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## Interim Report

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### **Educational Attainment in Brazil: An Analysis of the Rates Between 1970 and 2000**

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## Contents

Introduction .....	1
Data.....	2
Educational Attainment Between 1970 and 2000 .....	4
Cohort Analysis .....	10
The Effects of Immigration on the Prevalence Rates by Education.....	13
The Effect of the Change in Age Structure on the Level of Completed Education .....	17
Conclusion.....	22
References .....	23

## **Abstract**

This paper analyzes the differentials in the rates of educational attainment in Brazil for people 15 years and older, between 1970 and 2000, by age groups and sex, according to period and cohort. For the oldest age groups, a growth in formal education resulted in an increase in the ratio of people with a primary education. For the youngest age groups, the increase in the ratio of people with secondary and tertiary education is more significant. As expected, the cohort analysis shows that in the long term, the biggest increases in secondary and tertiary education are found within the youngest cohorts and for women. The older age structure of the Brazilian population in 2000 causes the difference between the prevalence rates of 1970 and 2000 to diminish for those with no formal education, basic and secondary education. With relation to the tertiary level, however, it causes the difference to increase. The educational distribution of the international immigrants registered by the censuses of 1991 and 2000 indicates an increase in the rates of higher levels of education.

## **Acknowledgments**

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# **Educational Attainment in Brazil: An Analysis of the Rates Between 1970 and 2000**

Moema Gonçalves Bueno Fígoli

## **Introduction**

The behavior of demographic and economic variables has been frequently studied, taking in account the differentials in the distribution of the population by education. For example, the fertility level has shown, with few exceptions, an inverse relation with the education of the mother. Also, it has been verified that children of less educated mothers have a higher mortality in infancy than the children of more educated mothers (see, for example, Sawyer and Soares 1982; Fernandes 1984; Hakkert 1986; Castilla 1996; Santos and Moura 1998; Sastry 1996, 2004). Although adult mortality is higher among the less educated, according to studies carried out in developed countries, the differential between the more educated and less educated is larger for the younger population and for men than for the older population and for women (see, for example, Kunst and Mackenbach 1994; Desplanques 1976, 1984; Elo and Preston 1996; Pappas et al. 1993; Feldman et al. 1989; Shkolnikov et al. 1998). Moreover, some studies show that the level of education can be affected by international migration, given that the education of migrants and the resident population is often different (Borjas 1994, 1999; Chiswick 1986).

Economic studies have emphasized the important role of education on economic growth.<sup>1</sup> Mingat and Tan (1996) concluded that the variation of returns is not only a result of the level of education, but is influenced as well by the level of development of the country. Therefore, an evaluation of returns requires consideration of both variables simultaneously. According to the authors, for the countries with a lesser income, it would be best to invest in primary education; for countries of average income, where primary education is already extensive, investments in secondary education would bring the highest returns; for countries of high income, investments in tertiary education would yield the best returns.

The importance of defining the population according to educational attainment for the purpose of population projections is argued by Lutz et al. (1999):

...adding education to age and sex as an explicitly considered demographic dimension in population forecasting also affects the demographic output parameters themselves, because a significant source of so far unobserved heterogeneity is being observed and endogenized explicitly. It may, therefore, be

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<sup>1</sup> For example, Psacharopoulos and Patrinos (2002) revised a series of studies in countries in different stages of development.

considered an improvement even of the purely demographic output parameters of the projection. More importantly, however, the overriding substantive importance of education means that the future educational composition of the population is of interest in its own right. (cited in Goujon and Lutz 2004, p. 125)

In fact, even if the age-specific rates of mortality, fertility and migration are kept constant for each level of education, a change in the relative size of the population according to educational attainment in the long term will result in a modification of the rates for the total population.

Many studies have used school enrollment and illiteracy rates<sup>2</sup> to measure a population's level of education, but, as pointed out by Barro and Lee (1993, 2000), these variables do not measure the supply of available human capital. The school enrollment rates, for example, reflect the current flow of human capital, but, as the educational process is slow, there is a long interval between the flow and supply of education. Moreover, information on school registration normally mentions the number of students at the beginning of the school year, but gives no information on the number of students who actually attended school during the entire period. The illiteracy rate, in turn, is a very collective measure of the supply of human capital. It evaluates the initial step of education but does not reflect the real qualification of the population.

Based on this knowledge, this paper will analyze the differentials in the rates of education in Brazil, according to the highest level of attainment, for people 15 years and older, between 1970 and 2000, by age groups and sex, according to period and cohort, with the objective of evaluating the long-term behavior of the population with regard to education. The possible impacts of international immigration and the differentials of mortality by education on the prevalence rates<sup>3</sup> will also be discussed. Finally, the effects of the change in age structure of the population in the given period on the total rates of education will be analyzed.

## Data

The analyses in this paper are based on the micro-data of the results of the samples of the 1970, 1980, 1991 and 2000 censuses that were supplied by the IPUMS (Integrated Public Use Micro-data Series) International Census Micro-data for Social and Economic Research ([www.ipums.umn.edu](http://www.ipums.umn.edu)). The data of the 1991 census has been adjusted for 1990 to allow a comparison of the results in intervals of 10 years. In this database, the individual registers of completed levels of education, relative to Brazil, are classified in the following categories:

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<sup>2</sup> The word "rate" is used differently in demography and in education statistics. While in demography, it refers to a transition intensity (e.g., the birth rate), in education it is used mostly for a simple proportion (e.g., the literacy rate, which is the proportion literate). In this paper it will be used in the latter sense, describing a proportion.

<sup>3</sup> The number of people in an age group having completed at least one educational level, divided by the total number of people in that age group.

**Less than primary completed**

No schooling  
Some primary  
Primary (4)

**Primary completed, less than secondary**

Primary (6)  
Lower secondary / General track

**Secondary completed**

Secondary only  
Some college / university

**University completed**

The above levels of education were aggregated according to the levels described below, in order to become the education attainment level considered in this paper:

- **No education:** those who have no formal education (no schooling category in the database).
- **Primary:** those who have completed, with approval, at least one year of education in the primary formal cycle and in the maximum eight years, but who have not passed to the following cycle (some primary, primary (4) and primary (6) categories in the database).
- **Secondary:** those who have completed more than eight years of studies, with approval, but who have not attended any series of the tertiary level (lower secondary / general track and secondary only categories in the database).
- **Tertiary:** those who have attended at least one year at the tertiary level, having completed or not completed the course (some college/university and university completed categories in the database).

This classification is based on the current Brazilian educational system. Some modifications in the organization of the system were introduced between 1970 and 2000.<sup>4</sup> With the objective of making the levels of education comparable, the following amendments were necessary with regard to the primary level:

- People who had completed, with approval, the degrees Elementary I<sup>5</sup> and Medium of the first cycle,<sup>6</sup> in accordance with the 1970 census, were included in the primary level.
- People who had completed, with approval, the degrees Primary or Elementary,<sup>7</sup> Gymnasium or Medium of the first cycle,<sup>8</sup> in accordance with the censuses of 1980 and 1991, were included in the primary level. The first degree of the 1991 census already corresponded to the eight series in the primary level.

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<sup>4</sup> For information about changing the Brazilian educational system, see Rigotti (2004).

<sup>5</sup> Consists of four grades, but it is possible to remain up to six years in this grade while waiting for the approval from the admissions examination to advance to the next cycle.

<sup>6</sup> Consists of four grades.

<sup>7</sup> Consists of four grades, but it is possible to remain up to six years in this grade while waiting for the approval from the admissions examination to advance to the next cycle.

<sup>8</sup> Consists of four series.



## **Educational Attainment Between 1970 and 2000**

From Tables 1 and 2 we can observe that between 1970 and 2000, an improvement occurred in the level of completed education in all age groups and for both sexes. During these 30 years, there was a significant reduction in the ratio of people with no formal education in all age groups. For the more elderly age groups, the growth of formal education in this period, given by the reduction of people with no level of instruction, resulted in an increase in the proportion of people holding primary degrees. For the younger age groups, the increase in the proportion of people with secondary and tertiary education is more significant.

Independent of the analyzed period and sex, the younger ages have a greater proportion of people with higher levels of education than the older ages. In 1970, for example, the group of females aged 20-24 years (Table 1) comprised 11.24 percent of the population having completed a degree of education higher than primary, as opposed to 3.2 percent of the 55-59 year old females. In 2000, the proportion of the female population having completed a degree of education higher than primary was 42.56 percent for the age group 20-24 years and 15.58 percent for the age group 55-59 years. This comparison shows that while the population attained a lesser degree of education in 1970, by 2000 a significant increase in higher levels of education for all age groups had occurred.

In the age groups 15-19 and 20-24 we observe a reduction in the proportion of people with primary education, and an increase in the proportion of other levels, mainly, secondary. This suggests that although the ages 7 to 14 are assumed to be adequate for primary education, the sample finds the ages to be higher.

From the point of view of the differentials between sexes for age groups, the proportion of women younger than 20-24 years who had reached secondary and tertiary education in all the analyzed periods is greater than for men. After this age group, the percentage of women with education higher than primary is below the percentage of men: 25-29 years in 1970; 30-34 years in 1980; 35-39 years in 1990; and 50-54 years in 2000. These results show that the participation of women in higher education lags behind the men.

We can consider that the highest point of the prevalence rates in educational attainment according to age group and year, indicates at which moment the population completes its studies in each level, or when transitions cease to take place between the levels. Thus, in Figures 1 to 8, we can perceive a change in the format of the curves of the prevalence rates for each school level, per age group and year, mainly those that describe the behavior of secondary and tertiary completion for the years 1990 and 2000, suggesting a longer attendance period of people in school. With relation to the secondary degree for 1990 and 2000, the biggest ratio of people is reached in the age group 20-24. The ratio of people who had completed at least one year in the tertiary level in 2000 seems to stabilize for the age groups 25-29 and 30-34, and later grows, keeping high values until around age 45-49 years. This behavior suggests that people who had already left school decided to return, and had reached higher levels of final education, probably motivated by the job market.

Table 1. Educational attainment by level and age for females, 1970-2000.

Age	Level	1970	1980	1990	2000
15-19	No education	23.66	13.76	8.37	2.72
	Primary	70.53	72.82	69.28	81.46
	Secondary	5.57	12.85	20.59	14.57
	Tertiary	0.24	0.57	1.75	1.25
20-24	No education	29.97	15.89	9.76	3.43
	Primary	58.78	60.26	58.30	54.01
	Secondary	9.09	17.48	24.07	32.64
	Tertiary	2.15	6.37	7.87	9.92
25-29	No education	35.13	19.39	10.62	4.36
	Primary	56.41	59.58	57.15	55.43
	Secondary	6.53	13.22	22.39	29.26
	Tertiary	1.94	7.81	9.84	10.95
30-34	No education	37.96	24.37	12.75	5.81
	Primary	55.56	59.12	58.75	57.40
	Secondary	5.10	9.79	18.37	25.75
	Tertiary	1.38	6.72	10.14	11.05
35-39	No education	42.29	30.12	17.04	6.93
	Primary	52.71	58.36	58.79	57.76
	Secondary	3.91	7.01	14.52	23.43
	Tertiary	1.10	4.52	9.65	11.87
40-44	No education	45.25	34.16	22.62	8.96
	Primary	50.27	57.11	58.38	59.29
	Secondary	3.54	5.50	10.94	20.09
	Tertiary	0.93	3.23	8.07	11.66
45-49	No education	49.71	37.95	27.96	12.64
	Primary	46.45	54.99	58.05	60.21
	Secondary	3.15	4.63	8.30	16.15
	Tertiary	0.70	2.44	5.70	11.00
50-54	No education	54.90	42.11	32.53	17.77
	Primary	41.60	51.87	56.90	60.79
	Secondary	2.94	4.18	6.75	12.54
	Tertiary	0.56	1.84	3.81	8.90
55-59	No education	56.53	47.44	37.77	23.93
	Primary	40.26	47.54	53.65	60.48
	Secondary	2.74	3.77	5.61	9.37
	Tertiary	0.46	1.25	2.97	6.21
60-64	No education	61.81	53.11	42.05	28.51
	Primary	35.51	42.44	50.91	59.59
	Secondary	2.24	3.44	4.88	7.64
	Tertiary	0.43	1.01	2.16	4.26
65-69	No education	62.16	58.95	48.01	33.84
	Primary	35.41	37.32	46.11	56.46
	Secondary	2.10	3.04	4.26	6.52
	Tertiary	0.43	1.01	2.16	4.26

Table 2. Educational attainment by level and age for males, 1970-2000.

Age	Level	1970	1980	1990	2000
15-19	No education	26.25	18.06	12.82	4.28
	Primary	68.85	71.19	70.76	84.02
	Secondary	4.66	10.37	15.28	10.87
	Tertiary	0.24	0.38	1.14	0.83
20-24	No education	29.15	17.18	12.95	5.41
	Primary	58.78	60.26	58.30	54.01
	Secondary	7.53	15.80	19.75	26.65
	Tertiary	3.16	5.43	6.00	7.30
25-29	No education	31.67	18.75	12.88	6.66
	Primary	59.15	61.39	58.74	60.16
	Secondary	5.42	11.75	19.92	24.57
	Tertiary	3.77	8.11	8.46	8.61
30-34	No education	32.72	22.42	13.56	8.07
	Primary	59.76	60.81	59.51	60.52
	Secondary	4.32	8.61	17.11	22.44
	Tertiary	3.20	8.17	9.82	8.97
35-39	No education	34.61	26.29	16.34	8.68
	Primary	58.71	60.55	60.13	59.59
	Secondary	3.67	6.47	13.35	21.53
	Tertiary	3.02	6.69	10.19	10.20
40-44	No education	37.29	29.22	20.30	9.87
	Primary	56.57	60.28	60.03	60.39
	Secondary	3.20	5.41	10.15	18.71
	Tertiary	2.94	5.10	9.52	11.02
45-49	No education	40.15	31.17	24.64	12.23
	Primary	54.36	59.35	59.48	61.46
	Secondary	2.69	4.84	8.16	15.17
	Tertiary	2.80	4.64	7.71	11.14
50-54	No education	43.76	35.03	27.17	16.38
	Primary	51.70	56.64	59.69	61.63
	Secondary	2.09	4.24	7.00	11.90
	Tertiary	2.44	4.09	6.14	10.09
55-59	No education	45.63	39.81	31.46	21.06
	Primary	49.84	53.28	57.42	61.16
	Secondary	1.84	3.34	5.99	9.39
	Tertiary	2.68	3.56	5.13	8.39
60-64	No education	49.72	44.45	36.06	25.14
	Primary	46.30	49.89	54.35	60.53
	Secondary	1.78	2.61	4.85	7.90
	Tertiary	2.20	3.05	4.75	6.44
65-69	No education	50.64	50.79	42.47	29.37
	Primary	45.24	44.19	49.67	58.28
	Secondary	1.73	2.13	4.00	6.79
	Tertiary	2.39	2.89	3.86	5.57

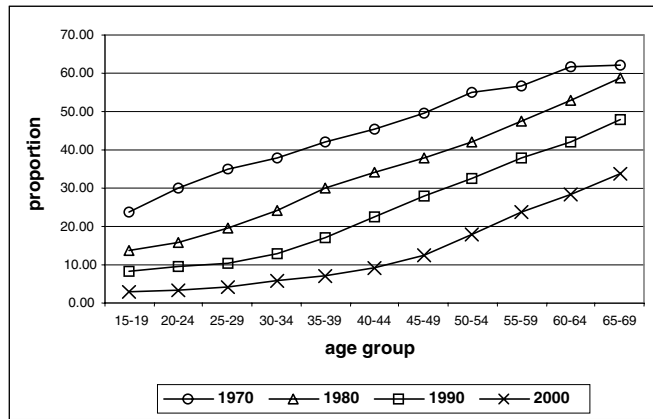


Figure 1. Proportion of people with no formal education by year of the census and age group, females.

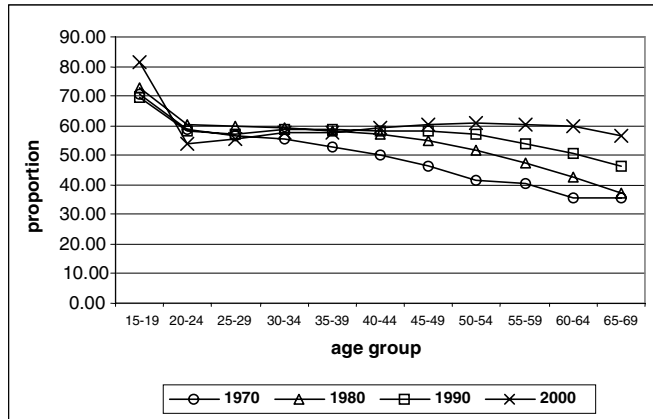


Figure 2. Proportion of people with primary degree by year of the census and age group, females.

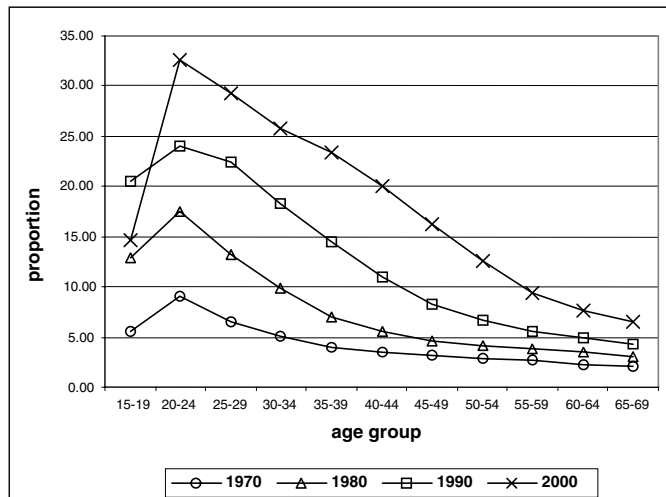


Figure 3. Proportion of people with secondary degree by year of the census and age group, females.

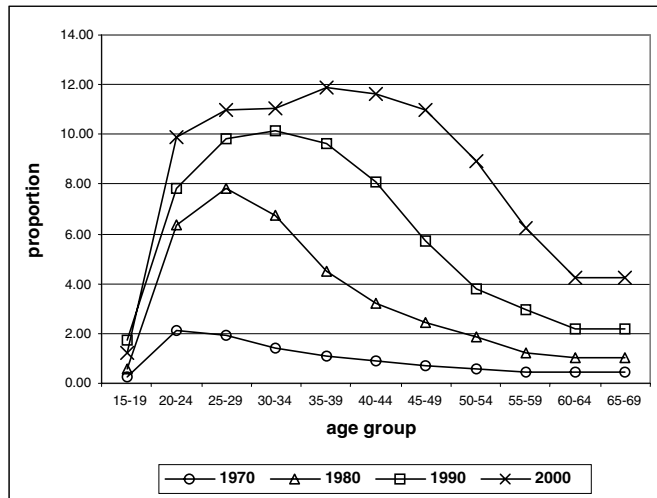


Figure 4. Proportion of people with tertiary degree by year of the census and age group, females.

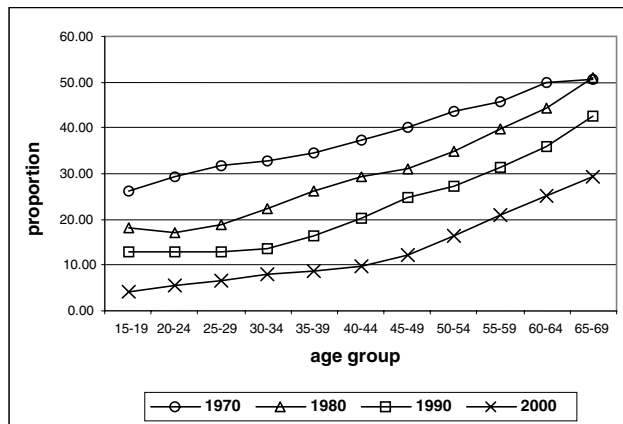


Figure 5. Proportion of people with no formal education by year of the census and age group, males.

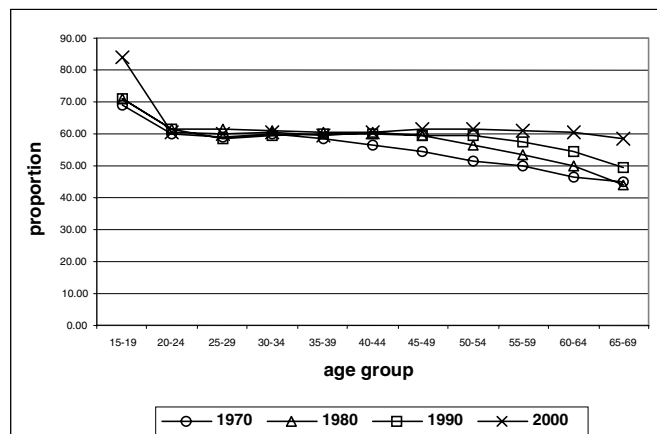


Figure 6. Proportion of people with primary degree by year of the census and age group, males.

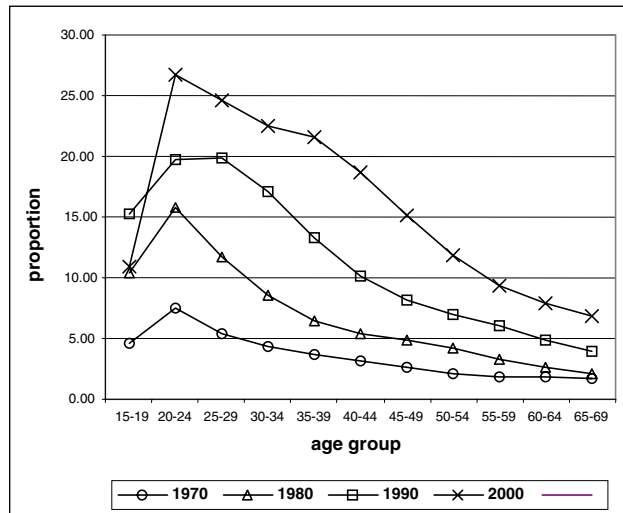


Figure 7. Proportion of people with secondary degree by year of the census and age group, males.

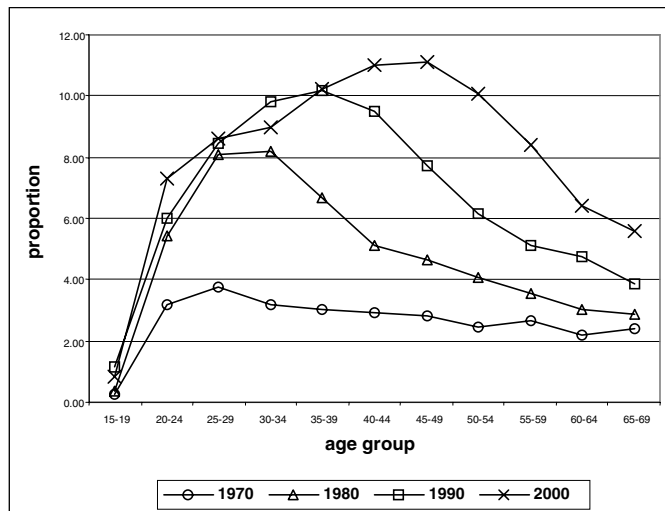


Figure 8. Proportion of people with tertiary degree by year of the census and age group, males.

The growth in the prevalence rates analyzed above can be, in part, the result of the immigration of people with levels of education higher than the resident population, or of differentials of mortality by education, as we will see below. However, the number of immigrants and survivors is not big enough to substantially modify the proportions, as will be discussed later on.

## Cohort Analysis

In Figures 9 to 12 we can observe the behavior of the prevalence rates in the levels of secondary and tertiary education between 1970 and 2000, according to sex and cohort. Each line corresponds to one cohort, defined as the proportion of people of the age group that had at least one year of study completed in each of the two levels in 1970. Thus, in each figure, eight cohorts are represented – one for each age group between the ages of 15-19 and 50-54 in 1970. The database consists of only four points in time, with intervals of 10 years between them referring to the dates of the censuses. However, to facilitate the drawing of the graphs in age groups of five years, and to show the comparison between cohorts, three more points were placed by interpolation.

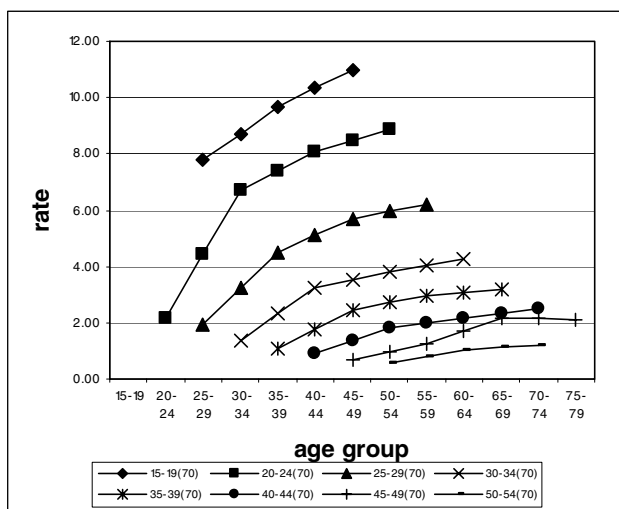


Figure 9. Prevalence rates by cohort, tertiary level, females, 1970 to 2000.

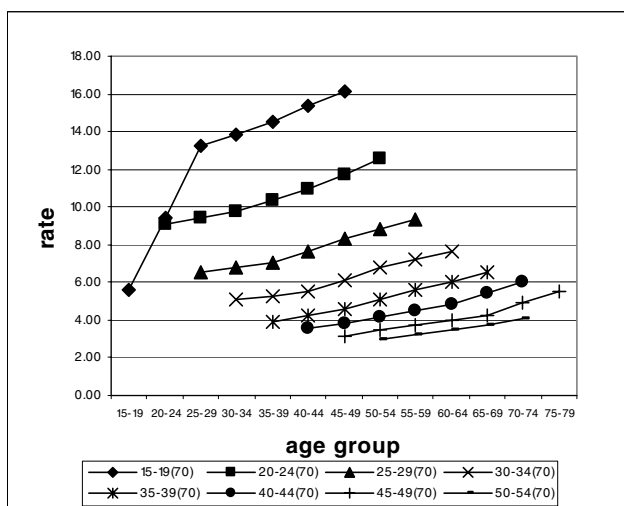


Figure 10. Prevalence rates by cohort, secondary level, females, 1970 to 2000.

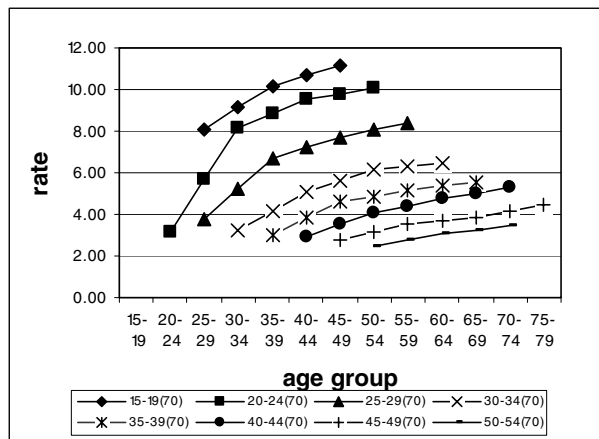


Figure 11. Prevalence rates by cohort, tertiary level, males, 1970 to 2000.

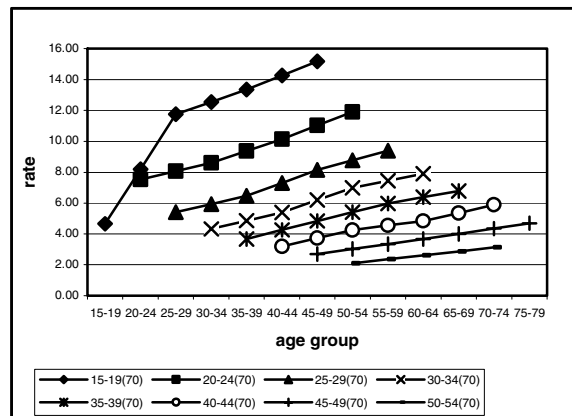


Figure 12. Prevalence rates by cohort, secondary level, males, 1970 to 2000.

According to Figures 9 through 12, the proportion of people with at least one year of secondary or tertiary education grew within all cohorts and is higher for younger cohorts. The proportion of women with tertiary education is smaller than for men in all cohorts in the analysis. As a result of the sharp growth in the level of education between the younger female cohorts, added to the higher survival rates of females, the cohort aged 15-19 in 1970 has a proportion of people with tertiary degrees similar to the proportion of men in 2000, when the members of the cohort reach 45-49 years. In this last year and age group, the proportion of men with tertiary education is 11.14 percent as opposed to 11 percent for women. The proportion of women with secondary education is superior to the proportion of men in all points in time, for cohorts 15-19 and 20-24 years in 1970.

The growth of the proportions of all cohorts as observed in the figures suggests that transitions from lower levels of education to higher occur for groups of advanced ages, such as 70-74 or 75-79, and for cohorts aged 40-44 and 45-49 in 1970. However, as seen in the previous section, given the behavior of the rates in the periods, it is plausible that the transitions to secondary education happen up to the age of 35-39, and to tertiary levels up to 45-49 years. We would find a possible explanation for this behavior, apart from problems with data quality, in the differentials of mortality for



education, resulting in bigger proportions of survivors in these two upper levels of formal education, relative to the others. This can occur because we are working with a proportion of people according to educational level and age group, and the sum of the proportions in the age group total 100 percent. Thus, if that is the differential of mortality by education, then the level with the bigger number of survivors between two periods will have a bigger proportion in the second period, compared to that proportion in the previous period.

In order to have an indication of the heterogeneity of mortality by education and sex in Brazil, we calculated for each sex<sup>9</sup> the differentials between the survival rates of the age groups 45-49 to 60-64 using the 1991 census,<sup>10</sup> and the age groups 55-59 to 70-74 using the 2000 census. These results would be indicative of the mortality differentials only if the coverage of the two censuses were the same. Although the author is not aware of any evaluation of the census coverage in the year 2000, all of the evaluations until 1991 show that the census coverage in Brazil was almost the same.

The decision to choose higher age groups to construct the estimates of mortality by education was made in order to prevent the incorporation of the effect of transition between the educational levels and the international migration computed in the mortality differentials. The choice of wider age groups can minimize the effect of the age declaration error among the elderly. For males, the levels of formal education that are being compared are: no education; at least one completed series of primary education; and at least one completed series of secondary and/or tertiary.<sup>11</sup> The same aggregation was not possible for females – probably because of problems with the data – because the survival rates calculated for these levels and the aggregations were too high. Thus, the results for females apply only to those who have completed degrees.

The comparison of the survival rates for males showed that those who completed at least one year of study at the primary level have a 90 percent survival rate compared to those who have completed some years of study at the secondary level or higher; those without any formal education have an 80 percent survival rate. This means that men who have higher educational degrees have lower mortality. For women, those who do not have a formal education have higher mortality. For women with no formal education, the survival rate was 79 percent compared to women with varying degrees of

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<sup>9</sup> The survival rates for other censuses were also investigated, but the results for males between the periods 1970/1980 and 1980/1990 were surprising; the survival rate calculated for those people with at least one year of primary education was smaller than for people with no formal education. For the females, this behavior was observed only for the survival rate calculated between 1970 and 1980. After some analyses of 1) the differentials of the mortality of those people with no formal education and some primary education in the rural and urban sectors, where the same results were found, and 2) the behavior of cohorts that show an increase in the number of people with no formal education in the older cohorts, we suggest that there could have been an improvement in the coverage of people with no formal education in the censuses of 1980 and 1990, which could explain the differentials in the survival rates. The survival rates between the censuses of 1970 and 1980, and 1980 and 1990, for females with a tertiary education – either because few of the eldest women had reached the tertiary level, or because of other problems in the data – showed very low values, when compared with 1990/2000 and the masculine sex. These results do not seem consistent.

<sup>10</sup> The data of the 1991 census were adjusted to 1990.

<sup>11</sup> Preliminary studies show that there are no differences between the survival rates of people with secondary and tertiary education.

education. From these results, one can imagine that the highest survival rate of the most educated people contributes to the growth of the prevalence rates of the cohorts in the secondary and tertiary levels, with no transitions occurring in the older ages.

Another factor that can influence the growth of the proportion of people in the highest levels of education over the long term is international migration. In the case of Brazil, after maintaining closed borders between 1940 and 1980, it is now open to international migration. If the proportional distributions of migrants by education are different to those of the non-migrant population, immigration will affect the prevalence rates by education, as will be seen in the next section.

## **The Effects of Immigration on the Prevalence Rates by Education**

José Alberto M. Carvalho (1996) warns that immigration and emigration in Brazil often take place under illegal or clandestine circumstances. Therefore, the census information on migration is not fully reliable. Indirect estimates of international migratory movements by level of education do not exist. “Illegal” or “clandestine” movements can have a significant weight, showing a distribution by education that is completely different from the legal immigrants, and having a different impact on the results. Despite these limitations, we decided to investigate the distribution of the international immigrants, according to the information gathered in the 1991 and 2000 censuses, and see how they influence the prevalence rates of the Brazilian population according to the level of education and sex.

The direction of the impact of immigration on the prevalence rates by education depends more on how they are distributed in the educational levels than on their numbers. If the distribution of migrants indicates a bigger concentration in the higher levels of education, the impact will be bigger, since the prevalence rates of the resident population are lower in these levels. Rios-Neto (2005, p. 13) writes: “It is hard to conceive the idea of finding a flow on undocumented (illegal) skilled migrants.” Taking this into account, the results can be viewed as an optimistic scenario of the impact of immigration on the rates of education, since it is expected that the legal immigrants will be more concentrated in the higher levels of education than the total immigration (legal and illegal combined).

In this direction, let us analyze the equation:

$$\frac{[(\text{Pop}_i + X_i) / (\text{PopT} + I)]}{[\text{Pop}_i / \text{PopT}]} \quad (1)$$

where:

- $\text{Pop}_i$  = the population in the date of the census with at least one completed year in the  $i$  educational level, excluding immigrants.
- $X_i$  = the number of immigrants in the date of the census with at least one completed series of the educational level  $i$ .
- $I$  = the total number of immigrants in the date of the census.
- $\text{PopT}$  = the total population in the date of the census, excluding the immigrants.

Immigration will not affect the rates when the above relation is 1; it will diminish the rates if the relation is less than 1; and it will increase the rates if the relation is greater than 1.

We can write the numerator of Eq. (1) as:

$$\text{Pop}_i / (\text{PopT} + I) + X_i / (\text{PopT} + I) \quad (2)$$

According to Eq. (2), immigration will affect the rates when, in relation to the total population, the proportion of immigrants in one determined level of education is different to the decline in the proportion of the non-migrant population of that level, which is caused by the increase in total population (denominator) for the aggregation of immigrants. More specifically, if

$$X_i / (\text{PopT} + I) = \text{Pop}_i / \text{PopT} - \text{Pop}_i / (\text{PopT} + I) \quad (3)$$

then the rates will show no alteration.

If

$$X_i / (\text{PopT} + I) < \text{Pop}_i / \text{PopT} - \text{Pop}_i / (\text{PopT} + I) \quad (4)$$

then the rates of the non-migrant population in the given period will be diminished by immigration.

If

$$X_i / (\text{PopT} + I) > \text{Pop}_i / \text{PopT} - \text{Pop}_i / (\text{PopT} + I) \quad (5)$$

then immigration will contribute to the increase in the rates of the non-migrant population.

Given a total  $I$  of immigrants, the number of immigrants necessary to keep the prevalence rates constant in each educational level will be:

$$X_i = [ \text{Pop}_i * (\text{PopT} + I) - \text{Pop}_i * \text{PopT} ] / \text{PopT} = \text{Pop}_i / \text{PopT} * I$$

or the proportion of the non-immigrant population in the educational level, multiplied by the total number of immigrants.

Table 3 shows the results of the measures described above, according to the immigrants registered in the censuses of 1991 and 2000 by sex. Item I in the table refers to the distribution of these immigrants by educational level. We can see that those registered in 1991 are more concentrated in the highest levels of education than those registered in 2000. In item II we can observe the result of the second relation of Eq. (2): the proportion of immigrants in relation to the total population. In item III, we see the proportion of immigrants that would keep the prevalence rates constant, which is the result of Eq. (3). Item IV gives the prevalence rates for education, including immigrants. Item V gives the same rates, using the hypothesis that there is no migration. The variation in percentage of the proportion of people in a particular educational level as a consequence of immigration is given in item VI.

Table 3. Information about immigrants registered in the 1991 and 2000 censuses by level of education and sex.

	1991 males	1991 females	2000 males	2000 females
<b>I Distribution</b>				
No education	4.18	6.19	9.59	8.58
Primary	24.47	28.56	57.44	57.00
Secondary	25.56	29.49	19.22	22.05
Tertiary	45.79	35.76	13.75	12.38
<b>II Proportion in relation to the total population</b>				
No education	0.005	0.004	0.087	0.078
Primary	0.027	0.026	0.524	0.521
Secondary	0.028	0.027	0.175	0.202
Tertiary	0.051	0.048	0.125	0.113
<b>III Proportion that will keep the rate constant</b>				
No education	0.021	0.018	0.103	0.103
Primary	0.067	0.053	0.582	0.555
Secondary	0.015	0.014	0.160	0.182
Tertiary	0.007	0.006	0.068	0.075
<b>IV Proportion of the population including immigrants</b>				
No education	19.26	19.84	11.24	11.25
Primary	60.45	58.16	63.70	60.61
Secondary	13.73	15.65	17.52	19.93
Tertiary	6.57	6.35	7.54	8.20
<b>V Proportion of the population excluding immigrants</b>				
No education	19.27	19.85	11.26	11.28
Primary	60.49	58.19	63.75	60.64
Secondary	13.72	15.63	17.50	19.92
Tertiary	6.52	6.33	7.49	8.16
<b>VI Variation in the proportion due to immigration</b>				
No education	-0.086	-0.063	-0.135	-0.219
Primary	-0.066	-0.047	-0.090	-0.055
Secondary	0.095	0.081	0.089	0.098
Tertiary	0.664	0.426	0.764	0.472
<b>VII Number of immigrants that will keep the rates constant</b>				
No education	9575	8644	59614	63431
Primary	30054	25335	337620	341090
Secondary	6815	6807	92694	112016
Tertiary	3241	2755	39640	45917
Total	49685	43540	529568	562454

According to the 1991 census, the registered, legal international immigrants represented a small group of the population over 15 years of age (93,225 people, or 0.10 percent). Of these, 53.3 percent were males and 46.7 percent females. They were highly concentrated in the higher levels of education (item I in Table 3). When comparing items II and III in Table 3, we see that the distribution of immigrants by level of education indicates an increase in the rates of higher education (secondary and tertiary). At these levels, the proportion of migrants in relation to the total population (item II) is larger than the proportion that keeps the rates constant (item III). The immigrants registered in 2000 were more numerous than in 1991, and represented 0.94 percent of the population. Their distribution according to educational attainment was completely different from those registering in 1991, and they were highly concentrated in the primary level. The conclusions are nevertheless the same with relation to the influence on the prevalence rates of the non-migrant population: immigration favored an increase in the rates of higher levels of education and a reduction in the lower levels. This behavior occurred because the proportion of immigrants registered in 2000 was larger than the same proportion of non-migrants in the higher levels of education, and smaller in the no education and primary levels. We can conclude that for the legal immigrant, the differences in distribution by education were not big enough to significantly change the prevalence rates by education in Brazil, as shown by the percentage of variation in the rates registered in item VI of Table 3.

In order to assess the range of impact of the distribution of immigrants on the prevalence rate of the non-migrant population in the given period, we will evaluate the variation in the rate under the hypotheses that 1) no one will immigrate and, 2) all will immigrate to a specific level of education. If there is no immigration to a specific level of education, Eq. (1) becomes:

$$\text{PopT} / (\text{PopT} + \text{I}) \tag{6}$$

that is, the percentage of reduction in the proportion of the non-migrant population in one determined educational level will be the same for the total population. Thus, the impact will depend on how large the immigrant population is in relation to the non-migrant population. For male immigrants, if no one had a determined educational degree, this would imply a reduction of 0.11 percent in the rate of this level for the total immigrants in 1991, and 0.91 percent for the 2000 total. Moreover, the non-migrant population is usually much larger than the migrant population. This relation is sufficiently steady. The impact of immigration on the proportion of people is not so big, even in the levels of education with a lesser proportion. For example, if we assume that the total number of immigrants represented 2 percent of the male population over 15 years in 1991, or 901,024 persons, then the reduction in any of the ratios of the four levels of education would be 2 percent, providing that none of these immigrants had reached that level.

If all migrants have the same level of education, Eq. (1) can be written as:

$$[\text{PopT} / (\text{PopT} + \text{I})] (1 + \text{I} / \text{Pop}_i) \tag{7}$$

In this case, an increase in the proportion of the non-migrant population in one specific level depends on 1) the inverse of the growth of the total population given by immigration (as seen above, this relation is sufficiently steady), and 2) the rate between the number of migrants and non-migrants at a particular educational level. Considering the number of male immigrants in 1991, if all had no formal education, this level would

grow by 0.46 percent; if all had primary education, the increase would be 0.07 percent; if all had secondary education, the growth would be 0.7 percent; and, if all had tertiary education, the increase would be 1.6 percent. Of course, for each case there would be a reduction of 0.11 percent in the rates of the other levels, calculated using Eq. (6) as a form of compensation. Once more, immigration did not substantially change the prevalence rate.

## The Effect of the Change in Age Structure on the Level of Completed Education

The total rate of education by level (TET<sub>i</sub>) is given by:

$$TET_i = PoP_i / PoPT = \sum_n PoP_{i_x} / {}_nPoP_x * {}_nPoP_x / PoPT = \sum_n TE_{i_x} * {}_nC_{ix}$$

where:

PoP<sub>i</sub> = the number of people with at least one completed grade in educational level *i*;

PoPT = the total population;

<sub>n</sub>PoP<sub>i\_x</sub> = the number of persons in the age group *x* to *x+n* with at least one completed year of educational level *i*;

<sub>n</sub>PoP<sub>x</sub> = the number of people in the age group *x* to *x+n*;

<sub>n</sub>TE<sub>ix</sub> = the education rate by age group;

<sub>n</sub>C<sub>x</sub> = the age distribution of the population;

that is, the weighted mean of the rates of education, where the weights are given by the distribution of the population for each age group.

Between 1970 and 2000, the rates of educational attainment for the total population had moved sufficiently for both sexes, registering a reduction in the proportion of people with no formal education and a growth in all other levels (see Tables 4 and 5). However, the age structure of the population also moved, revealing more elderly, as can be observed in Figures 13 and 14. As discussed earlier, the improvement in educational attainment was more accented in the younger age groups. Let us now analyze how much of the difference among the prevalence rates by level of education in the period can be attributed to the change in the age structure of the population, and how much to the change in education rates, in synthesis, to decompose the effect.

Table 4. Educational attainment by level and year, females.

	No education	Primary	Secondary	Tertiary
1970	39.44	54.35	5.14	1.06
1980	28.08	58.26	9.83	3.83
1990	19.84	58.16	15.65	6.35
2000	11.25	60.61	19.93	8.20

Table 5. Educational attainment by level and year, males.

	No education	Primary	Secondary	Tertiary
1970	34.83	58.41	4.27	2.49
1980	25.89	60.66	8.70	4.75
1990	19.26	60.45	13.73	6.57
2000	11.24	63.70	17.52	7.54

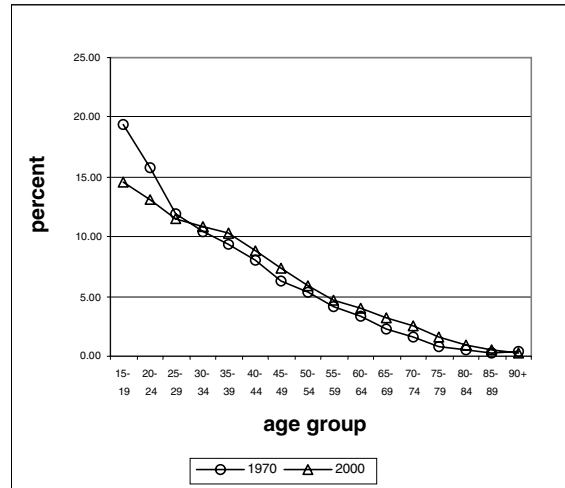


Figure 13. Relative distribution of the female population by age group, 1970 and 2000.



Figure 14. Relative distribution of the male population by age group, 1970 and 2000.

The expression used to decompose the difference ( $\Delta$ ) between the rates will be:<sup>12</sup>

$$\begin{aligned} \Delta &= TET_i^A - TET_i^B = \sum_n TE_{ix}^A * {}_nC_{ix}^A - \sum_n TE_{ix}^B * {}_nC_x^B \\ &= \sum ({}_nC_{ix}^B - {}_nC_{ix}^A) * [({}_nTE_{ix}^A + {}_nTE_{ix}^B)/2] + \sum ({}_nTE_{ix}^A - {}_nTE_{ix}^B) * [({}_nC_{ix}^B + {}_nC_{ix}^A)/2] \end{aligned}$$

<sup>12</sup> For more details, see Preston et al. (2001, pp. 28, 29).

where the first term computes the contribution for the difference between rates *A* and *B* that can be attributed to the change in the distribution of the population by age group; the second can be attributed to the change in the rates by education.

The results of the decomposition by sex can be seen in Tables 6 and 7. Comparing the first line of the two tables, we can see that the improvement in the level of education for women in the given period was greater than for men. The effect of the change in the age structure on the difference in the rates by education depends on the level that is being analyzed. For people with no formal education, the older age structure tends to increase the TETi, because the rates are higher in the older ages, diminishing the difference between the rates of the two periods. In fact, if there were no change in the age distribution, the rates in 2000 would be lower in this educational level, and the difference between the rates would be bigger.

Table 6. Decomposition of the difference in the female prevalence rates between 1970 and 2000.

	No education	Primary	Secondary	Tertiary
Original difference	-28.19	6.26	14.80	7.14
Contribution of the difference between distribution 1	2.00	-1.55	-0.51	0.07
Contribution of the difference between age specific rates 2	-30.19	7.81	15.31	7.07
Total contribution	-28.19	6.26	14.80	7.14
Proportion of the difference given by 1	-0.07	-0.25	-0.03	0.01
Proportion of the difference given by 2	1.07	1.25	1.03	0.99

Table 7. Decomposition of the difference in the male prevalence rates between 1970 and 2000.

	No education	Primary	Secondary	Tertiary
Original difference	-23.59	5.29	13.25	5.06
Contribution of the difference between distribution 1	0.85	-0.84	-0.17	0.16
Contribution of the difference between age specific rates 2	-24.44	6.13	13.41	4.90
Total contribution	-23.59	5.29	13.25	5.06
Proportion of the difference given by 1	-0.04	-0.16	-0.01	0.03
Proportion of the difference given by 2	1.04	1.16	1.01	0.97



With relation to the primary and secondary levels, the two components of the difference have contrary signs, but in contrast to the previous level, the TETi grew in the given period. The results show that the aging of the population caused a decrease in the difference between the rates of the two periods or, said another way, the TETi 2000 would have been bigger if the age structure of the population had not changed. The effect of the change in the distribution of the population is bigger for the primary level than for the secondary, since the first population tends to be younger than the second. For the tertiary level, the population at this level is older, and the two components act in the same direction, increasing the difference between the periods and the TETi of 2000. Between levels, the effect of the change in the age structure is stronger at the primary level (-25 percent and -16 percent of the rates for females and males, respectively), since people complete this level at lower ages.

In Table 8 we can observe how the difference between education rates among women and men in 2000 can be explained by the variation in age structures. In 2000, the proportion of women who completed at least one year of secondary and tertiary education is greater than for men, and less for those who completed at least one year in primary. Thus, the difference between rates is positive for the higher levels and negative for the lower level. The older age structure of women who completed at least one series at the primary level (Figure 15) is responsible for 11 percent of the difference. However, as more women have recently begun to take advantage of the opportunity for secondary and tertiary education, the age structure in these levels has become younger (Figures 16 and 17). The difference in the age structure diminishes the difference between rates. Even if men and women had the same age distribution in these levels, women would still have the bigger prevalence rates over men.

Table 8. Decomposition of the difference between male and female prevalence rates in 2000.

	Primary	Secondary	Tertiary
Original difference	-3.09	2.42	0.66
Contribution of the difference between distribution 1	-0.35	-0.30	-0.01
Contribution of the difference between age specific rates 2	-2.74	2.72	0.67
Total contribution	-3.09	2.42	0.66
Proportion of the difference given by 1	0.11	-0.13	-0.02
Proportion of the difference given by 2	0.89	1.13	1.02

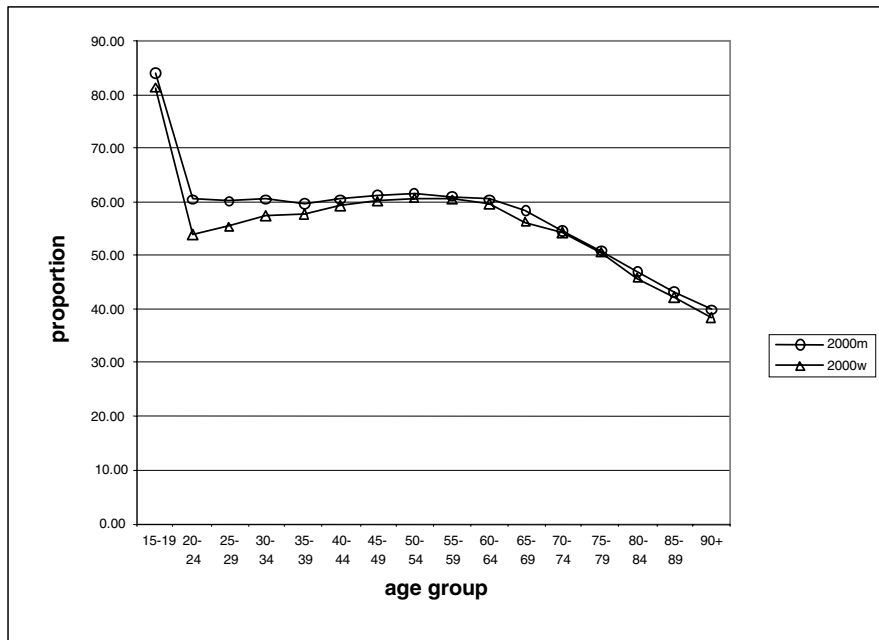


Figure 15. Proportion of men and women with primary degrees by age group, 2000 census.

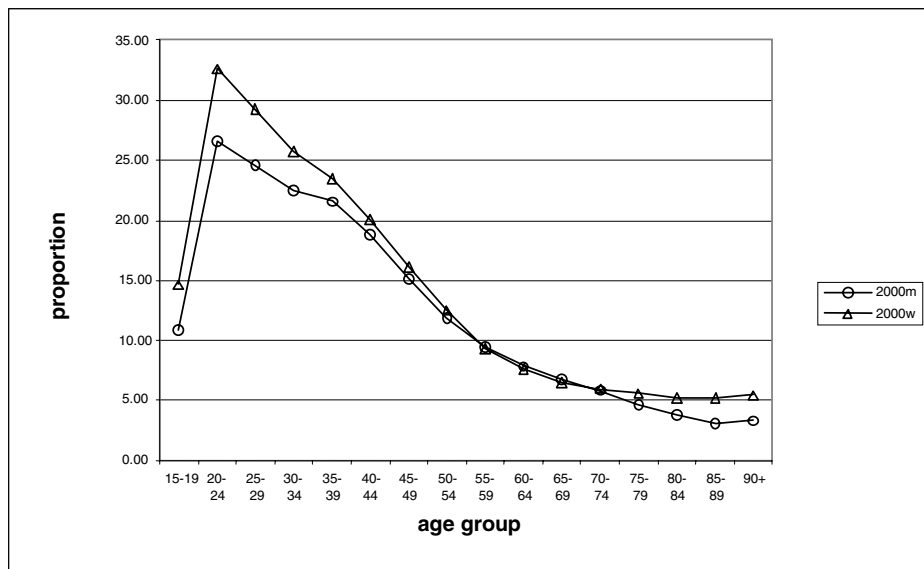


Figure 16. Proportion of men and women with secondary degrees by age group, 2000 census.

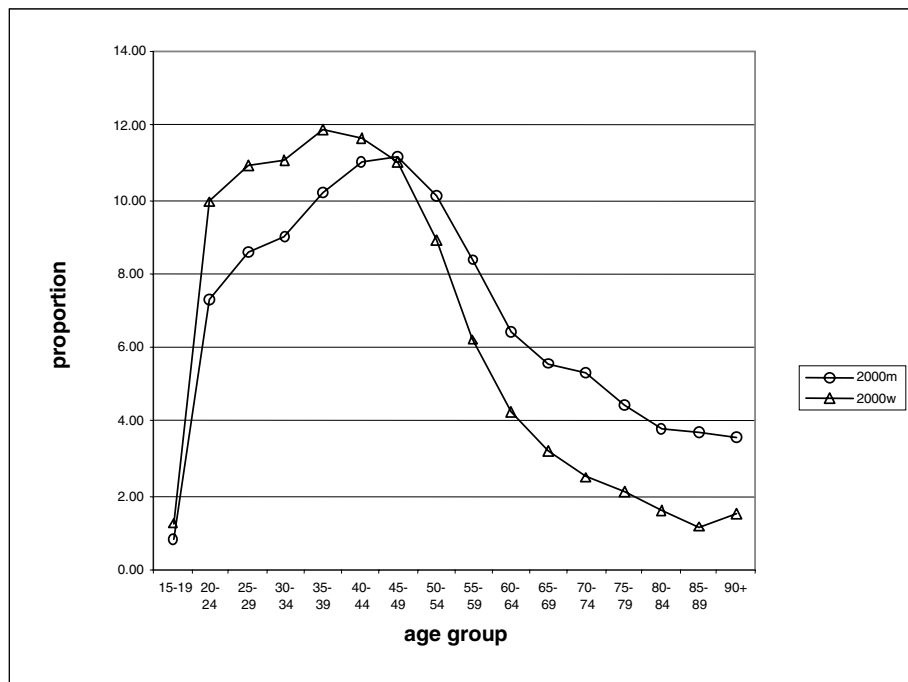


Figure 17. Proportion of men and women with tertiary degrees by age group, 2000 census.

## Conclusion

In this paper we examined the changes in the prevalence rates of education for people 15 years and older with no formal education and with at least one completed level of primary, secondary, and tertiary education, by age groups and sex, for the period 1970 to 2000. We observed that in this 30 year period, there was a noticeable decrease in the proportion of males and females with no formal education in all age groups. For the older age groups, an increase in formal education resulted in an increase in the percentage of people with a primary education. For the younger age groups, the increase in the ratio of people with secondary and tertiary education is more significant. As a consequence, the analysis of the curves of the prevalence rates in secondary and tertiary education, by age group and year, suggests a bigger school attendance period for the years 1990 and 2000.

The cohort analysis showed that although the participation of women in the higher degrees of education was lagging behind the men, there was an increase in the participation of the cohort aged 15-19 years in 1970 in the tertiary level. Added to a longer life expectancy for women, men and women in 2000 practically had the same proportion. For secondary education, the proportion of women in the two younger cohorts, 15-19 and 20-24 was already superior to men in 1970.

Moreover, preliminary analyses on mortality differentials and immigration by education demonstrated the importance of these variables in the study of the growth of prevalence rates for educational levels.

When comparing the differences between the rates of 1970 and 2000 for educational attainment, we find that the relative rates for women showed a bigger alteration than for men. We also found that part of this difference can be attributed to the change in the age structure of the Brazilian population. The older age structure in 2000 tended to diminish the difference among the rates for no formal education, primary and secondary, but the impact on the 2000 rates is not the same in the three levels. The rates for people with no formal education decreased in the given period and the difference is negative. We can say that had there been no change in the age distribution of the population, the rate in 2000 would be even less. For primary and secondary education, the difference is positive, and had the age structure been the same as in 1970, the rates of 2000 would be bigger. With relation to the tertiary level, the older age structure contributed to an increase in the rate for 2000.

The impact of the different age structures of men and women by education in 2000 showed that if men and women in the secondary and tertiary levels had the same distribution by age, then the rates for women in these levels would be higher.

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