Educational Differentials in Adult Women's Mortality in Brazil

Elisenda Rentería Pérez – elisenda@cedeplar.ufmg.br

Cedeplar – Universidade Federal de Minas Gerais, Brazil

Cássio Maldonado Turra

Cedeplar – Universidade Federal de Minas Gerais, Brazil

European Population Conference in Barcelona, Spain, 9-12 July, 2008

Educational Differentials in Adult Women's Mortality in Brazil[1]

Elisenda Rentería Pérez♣

Cássio Maldonado Turra♦

1. Introduction

It has been widely showed that individuals with lower educational levels, lower income or occupational status, have lower chances of survival and higher morbidity rates than individuals with higher socioeconomic status (Preston & Taubman, 1994; Goldman, 2001; Cutler et al., 2005). This association extends across all the distribution of socioeconomic variables, also within the highest social groups, defining what researchers call as social "gradient" in health and mortality (Adler et al., 1994).

The study of the association between adult mortality and socioeconomic status (SES) is of great importance to understand the causes and consequences of health inequality. As Preston and Taubman (1994) pointed out, examining inequality is important in itself, as societies are specially interested in knowing about the distribution of wellbeing. Also, looking at health inequalities has brought clues about the origin and causes of some diseases. Finally, studying differentials of mortality by social groups allows one to identify which groups have higher risks of mortality and morbidity and define better and more focused public health policies.

In many developed countries, particularly in the U.S., a variety of studies have shown great mortality and health differences by income, education and race. (Preston & Taubman, 1994; Rogers et al., 2000; Elo & Preston, 1996; Goldman, 2001; Cutler et al., 2005). Similar patterns of inequality have been found in Canada (Wolfson et al., 1993) and in Europe, where there is a great interest in occupational disparities (Fox, 1989, Macintyre, 1997; Marmot & McDowall, 1986; Kunst et al., 1998) either.

[1] Paper presented in the European Population Conference organized by the IUSSP in Barcelona, Spain, 9-12 July, 2008.

♣ Estudante de doutorado em Demografia no CEDEPLAR/UFMG.

♦ Professor do departamento de Demografia no CEDEPLAR/UFMG.

Although there is a vast and old literature in mortality differentials by SES, the interest on this topic has been increasing in the last decades due to two findings, mainly. The first one is the observation that the differentials are increasing over time, which goes against what it would be expected (Pappas et al., 1993; Preston & Elo, 1995; Kunst et al., 2004). The second finding is the fact that disparities in adult mortality seem to be lower at older than at younger ages (Kitagawa & Hauser, 1973; Elo & Preston, 1996; Lianga et al., 2005; Beckett 2000; House et al. 1994 and Hoffman 2005). The most common explanation behind this finding is selection of mortality, which means that among individuals with lower SES, those who have more health problems will die younger, not reaching the highest ages. Instead, those with higher SES live longer but with increasing worst health, which will make social disparities in mortality decrease at older ages. But it is also possible that income and health insurance disparities reduce at older ages (e.g. Medicare in the U.S) due to the social programs directed to this age group, which would explain the decrease in mortality differentials at older ages among SES groups. These findings have intensified the debate about the effects of selection and protection, and about the role of health services for the elderly. Yet, although most of the results have shown reducing health and mortality disparities at older ages, there are some authors (e.g. Ross & Wu 1996) who defend the theory of cumulative advantage based on their own empirical findings. They argue that social effects on health coming from education, working place, occupation or income, accumulate during life, and thus, disparities reveal higher when the person gets older.

All these studies have been criticized for using cross-section data and not paying attention to a cohort perspective of the aging process. Some authors emphasize the importance of working with longitudinal data to study social inequality in mortality (Lauderdale, 2001; Elo & Preston, 1996), particularly to disentangle effects by age, cohort and period.

Among developing countries this kind of studies are very rare. Whereas there is an important literature on in child mortality disparities, there are not many studies on adult mortality, mostly due to the lack of information or data quality issues. Brazil is a country where social and income inequality is very high and persistent over time, with a long tradition of studies in this area (Barros, Foguel e Ulyssea 2007). However, we know very little about how the income and social inequalities translated into adult mortality disparities. The greatest difficulty is to find reliable data to generate robust estimates. Unfortunately, Brazil doesn't have mortality follow-up studies where a socioeconomic survey is matched with death records such as those conducted in developed countries. In addition, our data (death records and demographic census) suffer from lack of information and inconsistencies in the report of socioeconomic variables. For example, death records miss, on average, almost one third of the information about education of deceased and, certainly, missing is not at random. Another good example, comes from data for new notifications of tuberculosis (Sistema de Notificação de Agravos de Tuberculose, SINAN-TB) where information on educational attainment is missing in about 41% (SVS, 2005). Despite the data issues, authors have looked for different alternatives to approach the analysis of social disparities in mortality in Brazil. One of the most prominent studies is from Wood and Carvalho (1988). The authors used indirect demographic methods based on infant mortality to estimate mean years of life by household income. The results show that people from higher income families lived, on average, 12 years more than people living in families from the lowest income group.

Since Brazil is a country with great regional disparities, a great deal of studies has examined mortality differentials by region, associating the latter to a series of macroeconomic socioeconomic variables (Cerqueira & Paes, 1998; Duarte et al., 2002; Messias, 2003; Barros e Ramos, 2006; Ishitani et al., 2006). In general, these studies show that better social indicators, as better literacy rates, higher urbanization or higher PIB per capita, are highly correlated with lower mortality rates or greater life expectancy. In addition, Messias (2003) shows that higher income inequality is associated with lower life expectancy, but the association becomes non-significant when literacy rate is included in the model, suggesting the importance of education to explain mortality differentials among adults. Ishitani et al. (2006) comes up with a similar result, by looking at the association between education and cardiovascular diseases.

Estimations from Wood and Carvalho (1988) also contribute for the study of regional differentials in mortality. The authors find that most of the mortality differences by region are, in fact, caused by unequal distribution of income by region, since poorer people tend to live in the less developed regions of the country. A similar pattern applies to rural-urban differences.

However, in the 1960s, urban areas offered higher life expectancy only for rich families. Poorer families living in rural areas had an advantage when compared to the same SES groups in the urban sectors, probably due to the less aggressive environment they were exposed to.

Several other studies have included aggregate variables as PIB per capita, literacy rate and quality of infrastructure at a level of neighborhood or local district in the analysis of mortality disparities in an attempt to get nearer of individual characteristics (Drummond & Barros, 1999; Silva et al., 1999; Szwarcwald et al., 1999; Paes-Souza, 2002). Other authors have ventured in the analysis of differentials mortality at individual level using occupational status data from death records (Duncan et al., 1994; Cordeiro e Silva, 2001). These studies, however, are restricted to very small areas (São Paulo State and the city of Botucatu, São Paulo, respectively).

In this study we try to fill the gap in the literature by examining differentials in mortality by level of education among adult women in Brazil, by using individual data. The study combines information about mother's survival and education, collected from participants in a nationally representative household survey (PNAD) carried out in 1996. The data allow us to estimate mortality rates by education and age. The contribution of this article goes beyond the estimation of how large are educational disparities in mortality in Brazil, as we are proposing an alternative method to estimate mortality risk that could be easily applied in other populations with defective mortality data.

2. Methods

2.1. Data and variables

Data for this study comes from the Pesquisa Nacional por Amostra de Domicílios (PNAD) collected in 1996. The survey is representative of the population of Brazil, not living in institutions and in the rural areas of the Northern region. 331,219 people were interviewed, but we excluded 1,880 housekeepers, relatives of housekeepers, as well as pensioners living in the households Among the remaining cases, we kept 328,726 individuals after excluding 613 people who where living in households where the ages from mother and child where missing. In the final sample, 71,155 individuals answered that their mother was already dead (21%) by the date of the interview.

In 1996, the PNAD collected a special supplement on social mobility, which allows us to learn about the level of education for most of the respondents' parents. We use education as our measure of SES because it is easier to be collected and easier to work with it, which simplifies comparisons between subgroups. Also, education has been shown to be related to social status in many ways (Preston & Taubman, 1994). Educational attainment is correlated with cognitive ability, health-related behaviors, and indicates the quality and amount of access to health information. Further, education is positively associated with occupational status and income, which determine the amount of health goods and services, that individuals can purchase (Lleras-Muney, 2005).

Unfortunately, information about education was collected only for people who were 15 years and older, and were household heads or spouses of household heads at the time of the interview. Thus, for those who were not asked about parents' education we defined it according to two methodological strategies. First, for those with living mothers in the same household, we obtained the information on mother's education directly from the survey. Second, for those with no information about the mother (because she died or she does not live in the same household) we imputed the educational levels. This subgroup represents only about 16% of our total sample.

The imputation was done using the "ice" command available in STATA 9 (Royston, 2004). This command is an abbreviation for *Multiple Imputation by Chained Equations*. It imputes missing values using a multivariate iterative regression that allows one to impute categorical variables and to indicate what kind of regression it is more suitable. For the variable of education we use an ordinary logistic regression as levels of education have an order and are categorical. The other variables used to impute education where: children's age, child's region of residence (divided in the five great regions of Brazil), household income per capita of the child (continuous) and a variable we constructed to indicate the maximum educational level attained by anyone in the household. We impute the variable of education 10 times for the 16% of missing of the survey, and choose the most frequent category.

To validate the imputation method we conducted a test using only a sub-sample formed by individuals for whom we had *ex-ante* information about mother's education. After repeating the imputation ten times we get exactly the right levels of education in 50% of the cases, and for other 45% of the cases it missed for just one category.

2.2. Mortality rates

We estimated mortality rates for women by ten-year age groups (20-29 through 70-79) and by years of schooling, divided in four categories (0: without education, 1: 1-4 years of schooling, 2: 5-8 years of schooling, 3: 9 or more years of schooling.

To estimate mortality rates we need to know the time of exposure to death for all mothers. It corresponds to the time period between the respondents' date of birth (when all mothers were necessarily alive) and the date of death for mothers who died thereafter, or the date of the interview for mothers who survived. We assigned date of birth (and thus, maternal age), and date of death by using probability distributions of fertility and mortality.

In the case of date of birth, we used discrete historical fertility functions estimated by Horta, Carvalho & Frias (2000) for Brazil to randomly assign them. We applied different fertility functions according to children's (respondents') age reported in PNAD. To calculate age at death we randomly chose ages between maternal age and the age that the mother would have if she were alive at the time of the interview. We assumed 100 years old as the possible highest age. In addition, we used three distributions of mortality rates according to the period of exposure. If the median year of the time of exposure is before 1970, we applied the mortality rates from 1965 (Carvalho, 1974); if it is between 1970 and 1980, we applied mortality rates from 1975 (Carvalho e Pinheiro, 1986), and for those with median year after 1980, we applied mortality rates from 1985 (IBGE)[1].

[1] We worked with single years of age. Because life tables were constructed in 5-years age groups we use the multipliers of Karup-King (Shryock and Siegel, 1973) to open the age groups and a logit function from Himes et al. (1994) to expand the probabilities of death until age 100.

Once we had all the ages we used Poisson regressions to model the number of deaths by persons-year lived (total time of exposure), 10-year age groups and education (four categories). We estimated several regression models. First, controlling only for age. Next, controlling for age and education, and finally we interact age with education in a third model. We present the estimated mortality rates by educational level for three age groups (20-29, 40-49 and 60-69).

3. Results

Table 1 shows the number of deaths and person-years lived by age and level of education. As suggested by the numbers we have enough observations to conduct our analysis. Also, as expected, death rates increase with age and decrease at higher levels of education.

Table 1: Number of deaths, person-years of exposure and death rates by age and level of education for women in Brazil. PNAD 1996

	Deaths	Person-years of exposure	Death rates
Age			
20-29	2,128	1148434	1.85
30-39	5,535	2026882	2.73
40-49	9,901	1899519	5.21
50-59	12,182	1357275	8.98
60-69	15,266	820555	18.60
70-79	15,829	384638	41.15
Education			
without education	42312	3386042	12.50
1-4 years of school	23752	3098419	7.67
5-8 years of school	2853	758756	3.76
9 + years of school	2238	623802	3.59

Source: PNAD 1996

Table 2 shows the regression coefficients from the Poisson models. In the first model, which controls only for age, all age groups are statistically significant ($p<0.01$) and, as expected, positively related to deaths. Based on these regression coefficients we estimate the life expectancy at age 20, which is 50.58 years. This result is very similar to previous estimates: life expectancy of 49.49 years in 1975 and 50.74 years in 1980 (IBGE, 1991). Since we know that the median year of death is near 1980, we are pretty sure our data are fairly reliable.

In the second Poisson regression model (Table 2), we added educational levels, which are all statistically significant. The coefficients for age groups are now slightly smaller, meaning that a small part of the age effect is related to the fact that younger people is more educated. There is clearly a negative relation between education and number of deaths, controlling for age and time of exposure.

In the third model we included interaction effects between age and education, since we want to examine whether education effects are different at different age groups. Not all coefficients for the interaction terms are statistically significant, although they are jointly significant (results not presented). The coefficients for the interaction terms are positive and increase with age and educational level, which suggests that educational differences in mortality are lower at older ages.

Table 2: Possion Regressions of number of deaths by age and education, using information about mother's survival from PNAD 1996

Variables	Coefficient	Interval	Coefficient	Interval	Coefficient	Interval
Age						
30-39	0.3467 **	[0.2966-0.3967]	0.3107 **	[0.2607-0.3608]	0.2908 **	[0.2126-0.3689]
	0.0255		0.0256		0.039865	
40-49	0.9778 **	[0.9310-1.0247]	0.9005 **	[0.8535-0.9475]	0.8452 **	[0.7721-0.9183]
	0.0239		0.0240		0.0372874	
50-59	1.5167 **	[1.4706-1.5628]	1.4148 **	[1.3685-1.4611]	1.3922 **	[1.3206-1.4638]
	0.0235		0.0236		0.0365273	
60-69	2.2456 **	[2.2002-2.2910]	2.1277 **	[2.0820-2.1734]	2.1199 **	[2.0494-2.1905]
	0.0232		0.0233		0.0359949	
70-79	3.0395 **	[2.9942-3.0848]	2.9070 **	[2.8613-2.9526]	2.9053 **	[2.8351-2.9756]
	0.0231		0.0233		0.035844	
Education						
1-4 years school			-0.2258 **	[-0.2430- -0.2087]	-0.189 **	[-0.2827- -0.0954]
			0.0088		0.0477698	
5-8 years school			-0.5803 **	[-0.6203- -0.5403]	-0.842 **	[-0.9948- -0.6894]
			0.0204		0.0778917	
9 + years school			-0.6693 **	[-0.7144- -0.6243]	-0.711 **	[-0.8794- -0.5422]
			0.0230		0.0860247	
Age*Education						
30-39*1-4 y.school					0.0102	[-0.0992-0.1197]
					0.0558462	
30-39*5-8 y.school					0.203	[0.0191-0.3870]
					0.0938573	
30-39*9+ y.school					-0.132	[-0.3376-0.0731]
					0.1047617	
40-49*1-4 y.school					0.0548	[-0.04774-0.1572]
					0.0522907	
40-49*5-8 y.school					0.3246 **	[0.1479-0.5012]
					0.0901315	
40-49*9+ y.school					0.0325	[-0.1639-0.2289]
					0.1002026	
50-59*1-4 y.school					-0.033	[-0.1335-0.0685]
					0.0515235	
50-59*5-8 y.school					0.3295 **	[0.1525-0.5066]
					0.0903206	
50-59*9+ y.school					0.1022	[-0.0952-0.2996]
					0.1007116	
60-69*1-4 y.school					-0.07	[-0.1698-0.0297]
					0.0508859	
60-69*5-8 y.school					0.2888 *	[0.1119-0.4658]
					0.0902989	
60-69*9+ y.school					0.0994	[-0.0967-0.2955]
					0.1000654	
70-79*1-4 y.school					-0.098	[-0.1974-0.0023]
					0.050947	
70-79*5-8 y.school					0.3022 *	[0.1219-0.4825]
					0.0919874	
70-79*9+ y.school					0.1422	[-0.0566-0.3409]
					0.1013977	
constant	-6.2299 **	[-6.273--6.187]	-5.9871 **	[-6.031--5.943]	-5.971 **	[-6.038--5.9031]
	0.0217		0.0223		0.0344828	

** P<0.001

* P<0.01

Source: PNAD 1996

Table 3 presents mortality rates estimated from coefficients shown in the third model. Not surprisingly, mortality rates among those with less education are higher than among those with higher levels of education by about two times. The educational disparities are therefore, not trivial. This pattern is true for all age groups, although, the ratio between mortality rates for women without any education and those with 9 years of schooling decreases with age. This result confirms previous studies for other countries that suggest selection or protection effects at more advanced ages.

Table 3: Estimated Mortality Rates (x1000) by level of education, among age groups 20-29, 40-49 e 60-69 for women in Brazil 1996

Age and level of education	Rate	Interval 95%	
20-29			
without educ	2.5525	2.3857	2.7310
1-4 y. school	2.1128	1.7982	2.4824
5-8 y. school	1.0996	0.8823	1.3706
9+ y. school	1.2539	0.9901	1.5879
without educ./9+ y. school	2.0357	2.4095	1.7198
40-49			
without educ	5.9432	5.1633	6.8409
1-4 y. school	5.1962	3.7104	7.2770
5-8 y. school	3.5421	2.2138	5.6672
9+ y. school	3.0159	1.8189	5.0005
without educ./9+ y. school	1.9707	2.8388	1.3680
60-69			
without educ	21.2642	18.5208	24.4141
1-4 y. school	16.4097	11.7797	22.8595
5-8 y. school	12.2286	7.6599	19.5224
9+ y. school	11.5375	6.9778	19.0766
without educ./9+ y. school	1.8431	2.6542	1.2798

Source: Rates calculated from Poisson regressions, using PNAD 1996 data

4. Final considerations

Many studies have shown that educational differentials in mortality are large and significant. However, the majority of these studies examine data from developed countries. In the case of

Brazil, a very unequal society, only very few studies have tried to looked at mortality differentials at the individual level, and those that did it used variables related to occupational status or small regions (Duncan et al., 1994; Cordeiro e Silva, 2001). Defective data, particularly missing data on education, have precluded additional studies in developing countries.

In this article, we have estimated mortality rates among adult women using information on survivorship and educational attainment of mothers from respondents of a nationally representative survey in Brazil. Our study, which applies a methodology that has it roots on the traditional Brass method for adult mortality, allowed us not only to calculate mortality rates by level of education at an individual level for the first time in Brazil, but also to analyze how these differentials behave by age and education together. We believe this method could be applied in other countries that face the same data quality issues.

Our results agree with the international literature in showing larger mortality rates for older and less educated people. The differences by educational levels are not trivial at all (about two times between the highest and lowest educational groups), and it seems to reduce at older ages, suggesting that protection or selection effects may also operate also among old Brazilians.

Our results certainly call the attention for the harsher face of socioeconomic disparities in Brazil. Ignoring educational differences in adult mortality seems to be unacceptable in a country where, for decades, too much attention has been given to the possible consequences of differences in income distribution. Just to mention one of these consequences, we can expect, for example, that differences in mortality by SES at older ages certainly make the social security system more regressive in Brazil, since the social security benefits are calculated without accounting for the fact that poorer people live shorter, even at advanced ages.

We should exercise some caution about our current results since we have not looked at cohort and period effects yet. Therefore, some of the effects we are attributing to age or education might change when we control for differences by these two other effects. In a future version of this article, given that we have enough number of observations, we will test for the cohort and period effects, which will allows us to better foresee future patterns of mortality differences by SES in Brazil.

References

ADLER, N.E., BOYCE, T., CHESNEY, M. A., COHEN, S., FOLKMAN, S., KAHN, R. L., SYME, S. L. Socioeconomic status and health: the challenge of the gradient. American Psychologist 49(1):15-24, 1994.

BARROS, G. B., RAMOS, M. Condicionantes da mortalidade na população no extremos sul do Brasil. In: Anais do XV Encontro Nacional de Estudos Populacionais da ABEP, Caxambu, 2006.

BARROS, R. P., FOGUEL, M., ULYSSEA, G. Desigualdade de Renda no Brasil: uma análise da queda recente. Ed. IPEA, v. 2., 900 p., 2006.

BECKETT, M., 2000. Converging health inequalities in later-life: an artifact of mortality selection. Journal of Health and Social Behaviour 41:106-119.

CARVALHO, J. A. M. Tendências regionais de fecundidade e mortalidade no Brasil. Belo Horizonte, CEDEPLAR, UFMG, Monografia no. 8, 1974.

CARVALHO, J. A. M., WOOD, C. H. Renda e concentração da mortalidade no Brasil. Estudos Econômicos, 7(1):107-30, 1977.

CARVALHO, J. A. M., PINHEIRO, S. M. G. Fecundidade e mortalidade no Brasil 1970/1980. Belo Horizonte, CEDEPLAR, UFMG (Relatório de pesquisa), 1986.

CERQUEIRA, C. A., PAES, N. A. Mortalidade por Doenças Crônico-Degenerativas e Relações com Indicadores Socioeconômicos no Brasil. In: Anais do XI Encontro Nacional de Estudos Populacionais da ABEP, Caxambu, 1998.

CORDEIRO, R., SILVA, E. A. Desigualdade da sobrevivência de trabalhadores de Botucatu, São Paulo, Brasil. Cadernos de Saúde Pública, v.17 n.4, Rio de Janeiro, 2001.

CUTLER, D. M., DEATON, A., S., LLERAS-MUNEY, A. The Determinants of Mortality. Working Paper 11963, http://www.neber.org/papers/w11963. NBER, 2006.

CUTLER, D. M., LLERAS-MUNEY, A. Education and Health: Evaluating Theories and Evidence. NBER Working Paper No. 12352, June 2006.

DENNIS, M., WILMOTH, J. R. Social differences in older adult mortality in the United States: Questions, data, methods, and results. In: Robine, J. M. et al. (eds.), Human longevity, individual life duration, and the growth of the oldest-old population, Oxford, U.K.: Oxford University Press, 2001.

DRUMMOND Jr., M. BARROS, M. B. A. Desigualdades socioespaciais na mortalidade do adulto no Município de São Paulo. Revista Brasileira de Epidemiologia. Vol.2, no 1/2, 1999.

DUARTE, E. C., SCHNEIDER, M. C., PAES-SOUSA, R., SILVA, J. B., CASTILLO-SALGADO, C. Expectativa de vida ao nascer e mortalidade no Brasil em 1999: análise exploratória dos diferenciais regionais. Revista Panamericana de Salud Publica, 12(6), 2002.

DUNCAN, B. B. RUMEL, D., ZELMANOWICZ, A., MENGUE, S. S., SANTOS, S., DALMAZ, A. Social Inequality in Mortality in São Paulo State, Brazil. International journal of Epidemiology, vol. 24, n.2, 1995.

ELO, I. T., PRESTON, S. H. Educational differentials in mortality: United States, 1979-85. Social Science and Medicine 42: 47-57, 1996.

FOX, A. J., ADELSTEIN, A. M., 1978. Occupational mortality: Work or way of life? Journal of Epidemiology and Community Health, 32:73-78.

GOLDMAN, N. Social inequalities in health, disentangling the underlying mechanisms. Annals New York Academy of Sciences, 2001.

HIMES, C. L., PRESTON, S. H., CONDRAN, G. A. A relational modelo f mortality at older ages in low mortality countries. Population Studies, v. 48, n.2, p. 269-291, 1994.

HOFFMANN, R. Do socioeconomic mortality differences decrease with rising age? Demographic Research, Max Planck Institute for Demographic Research, Rostock, Germany, vol. 13(2): 35-62, August, 2005.

HORTA, C. J. G., CARVALHO, J. A. M., FRIAS, L. A M. Recomposição da fecundidade por geraçao para Brasil e regiões: atualização e revisão. In: Anais do XII Encontro Nacional de Estudos Populacionais da ABEP, Caxambu, 2000.

HOUSE, J. S., LEPKOWSKI, J. M., KINNEY, A. M., MERO, R. P., KESSLER, R. C., HERZOG, A. R. The social stratification of aging and health. Journal of Health and Social Behavior, 35,213-234, 1994

HUMMER, R.A., ROGERS, R. G., EBERSTEIN, I. W. Sociodemografic Differentials in Adult Mortality: A Review of Analytic Approaches. Population and Development Review 24.3: p. 553, sept 1998.

IBGE (Instituto Brasileiro de Geografia e Estatística). Pesquisa Nacional por Amostra de Domicílios de 1996.

IBGE (Instituto Brasileiro de Geografia e Estatística). Anuário Estatístico do Brasil. Rio de Janeiro: IBGE, 1991.

ISHITANI, L. H., FRANCO, G. C., PERPÉTUO, I. H. O., FRANÇA, E. Desigualdade social e mortalidade precoce por doenças cardiovasculares no Brasil. Revista de Saúde Pública, 40(4): 684-91, 2006.

KITAGAWA, E. M., HAUSER, P. M. Differential mortality in the United States: a study in socioeconomic epidemiology. Cambridge: Harvard University Press; 1973.

KUNST, A. E., GROENHOF, F., MACKENBACH, J. P. Occupational class and cause specific mortality in middle aged men in 11 European countries: comparison of population based studies. British Medical Journal (BMJ) 316:1636–42, 1998.

KUNST, A. E., BOS, V., ANDERSEN, O., CARDANO, M., COSTA, G., HARDING, S., HEMSTRÖM, Ö., LAYTE, R., REGIDOR, E., REID, A., SANTANA, P., VALKONEN, T., MACKENBACH, J. P. Monitoring of trends in socioeconomic inequalities in mortality: Experiences from a European project. Demographic Research, special collection 2, art. 9, 2004.

LIANGA, J., BENNETTA, J., KRAUSEA, N., KOBAYASHID, E., KIMD, H., BROWNA, J. W., AKIYAMAC, H., SUGISAWAD, H., JAINA, A. Old Age Mortality in Japan: Does the Socioeconomic Gradient Interact With Gender and Age?. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences n. 57, p. 294-307, 2002.

LLERAS-MUNEY, A. The relationship between Education and Adult Mortality in the United States. Review of Economic Studies, 72, p.189–221, 2005.

MARMOT, M. G., MCDOWALL, M. E. Mortality decline and widening social inequalities. Lancet 2(8501):274-6, 1986.

MESSIAS, E. Income Inequality, Illiteracy Rate, and Life Expectancy in Brazil. American Journal of Public Health, vol 93, no. 8, 2003.

PAES-SOUSA, R. Diferenciais intra-urbanos de mortalidade em Belo Horizonte, Minas Gerais, Brasil, 1994: revisitando o debate sobre transições demográfica e epidemiológica. Cadernos de Saúde Pública, Rio de Janeiro, 18(5): p.1411-1421, 2002.

PAPPAS, G. QUEEN, S., HADDEN, W., GAIL, F. The increasing disparity in mortality dettween socioeconomic groups in the United States, 1960 and 1986. The New England Journal of Medicine, vol. 39 (2), 1993.

PRESTON, S. H., ELO, I. T. Are educational differentials in adult mortality increasing in the United States? Journal of aging and health 7: 476-96, 1995.

PRESTON, S. H., TAUBMAN, P. Socieconomic differences in adult mortality and health status. In: MARTIN, L.G., PRESTON, S.H., Demography of aging, ed. National Academy Press. Washington, DC, p. 279-318, 1994.

ROYSTON, P. Multiple imputation of missing values. Stata Journal 4(3): 227–241, 2004.

ROSS, C., WU, C. Education, age, and the cumulative advantage in health. Journal of Health and Social Behavior, 37,104-120, 1996.

ROSSUM, C. T. M., SHIPLEY, M. J., MHEEN, H., GROBBEE D. E., MARMOT, M. G. Employment grade differences in cause specific mortality. A 25 year follow up of civil servants from the first Whitehall study. Journal of Epidemiology and Community Health 54:178-184, 2000.

RUMEL, D. Razões de mortalidade frente ao efeito desigualdade em estudos de mortalidade associada a categorias ocupacionais e níveis sociais. Revista de Saúde Pública, S. Paulo, 22:335-40, 1988.

SHRYOCK, H. S., SIEGEL, J. S. The Methods and Materials of Demography. 2 Vols. U.S. Bureau of the Census, Washington, 1973.

SILVA, L. M. V., PAIM, J. S., COSTA, M. C. N. Desigualdades na mortalidade, espaço e estratos sociais. Rev. Saúde Pública, 33 (2): 187-97, 1999.

SECRETARIA DE VIGILÂNCIA EM SAÚDE (Departamento de Análise da Situação de Saúde). Saúde Brasil 2005: uma análise da situação de saúde. Cap. 11: Uma análise da situação da Tuberculose no Brasil. Ministério da Saúde, 2005.

SZWARCWALD, C. L., BASTOS, F. I., ESTEVES, M. A. P., ANDRADE, C. L. T., PAEZ, M. S., MÉDICI, E. V., DERRIÇO, M. Desigualdade de renda e situação de saúde: o caso do Rio de Janeiro. Cadernos de Saúde Pública, Rio de Janeiro, 15(1):15-28,1999.

WOLFSON M. C., ROWE G., GENTLEMAN J. F., TOMIAK M. Career earnings and death: a longitudinal analysis of older Canadian men. Journal of Gerontology 48:167–179, 1993.

WOOD, C. H., CARVALHO, J. A. M. The Demography of Inequality in Brazil. London: Cambridge University Press, 1988.