation in these relationships by age group, gender, and region, in the directions described in the previous chapter. That is, I expect to find more pronounced educational inequalities in death for men than for women, for younger adults than for older adults, and in regions with lower educational levels (North and Cuyo) than in regions with higher educational levels (Buenos Aires, Centro, and Patagonia).

This chapter first presents an analysis of educational differentials in adult mortality by underlying cause of death, focusing on age and sex variations. I subsequently turn to a regional analysis of educational differentials in cause-specific adult mortality.

Educational Differentials in Adult Mortality by Underlying Cause of Death

Are there unique patterns of educational differences in mortality for specific causes of death?

Table 7.1 presents the number of deaths and the cause-specific mortality rates (per 1,000 population) by sex and by 10-year age groups, [11] specified for each educational group. It also shows the mortality ratios between educational groups for each specific cause of death. Based on the proposed hypotheses, I expect to find mortality ratios greater than one for the low education groups in the case of "Certain Infectious and Parasitic Diseases" and "External Causes of Mortality", and mortality ratios close to one or less than one for the low education groups in the case of "Neoplasms".

As observed in the previous chapter, the basic mortality differences across educational groups are very large. For example, men aged 55-64 years old with 13 years of education or more have almost the same mortality rate than all men aged 45-54 and lower than men aged 45-54 years old with less than 8 years of education (6.23 vs. 5.68 and 7.86, respectively). With generally lower mortality rates, we find a similar pattern in the case of the female population. These very high absolute differences in mortality rates shape patterns in mortality ratios across educational groups, as we will see below.

[11] As mentioned before, in this section we use 10-year age groups instead of 5-year age groups as in the previous chapter because of the limitations in the number of cases when examining cause-specific mortality.

Table 7.1 Deaths by Underlying Cause of Death, Mortality Rates by Specific Underlying Causes of Death, by educational attainment, age groups and sex: Argentina, 2010.

		Deaths				Mortality Rates by Specific Underlying Causes of Death				Mortality Rate Ratios		
Sex and Age	Underlying Cause of Death											
		Years of school completed				Years of school completed				Years of school completed		
		Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
Males 25-34	Total	4,761	2,759	1,647	355	1.553	2.785	1.220	0.490	5.7	2.5	1.0
	Certain infectious and parasitic diseases	310	188	98	24	0.101	0.190	0.073	0.033	5.7	2.2	1.0
	Neoplasms	425	208	162	55	0.139	0.210	0.120	0.076	2.8	1.6	1.0
	Diseases of the circulatory system	388	228	129	31	0.127	0.230	0.096	0.043	5.4	2.2	1.0
	Diseases of the respiratory system	260	154	90	16	0.085	0.155	0.067	0.022	7.0	3.0	1.0
	Diseases of the digestive system	115	84	27	4	0.038	0.085	0.020	0.006	15.4	3.6	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	231	141	72	18	0.075	0.142	0.053	0.025	5.7	2.1	1.0
	External causes of morbility and mortality	2,678	1,537	960	181	0.874	1.551	0.711	0.250	6.2	2.8	1.0
	All the other causes	354	219	109	26	0.115	0.221	0.081	0.036	6.2	2.3	1.0
Males 35-44	Total	5,682	3,553	1,733	396	2.293	3.477	1.840	0.770	4.5	2.4	1.0
	Certain infectious and parasitic diseases	563	353	170	40	0.227	0.345	0.181	0.078	4.4	2.3	1.0
	Neoplasms	773	452	256	65	0.312	0.442	0.272	0.126	3.5	2.2	1.0
	Diseases of the circulatory system	977	599	308	70	0.394	0.586	0.327	0.136	4.3	2.4	1.0
	Diseases of the respiratory system	443	285	124	34	0.179	0.279	0.132	0.066	4.2	2.0	1.0
	Diseases of the digestive system	358	240	104	14	0.144	0.235	0.110	0.027	8.6	4.1	1.0
	Syntoms, signs, and abnormal clinical and laboratory	417	256	129	32	0.168	0.251	0.137	0.062	4.0	2.2	1.0
	External causes of morbility and mortality	1,789	1,127	543	119	0.722	1.103	0.577	0.231	4.8	2.5	1.0
	All the other causes	362	241	99	22	0.146	0.236	0.105	0.043	5.5	2.5	1.0
Males 45-54	Total	11,478	7,621	3,078	779	5.685	7.863	4.620	2.030	3.9	2.3	1.0
	Certain infectious and parasitic diseases	600	396	173	31	0.297	0.409	0.260	0.081	5.1	3.2	1.0
	Neoplasms	2,610	1,666	725	219	1.293	1.719	1.088	0.571	3.0	1.9	1.0
	Diseases of the circulatory system	2,975	1,932	824	219	1.473	1.993	1.237	0.571	3.5	2.2	1.0
	Diseases of the respiratory system	978	667	254	57	0.484	0.688	0.381	0.149	4.6	2.6	1.0
	Diseases of the digestive system	952	656	244	52	0.471	0.677	0.366	0.136	5.0	2.7	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	908	631	228	49	0.450	0.651	0.342	0.128	5.1	2.7	1.0
	External causes of morbility and mortality	1,583	1,067	408	108	0.784	1.101	0.612	0.281	3.9	2.2	1.0
	All the other causes	872	606	222	44	0.432	0.625	0.333	0.115	5.5	2.9	1.0
Males 55-64	Total	24,485	17,406	5,484	1,595	15.387	19.529	12.341	6.239	3.1	2.0	1.0
	Certain infectious and parasitic diseases	1,026	758	217	51	0.645	0.850	0.488	0.199	4.3	2.4	1.0
	Neoplasms	6,751	4,627	1,586	538	4.242	5.191	3.569	2.104	2.5	1.7	1.0
	Diseases of the circulatory system	7,075	5,026	1,593	456	4.446	5.639	3.585	1.784	3.2	2.0	1.0
	Diseases of the respiratory system	2,580	1,860	579	141	1.621	2.087	1.303	0.552	3.8	2.4	1.0
	Diseases of the digestive system	1,768	1,336	349	83	1.111	1.499	0.785	0.325	4.6	2.4	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	1,833	1,326	407	100	1.152	1.488	0.916	0.391	3.8	2.3	1.0
	External causes of morbility and mortality	1,483	1,041	330	112	0.932	1.168	0.743	0.438	2.7	1.7	1.0
	All the other causes	1,969	1,432	423	114	1.237	1.607	0.952	0.446	3.6	2.1	1.0

Table 7.1 Deaths by Underlying Cause of Death, Mortality Rates by Specific Underlying Causes of Death, by educational attainment, age groups and sex: Argentina, 2010. (Cont.)

		Deaths				Mortality Rates by Specific Underlying Causes of Death				Mortality Rate Ratios		
Sex and Age	Underlying Cause of Death											
		Years of school completed				Years of school completed				Years of school completed		
		Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
Females 25-34	Total	2,249	1,233	744	272	0.713	1.408	0.603	0.260	5.4	2.3	1.0
	Certain infectious and parasitic diseases	179	106	56	17	0.057	0.121	0.045	0.016	7.4	2.8	1.0
	Neoplasms	482	251	172	59	0.153	0.287	0.140	0.056	5.1	2.5	1.0
	Diseases of the circulatory system	253	149	74	30	0.080	0.170	0.060	0.029	5.9	2.1	1.0
	Diseases of the respiratory system	203	123	58	22	0.064	0.140	0.047	0.021	6.7	2.2	1.0
	Diseases of the digestive system	79	47	29	3	0.025	0.054	0.024	0.003	18.7	8.2	1.0
	Pregnancy, childbirth and the puerperium	144	75	53	16	0.046	0.086	0.043	0.015	5.6	2.8	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	108	66	30	12	0.034	0.075	0.024	0.011	6.6	2.1	1.0
	External causes of morbility and mortality	495	246	171	78	0.157	0.281	0.139	0.075	3.8	1.9	1.0
	All the other causes	306	170	101	35	0.097	0.194	0.082	0.033	5.8	2.4	1.0
Females 35-44	Total	3,447	1,959	1,082	406	1.329	2.005	1.240	0.545	3.7	2.3	1.0
	Certain infectious and parasitic diseases	296	196	77	23	0.114	0.201	0.088	0.031	6.5	2.9	1.0
	Neoplasms	1,134	614	358	162	0.437	0.628	0.410	0.218	2.9	1.9	1.0
	Diseases of the circulatory system	501	285	167	49	0.193	0.292	0.191	0.066	4.4	2.9	1.0
	Diseases of the respiratory system	316	196	97	23	0.122	0.201	0.111	0.031	6.5	3.6	1.0
	Diseases of the digestive system	128	82	34	12	0.049	0.084	0.039	0.016	5.2	2.4	1.0
	Pregnancy, childbirth and the puerperium	95	59	22	14	0.037	0.060	0.025	0.019	3.2	1.3	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	193	111	62	20	0.074	0.114	0.071	0.027	4.2	2.6	1.0
	External causes of morbility and mortality	429	209	154	66	0.165	0.214	0.176	0.089	2.4	2.0	1.0
	All the other causes	355	207	111	37	0.137	0.212	0.127	0.050	4.3	2.6	1.0
Females 45-54	Total	7,134	4,440	1,960	734	3.307	4.613	2.938	1.391	3.3	2.1	1.0
	Certain infectious and parasitic diseases	370	254	86	30	0.172	0.264	0.129	0.057	4.6	2.3	1.0
	Neoplasms	2,998	1,706	901	391	1.390	1.772	1.351	0.741	2.4	1.8	1.0
	Diseases of the circulatory system	1,369	890	373	106	0.635	0.925	0.559	0.201	4.6	2.8	1.0
	Diseases of the respiratory system	621	405	159	57	0.288	0.421	0.238	0.108	3.9	2.2	1.0
	Diseases of the digestive system	324	232	66	26	0.150	0.241	0.099	0.049	4.9	2.0	1.0
	Pregnancy, childbirth and the puerperium	4	3	0	1	0.002	0.003	*	0.002	1.6	*	1.0
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	403	259	107	37	0.187	0.269	0.160	0.070	3.8	2.3	1.0
	External causes of morbility and mortality	423	269	105	49	0.196	0.279	0.157	0.093	3.0	1.7	1.0
	All the other causes	622	422	163	37	0.288	0.438	0.244	0.070	6.3	3.5	1.0
Females 55-64	Total	13,847	9,662	3,042	1,143	7.789	10.071	6.175	3.509	2.9	1.8	1.0
	Certain infectious and parasitic diseases	665	483	137	45	0.374	0.503	0.278	0.138	3.6	2.0	1.0
	Neoplasms	5,252	3,449	1,248	555	2.954	3.595	2.533	1.704	2.1	1.5	1.0
	Diseases of the circulatory system	3,120	2,213	664	243	1.755	2.307	1.348	0.746	3.1	1.8	1.0
	Diseases of the respiratory system	1,428	1,056	287	85	0.803	1.101	0.583	0.261	4.2	2.2	1.0
	Diseases of the digestive system	631	461	127	43	0.355	0.481	0.258	0.132	3.6	2.0	1.0
	Pregnancy, childbirth and the puerperium	0	0	0	0	*	*	*	*	*	*	*
	Syntoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	898	640	204	54	0.505	0.667	0.414	0.166	4.0	2.5	1.0
	External causes of morbility and mortality	414	284	102	28	0.233	0.296	0.207	0.086	3.4	2.4	1.0
	All the other causes	1,439	1,076	273	90	0.809	1.122	0.554	0.276	4.1	2.0	1.0

Sources: Elaborated by the author based upon Argentine Mortality Files-Vital Statistics 2010.

Several key findings stand out. First, Table 7.1 shows that the mortality rates between the different educational groups are consistently higher for the lowest educational group in comparison to the highest group; in other words, the mortality ratios are always greater than one. Thus, the low educational group is uniformly characterized by higher mortality for every cause. In this sense, the working hypothesis of this chapter needs to be rejected because I expected higher neoplasm mortality for the highly educated. However, I do observe some mortality differences by underlying cause that are largely in the direction that was expected based on previous research. For example, although the mortality ratios are always higher for the less educated groups than for the group with the highest education level, the mortality ratios for neoplasms are much lower than the mortality ratios for the other causes. In this sense, the original working hypothesis could be re-stated in a post-hoc fashion: mortality differences across educational groups are smaller for neoplasms than for infectious/parasitic diseases or external causes.

As observed in Chapter 6 when analyzing all-cause mortality ratios, I found that for all underlying causes of death the mortality ratios tend to decrease with age. That is, even though educational inequality in mortality is present at all ages, it is especially high for at ages 25-34.

Educational Differences in Cause-Specific Mortality among Men

Even though the mortality rates for diseases of the digestive system are low in all age groups, they are characterized by very large educational attainment differences. For example, for the youngest age group, the mortality rate for diseases of the digestive system among men with a low education level is almost 15 times the mortality rate for the same cause in men with a high

education level. This educational inequality declines abruptly as age grows, although it continues as the most discriminating cause of death for all the age groups among males.

There are important differences by age in those causes that exhibit the highest educational inequalities among men. Even when there are some causes of death that show some stability of their mortality ratios at all age groups, with a relative high impact (e.g., diseases of the digestive system) or a relative low impact (e.g., neoplasms), there are other causes of death for which the mortality ratios differ across age groups. For example, deaths caused by infectious and parasitic diseases exhibit the second highest mortality ratios in the 55-64 age group; meanwhile, it is only the fifth highest in the 25-34 age-group (4.3 and 5.7, respectively).

Educational Differences in Cause-Specific Mortality among Women

The analysis of the female mortality ratios shows three of the same patterns found when analyzing male mortality ratios: mortality ratios for all the different causes of death are much higher than one, the ratios show expected declines as age increases for all causes of mortality, and the mortality ratios are especially high for diseases of the digestive system.

Similarly to what was found among men, there are important differences by age in those causes that exhibit the highest educational inequalities, but the patterns are sometimes different. For example, deaths due to infectious and parasitic diseases show the second highest mortality ratios among all age groups. This contrasts to what was found when analyzing male mortality, where this cause of mortality did not show especially high mortality ratios.

There are also important differences to what was found when analyzing male mortality. Deaths due to diseases of the circulatory system have higher mortality ratios among women than

among men. Mortality ratios for deaths due to external causes are lower and relatively constant at all age groups, near 3.0 in all age groups except in the 25-34 age group where it is a little higher (3.8).

Mortality ratios for deaths due to neoplasms show a similar pattern to what was found among men: smaller differences across educational groups and almost the same mortality ratio between extreme educational groups for all age groups (around 2.5). The relative differences for neoplasms also goes against the direction of the general declining pattern of mortality ratios as age grows.

Regional differences

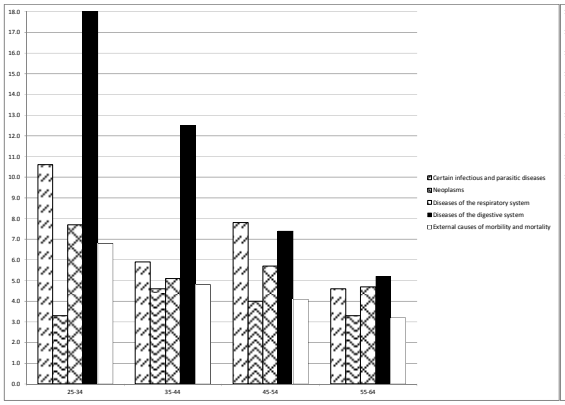
There are two main regional patterns for the mortality ratios for selected causes of death. The Buenos Aires, Center and, to some extent, Patagonia regions show very high mortality ratios for all causes of death analyzed; meanwhile, the Cuyo and North regions, where the general mortality rates are higher, show lower mortality ratios. For example, we found that the mortality ratio for neoplasms in the oldest age groups is close to one in both the Cuyo and North regions. These patterns are consistent with the findings of Chapter 6, when analyzing general mortality rates (Graphs 7.1 and 7.2).

Moreover, it can be noticed that the declining trend of mortality ratios as age grows is less pronounced in the Cuyo and North regions than in the other regions. In the last two regions, the inequalities seem to be more constant across ages than in the Buenos Aires, Center and Patagonia regions. Interestingly, in the age group 55-64, the mortality ratios show similar values for all five regions.

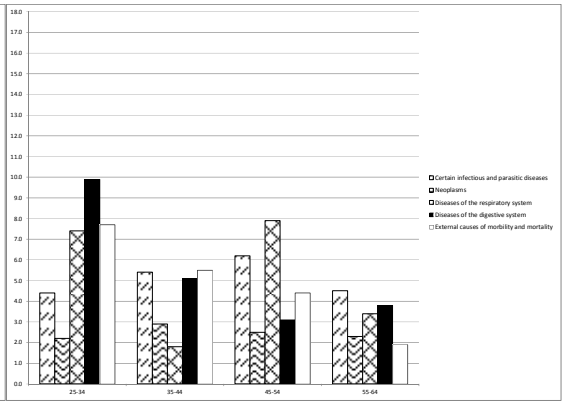
The regional analysis gives us an important piece of information for understanding the extreme high mortality ratios for diseases of the digestive system that was found in the previous section. These high mortality ratios are mainly concentrated in the Buenos Aires region. The large population size of this region explains why this cause of mortality showed very high mortality ratios at the national level.

Graph 7.1 Mortality Ratios between educational groups for selected Underlying Causes of Death among men, by region and age group: Argentina, 2010.

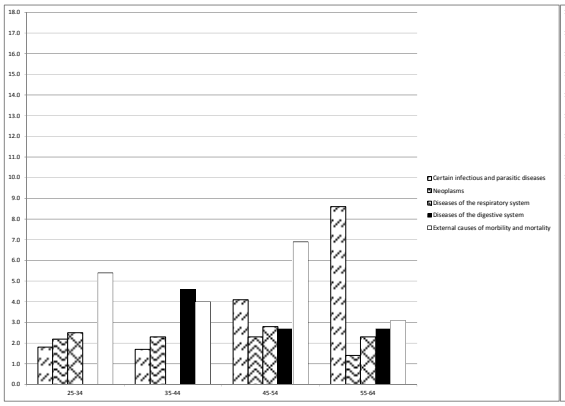
Buenos Aires Region



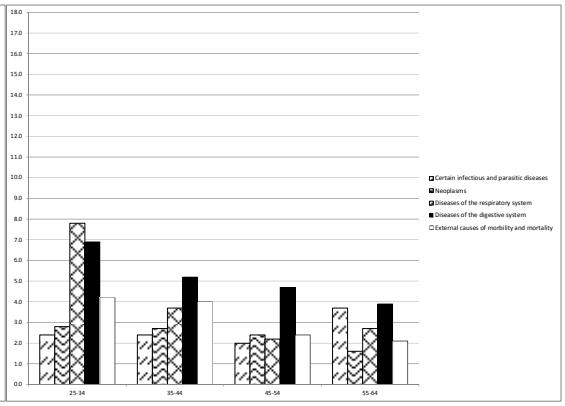
Central Region



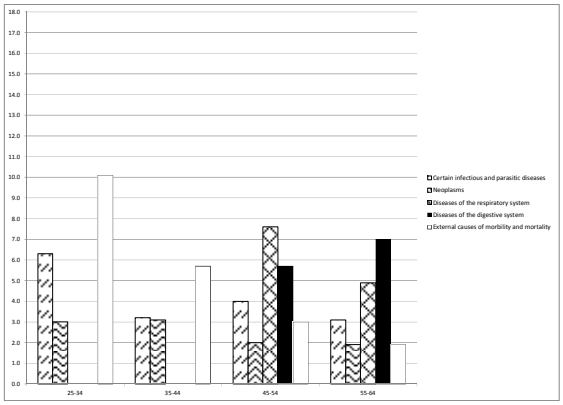
Cuyo Region



North Region



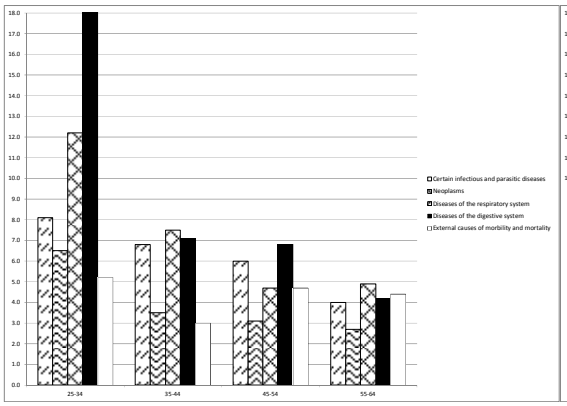
Patagonia Region



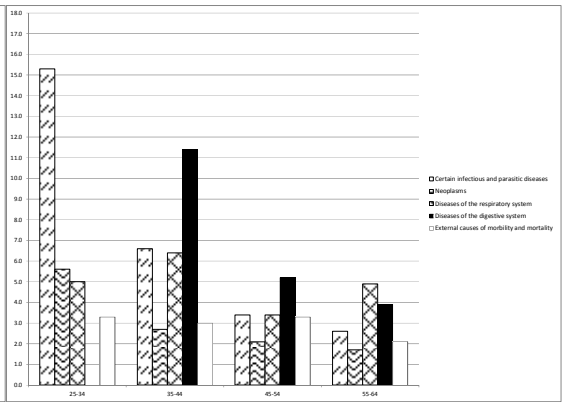
Sources: Elaborated by the author based upon Argentine National Census 1991 and Argentine Mortality Files-Vital Statistics1991.

Graph 7.2 Mortality Ratios between educational groups for selected Underlying Causes of Death among women, by region and age group: Argentina, 2010.

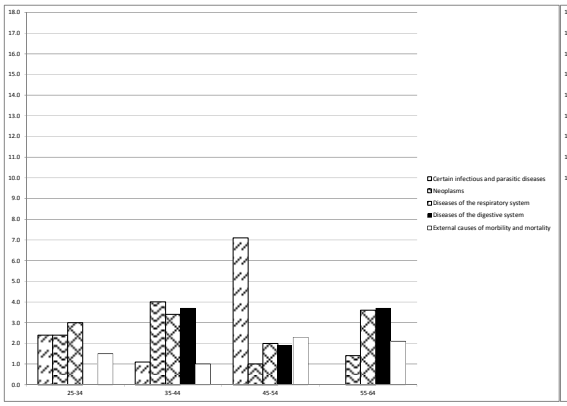
Buenos Aires Region



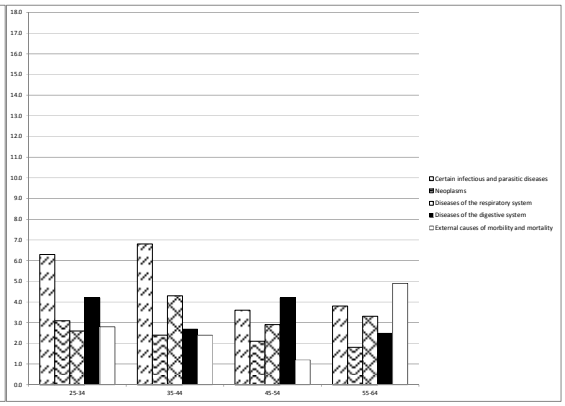
Central Region



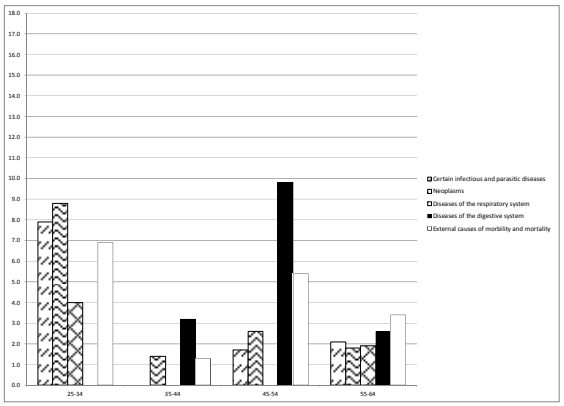
Cuyo Region



North Region



Patagonia Region



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

It can also be observed that the causes of death that exhibit the highest mortality ratios are also different by region. In the Buenos Aires and Center regions, we found the highest mortality ratios among men for deaths caused by diseases of the digestive system, infectious and parasitic diseases, and diseases of the respiratory system. In the North and Cuyo regions the pattern is different, with smaller differences by educational attainment than the other regions for death due to external causes and infectious and parasitic diseases (Graph 7.1).

The extremely high female mortality ratios for diseases of the digestive system at the national level seem also to be mainly determined by the differential importance of this cause of death among the less educated in the Buenos Aires region. Moreover, we found higher mortality ratios for certain infectious and parasitic diseases among females than among males (Graph 7.2).

Conclusions

In this chapter I analyzed the relationship between educational attainment and cause-specific adult mortality in Argentina for the year 2010. The hypothesis of this chapter was that the relationship between educational attainment and mortality risk will vary significantly for different causes of death. I found evidence that supports this hypothesis. However, the hypothesis suggesting a positive relationship between neoplasm mortality and educational attainment, and a negative relationship between educational attainment and transmittable disease mortality and external causes of death could not be supported because neoplasm mortality was higher among those who are low educated – a pattern very similar to the other causes of death.

The mortality rate differences across the different educational groups are consistent: there is no underlying cause of mortality that shows higher mortality ratios for the group with the highest education level. However, we do observe some differences among underlying causes of

mortality in the direction that was expected from previous research. For example, although the mortality ratios are always higher for the less educated groups than for the group with highest education level, the mortality ratios for neoplasms are much lower than the mortality ratios for the other causes.

Similarly to what was found in Chapter 6, when describing the regional analysis we found two main patterns on mortality ratios for selected causes of death: the Buenos Aires, Center and Patagonia regions show very high mortality ratios for all causes of death analyzed; meanwhile, in the Cuyo and North regions, where the general mortality rates are higher, there are lower mortality ratios across educational attainment groups. Moreover, the declining pattern of mortality ratios as age increases is less pronounced in the Cuyo and North regions than in the other regions. Finally, the causes of death that exhibit the highest mortality ratios are different across regions.

CHAPTER 8: Changes in Educational Inequalities in Mortality from 1991 to 2010

In this Chapter, I address the second specific aim of this dissertation, which is to analyze changes in educational differences in mortality between 1991 and 2010 in Argentina.

A large set of studies has specifically analyzed the phenomenon of widening socioeconomic differences in adult mortality; this body of research constitutes the fundamental source of information for this chapter. 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. 2010; 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 studies have registered a widening gap in life expectancy and specific mortality rates between educational groups, which goes against the expectation of decreasing differences in health across population subgroups.

The working hypothesis of this chapter 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.

This chapter first presents an analysis of the educational differentials in adult mortality in three different years: 1991, 2001, and 2010. Second, it focuses on changing educational differentials in adult mortality by age and by sex. The third section of this chapter analyzes

changes in educational differentials in adult mortality by geographical region, considering age and sex specific patterns. The fourth section closes with a summary of the findings.

Educational Differentials in Adult Mortality across Time

How is the relationship between adult mortality and educational attainment unfolding across time in Argentina? Are mortality differences across educational levels increasing, as they have in other countries?

To answer this question, 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.[12] 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 chapter 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 dissertation but show the way for future research. Nonetheless, given

[12] 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.

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 8.1 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. As mentioned in the methodological section, 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 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 2000 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 8.1 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 8.1. 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.[13]

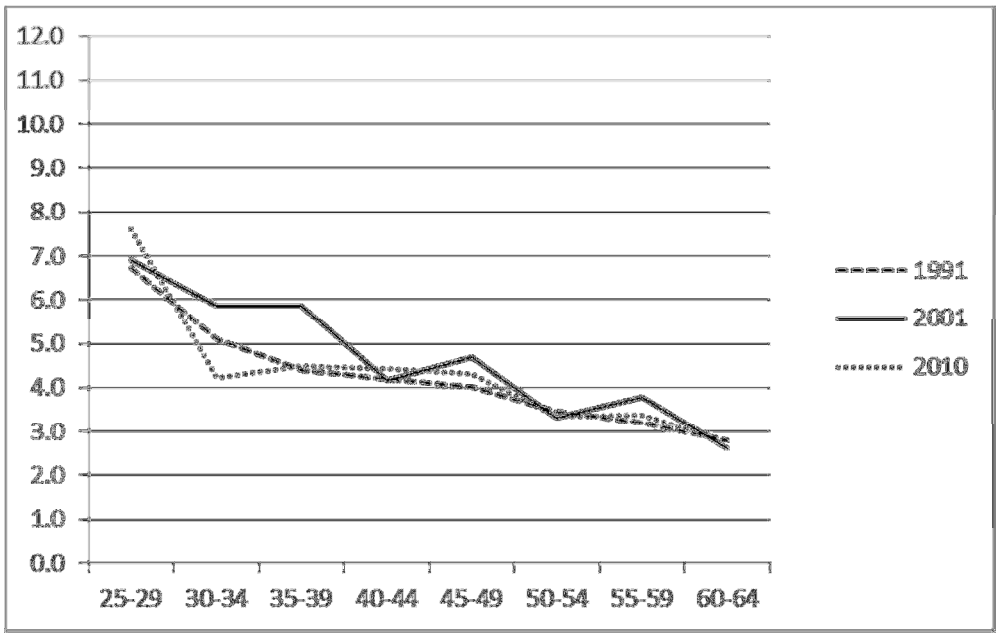
Second, educational inequalities in mortality among women tend to be significantly lower in the last period analyzed, with the exception of the youngest group. Although mortality ratios for both men and women tend to be the highest for both women and men, in the year 2010 we find the lowest female mortality 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 8.1 and 8.2 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

[13]As mentioned before, 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 (See Chapter 2).

for 2010. As expected, the ratios for 2001 tend to be the highest on both graphs. In Graph 8.1, 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 8.2, 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.

Graph 8.1 Age-Specific Mortality Ratios by Educational Attainment Across Time for the Adult Male Population in Argentina

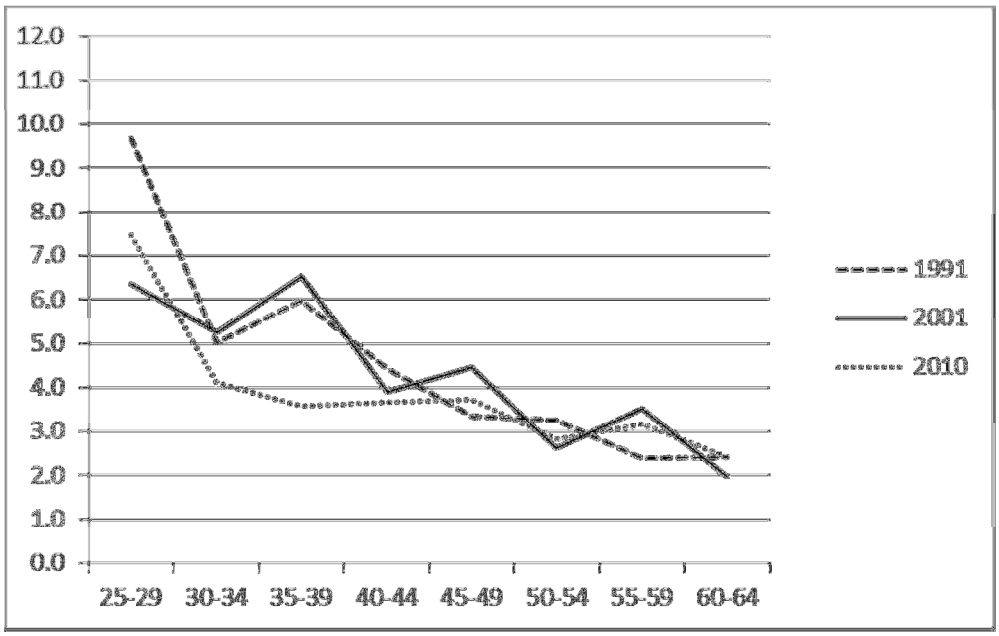


Sources: Elaborated by the author based upon Argentine National Census 1991, 2001 and 2010, and Argentine Mortality Files-Vital Statistics1991, 2001 and 2010.

Graph 8.1 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 8.1 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 chapter: 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 8.2 Age-Specific Mortality Ratios by Educational Attainment Across Time for the Adult Female Population in Argentina



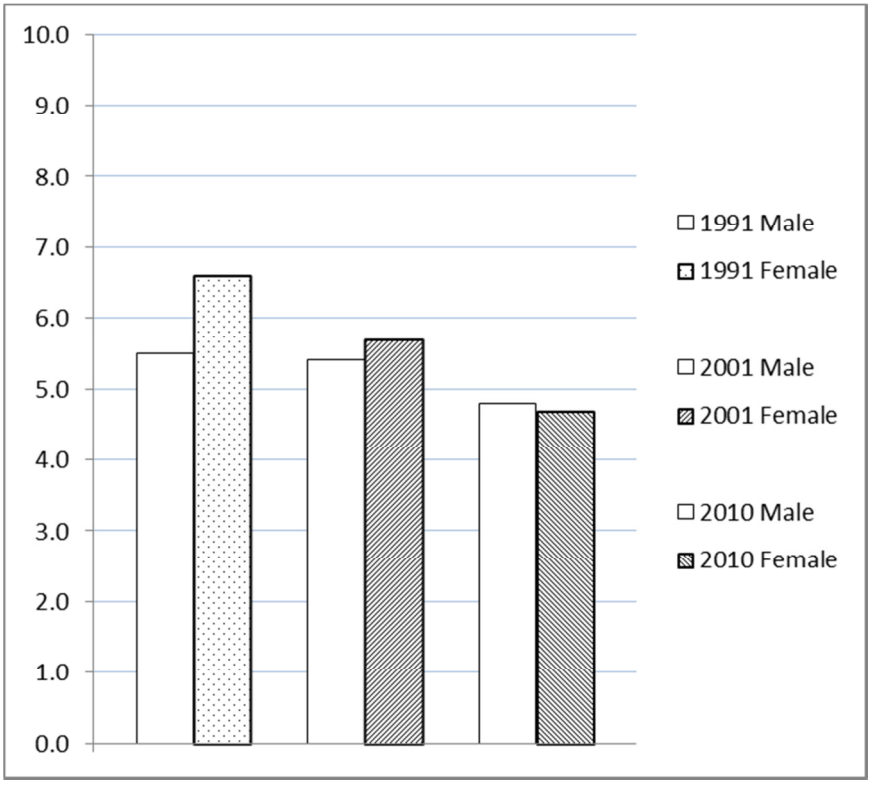
Sources: Elaborated by the author based upon Argentine National Census 1991, 2001 and 2010, and Argentine Mortality Files-Vital Statistics1991, 2001 and 2010.

Graph 8.2 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 8.2 for women also displays also a different pattern for changing inequalities than what was shown for men in Graph 8.1. 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 8.1). 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 8.3.

Graph 8.3 A Comparison of Mortality Ratios by Educational Attainment for Men and Women among the Adult Population in Argentina: 1991, 2001 and 2010.



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

More specifically Graph 8.3 shows[14] 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.

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 8.4 displays the information for the male population and Graph 8.5 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 either 1991 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

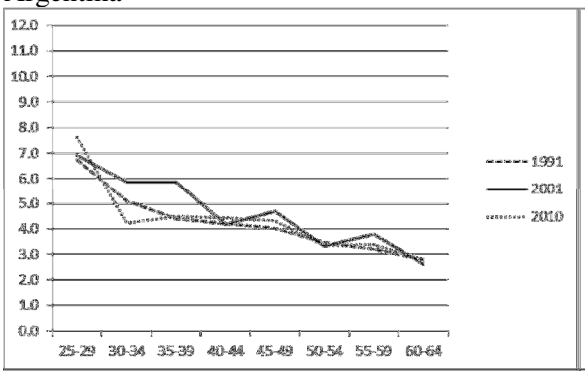
[14] Similarly to what was noted for Graph 6.2 (Chapter 6), this graph gives us only a rough view of the gender differences since all the age groups are included.

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.

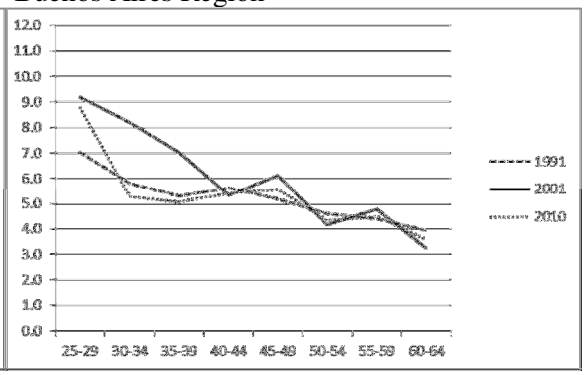
The Cuyo region presents a peculiar pattern, where we find higher mortality ratios in the year 1991 and lower ratios in 2010. In this region, male educational inequalities seem to decline substantially across time, again with the exception of the youngest age group where they have increased just as in the rest of the country (Graph 8.4).

Graph 8.4 Age-Specific Mortality Ratios by Educational Attainment among the Adult Male Population in Regions of Argentina: 1991, 2001, and 2010.

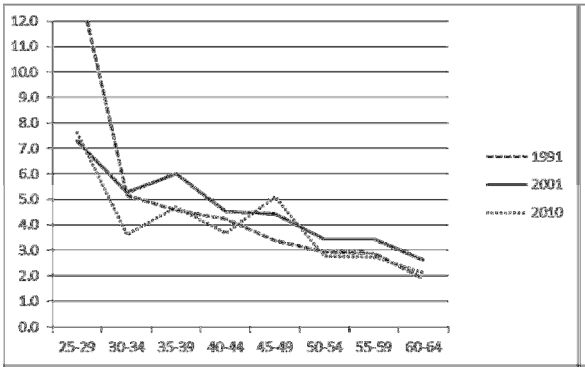
Argentina



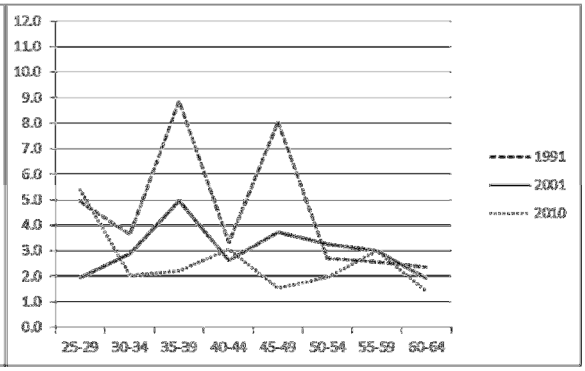
Buenos Aires Region



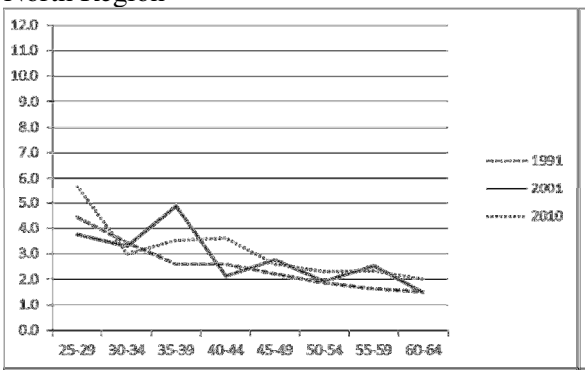
Center Region



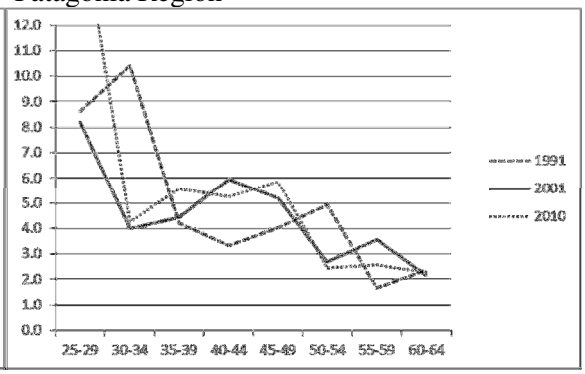
Cuyo Region



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 (Graph 8.4).

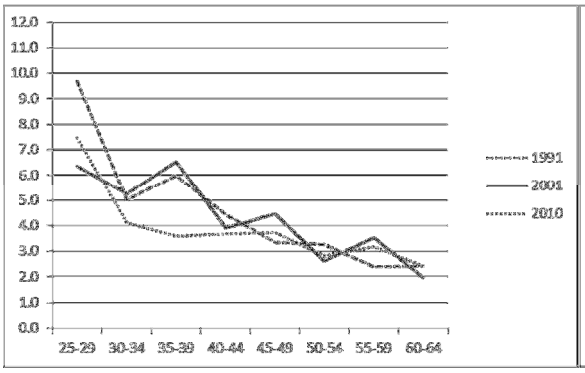
As observed in Chapter 6, the North region presents lower educational inequalities in mortality than the other regions. However, it is important to notice that in this region the dotted line (2010) is over the other two lines for almost age groups, indicating an increasing trend over time (Graph 8.4).

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 8.5).

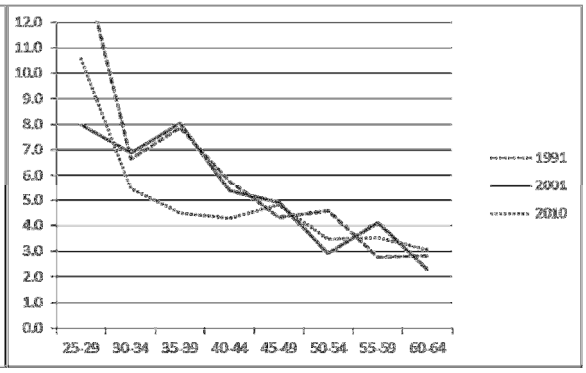
The mortality ratios for the youngest female group in 2010 are in general lower than those from 1991. In the case of Center, Cuyo, and North regions, the mortality ratios in the 25-29 age groups are lower than from those the years 1991 and 2001 (Graph 8.5). Different in comparison to what was found among men: the educational inequalities in death among women in this age group seem to be decreasing across time.

Graph 8.5 Age-Specific Mortality Ratios by Educational Attainment among the Adult Female Population in Regions of Argentina: 1991, 2001, and 2010.

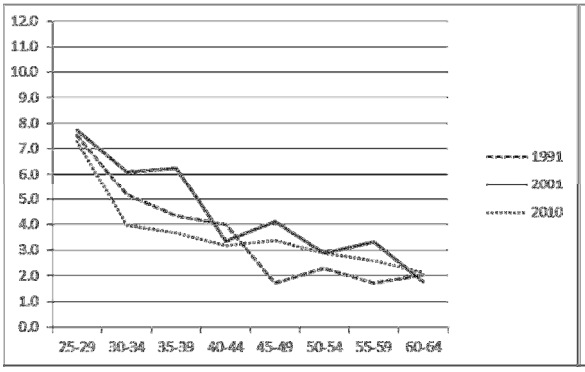
Argentina



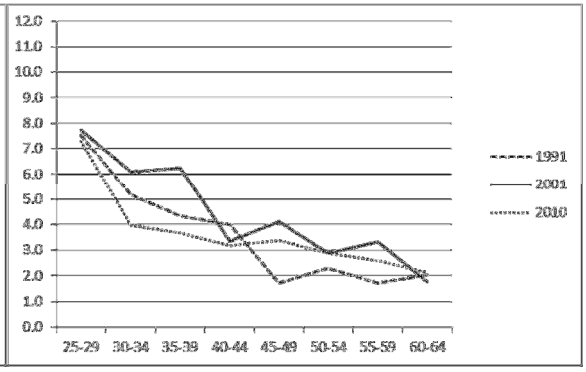
Buenos Aires Region



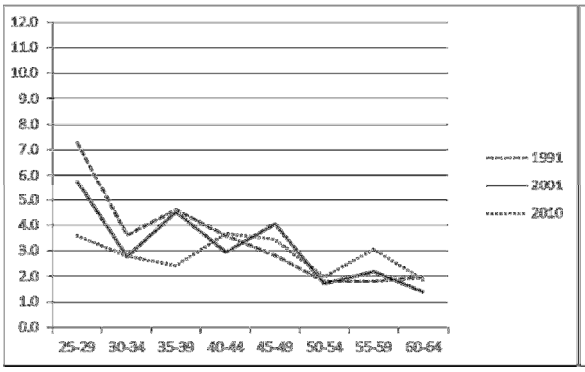
Center Region



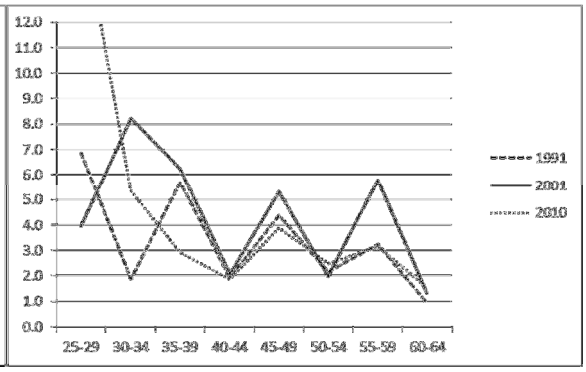
Cuyo Region



North Region

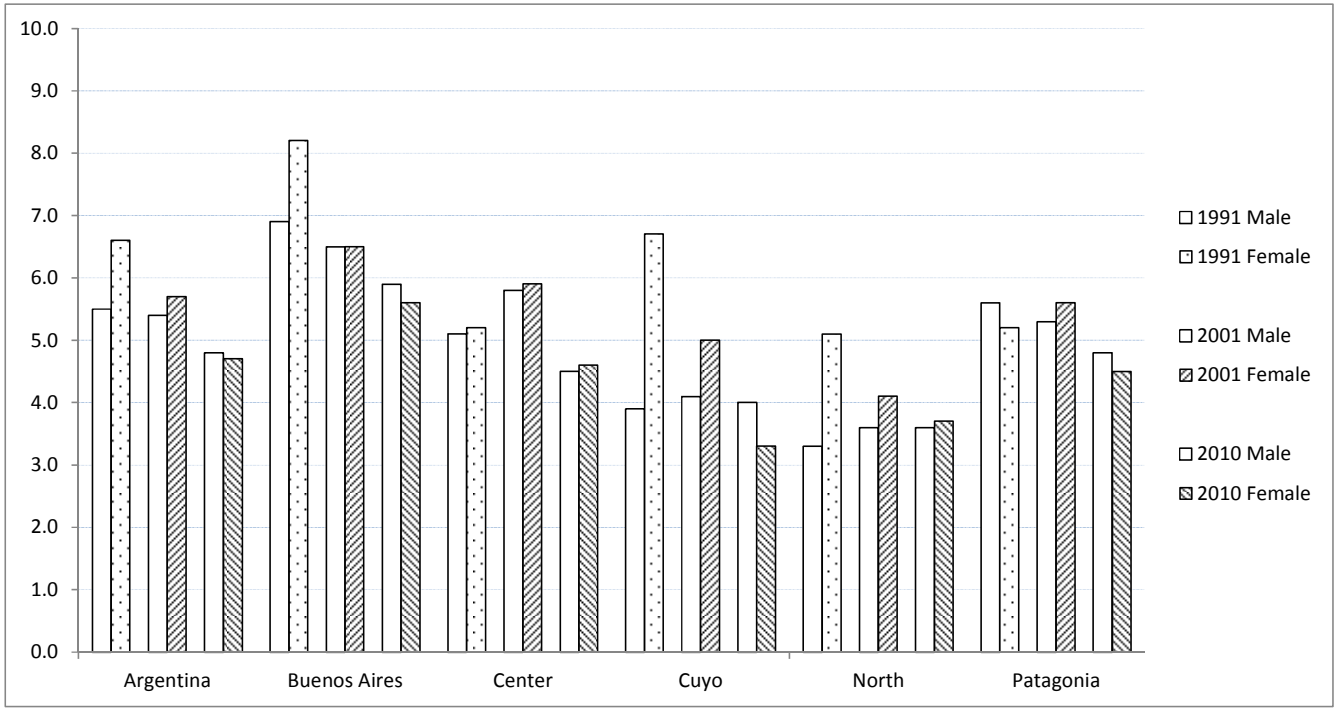


Patagonia Region



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

Graph 8.6 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 Statistics1991, 2001 and 2010.

Conclusions

This chapter addressed one of the core questions of this dissertation: 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 chapter 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.

CHAPTER 9: Conclusions

This dissertation addressed fundamental and important questions on the study of inequality and mortality: How are overall adult mortality patterns in Argentina differentiated by education level? Does the association between education and adult mortality vary by age group, gender and region, as has been found in other countries? These questions are centrally important to the standing of health and mortality inequalities in one of the largest countries in the Latin America, and to date, these questions have been completely open in Argentina.

The first part of this dissertation described the specific demographic background of Argentina in a context of substantial socioeconomic inequalities that make Latin American countries, and Argentina in particular, interesting settings for studying mortality inequalities. The literature review on adult mortality in Latin America showed that this specific issue has been largely neglected. However, the scarcity of studies analyzing socioeconomic differentials and the incipient group of studies trying to overcome data limitations with new data sources show that a strong inverse association exists between adult mortality and socioeconomic factors. Hypotheses based on previous research, largely from other countries, were developed to guide the analysis.

The first working hypothesis focused on the inverse relationship between educational attainment and overall adult mortality. The analysis for this hypothesis was based on death rates and mortality ratios by educational attainment. We found a clear gradient in the specific mortality rates according to educational groups, for both sexes and for all five-year age groups between ages 25 and 64. The existence and direction of this relationship was as expected; however, the magnitude of educational differences was much higher than what has been found in other countries. It is clear, then, that educational attainment very strongly differentiates mortality rates among Argentinean adults.

Several corollary hypotheses were formed around the second working hypothesis of this paper. These corollary hypotheses guided the analysis of educational differences in mortality specific to gender, age group, and region among adults in Argentina. Again, we used age-specific mortality rates and rate ratios by educational attainment to examine these patterns.

The first corollary hypothesis regarding age differences was confirmed; the data exhibited a clear declining trend in mortality inequalities by education as age increased. In particular, the younger age groups had much higher mortality ratios than the older age groups.

We had also found evidence consistent with our second corollary hypothesis. Educational inequalities in mortality are stronger for men than for women. However, there were some exceptions to this overall pattern in some age groups. In general, gender differences in educational differences in mortality were larger at younger ages when educational inequalities are the highest, and smaller at older ages when educational inequalities are smaller. Clearly, low educated young men appear to exhibit the highest relative mortality disadvantages in Argentina.

Moreover, in relation with the regional differences, it was found that the North and Cuyo regions exhibited the smallest educational inequalities in mortality. On the other hand, the Buenos Aires, Center, and Patagonia regions presented very high mortality ratios between the lowest and highest educational groups.

In chapter 7, it was found evidence that supports the hypothesis sustaining that the relationship between educational attainment and mortality risk will vary significantly for different causes of death. However, the hypothesis suggesting a positive relationship between neoplasm mortality and educational attainment, and a negative relationship between educational attainment and transmittable disease mortality and external causes of death could not be supported because neoplasm mortality was higher among those who are low educated. Nevertheless, we do observe

some differences among underlying causes of mortality in the direction that was expected from previous research. We observed lower mortality ratios in death by neoplasms than in other underlying causes of death. In relation with the regional differences, we found that Buenos Aires, Center and Patagonia regions show very high mortality ratios for all causes of death analyzed; meanwhile, in the Cuyo and North regions, where the general mortality rates are higher, there are lower mortality ratios across educational attainment groups. Moreover, the causes of death that exhibit the highest mortality ratios are different across regions.

The results did not provide support for the working hypothesis stating that educational differences in overall adult mortality will increase over time during the period 1991-2010. The year 2001 generally displayed 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. In relation with sex differences, we found that educational inequalities among women were reduced between 1991 and 2010, with the exception of the youngest group. 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 dissertation answered key unanswered questions in Argentina; however, the dissertation 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.

There is also a set of points related to data quality that must be considered when analyzing and interpreting the results of this dissertation. Although the quality of vital statistics data in Argentinian data has been considered as one of the best in the region in terms of completion and coverage (Chackiel 1987; Jaspers-Faijer and Orellana 1994; Jaspers-Faijer and Orellana 1996; Grushka 1996; Paes Antunes 2007; Piscoya-Díaz and Queiroz 2010), it must be noted that the percentage of the population not covered by vital statistics is probably select in different ways. This potential bias in the coverage presumably underestimates more vulnerable populations (women and less-educated people). In this sense, there is a need for methodological research to complement the substantive results of this dissertation. Another important point is that the Argentinian data is less reliable in specific scenarios. For example, the study of educational inequalities in mortality at the national level is much more reliable in comparison to the analysis of educational inequalities at death at regional levels. Indeed, at the regional level, small fluctuations in the number of deaths in any one year could cause a sizable change in mortality rates among regions with a small number of cases like Patagania and Cuyo. Future steps of this research should necessarily consider this limitation and contemplate methodological ways of overcoming it. Furthermore, another limitation regards potential problems in the quality of the

registration of the underlying cause of death. In sum, results of this research need to be considered cautiously.

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 dissertation relate to relevant policy questions about health care and social inequalities in death. For example, even when a declining trend in mortality inequalities by education as age increased was expected, young adults have very high mortality inequality ratios; this is true for both men and women. Indeed, the mortality ratio for young adults with the lowest education compared to those with the highest education is greater than 7. 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?

Finally, this dissertation also speaks to education policy. In 2010, it was still the case that only 24 percent of Argentinian adults aged 25-64 had 13 or more years of schooling, as I showed in Table 5.1. Yet these individuals had rates of mortality that are substantially lower than their less educated counterparts. While this dissertation does not have the data to show that high education causes lower mortality, there is a great deal of theory and empirical support in this area of research that strongly suggests that at least part of the relationship between higher educational attainment and lower adult mortality is causal (Mirowsky and Ross 2003, Lleras-Muney 2005). As such, future increases in educational attainment in Argentina will most likely lead to lower adult mortality rates and longer life expectancies. Policymakers in Argentina should be aware of

these very wide mortality inequalities and work to assure that all Argentinians have access to higher levels of schooling that help to alleviate the continuing high mortality rates experienced by the less educated segments of this society.

Appendix

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

			Deaths per 1,000 population				Mortality Ratio		
Sex and Age				Years of school completed			Years of school completed		
	Population	Deaths	Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	4,337,024	22,073	5.1	8.9	3.3	1.5	5.9	2.2	1.0
25-29	713,317	1,070	1.5	4.0	1.0	0.4	8.8	2.3	1.0
30-34	719,397	1,111	1.5	2.5	1.2	0.5	5.3	2.6	1.0
35-39	612,819	1,258	2.1	3.5	1.5	0.7	5.1	2.1	1.0
40-44	561,610	1,579	2.8	4.4	2.2	0.8	5.4	2.7	1.0
45-49	478,409	2,046	4.3	7.0	3.1	1.3	5.6	2.4	1.0
50-54	482,073	3,302	6.8	9.7	5.6	2.2	4.4	2.5	1.0
55-59	410,654	4,982	12.1	18.0	8.7	4.0	4.5	2.2	1.0
60-64	358,745	6,725	18.7	24.7	14.1	6.9	3.6	2.1	1.0
Female	4,637,784	12,965	2.8	5.1	2.0	0.9	5.6	2.2	1.0
25-29	724,959	458	0.6	2.1	0.5	0.2	10.5	2.4	1.0
30-34	746,939	582	0.8	1.4	0.7	0.3	5.5	2.8	1.0
35-39	636,281	738	1.2	2.0	1.0	0.5	4.5	2.2	1.0
40-44	598,423	944	1.6	2.5	1.4	0.6	4.3	2.3	1.0
45-49	509,768	1,403	2.8	4.5	2.3	0.9	4.8	2.5	1.0
50-54	535,377	2,042	3.8	5.6	2.9	1.6	3.5	1.8	1.0
55-59	456,061	2,855	6.3	9.4	4.6	2.7	3.5	1.7	1.0
60-64	429,976	3,943	9.2	11.9	6.8	3.9	3.1	1.8	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

Table 3. Death Rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: Central Region, Argentina, 2010.

Sex and Age	Population	Deaths	Deaths per 1,000 population				Mortality Ratio		
				Years of school completed			Years of school completed		
			Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	1,785,269	9,287	5.2	8.1	3.9	1.8	4.5	2.1	1.0
25-29	302,254	419	1.4	3.0	1.1	0.4	7.6	2.8	1.0
30-34	290,860	435	1.5	2.2	1.3	0.6	3.6	2.2	1.0
35-39	247,770	450	1.8	2.9	1.5	0.6	4.7	2.5	1.0
40-44	228,783	568	2.5	3.4	2.3	0.9	3.7	2.5	1.0
45-49	194,890	908	4.7	6.8	4.0	1.3	5.1	3.1	1.0
50-54	200,425	1,378	6.9	8.6	6.0	3.1	2.8	1.9	1.0
55-59	170,733	2,122	12.4	15.9	10.2	5.8	2.7	1.8	1.0
60-64	149,554	3,007	20.1	22.6	18.8	10.7	2.1	1.8	1.0
Female	1,879,747	4,906	2.6	4.3	2.2	0.9	4.6	2.3	1.0
25-29	304,597	158	0.5	1.3	0.5	0.2	7.3	3.1	1.0
30-34	299,922	192	0.6	1.1	0.6	0.3	4.0	2.3	1.0
35-39	255,490	229	0.9	1.4	0.9	0.4	3.7	2.3	1.0
40-44	240,048	333	1.4	1.9	1.4	0.6	3.2	2.4	1.0
45-49	204,486	571	2.8	4.1	2.6	1.2	3.4	2.2	1.0
50-54	216,046	768	3.6	4.3	3.9	1.5	2.9	2.7	1.0
55-59	184,039	1,142	6.2	8.3	5.1	3.2	2.6	1.6	1.0
60-64	175,119	1,513	8.6	10.0	7.7	4.7	2.1	1.7	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

Table 4. Death Rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: Cuyo Region, Argentina, 2010.

Sex and Age	Population	Deaths	Deaths per 1,000 population				Mortality Ratio		
				Years of school completed			Years of school completed		
			Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	707,848	3,224	4.6	7.0	3.2	1.8	4.0	1.8	1.0
25-29	121,219	171	1.4	2.9	1.1	0.4	6.6	2.4	1.0
30-34	118,960	175	1.5	2.4	1.0	0.6	3.8	1.7	1.0
35-39	101,336	166	1.6	2.5	1.3	0.7	3.6	1.9	1.0
40-44	89,253	165	1.8	2.5	1.6	0.9	2.9	1.8	1.0
45-49	76,031	286	3.8	5.9	2.5	1.4	4.2	1.8	1.0
50-54	77,621	470	6.1	7.1	6.0	2.7	2.6	2.2	1.0
55-59	66,122	781	11.8	14.8	9.6	5.9	2.5	1.6	1.0
60-64	57,306	1,010	17.6	19.8	15.6	10.3	1.9	1.5	1.0
Female	749,647	2,001	2.7	4.1	2.1	1.2	3.3	1.7	1.0
25-29	122,417	67	0.5	1.3	0.4	0.2	5.4	1.8	1.0
30-34	123,686	92	0.7	1.1	0.6	0.5	2.1	1.2	1.0
35-39	105,362	110	1.0	1.4	1.0	0.6	2.2	1.6	1.0
40-44	94,876	131	1.4	1.8	1.6	0.6	3.1	2.7	1.0
45-49	80,821	213	2.6	3.1	2.6	2.0	1.6	1.3	1.0
50-54	84,682	306	3.6	4.3	3.4	2.2	2.0	1.5	1.0
55-59	72,137	460	6.4	8.4	5.3	2.8	3.0	1.9	1.0
60-64	65,666	622	9.5	10.4	8.1	7.3	1.4	1.1	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

Table 5. Death Rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: North Region, Argentina, 2010.

Sex and Age	Population	Deaths	Deaths per 1,000 population				Mortality Ratio		
				Years of school completed			Years of school completed		
			Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	1,740,233	9,278	5.3	7.2	4.1	2.0	3.6	2.1	1.0
25-29	306,015	571	1.9	2.9	1.7	0.5	5.7	3.3	1.0
30-34	293,279	518	1.8	2.2	1.6	0.7	3.0	2.2	1.0
35-39	249,830	516	2.1	2.7	1.9	0.8	3.5	2.5	1.0
40-44	223,741	642	2.9	3.6	2.7	1.0	3.6	2.7	1.0
45-49	190,594	968	5.1	6.5	4.0	2.5	2.6	1.6	1.0
50-54	191,102	1,438	7.5	8.2	7.8	3.6	2.3	2.2	1.0
55-59	162,790	2,129	13.1	14.8	11.8	6.4	2.3	1.8	1.0
60-64	122,882	2,496	20.3	21.4	21.0	10.6	2.0	2.0	1.0
Female	1,831,026	5,459	3.0	4.1	2.5	1.1	3.7	2.2	1.0
25-29	321,091	250	0.8	1.3	0.7	0.4	3.6	1.8	1.0
30-34	311,385	318	1.0	1.3	1.0	0.5	2.8	2.0	1.0
35-39	265,254	327	1.2	1.6	1.1	0.7	2.4	1.7	1.0
40-44	234,670	436	1.9	2.4	2.0	0.6	3.7	3.1	1.0
45-49	199,904	615	3.1	4.1	2.8	1.2	3.5	2.4	1.0
50-54	197,906	849	4.3	4.8	4.4	2.4	2.0	1.8	1.0
55-59	168,586	1,202	7.1	8.4	7.2	2.7	3.1	2.6	1.0
60-64	132,230	1,462	11.1	11.9	11.0	6.4	1.9	1.7	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

Table 6. Death Rates (per 1,000 population) and Mortality Ratios by educational attainment, age groups and sex: Patagonia Region, Argentina, 2010.

Sex and Age	Population	Deaths	Deaths per 1,000 population				Mortality Ratio		
				Years of school completed			Years of school completed		
			Total	Less than 8 years	8 to 12 years of education	13 years of education or more	Less than 8 years	8 to 12 years of education	13 years of education or more
AGE SPECIFIC RATES									
Male	583,899	2,578	4.4	7.1	3.1	1.5	4.8	2.1	1.0
25-29	99,609	158	1.6	3.9	1.1	0.2	16.4	4.5	1.0
30-34	100,738	138	1.4	2.3	1.0	0.5	4.3	1.9	1.0
35-39	85,814	152	1.8	3.2	1.2	0.6	5.6	2.1	1.0
40-44	77,257	188	2.4	3.8	1.7	0.7	5.3	2.4	1.0
45-49	65,811	274	4.2	6.4	3.0	1.1	5.9	2.7	1.0
50-54	62,136	410	6.6	7.9	6.0	3.2	2.4	1.9	1.0
55-59	52,931	548	10.4	12.2	10.0	4.8	2.6	2.1	1.0
60-64	39,603	710	17.9	19.3	18.9	8.5	2.3	2.2	1.0
Female	585,306	1,370	2.3	3.9	1.8	0.9	4.5	2.1	1.0
25-29	97,869	54	0.6	2.0	0.4	0.1	16.2	3.1	1.0
30-34	100,982	80	0.8	1.4	0.7	0.3	5.3	2.5	1.0
35-39	86,022	95	1.1	1.4	1.3	0.5	2.9	2.8	1.0
40-44	78,187	110	1.4	1.6	1.6	0.9	1.9	1.8	1.0
45-49	66,603	146	2.2	3.1	2.2	0.8	3.9	2.8	1.0
50-54	61,760	227	3.7	4.2	4.1	1.7	2.5	2.4	1.0
55-59	52,610	286	5.4	7.1	4.7	2.3	3.1	2.1	1.0
60-64	41,273	372	9.0	10.5	6.1	6.7	1.6	0.9	1.0

Sources: Elaborated by the author based upon Argentine National Census 2010 and Argentine Mortality Files-Vital Statistic 2010.

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