HEALTH ECONOMICS
EQUITY
Health Econ. **11**: 141–154 (2002)
Published online 5 December 2001 in Wiley InterScience (www.interscience.wiley.com). **DOI:**10.1002/hec.649

Socio-economic health inequalities in Brazil: gender and age effects

M. Dolores Montoya Diaz*
Department of Economics, Economics, Management and Accounting Faculty (FEA-RP), University of São Paulo, Ribeirão Preto Campus, Av. dos Bandeirantes, 3900 14049-900 – Ribeirão Preto, SP, São Paulo, Brazil

Summary

This paper analyses Brazilian socio-economic inequalities in health by measuring the concentration indices for the following variables: health expectancy, self-assessed health status and chronic health problems. Data used were taken from the 1996/1997 Living Standard Measurement Study (LSMS). In summary, as far as gender distinction is concerned, the results showed that up to 5 years of age the mortality rates, reported appearance of chronic health problems as well as the self-assessed health indicated that the boys were in worse health condition than the girls. After this age group there was a tendency for differences to disappear until adulthood, when the situation changed and the women consistently considered themselves less healthy. With reference to the socio-economic inequalities, one generally finds larger differences within the women's groups. The analysis for the different age groups indicated that the pro-rich inequalities increased with age. Both results were clearly proved, especially for the health expectancy variable, by adopting an adjustment of the dominance concept derived from literature on economic inequalities, consisting of comparing concentration curves.

Keywords health inequalities; health expectancy; gender differences; brazil

Introduction

There are countless studies published with the purpose of analysing socio-economic inequalities present in the health area as shown in distinct aspects. These works have essentially focused upon diagnosing and measuring inequalities occasionally present. They have, however, recently and more effectively been contributing to the decrease in the number of inequalities found.

The Brazilian situation has some peculiarities that make this kind of analysis even more important.

On the one hand, India is the only country, which is worse than what we are, therefore, we have to live with the dishonourable second to worst place according to Hansen's disease sufferers world ranking. On the other hand, we hold a high childhood immunisation standard (BCG, Polio, DPT3, Measles, etc.) comparable with that of the developed countries. Besides this, our free medication distribution and even AIDS prevention and treatment programmes are internationally praised. Such results only seem to indicate a great concern about problems that equally affect the rich and the poor, with a by-now traditional abandoning of problems predominantly associated with poverty.

In several works analysing socio-economic health inequalities, different approaches were adopted for addressing the issue, as well as for

*Correspondence to: Av. Nova Cantareira, 1304 apt. 64, 02330-001-São Paulo, SP, Brazil. Tel.: 55-11-69595281; fax: 55-11-38143379; e-mail: madmdiaz@usp.br

Received 3 April 2000
Accepted 14 May 2001

determining both the health status variable and the socio-economic condition variable [1].

Among the latest and most challenging studies, the main ones are those which adopt the methodology presented by Wagstaff *et al.* [2], supplemented and adapted by Wagstaff and van Doorslaer [3], and Kakwani *et al.* [4] to calculate the standard errors and incorporate the confounding effects of demographic factors.

On the other hand, there is a series of analyses, which is also very thought provoking and more focused upon gender inequality assessment. This series has systematically shown that the effects of demographic factors, specially those related to gender and age differences, vary, not only in relation to the social context where the individuals are included, but also according to the particular condition or symptom being analysed [5–9].

These conclusions, along with their developments and new reflections, have been raising doubts about the reliability of the results of works designed to measure inequalities, above all if such results are not explicitly qualified by gender and age.

Thus, any analysis incorporating such aspects on an implicit basis only, as currently defended [3,4,10,11], will hardly provide adequate input for decision taking by policy-makers intending to promote further equity in the health area. To be sure, this concern has been gaining ground in the agenda of discussions about socio-economic inequalities in health status [12].

Therefore, this paper has three purposes. The first is to look for evidence of the presence of socio-economic health inequalities in Brazil, taking two conventionally analysed aspects into consideration – chronic health problems and self-assessed health status. These along with a third aspect, health expectancy, still not assessed in studies using the concentration index approach. The choice of variables to be analysed has been made depending on the complexity involved in establishing each one. Thus, the second is to check whether more complete and more complex variables, such as health expectancy would produce higher quality results than those obtained from the much simpler variables, such as chronic problems. The final purpose is to contribute to the improvement of the methodology initially presented by Wagstaff *et al.* [2], which has been applied in countless works, aiming at making the results more operationally useful for policy-makers.

Methods

The theoretical framework proposed by Wagstaff *et al.* [2], Wagstaff and van Doorslaer [3], and Kakwani *et al.* [4] will be essentially used. Analysis logic follows the conception that supports the construction of Lorenz curves and Gini coefficient. The methodological choice of the concentration index has the advantage of meeting three important requirements regarding a health inequality index: '(i) it reflects the socio-economic dimension to inequalities in health; (ii) it reflects the experiences of the entire population; and (iii) it is sensitive to changes in the distribution of the population across socio-economic groups' [13].

In Figure 1, in addition to the diagonal, examples of two curves are shown – the $L(s)$ concentration curve and the $L^*(s)$ standardised concentration curve. The health concentration curves are the plot of the cumulative proportion of the population ranked by socio-economic status, beginning with the most disadvantaged against the cumulative proportion of health [actual in the case of $L(s)$, or standardised to incorporate the differences between gender and age in the case of $L^*(s)$].

The health concentration index is defined as twice the area between $L(s)$ and the diagonal. The inequality index, which already incorporates standardisation effects, corresponds to twice the area between $L(s)$ and $L^*(s)$ or to the simple difference between the concentration index calculated for the actual distribution of the variable which has

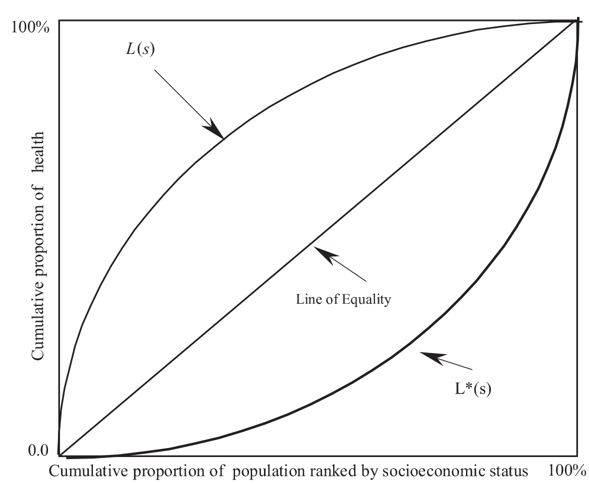

Figure 1. Illness concentration curves

generated $L(s)$ and the index calculated for the distribution of the variable generated by the standardisation procedure.

As stressed by Wagstaff and van Doorslaer [11], a standardisation procedure is required since the sheer measurement of the concentration index associated with $L(s)$ presumes that all socio-economic inequalities in the aspect assessed could be eliminated, which is obviously impossible. Thus, it would be unreasonable to consider the possibility of making all elderly people as healthy as a young person. Then, the authors gave the following example: 'If older people are concentrated amongst the lower income groups, $L(s)$ will lie above the diagonal simply because of (a) the link between age and ill health and (b) the association between age and rank in income distribution. For health policy purposes, one might want to take (a) and (b) as given and view such effects as confounders.' Hence, it would be necessary to construct a more specific measure that could indicate just the magnitude of the 'eliminable health inequalities'.

There would then be two possibilities: direct and indirect methods of standardisation.

The direct method would require grouped data for the calculation of age-sex-specific average illness or health rates of each socio-economic, familiar consumption or income groups, social class, etc., depending upon the definition of the variable analysed. As clarified by Wagstaff and van Doorslaer [11], the method consists of applying 'age-sex-specific average ill health rates of each SEG (socio-economic groups) to the age and gender structure of the population. (...). In effect, the procedure 'corrects' differences in morbidity rates across SEGs for demographic differences by assuming that all SEGs have the same demographic composition, equal to the demographic composition of the population as a whole'.

The indirect method of standardisation, on the other hand, can be applied on individual-level data, which is an advantage. Here, the adopted procedure consists of 'replacing person *i*'s degree of illness by the degree of illness suffered on average by persons of the same age and gender as person *i*' [4].

In spite of being correct, the use of the standardisation procedure ultimately disguises demographic factor effects, thus making it difficult to understand the actual mechanisms underlying the presence of inequalities in individuals' health. The result of such an analysis is a figure that represents the country's profile regarding the aspect assessed. Yet, what is the use of simply obtaining a statistically significant inequality index, for example of -0.09 or -0.20, for an ill-health variable? Socio-economic inequalities are known to exist in health, thus favouring individuals with greater economic power. Nevertheless, how should one act? Should one create programmes to assist old men? Old women? Children?

Thereby, results ultimately have a limited application to identify problems, which is indispensable but not sufficient to face them. It is necessary to continue moving forward. In addition, unfortunately, in the conventional way that the analysis has been carried out, it does not provide enough elements to contribute to a more effective performance with the purpose of reducing or even eliminating this inequity category.

Therefore, what is proposed is that standardisation procedure be replaced by the construction of indices for more homogeneous groups of individuals.

Thus, subsets of individuals aggregated by gender and/or age group will be constructed. These are the categories to be analysed: overall, female, male, 10 age groups (under 5, 5–9, 10–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, over 80) and for all combinations between age group and gender. It should be noted that a confidence interval was built in for all indices and a test was carried out to check whether they were statistically significant. Hence, one can clearly verify whether or not only socio-economic inequalities were present but also how they worked. However, there is still a pending question: Is the difference between the various indicators calculated statistically really significant?

To seek an answer to this question, an adjustment of the dominance concept was adopted, derived from literature on economic inequalities, consisting of comparing concentration curves. Such a procedure has already been used for the inequality level comparison on the self-assessed health variable among some countries [10].

The analysis essentially consists of verifying whether a concentration curve dominates, strictly dominates another, or whether they intersect. Strict dominance implies there is no coincidence between the curves for any quintile, and it essentially consists of verifying which curve is farther from the diagonal [10]. Therefore, for instance, if the concentration curve obtained by considering only individuals under 5 years of age is nearer the diagonal for all quintiles considered than the curve generated by the analysis of the individuals over 80, the youth curve can be said to dominate the elderly curve.

Data and variable definitions

For this study, the Living Standards Measurement Study (LSMS) database was used. The Brazilian Institute of Geography and Statistics (IBGE) carried it out between 1996 and 1997 due to an arrangement made with the World Bank. The survey was focused only upon two of the large regions into which the country is divided: the northeastern and the southeastern. The northeastern one consists of: the metropolitan area of Fortaleza; the metropolitan area of Recife; the metropolitan area of Salvador; the remaining urban areas of the northeastern region; the remaining rural area of the northeastern region. The southeastern regions being – the metropolitan area of Belo Horizonte; the metropolitan area of Rio de Janeiro; the metropolitan area of São Paulo; the remaining urban area of the southeastern region; and the remaining rural area of the southeastern region. These took 10 geographic strata into account. This decision essentially reflects on the procedure of extending the results from this sample to the whole country, which was therefore, inadvisable. Altogether 19 409 individuals were surveyed in 4 940 households.

The measure of socio-economic status used was the total household consumption expenditure per equivalent adult, defined as follows:

$$e_{\mathrm{h}} = (A_{\mathrm{h}} + \alpha C_{\mathrm{h}})^{\theta}$$

where e_{h} is the equivalence factor for the household h, A_{h} and C_{h} correspond, respectively, to the number of adults and children in the household. The α coefficient corresponds to a 'deflator' of children cost in relation to adults and the θ parameter defines the level of economies of scale in relation to the actual size of the household. Household scale economies can appear, for example, as a result of using durable or public goods that are shared by every member in the same household. Both parameters are in the interval between zero and one.

Hence, the creation of the proposed socio-economic scale depends on the definition of parameters (α, θ). Such a definition, however, is not trivial [14]. Thus, following the Wagstaff and van Doorslaer [11] conclusion, the (0.75,0.75) composition was used.

It should be noted that the variables assessed were based on questions answered by individuals, which implies that all results are based on the respondents' self-perception of their own health status. Children's and occasionally some teenagers' answers represent exceptions, since responses were given by their parents or guardians.

The following variables were analysed: indication of chronic health problem (dummy variable: 1 for yes and 0 for no), self-assessed health scores and health expectancy, obtained through the procedure explained below.

The self-assessed health question – How do you assess your health condition? – presented seven response categories – (1) excellent, (2) very good, (3) good, (4) fair, (5) poor, (6) not assessed, (7) does not know. The observations corresponding to options (6) and (7) were not taken into consideration. It was essentially assumed that underlying the responses is a latent self-assessed health variable with a standard lognormal distribution. Latent health scores corresponding to each of the five options examined were obtained through dividing the area under the standard lognormal distribution according to sample proportions falling into each of the response categories. The latent health score corresponding to his/her answer [3] was assigned to each individual.

Health expectancy is a composite health indicator that combines mortality and morbidity rates. Sullivan's method was used to calculate this variable [15,16]. It is calculated by applying the prevalence rates of good (ill) health to the expected number of years of life so as to obtain the expected number of years in good (ill) health. It is essentially based on the concept of life expectancy.

To construct the health expectancy variable, information on the death probabilities is required. Life tables obtained from Census 2000 preliminary data on the five-year age group and gender were supplied by IBGE.

Additionally, data on under-five mortality from LSMS were used, which allowed for the calculation of the probabilities of death by gender and by quintile of household total consumption expenditure per equivalent adult.

Joining life tables with rates computed from LSMS generated to new tables – a set of tables for males and another for females, relating to each quintile of household consumption.

Such information enables the calculation of life expectancy by quintile of household consumption and by gender, taking the hypothesis into account that after 5 years of age no differences would be observed regarding the probabilities of death associated with socio-economic conditions. Here, it is worth pointing out that as far as the male teenagers are concerned, this may not be a defensible hypothesis, primarily because of the risk of violent death to which those from the poorer strata of the population are subject to. So far, unfortunately, there has been no interest in producing life tables that could enable differentiation by gender and socio-economic conditions while indicating the impact of violence on the probabilities of lower income youths' deaths.

It is also interesting to remember that some works [13,17] showed that self-assessed health is a good proxy of the actual health status of individuals, while other studies highlighted the qualities of the health expectancy variable as a more complete indicator and, therefore, better suited for carrying out analyses on health inequalities [15,16,18,19].

However, the main reason for choosing to analyse the health expectancy variable was an attempt to deepen the results achieved by Wagstaff [20]. Also, based on the LSMS 1996/1997, the author identified concentration indices for infant and under-five mortality of -0.284 and -0.322, respectively, for Brazil. These values indicate an extremely high level of pro-rich inequalities in infant and under-five mortality. Thus, evidence suggests that as far as Brazil is concerned the great difference really lies in the mere survival of individuals. Hence, a new special interest arises, which is to check the hypothesis that, in fact, among the poorer, only those who actually possess more favourable health status survive and that lower income individuals gradually loose this possible early advantage throughout life. This situation would be represented by the presence of pro-poor inequalities in the first age group (aged under 5) for the health expectancy variable, accompanied by declining infant mortality rates by quintile of the socio-economic characterisation variable.

Results

Table 1 shows the mortality rates and corresponding life expectancy variable by age group. For the first age group, the values are presented by quintile of the household consumption expenditure per-adult equivalent variable. One can see that there is a declining trend in the under-five mortality rates with the increase in the quintiles of socio-economic variable, mainly for males. Consequently, the life expectancy at birth increases from 62.6 years for the first quintile boys until it reaches the range

Table 1. Mortality rates and life expectancy by age groups and quintiles of household total consumption expenditure per equivalent adult

	Mortality rate		Life expectancy – $E(X)$	
	Male	Female	Male	Female
Less than 5				
Quintile 1	75.7	26.4	62.6	72.9
Quintile 2	30.9	23.0	65.5	73.2
Quintile 3	45.5	13.2	64.6	73.9
Quintile 4	19.7	17.4	66.2	73.6
Quintile 5	0.0	13.3	67.5	73.9
Between 5 and 9	2.6	1.7	62.5	69.8
Between 10 and 19	11.1	4.2	57.7	64.9
Between 20 and 29	29.1	8.6	48.3	55.2
Between 30 and 39	41.6	15.8	39.6	45.6
Between 40 and 49	70.7	34.4	31.1	36.3
Between 50 and 59	135.1	75.9	23.1	27.4
Between 60 and 69	264.5	164.8	15.9	19.2
Between 70 and 79	542.9	396.0	9.8	12.0
More than 80	1000.0	1000.0	5.5	6.7

of 67.5 years for richer family boys. As for girls, a relative stability in the range of 73 years is observed.

While analysing the health expectancy variable, differences mount up sharply. Thus, Table 2 shows that, at birth, lower income male expectation is to enjoy 43.3 years of healthy life while among the better-off males this value grows to 58.9 years, that is, a pro-rich difference of 15.6 years. Women, on the other hand, show an even greater difference, reaching an amazing 18.4-year mark. It should be mentioned that the differences between the first and the last quintile are always in favour of the better-off individuals.

For each of the homogeneous groups analysed, Table 3 shows the information regarding the number of observations (*N*), the average of the variable analysed in the group, the *t*-statistic of a test on equality of means of males and females, the concentration index and corresponding standard error, *t*-statistic, and confidence interval.

To better understand the results, it is worth pointing out that averages of chronic health problems variable correspond to the percentage of problems reported in the group. As for concentration indices, it should be stressed that negative values were found when individuals from the lower strata of the population reported more health problems than those who are better off, again being representative of pro-rich inequalities.

In this case, only individuals aged 5–19, as well as those over 80, have not statistically shown significant differences between males and females in the percentage of chronic problems reported. In all other ranges, the difference of averages between the groups was statistically significant at the level of 5%. Also, note that only among adults and the elderly, a steady trend towards more reporting of chronic problems was observed in women.

The analysis of socio-economic inequalities in the chronic health problem variable initially presented astonishing results. Indeed, statistically significant inequalities represented by a positive concentration index of 0.054 were identified. This means that richer individuals claimed to suffer from more chronic problems than the poorer. Initially, one attributed this result to chronic problems reported by the elderly. When carrying out the disaggregated analysis, however, the great differences turned out to be among children and teenagers. The concentration index reached the staggering mark of 0.181 for the age group between 5 and 9 years old. When distinction by

Table 2. Healthy life expectancy by age groups and quintiles of household total consumption expenditure per equivalent adult

	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5		Difference between the fifth and first quintiles	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Less than 5	43.3	43.4	48.4	46.8	49.6	50.3	53.1	53.9	58.9	61.8	15.6	18.4
Between 5 and 9	42.3	40.2	45.5	43.4	47.6	46.2	49.5	50.2	54.2	57.8	11.9	17.7
Between 10 and 19	38.0	35.8	41.2	39.0	43.0	41.7	44.9	45.6	49.7	53.1	11.7	17.2
Between 20 and 29	29.6	27.1	32.3	30.0	34.2	32.7	35.7	36.3	40.5	43.5	10.9	16.4
Between 30 and 39	22.1	19.4	24.0	21.9	25.7	24.2	27.3	27.9	32.2	34.5	10.2	15.1
Between 40 and 49	15.3	12.7	16.6	14.6	18.4	16.7	19.5	19.8	24.2	25.8	9.0	13.1
Between 50 and 59	9.8	8.5	10.3	8.5	11.6	10.4	12.9	13.0	17.1	18.4	7.3	9.9
Between 60 and 69	5.9	5.2	6.1	5.0	6.7	6.2	8.4	8.1	11.1	11.7	5.3	6.5
Between 70 and 79	3.4	3.4	3.2	2.6	3.4	3.7	5.3	5.3	6.1	7.4	2.6	3.9
More than 80	1.7	2.0	2.4	1.3	1.1	2.1	3.7	3.1	3.9	3.1	2.2	1.1

Table 3. Health variable number of observations and mean by demographic group, health concentration indices, *t*-statistics and confidence intervals

Demographic group	N	Mean	Two-sample test *t*-Stat H_o: Mean(male) – Mean(female) = 0	Concentration index	Std error	*t*-Stat	(95% Conf. interval)		
Chronic problem									
Overall	19409	0.155		0.054	0.009	5.765	0.036	0.073	**
Male	9410	0.130	−9.2703 **	0.050	0.015	3.350	0.021	0.080	**
Female	9999	0.179		0.052	0.012	4.343	0.029	0.076	**
<5 years	1917	0.081		0.098	0.044	2.260	0.013	0.184	**
5–9 years	1885	0.085		0.181	0.040	4.493	0.102	0.260	**
10–19 years	4352	0.066		0.099	0.031	3.197	0.038	0.159	**
20–29 years	3245	0.083		−0.023	0.035	−0.669	−0.092	0.045	—
30–39 years	2783	0.136		−0.087	0.027	−3.191	−0.140	−0.033	**
40–49 years	2152	0.220		−0.053	0.023	−2.289	−0.098	−0.008	**
50–59 years	1414	0.354		−0.064	0.020	−3.148	−0.103	−0.024	**
60–69 years	947	0.450		−0.021	0.021	−0.999	−0.061	0.020	—
70–79 years	503	0.543		0.032	0.024	1.339	−0.015	0.079	—
$\geqslant 80$ years	211	0.441		−0.080	0.045	−1.792	−0.168	0.008	*
Male, <5	951	0.093	1.8618 **	0.113	0.055	2.032	0.004	0.221	**
Female, <5	966	0.069		0.091	0.070	1.300	−0.046	0.228	—
Male, 5–9	953	0.090	0.8442	0.125	0.056	2.226	0.015	0.234	**
Female, 5–9	932	0.079	—	0.242	0.058	4.203	0.129	0.355	**
Male, 10–19	2234	0.065	−0.2840	0.088	0.044	2.020	0.003	0.174	**
Female, 10–19	2118	0.067	—	0.110	0.044	2.530	0.025	0.195	**
Male, 20–29	1554	0.060	−4.5248	−0.075	0.059	−1.268	−0.191	0.041	—
Female, 20–29	1691	0.103	**	−0.006	0.043	−0.138	−0.090	0.078	—
Male, 30–39	1335	0.118	−2.6966	−0.064	0.044	−1.448	−0.151	0.023	—
Female, 30–39	1448	0.153	**	−0.103	0.034	−3.028	−0.170	−0.036	**
Male, 40–49	1020	0.174	−4.9918	−0.041	0.040	−1.025	−0.119	0.037	—
Female, 40–49	1132	0.262	**	−0.062	0.028	−2.203	−0.117	−0.007	**
Male, 50–59	632	0.293	−4.3305	−0.024	0.035	−0.677	−0.093	0.045	—
Female, 50–59	782	0.403	**	−0.088	0.025	−3.598	−0.136	−0.040	**
Male, 60–69	432	0.375	−4.2765	−0.035	0.035	−0.987	−0.104	0.034	—
Female, 60–69	515	0.513	**	−0.023	0.025	−0.932	−0.072	0.026	—
Male, 70–79	220	0.459	−3.3508	0.064	0.042	1.529	−0.018	0.146	
Female, 70–79	283	0.608	**	0.007	0.028	0.234	−0.049	0.062	—
Male, $\geqslant 80$	79	0.430	−0.2338	−0.084	0.074	−1.137	−0.229	0.061	—
Female, $\geqslant 80$	132	0.447	—	−0.080	0.056	−1.427	−0.190	0.030	—

Table 3 (*continued*)

Demographic group	N	Mean	Two-sample test t-Stat H_o: Mean(male) − Mean(female) = 0	Concentration index	Std error	t-Stat	(95% Conf. interval)		
Self-assessed health									
Overall	19376	1.572		−0.086	0.004	−19.430	−0.095	−0.077	**
Male	9389	1.478	−7.1668	−0.089	0.007	−13.567	−0.102	−0.077	**
Female	9987	1.661	**	−0.085	0.006	−14.304	−0.097	−0.073	**
< 5 years	1917	1.210		−0.107	0.013	−8.327	−0.132	−0.081	**
5–9 years	1884	1.132		−0.116	0.012	−9.980	−0.139	−0.094	**
10–19 years	4345	1.086		−0.100	0.008	−11.838	−0.116	−0.083	**
20–29 years	3237	1.253		−0.115	0.010	−11.281	−0.135	−0.095	**
30–39 years	2777	1.491		−0.127	0.012	−10.926	−0.149	−0.104	**
40–49 years	2146	1.818		−0.128	0.012	−10.613	−0.151	−0.104	**
50–59 years	1413	2.614		−0.144	0.013	−10.840	−0.170	−0.118	**
60–69 years	944	3.206		−0.122	0.015	−8.246	−0.151	−0.093	**
70–79 years	502	3.401		−0.133	0.020	−6.547	−0.172	−0.093	**
⩾80 years	211	3.602		−0.143	0.030	−4.772	−0.202	−0.084	**
Male, < 5	951	1.262	1.8178	−0.094	0.018	−5.214	−0.129	−0.059	**
Female, < 5	966	1.159	**	−0.117	0.018	−6.451	−0.153	−0.082	**
Male, 5–9	953	1.143	0.4562	−0.129	0.017	−7.572	−0.162	−0.095	**
Female, 5–9	931	1.121	—	−0.104	0.016	−6.530	−0.135	−0.073	**
Male, 10–19	2230	1.086	−0.0339	−0.106	0.013	−8.502	−0.131	−0.082	**
Female, 10–19	2115	1.087	—	−0.093	0.011	−8.392	−0.114	−0.071	**
Male, 20–29	1548	1.139	−4.6818	−0.117	0.016	−7.495	−0.148	−0.086	**
Female, 20–29	1689	1.357	**	−0.117	0.013	−8.824	−0.144	−0.091	**
Male, 30–39	1332	1.426	−2.0463	−0.110	0.018	−6.093	−0.145	−0.074	**
Female, 30–39	1445	1.551	**	−0.141	0.015	−9.417	−0.170	−0.112	**
Male, 40–49	1016	1.663	−3.7836	−0.136	0.019	−7.056	−0.173	−0.098	**
Female, 40–49	1130	1.958	**	−0.122	0.015	−8.044	−0.152	−0.093	**
Male, 50–59	631	2.376	−3.2520	−0.115	0.021	−5.440	−0.156	−0.073	**
Female, 50–59	782	2.807	**	−0.165	0.017	−9.735	−0.198	−0.131	**
Male, 60–69	430	2.984	−2.2702	−0.126	0.023	−5.385	−0.172	−0.080	**
Female, 60–69	514	3.392	**	−0.125	0.019	−6.586	−0.162	−0.088	**
Male, 70–79	219	3.401	0.0048	−0.118	0.031	−3.831	−0.179	−0.058	**
Female, 70–79	283	3.400	—	−0.144	0.027	−5.384	−0.196	−0.092	**
Male, ⩾80	79	3.595	−0.0249	−0.151	0.054	−2.808	−0.257	−0.046	**
Female, ⩾80	132	3.606	—	−0.138	0.036	−3.844	−0.209	−0.068	**
I * (standardised index)	19376			−0.119	0.004	−28.865	−0.127	−0.111	**

Table 3 (*continued*)

Demographic group	N	Mean	Two-sample test t-Stat H_o: Mean(male) − Mean(female) = 0	Concentration index	Std error	t-Stat	(95% Conf. interval)		
Health expectancy									
Overall	19409	32.186		0.026	0.002	13.790	0.022	0.030	**
Male	9410	33.008	7.4417	0.015	0.003	5.915	0.010	0.020	**
Female	9999	31.413	**	0.038	0.003	13.722	0.032	0.043	**
< 5 years	1917	50.949		0.063	0.001	77.914	0.061	0.064	**
5–9 years	1885	47.692		0.059	0.001	73.671	0.057	0.060	**
10–19 years	4352	43.190		0.062	0.001	108.707	0.061	0.064	**
20–29 years	3245	34.167		0.076	0.001	92.790	0.074	0.077	**
30–39 years	2783	25.906		0.093	0.001	89.387	0.091	0.095	**
40–49 years	2152	18.345		0.114	0.001	78.386	0.111	0.117	**
50–59 years	1414	12.012		0.140	0.002	67.457	0.136	0.144	**
60–69 years	947	7.414		0.155	0.003	57.787	0.149	0.160	**
70–79 years	503	4.401		0.166	0.004	45.140	0.159	0.173	**
⩾80 years	211	2.408		0.150	0.007	22.625	0.137	0.163	**
Male, < 5	951	50.663	−2.1439	0.057	0.001	52.879	0.054	0.059	**
Female, < 5	966	51.230	**	0.069	0.001	61.221	0.066	0.071	**
Male, 5–9	953	47.823	1.1154	0.046	0.001	56.461	0.045	0.048	**
Female, 5–9	932	47.558	—	0.071	0.001	59.886	0.069	0.073	**
Male, 10–19	2234	43.344	2.0875	0.050	0.001	82.649	0.049	0.051	**
Female, 10–19	2118	43.027	**	0.076	0.001	90.885	0.075	0.078	**
Male, 20–29	1554	34.441	3.1099	0.058	0.001	68.741	0.057	0.060	**
Female, 20–29	1691	33.916	**	0.092	0.001	82.312	0.090	0.094	**
Male, 30–39	1335	26.271	4.1239	0.072	0.001	63.980	0.070	0.074	**
Female, 30–39	1448	25.569	**	0.113	0.001	79.782	0.110	0.116	**
Male, 40–49	1020	18.813	5.2325	0.089	0.002	55.942	0.086	0.092	**
Female, 40–49	1132	17.924	**	0.139	0.002	72.813	0.136	0.143	**
Male, 50–59	632	12.337	3.3619	0.111	0.003	43.799	0.106	0.116	**
Female, 50–59	782	11.749	**	0.165	0.003	60.986	0.160	0.170	**
Male, 60–69	432	7.625	2.6398	0.134	0.003	42.416	0.128	0.141	**
Female, 60–69	515	7.237	**	0.177	0.004	50.265	0.170	0.184	**
Male, 70–79	220	4.283	−1.5709	0.138	0.003	44.927	0.132	0.144	**
Female, 70–79	283	4.492	*	0.187	0.005	37.125	0.177	0.197	**
Male, ⩾80	79	2.555	1.9082	0.174	0.011	16.092	0.153	0.196	**
Female, ⩾80	132	2.321	**	0.134	0.006	21.449	0.121	0.146	**
I * (standardised index)	19409			0.073	0.000	189.307	0.072	0.074	**

Note: ** Significant at the 5% level. * Significant at the 10% level. — Not significant.

gender and age was made, highly significant concentration indices of 0.125 and 0.242, for boys and girls, respectively, were found in this group.

It is also interesting to notice that among the adults and the elderly, that is, individuals over 29 years of age, inequalities presented an inverse direction disfavouring the poorer. The most significant result was found for the 30–39 year-old group, whose concentration index was of -0.087.

Regarding the self-assessed health scores variable, bear in mind that the higher its value the worse the health status, at least from the individual's point of view. Consequently, negative values for the concentration index indicate that poorer individuals tend to opt for higher values for this variable, revealing that health inequalities favour the richer.

The pattern observed for the previous variable is once again repeated with the presence of statistically significant differences between men and women. Up to 5 years of age, males tend to present a poorer self-assessed health. This difference disappears in the 5–19 year-old range and is inverted from that range onwards, whereas women tend to consider themselves less healthy than men. The difference in averages between males and females was statistically significant at the level of 5%, for the age groups in the 20–69 year-old range. For the two last age groups, differences are no longer statistically significant.

The socio-economic inequalities analysis for the self-assessed health scores variable indicates the unequivocal presence of inequalities favouring individuals from the upper strata in the adopted socio-economic scale. One can be certain that all indicators are statistically significant.

The overall concentration index was -0.086 but the analysis of indicators by groups showed a growing trend according to age, reaching its peak in the 50–59 year-old-group for women, represented by a concentration index of -0.165 and in the over -80 group for men with a -0.151 index.

Interestingly enough, the standardised inequality index (I^*) was -0.119. The indirectly standardised variable was obtained from a model in which the self-assessed health scores variable was regressed on the vector of nine age dummies, corresponding to the 10 age categories considered plus a gender dummy.

It is noticeable that the standardised index is lower than the unstandardised one, indicating that when the effects of demographic factors are considered, socio-economic inequality increases. This is in line with what was observed in the inequality analysis by groups, with the disadvantage that, in that way it is impossible to clearly identify how inequality permeates down to the various demographic groups.

The logic of the health expectancy variable is the opposite of the two prior ones, since higher values indicate that the expected number of years for an individual to enjoy good health is greater. Hence, positive concentration indices indicate that the richer accumulate a greater number of expected healthy years, resulting therefore, in pro-rich inequalities. Negative values are consequently indicative of pro-poor inequalities.

Results for the health expectancy variable have indicated that, broadly speaking, males have presented a slightly higher averages of good health years than females, and the differences cited were shown statistically significant at the level of 5% for most ranges. Exceptions were found in those groups including 5–9 years old – among which no significant differences were observed – and 70–79 year-old individuals, whose difference was significant at 10% level only.

Concentration indices for all age groups were positive, statistically significant and, in general, rising with age. Among males, indices increased from 0.046 in the 5–9 year-old range, reaching the high figures of 0.14 and 0.17 among individuals aged 70–79 and those over 80, respectively. Among females, indices rose from 0.07 for those under 5, reaching levels of 0.19 and 0.13 for each of the two last age groups, respectively.

One should be aware that mere observation of the numeric indicator differences does not provide enough elements for a conclusion about the real existing differences among the various groups. Therefore, graphs in Figures. 2 and 3 were prepared in order to check for the existence of dominance, whether strict or not, among the concentration curves.

It should also be mentioned that the conventional presentation of concentration curves follows the pattern in Figure 1 but, given the proximity of curves to the diagonal the option was to present each curve's deviation from the diagonal. This enabled the positions to be more accurately assessed.

In Figure 2(a), where only the distinction by gender, with no disaggregation by age groups was taken into account, strict dominance of the male

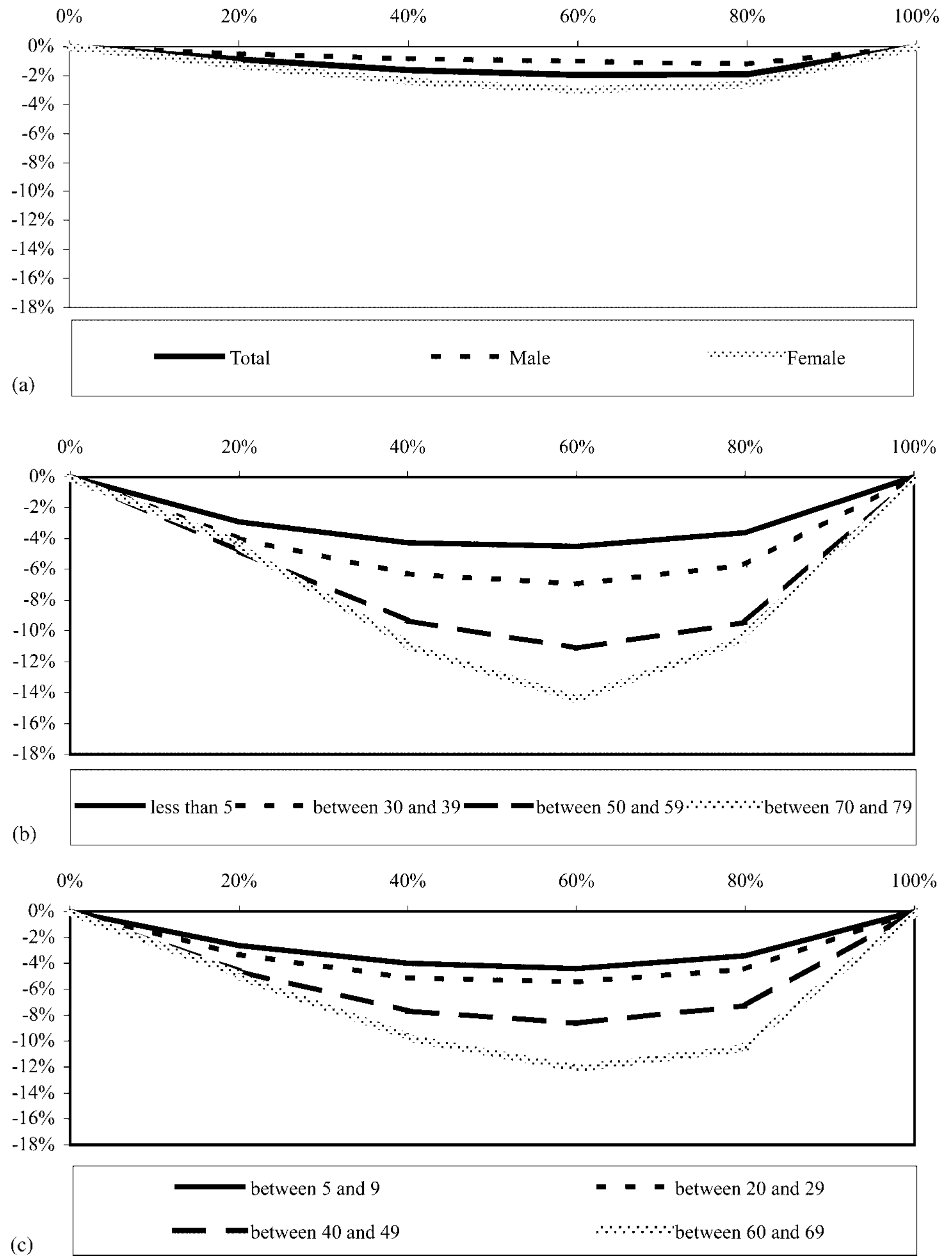

Figure 2. Concentration curves for health expectancy (in deviations from the diagonal)

curve over the total curve and the female curve is clear.

When the distinction is made taking age groups into account, as in Figures 2(b) and 2(c), the differences among groups are clear again. In general terms, younger age group curves strictly dominate older age group curves. Thus, the under-five children health concentration curve strictly dominates the other age group curves, and the same is true of the individuals included in the 30–39 year-old range against the groups aged 50–59 and those aged 70–79. The same occurred in

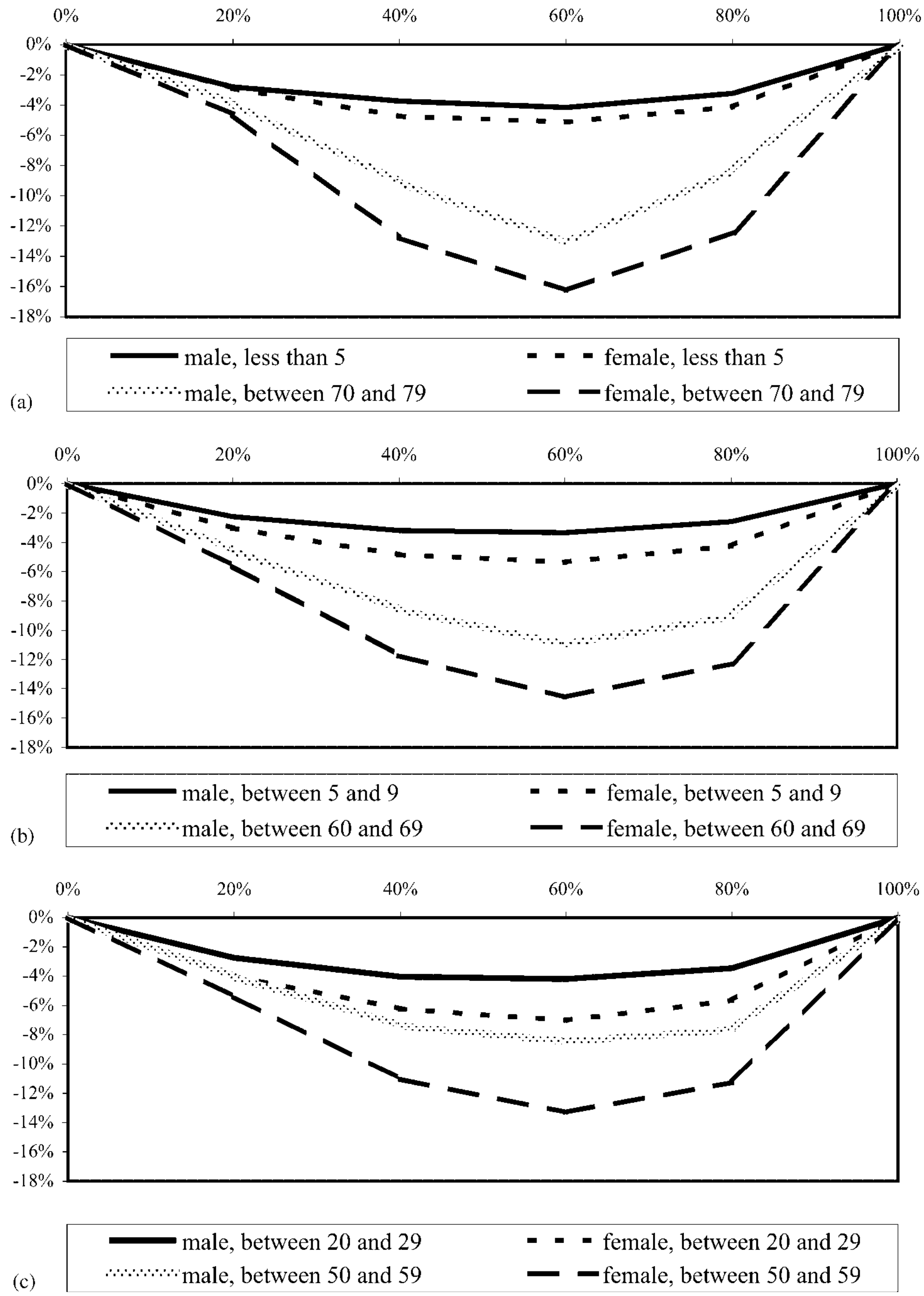

Figure 3. Concentration curves for health expectancy (in deviations from the diagonal)

the 5–9-year-old group curves in relation to the curve of the other age ranges.

In each of Figures 3(a)–(c) one can see the curves formed from the analysis of only taking two different age groups into account, disaggregated by gender. This option makes the comparison among curves possible. Therefore, for all age groups analysed, the male curve was verified to dominate that of the females, of the same age.

Conclusions and Discussion

The main objectives of this work were to confirm the existence of socio-economic inequalities in health in Brazil, as well as to show that the standardisation procedure conventionally applied in such an analysis ultimately hides some essential elements when designing and implementing policies to eliminate or at least reduce this kind of inequality. Three variables were analysed: chronic health problem, self-assessed health scores and health expectancy.

In summary, one sees that, as far as gender distinction is concerned, the results showed that up to 5 years of age the mortality rates, reported appearance of chronic health problems as well as the self-assessed health indicated that the boys were in worse health condition than the girls. After this age bracket the differences tend to disappear until adulthood, when they tend to invert and the women consistently consider themselves less healthy. This is despite the fact that, their mortality average rate is lower than those given for men in all age groups.

With reference to the socio-economic inequalities, one generally finds larger differences within the women's groups. It is important to mention here that, especially in the health expectancy variable this result was clearly proved by analysing the concentration curves, which consistently showed that the curves corresponding to the prevailing situation between people of the masculine gender dominated the women's curves for the same age groups.

When examining the results obtained for the different age groups one sees that the pro-rich inequalities increase with age. This fact indicates the urgency to pay special attention to the poorer elderly people's health.

Nonetheless, should one take the policy-makers' point of view, some of the other results will appear even more alarming.

The first point to consider refers to the understanding of the impact of the largest complexity involved in setting up a variable on the obtained results. As shown below, in the evaluation process and while following the socio-economic inequalities in the people's health the results obtained from the different variables prove that they are complimentary rather than substitutes.

In the analysis of chronic health problems what stood out were the pro-poor inequalities identified in the younger groups, that is, in the two ranges including individuals up to 19 years of age. Investigation into the causes reported shows that the problems that affect the 5–19 year-old age group are mostly allergies and respiratory diseases. These results may indicate that either the most favoured classes' lifestyle contributes to the appearing of this kind of problem or those individuals have access to more information, and can therefore identify these diseases more precisely.

Regarding this, however, it is vital to remember that some studies have identified the existence of a connection between infection with helminths and allergic inflammation/asthma. Yet, as shown by Ovington and Behm [21]: Epidemiological studies have attempted to make a causal link between helminth infection and the atopic/asthmatic state. The results of these studies have been highly variable and appear to be contradictory; it has been variously hypothesised that (i) helminth infection induces asthma; (ii) helminth infection protects against asthma; and (iii) asthma protects against helminth infection. Epidemiological investigations on this issue are in their initial stages in Brazil, with only a very few preliminary results having been shown at Brazilian Conferences but not published yet.

Therefore, strictly speaking, a third hypothesis should still be considered: one whose results are beginning to become obvious that, in fact, lower income individuals show fewer allergic/respiratory problems due to their parasitic infections. If so, the supposed advantage of the poorer would not exist and we would be face to face with another pro-rich inequality situation.

On the other hand, the analysis of the self-assessed health scores variable for the same group of individuals indicated that those from more economically disfavoured classes showed a poorer self-assessed health status.

An overall analysis suggests that, although one cannot exclude the possibility that people's lifestyles allow the occurrence of allergic and/or respiratory problems, the result of the self-assessed health scores variable seems to signal these two more plausible explanations: either the higher income individuals' access to better health services and more information enables them to identify allergies and respiratory problems and treat them more efficiently or there is a stronger presence of parasitic infections among the poor, which somehow shows a negative relation with the manifestation of allergic/respiratory problems.

Results obtained for the health expectancy variable indicate that, from birth onwards, socio-economic differences favour the more privileged strata of the population. In addition, to checking for inequality measures themselves, it should still be borne in mind that the intention was to verify whether among the poorer only those who actually enjoy more favourable health conditions survive and if lower income individuals gradually loose this possible early advantage throughout life. Consequently, results found ruled out this hypothesis, since both health expectancy and mortality rates have indicated the presence of pro-rich socio-economic inequalities.

A constitutional amendment has recently been approved by the Brazilian National Congress earmarking funds from the Union, States and Municipalities for health, which will ensure greater stability in the financing of the sector. Above all, this is precisely the most appropriate moment for an effort towards the inclusion of an explicitly defined additional goal in the area of health programmes: elimination, or at least reduction, of Brazilian socio-economic health inequalities.

Due to the fact that health is an essential element for one's well being this would obviously be just the beginning of a long process aimed at providing a better quality of life to the poor. It is clear that there is a need for a permanent surveillance to enforce that this new goal is put into action. Therefore, it makes both periodical assessments of inequality levels and investigations into the impacts of programmes for the different demographic groups indispensable.

Acknowledgements

I am grateful to two referees for helpful comments on a previous draft. Any errors are, course, my responsibility.

References

1. Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. *Soc Sci Med* 1997; **44**(6): 757–771.
2. Wagstaff A, Paci P, van Doorslaer E. On the measurement of inequalities in health. *Soc Sci Med* 1991; **33**(5): 545–557.
3. Wagstaff A, van Doorslaer E. Measuring inequalities in health in the presence of multiple-category morbidity indicators. *Health Econ* 1994; **3**: 281–291.
4. Kakwani N, Wagstaff A, van Doorslaer E. Socioeconomic inequalities in health: measurement, computation, and statistical inference. *J Econometrics* 1997; **77**: 87–103.
5. Macintyre S, Hunt K, Sweeting, H. Gender differences in health: are things really as simples as they seem? *Soc Sci Med* 1996; **42**(4): 617–624.
6. Matthews S, Manor O, Power C. Social inequalities in health: are there gender differences? *Soc Sci Med* 1999; **48**(1): 49–60.
7. Arber S. Comparing inequalities in women's and men's health: Britain in the 1990s. Soc Sci Med 1997; **44**(6): 773–787.
8. West P. Health inequalities in the early years: is there equalisation in youth? *Soc Sci Med* 1997; **44**(6): 833–858.
9. Power C, Matthews S, Manor O. Inequalities in self-rated health: explanations from different stages of life. *Lancet* 1998; **351**: 1009–1014.
10. van Doorslaer E, Wagstaff A. *et al*. Income-related inequalities in health: some international comparisons. *J Health Econ* 1997; **16**: 93–112.
11. Wagstaff A, van Doorslaer E. Inequalities in health: methods and results for Jamaica. Paper prepared for the Human Development Department of the World Bank, 1998.
12. Gwatkin DR. Health inequalities the health of the poor: what do we know? what can we do? *Bull World Health Organ* 2000; **78**(1): 3–18.
13. Humphries K, van Doorslaer E. Income-related health inequality in Canada. *Soc Sci Med* 2000; **50**(5): 663–671.
14. Deaton A, Paxson C. Poverty among children in developing countries. *Research Program in Development Studies*, Working Paper 179. Princeton University, 1997; http://www.wws.princeton.edu/~rpds/working.htm [03 Feb 2000].
15. Sullivan DF. A single index of mortality and morbidity. *HSMHA Health Report 1971*; **86**: 347–354.
16. van Oyen H, Tafforeau J, Roelands M. Regional Inequities in health expectancy in Belgium. *Soc Sci Med* 1996; **43**(11): 1673–1678.
17. Gerdthan UG, Johannesson M, Lundberg L, Isacson D. A note on validating Wagstaff and van Doorslaer's health measure in the analysis of inequalities in health. *J Health Econ* 1999; **18**: 117–124.
18. Sihvonen AP, Kunst A, Lahelma E, Valkonen T, Mackenbach JP. Socioeconomic inequalities in health expectancy in Finland and Norway in the Late 1980 s. *Soc Sci Med* 1998; **47**(3): 303–315.
19. Brønnum-Hansen H. Socioeconomic differences in health expectancy in Denmark. *Scand J Public Health* 2000; **28**: 194–199.
20. Wagstaff A. Socio-economic inequalities in child mortality: comparisons across nine developing countries. *Bull World Health Organ* 2000; **78**(1): 19–29.
21. Ovington KS, Behm CA. The Enigmatic Eosinophil: Investigation of the Biological Role of Eosinophils in Parasitic Helmint Infection. *Mem Inst Oswaldo Cruz 1997*; **92**(Suppl. II): 93–104; http://www.dbbm.fiocruz.br/www-mem/92sup2/3467.html [10 Oct 2000].