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# INEQUITIES IN HEALTH STATUS AND USE OF HEALTH SERVICES IN COLOMBIA : 1990 – 2000

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**EXECUTIVE SUMMARY**

*In 1993, Law 100 completely reformed the organization, financing and delivery of health services in Colombia. Before 1993, the health system had three parallel and independent subsystems. The 1993 health reform created a single structure which combined the principles of equity, solidarity and universality. Previous studies show important health inequalities among poor and non-poor or by socioeconomic status. Despite the enormous contribution of existing studies to an understanding of the relationship between health (status, access and use) and its determinants, more work needs to be done on the contribution of these elements to the inequities observed in health. This document seeks to make advances in that direction, and it has two objectives: first, secondary information is used to measure socioeconomic inequities and to describe trends between 1990 and 2000 with regard to health status, and access and use of health services. Second, this paper attempts to advance in the knowledge of the causes for the observed inequities in health status – infant mortality – by analyzing its determinants and their contribution to the problem. Thus results will allow policy recommendations to be made in the search for universal coverage and great equity in health.*

*Results indicate that in both 1995 and 2000 inequities in access and use of health services tend to be greater in rural areas than in the cities, and those in health status are greater in urban areas than in rural areas. Thus rural areas are in a worse position in both levels and inequities in access and use of health services, while the health status is at a lower level, but more equitable. In other words, health status of a rural area is worse than that of an urban area, but there is a smaller difference between individuals. In urban areas the differences in health status by socioeconomic level are much more marked, although on average health status is better than in rural areas. With regard to access and use of health services, rural areas have lower average coverage and greater differences between individuals than urban areas.*

*We find strong improvements in absolute and relative levels of enrollment in the health system in rural and low socioeconomic groups. Use of health care services (prenatal care and medical assistance at delivery) also show improvements in absolute levels and equities, but at a much lower pace. On the contrary, health status indicators (infant mortality, stunting rate, incidence of acute diarrhea, incidence of acute respiratory infection) show very little improvements in both absolute levels and inequities.*

*Although infant mortality has fallen in recent decades, inequity has increased. It is therefore important to make a detailed analysis of the causes of this inequity. The contribution of a factor to the inequities observed in infant mortality depends not only on its effect on mortality, but also on its inequity in itself. First, we estimate a survival model to identify the main proximate and socioeconomic determinants. Second, the results of the model are related to the inequities in the most important determinants in order to infer the contribution of each of them to the inequities observed.*

*We estimated a Cox hazard model with time-varying variables. In general, the results indicates that the place of residence, the education of the mother, the access to water and sanitation, the age of the mother at the birth of the child, the order of birth, the sex of the child, birth weight and breast-feeding are the most significant determinants. Of these, sanitation (water and sewerage) has the greatest effects, and an even greater one among the less educated groups. The next most important is breast-feeding, as child care, and the variable of birth weight, an indicator of perinatal factors.*

*Based on the elasticities calculated from the final estimated model, and considering the inequities observed for each independent variable, it can be said that the inequities in the educational level of the mother, access to*

*water supplies and sewerage, the age of the mother at the birth of the child, the number of children and the place of residence contribute to the inequities observed in infant mortality; while the inequities in the duration of breast-feeding lead to a reduction in infant mortality inequities.*

*For several reasons, the findings of this project may act as a frame of reference for the design and formulation of social policies: (1) because the results of indicators analyzed suggest priorities in the improvement of the level of health; (2) because it identifies the indicators in which the inequities are most present, so that action can prioritize the most unprotected groups; (3) because it permits an evaluation of some of the results of the social security reforms in health, and proposes some corrective actions to improve levels of health and equity; and (4) because it confirms the way in which progress in this area are not the results of isolated action in the health sector, but require ongoing inter-sector work, involving at least infrastructure and education.*

*The positive changes observed in coverage and equity by geographical zone and socioeconomic level, associated with the effects of the health subsidy brought by the 1993 health reform, call for more universal coverage. The development of the basic service networks for water supplies and sewerage, basic sanitation, appropriate sanitary installations and the promotion of education addressed to the lower socioeconomic groups and the rural population, would lead directly to a reduction in infant mortality and its inequities.*

**CONTENT**

## 1. Background

During the 1990s major structural reforms were introduced in Colombia, among them that of the health system. Law 100/93 reformed the whole organization, financing and delivery of health services with the creation of the General Health System SGSSS.

The new system arose from the transformation of a sector with three independent subsystems with different forms of organization, financing and delivery – the public system, the Social Security system and a private subsector – into a single structure which combined the principles of equity, solidarity and universality.

Available studies suggest that the progress made since the 1993 health reform has been concentrated in three areas: increased coverage, greater allocations of money and a new institutional scheme (Giedion and Acosta, 1998). The first of these areas has been the most successful, since coverage has risen from about 20% of the population in 1990 to 57% in 1997 and 58% in 2000. This progress towards universal coverage seems to have been accompanied by greater equity in potential access to health services: some 48% of the poor were covered by the system in 1997, while prior to the health reform the poor – classified by unsatisfied basic needs – were not even enrolled in any part of the health care system (Giedion and Acosta 1998)

Health differentials by socio-economic status have been identified in a number of studies, some going back to 1970 (for example, Ministry of Health and Ascofame, 1972, Vivas J et al. 1988; Pabon A, Rico J, 1984; Pabon 1991; Oróstegui M, 1990). The studies not only analyze health status; they also analyze access and use of health services and the distribution of health resources, evidencing a constantly positive relationship between the various health indicators and income, level of urbanization and urban/rural differences.

More recent studies try to infer the impact of the 1993 reform on equity in health status and use of health services (Castaño et al, 2000; Florez and Nupia, 2001; Céspedes, Jaramillo and Castaño, 2001; CIE Universidad de Antioquia, 2001). Results suggest that despite important advances in enrollment achieved by the reforms, coverage is still low, and that there are inequities which put rural areas and the poor at a disadvantage (PAHO, 2001; Florez and Nupia 2001; Profamilia, 2000).

While the average enrollment in health care in 2000 was 61% in urban areas, it was only 52% in rural areas. The main reason for the non-enrollment in rural areas, and in poor urban areas, is an economic one. This reflects the fact that even after the health reform, socioeconomic factors still affect potential access (capacity for use) and therefore also, individual health status (Florez and Nupia, 2001).

A number of studies have analyzed the determinant factors in health (indicators of status, access and use) but few have related them to inequalities or inequities in health (CIE, Universidad de Antioquia 2001; Florez and Nupia, 2001; Ministry of Health and Econometria, 2001). In assessing the status of health, measured in terms of infant mortality and chronic malnutrition among children, Florez and Nupia (2001) find that the educational level of the mother and the use of health services for child—care are factors which contribute to the inequities noted in 1995. There are also important effects derived from contextual factors, such as the socioeconomic inequities of a region. The positive effect of socioeconomic level on health status is greatest in the regions of greatest inequality, whether measure in terms of poverty levels, income distribution or educational level.

CIE-Universidad de Antioquia (2001) analyzes the socioeconomic determinants of access and use of health services by the enrolled population in Antioquia in the subsidized

SGSSS regime, and it finds that both potential and real enrollments are mainly affected by factors related to the isolation and poverty in the place where the individual lives. The Ministry of Health and Econometria (2001) analyze the determinants of enrollment in health care, and find that the economic and employment situation of the individual are important variables.

Despite the enormous contribution of existing studies to an understanding of the relationship between health (status, access and use) and its determinants, more work needs to be done on the contribution of these elements to the inequities observed in health. This document seeks to make advances in that direction, and it has two objectives: first, secondary information is used to measure socioeconomic inequities and to describe trends between 1990 and 2000 with regard to health status, and access and use of health services[1]. Second, this paper attempts to advance in the knowledge of the causes for the observed inequities in health status – infant mortality – by analyzing its determinants and their contribution to the problem. Thus results will allow policy recommendations to be made in the search for universal coverage and great equity in health.

## 2. Analytical Framework and Methods

### 2.1 What is an inequity, and how do we measure it?

First, we need to draw a distinction between inequalities and inequities (Whitehead 1992; Braveman, 1998). Inequality indicates relevant and systematic differences between individuals and groups in a given society or community. Inequalities in health which are unnecessary, avoidable and unfair, are held to be inequitable (Whitehead, 1992). Only the inequalities of a biological kind (sex or age) or those arising from freely adopted harmful conduct are not inequitable.

The quest for equity entails an attempt to narrow avoidable gaps in the health of the individual and in his access to and use of services, and their cost, with reference to different social and economic level. The measurement of inequities in the health sector must therefore not only determine their magnitude but also serve the basic purpose of their direction, applying criteria which will help to identify determinants and hence facilitate interventions designed to correct the situation (Dachs, 2001). Thus the measurement of socioeconomic inequalities in health is very useful and practical, since (1) it serves as a guide for interventions designed to reduce them, and (2) it facilitates the follow-up of inequities over time in order to evaluate the effect of policies and to compare inequities in geographical terms.

There are some available indicators for the measurement of health inequities by socioeconomic status (SES) (Wagstaff, Kakwani and Doorslaer, 1997; Mackenbach and Junst, 1997; Dachs, 2001). Two of these available forms of measurement were used: extreme groups (relationship between of low/high SES) and the concentration index (Gini-type coefficient). Wagstaff has developed and applied the concentration index in several countries. The curve and the concentration index are similar to the Lorenz curve and Gini coefficient as used in income distribution analyses where there is a comparison of the

[1] The issues of inequities by socioeconomic level in financing health services and of the redistribution of income associated with direct or indirect payments to the health system are not discussed here, not because they are not important, but because they merit separate research, and therefore go beyond the purposes of this paper.

accumulated percentage of population ordered by income level with the accumulated percentage of income earned by each group.

In this case, however, the ordering of individuals or groups on the abscissa is made on the basis of one criterion (socioeconomic status) while the accumulation of ordinates is effected by another (the health indicator analyzed)[2]. Therefore the concentration curve may lie above or below the diagonal (perfect equity) depending on how the health indicator is distributed by the ordering criterion. The diagonal, like the Lorenz earnings curve, represents the situation of perfect equity, i.e. uniform distribution.

The concentration indicator, like Gini coefficient, is the area between the distribution (concentration) curve observed and the diagonal. Therefore it may vary from -1 to +1 and be zero where the curve and the diagonal intersect. The further away from zero, the greater the inequity. The sign (+ or -) and the position of the curve (above or below the diagonal) show the expected direction of the link between the health indicator with socioeconomic situation and inequity.

Averages (levels) of the variable (or indicator) for health are as important as the inequities, i.e. the average is as important as the dispersion of the distribution. So, as well as measuring the size and direction of health inequities, the average of the variable (or indicator) analyzed was also taken into account.

### 2.2 What causes inequities in health?

The existence of differentials in health status due to socioeconomic condition is evident in social science and in medical studies in industrialized and developing countries alike. In the developing countries the little available information on health status among the adult population has been a limitation to research on that group, and the indicators are mainly centered on children.

Studies nonetheless constantly indicate that those in higher socioeconomic levels have better health than those below them. These inequalities have been identified over time, between places, or by sex or age-group (Goldman, 2001). There is also persistent evidence of that inequalities for the set of health indicators (mortality, morbidity, nutrition, perceived health status, etc.) and independently of the socioeconomic condition used (earnings, consumption, assets, education, occupation or urban/rural environment). Many studies also show that a positive relationship between health and socioeconomic position is not unique to the poor, but can be seen at every level of society, and generates what is known as the "social gradient" in health (Goldman, 2001). In other words, the status of health improves steadily with socioeconomic condition, but not necessarily in linear form.

Goldman (2001) identifies three kinds of hypothesis which have been used to analyze this gradient – i.e. the positive relationship between socioeconomic level and health status. One group refers to the set of causal mechanisms through which a number of factors have a potential effect on health. The second ("selection" or "inverse causality") refers to a set of actions in which less healthy people have a lower socioeconomic condition because they are less healthy. The third and less popular hypothesis includes artificial mechanisms such as errors of measurement. Goldman (2001) confirms a consensus in research in several

[2] As in the Lorenz curve, the order rises from low to high on both abscissa and ordinate. Since account must be taken of the size of the groups, the ordering of the abscissa should include only the population exposed to the health variable and the ordinates should include only the population affected by the health characteristic analyzed.

disciplines, in which health inequalities are mainly produced by the first hypothesis, i.e. by a complex of causes and not by selection, and much less by artificial construction.

Although there are indications that unhealthy people move down in the social scale, responsible opinion asks that this selection process should only be marginal to the observed association between a socioeconomic level and health status. Scientists equally say that artificial mechanisms (measurement errors or wrong kinds of measurement of health status or socioeconomic condition) are not important to the explanation of the relationships observed (Goldman, 2001).

Based on available literature, we start from the assumption that the positive relationship between health status and socioeconomic condition (the social gradient) is brought about by complex causal relationships through which several causes act on health. Therefore an understanding of inequities in health means that the determinants must be identified and the casual processes must be understood; but it also implies that inequities in the determinants must be identified.

### 2.3 What determines health status?

Studies show that there are a number of mechanisms and routes to connect associations between health and its determinants, and some say that the relationships between risk factors are hierarchical (Mosley Chen 1984, cited by Casterline, Cooksey and Fattah, 1989-;Victoria et al., 1997; Evans et al. 2001; Goldman 2001; Wagstaff, 2002).

Despite the complexities of interaction between factors, efforts have been made to understand the relationships by the use of simplified models of causality. A number of sets of determinants have been proposed for health status, but the complexity of relationships has meant that none of them are sufficient to explain health inequalities by itself (Goldman, 2001; Evans et al. 2001; Wagstaff, 2002)

The general conceptual framework used here is based on the extensive literature on the subject. Given the context of Wagstaff (2001) and Evans et al. (2001) bring together the proposals of a number of other studies, we take here an adaptation of them - see Figure 1. The conceptual framework starts with government policy for health and related sectors through which the supply and financing of health services and other sectors services affect health. The supply of health services, in terms of availability, accessibility, price and quality – affect its use and then affect health status (nutrition, morbidity, mortality, etc.). The supply of other sectors (infrastructure, access to water supplies and sewerage) affect health practices, and hence, health status.

Therefore government policy and action indirectly affect health status through factors which influence health practices and hygiene in the household, and those factors are usually classified as socioeconomic determinants of health.

In the household, there are a number of risk factors and actions which have a direct influence on health status ("proximal factors"). This includes the use of preventive and curative health services, nutrition, hygiene, lifestyle, biological considerations, demography and reproductive habits, amongst others.

### 2.4 Data sources

This paper uses Demographic and Health Surveys (DHS) of 1990, 1995 and 2000 which were part of the Macro International worldwide surveys started in the 1970s, designed mainly to collect information on family planning and maternal and infant health, infant survival and other aspects of reproductive health. The Colombian DHS were carried

out by the family planning agency Profamilia and cover an average of 10,000 households and 11,000 women of reproductive age. They have a multistage and probabilistic sample design of households which is representative in national, regional and subregional terms and include the three major urban centers of Colombia.

The surveys questionnaire include sections on housing (condition, general characteristics of members of the household), on women in reproductive age (marriage, fertility, family planning, maternal health, etc.) and the children of these women (diseases, infant mortality, nutrition, etc.).

Thus the results of questions about health status and access to services for specific conditions include the incidence or prevalence of certain children´s diseases, mortality among children under 5 (including neonatal mortality, post-neonatal mortality and infant and child mortality), nutritional status of the children and their mothers, access to prenatal care, care during childbirth, breast-feeding, family planning and fertility. While the 1990 survey does not include questions about enrollment in the social security health system, the 1995 survey contains one question which was asked of all members of the household; and the 2000 survey contains a whole section on health with questions for every member of the household, regarding enrollment, need for use (declared illness), use of services and perceived quality of services.

None of the DHS includes a section on household consumption and earnings; all have questions on the conditions of housing (access to basic services – water and sewerage – flooring material, overcrowding) and on family assets – car, motorcycle, TV, liquidizer, freezer, radio, tractor (rural) etc. – which provide an idea of the economic condition of the household.

### 2.5 Socioeconomic status (SES) and health indicators

The fact that the DHS did not provide information on household earnings or expenses is an effective limitation when identifying the socioeconomic status of the household and constructing indicators of inequity in health. World Bank and Macro International researchers have nonetheless developed a method – which uses an analysis of principal components - to assign socioeconomic status, using information from the DHS. It is an approach to household wealth measured by an index of physical assets. In this case, socioeconomic status of the household is defined in terms of fixed assets or wealth, and not in terms of earnings or consumption. The same method is used in this paper, and the asset index is defined for the household, and each individual receives the index for his household.

Based on the available information from the three DHS (1990-1995-2000), health indicators were selected according to the components of capacity and need for use, use of services and health status (Table 1). For each year, an average or rate was constructed as well as the concentration index and concentration curve for each indicator, stratified by sex and age as a control (both of them have an influence on the need and use of services). The analyses differentiate between urban and rural areas, given the wide differences in socioeconomic condition.

## 3. Evidence of inequities in health 1990-2000

The study covered all the indicators in Table 1, but this paper concentrates on the presentation and description of the main findings in relation to variables that will evidence a trend between 1990 and 2000, or only between 1995 and 2000. Figure 2 and Table 2

summarize the results of average rates (levels), and inequities in certain indicators of potential access, use of health services and health status, between 1990 and 2000.

The averages show, for each year, better conditions of access (enrollment) and use of health services (adequate prenatal control, medical care at childbirth and full scheme of vaccinations) and in health status (chronic malnutrition, acute diarrhea illness, and infant mortality) in urban than in rural areas. In other words, in the first instance inequities were observed in health, to the disadvantage of the rural sector, and this is maintained if controlled by sex and age. The concentration indexes confirm inequities in all indicators, favoring the higher socioeconomic groups in any year, in both urban and rural areas.

However, inequities in access and use of health services tend to be greater in rural areas than in the cities, and those in health status are greater in urban areas than in rural areas. Thus rural areas are in a worse position in both levels and inequities in access and use of health services, while the health status is at a lower level, but more equitable.

In other words, health status of a rural area is worse than that of an urban area, but there is a smaller difference between individuals. In urban areas the differences in health status by socioeconomic level are much more marked, although on average health status is better than in rural areas. With regard to access and use of health services, rural areas have lower average coverage and greater differences between individuals than urban areas.

Among the variables used as indicators for health status, that for infant malnutrition is the least prevalent, but the most inequitable (highest concentration) in both urban and rural areas. In this item progress towards better nutrition for children should come from efforts to reduce inequity. On the contrary, average inequities within each residential area are similar in terms of the various indicators of use of health services, and this implies the need for equally important efforts to obtain greater equity.

Trends between 1990 and 2000 show important progress in average potential access (enrollment) and the uses of maternity services, in which there has been a reduction in inequity, especially marked in rural areas. In contrast, the use of full vaccination services for children has taken a step backward in levels and in inequities in both urban and rural areas. Advances in the health status have been very modest (only observable in infant mortality) and have been accompanied by greater inequity, especially in urban areas (Figure 2, Table 2).

The changes which have occurred in recent years in average inequities are especially marked in enrollment – greater coverage with greater equity- within urban and rural area and between areas. Enrollment rose from 29.1% in 1995 to 58.1% in 2000. During this period the gap between city and countryside closed significantly, since advances have been greater in rural areas. In the cities, enrollment rose from 38.8% to 60.5% between 1995 and 2000, but from 8.6% to 51.6% in rural areas (Figure 2, Table 2).

This implies that the differences between rural and urban areas were substantially reduced. In 1995 urban enrollment was 4.5 times rural enrollment, while in 2000 it is only 1.2 times that. Thus, there has been a major advance in equity by zone and this persists after controlling by sex and age. Advances towards equity can also be noticed within each area, being much more marked in rural areas than in urban areas (Figure 2, Table 2). The concentration index fell from 0.46 to 0.02 in rural areas and from 0.25 to 0.08 in urban areas. In illustration , Figure 3 shows the change in concentration curves for enrollment between 1965 and 2000 for urban and rural women. The curves evidently come closer to the diagonal (i.e. a lower concentration index) and in rural areas the curve is almost on the diagonal, i.e. inequity is almost non-existent (concentration of zero).

The stronger trend towards greater coverage and greater equity in rural areas suggests that enrollment in rural areas has occurred in the lower quintiles of socioeconomic strata. This is consistent with the fact that in the cities enrollment to the contributory regime, which includes those in formal employment or with income of more than two National Minimum Monthly Salaries (NMMS. 1 NMMS=approx. $110 in 2002) is higher, while in rural areas enrollment to the subsidized regime is higher.

Despite major advances in enrollment in recent years, there are persistent differences by age, sex and place of residence. Averages tend to be higher in the older age-groups of both men and women in both urban and rural areas, probably because enrollment is greater in the contributory regime and the large numbers of pensioners enrolled in that regime (Tono and Londoño, 2000). The greater enrollment of the older age-groups may also reflect the cumulative effect of being a regular employee, associated to the enrollment in social security before the reforms to the health system were introduced (Florez and Nupia, 2001).

The changes observed in enrollment and distribution by area and socioeconomic level represent a major advance in compliance with the Constitutional mandate to offer universal coverage in the social security system; but there is still a gap of more than 40% of the population, which is not enrolled. This gap is especially marked in rural areas where almost half (48%) of the population do not belong to either regime.

The use of maternity services – adequate prenatal care and medical attention during childbirth – show major progress in coverage and equity in rural and urban areas (Figure 2, Table 2). In 1990, 70.7% of women receive adequate prenatal care for their most recent child born alive, in 2000 this had risen to 80.6%. The advances are greater in rural areas than in urban areas, rising from 53.1% to 67.7% in the decade, in comparison to the riser from 78.7% to 85-8% in cities. The distance between urban and rural coverage thus fell from 1.5 to 1.3 times, and this is an advance in equity by area. However, the inequity is greater in rural areas than that observed for the urban areas: the rural concentration curve is further away from the diagonal than the urban curve, see Figure 4.

In contrast to the progress made in levels of adequate prenatal care, advances towards equity have been more modest. Some progress has been made, but less in the cities (concentration index down from 0.075 to 0.043) than in rural areas (down from 0.181 to 0.096).

Figure 4 shows the change in the concentration curve over the decade, and this is maintained after controlling by age of the woman. Obviously progress towards equity has been greater in rural areas, especially between 1995 and 2000, when the curve comes closer to the diagonal for the period.

Changes in medical attention in childbirth also reflect marked progress in the delivery of services over the ten years period, especially in the last five. In 1971, 71% of women had medical attention in childbirth, and this rose to 82% in 2000 (Figure 2, Table 2). As with prenatal care, medical attention in childbirth increased more in rural areas than in urban areas over the period, leading to a reduction in inequities by place of residence (Table 2). This progress in levels was accompanied by a reduction in inequity in both areas. The concentration index falls from 0.083 to 0.039 in urban areas, and from 0.141 to 0.092 in rural areas (Table 2, Figure 5). These improvements are maintained when controlled by the age of the mother. Despite progress towards equity in both cases, however, there is greater inequity in rural areas than in urban areas.

The advances in level and equity observed in prenatal care and attention received in childbirth coincide with an active government policy to promote the use of mother-child

services. One of the targets of the policy is to reduce maternal and infant mortality, which are likely to be affected by prenatal care and attention in childbirth. Also, the increase in the use of maternal health services is probably associated with the 1993 health system reform. Despite this progress, however, there are still marked inequities in prenatal care and attention in childbirth in favor of the cities and the higher socioeconomic groups.

The use of child health services, expressed in terms of full vaccination, has declined in coverage and there are greater inequities in both urban and rural areas. In 1990, 77.9% of children aged 12-23 months received the full scheme, this had fallen to 66% in 2000. The decline is apparent among both boys and girls and in both rural and urban areas, and differentials between urban and rural coverage are maintained. In 1990, 81% of children aged 12-23 months received the vaccinations, compared to 71.7% of rural children; and in 2000 coverage had fallen to 69% and 59.7%, respectively (Table 2).

During the period analyzed the inequity suffered by rural areas is maintained. Full vaccination schemes are more widespread in urban areas. The rural areas, in addition to lower coverage, also suffer from greater inequity, i.e. greater differences between individuals than in urban areas (the concentration curve moves away more from the diagonal in the rural areas, Figure 6).

The greater inequity in rural areas may be related to geographical barriers which hamper access to health centers or lack of availability of a vaccine in remote rural centers. Studies show that the lower vaccination coverage in rural areas is related to problems of delivery: It is difficult to mobilize vaccination brigades, and there is no direct coverage of local health institutions, etc.; and this affects the poorest areas most.

The loss of vaccination coverage has been accompanied also by worse inequity. The concentration index rose from 0.034 to 0.051 in urban areas and from 0.029 to 0.105 in rural areas over the ten year period (Table 2). Figure 6 shows the changes in the concentration curves between 1990 and 2000, and these are maintained even after controlling by sex. Both curves move away from the diagonal during the decade, showing greater inequity. It seems that the loss of coverage in both cases was due to lower levels of vaccination in the lower socioeconomic strata.

Contrary to the trend in enrollment and the use of maternal services, the reduction in health status – measure by chronic malnutrition and infant mortality - has been very modest, and inequities have increased. Infant mortality was 27 per thousand in 1995 and 21 per thousand in 2000. The falling trend occurred in both areas, but was more marked in rural areas. In 1995 the rural mortality rate was 1.3 times the urban rate, but in 2000 it had fallen to 1.1 times (Table 2). There is still a differential in favor of the cities. In contrast to higher infant mortality in rural areas, average inequities are smaller (Figure 7). In other words, there was higher infant mortality in rural areas but fewer differences between socioeconomic groups.

The fall in infant mortality between 1995 and 2000 has been accompanied by an increase in inequity, more marked in the cities than in rural areas. In the cities the concentration index rose from –0.057 to –0.132, and in rural areas from –0.052 to –0.078 (Table 2, Figure 7). It seems that the higher socioeconomic groups, especially in urban areas, were more favored by the fall in infant mortality than the poorest groups.

Chronic malnutrition or retarded height for age fell moderately between 1995 and 2000, from 15.1% to 13.1%. Since this is a long-term indicator, no very evident changes could be expected in the short term. Despite these relatively low levels of chronic malnutrition, there are marked differences between rural and urban areas, in favor of the

latter to the extent that rural levels were 1.6 times those of the cities in 1995 and 1.8 times in 2000. In rural areas chronic malnutrition is high and remained almost constant over the five years at about 17%, while in the cities it is lower, and fell from 10.8% to 9.7%.

By contrast with the higher malnutrition of rural areas, their inequity indicator is better. Concentration is -0,244 in cities and –0.142 in rural areas in 2000. Thus, rural malnutrition is higher, but there are smaller differences between socioeconomic groups. This relative stability in chronic malnutrition has been accompanied by relative stability in inequity. The concentration curves do not move much during the period. (Figure 8)

The Colombian results for inequities in health status confirm the findings of Wagstaff (2001) in other developing countries, where improvements in the average health status have been accompanied by greater inequities. Wagstaff (2000), Wagstaff, Doorslaer and Watanabe (2201), Gwatkin et al (2000) and others measure and examine inequities in infant and child mortality and malnutrition in several developing countries and the results show the trends reflected around the world; children in the worst socioeconomic stratum tend to suffer higher rates of mortality and malnutrition than their fellows in better socioeconomic strata. The inequity index is not constant across countries, however.

Thus, most countries with low average infant mortality and malnutrition rates have the greatest difference in health between rich and poor (Wagstaff, 2001). For the few developing countries which have information on trends in health inequities, the results show that average improvements in health status are accompanied by negative trends in equity.

## 4. How inequities in infant mortality are generated: 2000

A good health status in a population (universal and equitable) is the final objective of health systems and policies. This section therefore attempts to find out mechanisms which generate the levels and inequities observed in health status, measure by infant mortality. First, the determinants must be identified and the an inference must be made of the contribution of each to inequities observed in infant mortality.

### 4.1 Determinants of infant mortality

Due to the strong link with poverty, infant mortality is one of the most popular indicators of health status within the set of representative indicators of the socioeconomic level of a country. As noted, in the case of Colombia, although infant mortality has fallen in recent decades, inequity has increased (see Section 3). It is therefore important to make a detailed analysis of the causes of this inequity.

The focus is on mortality during the first year of life (infant mortality). First, an estimate is made for a survival model to identify the main proximate and socioeconomic determinants. Second, the results of the model are related to the inequities in the most important determinants in order to infer the contribution of each of them to the inequities observed.

Following the conceptual framework of Section 2.3 above, a theoretical hierarchical model was constructed with factors potentially associated with infant mortality. (Figure 9).

The model includes factors of community and context such as region and area of residence (Level 1). Socioeconomic factors in the household (Level 2) include the education of the mother. Factors of household environment and hygiene, such as the source

of drinking water, type of sanitation and flooring material are added at Level 3. Reproductive factors in the mother (age at birth of first child, order of birth, preceding birth interval and survival of the previous child) are part of Level 4. The variable of sex is in Level 5. Perinatal factors such as the variable of weight at birth, are in Level 6; and finally the group of variables related to the care of the child (including months of breastfeeding) are in Level 7.

Since complete fertility histories are available, a duration analysis was made and a probability model for survival during the first year of life was constructed. The dependent variable is the risk of dying at each age between birth and one year, and time duration is measured in months. We use a Cox proportional risk semi-parametric model with covariates (Lelievre and Bringe, 1998; Rodriguez, 2001). Table 3 shows the results of the estimated hierarchical model indicating the effects as each new hierarchy was added.

In the first hierarchy, Model 1, variables related to the context and the community suggest that the effect of region is not significant in any of the models. This in turn suggests that the effect of macro differences between regions, due to culture or the supply of services, has no important impact on the survival probability during the first year of life. However, the sign of the coefficients by region is the expected one: living in the most backward regions with different cultural values, such as the Pacific seaboard and the Caribbean coast, increases the probability of dying in the first year of life in comparison to Bogota (base category).

The current place of residence shows the expected sign: living in a town or in a rural area increases mortality risks perhaps because health services are less available there. Living in rural areas represents twice the mortality risk of the major cities. The effect of the variable is significant in most specifications of the model, but loses significance when sanitation (model 3) and child care (model 7) are introduced. This implies that there are effects of the place of residence, especially if rural, which are channeled through factors such as sanitation, and other which are channeled through breast-feeding (child care).

In the second hierarchy (Model 2) the education of the mother is introduced as a proxy to socioeconomic level. This is a robust variable and significant in all models, and show the expected sign - years of education have a negative and increasing effect on infant mortality. Even after controlling by all other factors, there is an evident direct and significant effect of education which is not captured by succeeding factors. Thus, in Model 7, which contains all the hierarchies, the evidence is that the mortality risk falls significantly as years of education rise.

The inclusion of the third hierarchy – household sanitation – also shows the expected sign: living in unhealthy household conditions increases the risk of dying during the first year. The effect is relatively stable in models 2-6, but is significantly reduced, especially with regard to the variable of sewerage services, in model 7 when the factors of child care are introduced. The negative affects of poor sanitation are partly compensated by the effect of breastfeeding (child care). This situation also agrees with the literature on this topic.

The effects of sewerage services (type of toilette facility), adjusted by the effects of socioeconomic factors and without child care factor, show that lack of access increases mortality risks: lack of toilette facility generates 1.5 times the risk observed among children with mains sewerage systems. And the risk rises to 2.6 times without the effect of breastfeeding.

Likewise, the variable of drinking water source showed acceptable significance and robust effects. If water comes from the public supply system the mortality risk falls about

70%. This result is maintained and is not channeled through other hierarchies. Contrary to expectations, an earth floor significantly improves the chances of survival.

The interactions between sanitation and educational level suggest that the effect of each sanitation factor is greater on those with lower levels of education i.e. among the population with low levels of education, access to good sanitation have a greater impact on infant mortality than on those with higher levels of education.

The inclusion of the fourth hierarchy, reproductive factors (model 4), substantially improved the adjustment of the model. The coefficient of the age of the mother when the child is born and of the quadratic term, indicate - as suggested by the literature - that the children of younger mothers and older mothers are exposed to greater mortality risk. Studies indicate that there is a U-shaped effect of the age of the mother on the child risk of dying. In early years, the reproductive system is not sufficiently mature; and at the later ages the system is worn out and generates a higher mortality risk. The coefficient of this variable is significant in all models and is robust to the inclusion of other hierarchies, which means that there is an important and direct effect not mediated by the other variables.

The order of birth is significant in all specifications of the model, and gives the expected result: the mortality risk increases more slowly for each succeeding birth order. The effect of this variable is robust to the inclusion of variables of perinatal care and sex, but the effect of birth order loses significance and value with the inclusion of child care. This suggests that breastfeeding partly counters the negative effect of higher birth orders.

The variable of preceding birth interval turned out not to be significant although it did show the expected sign. With respect to the firstborn, the mortality risk is greater for a short interval (less than 15 months) and then falls as the interval increases (models 4-6).

However, in model 7, which includes child care (breastfeeding) the coefficients change and only a long birth interval reduces the mortality risk. This would suggest that the duration of breastfeeding is important as a control variable since short durations are associated with short birth intervals and higher infant mortality. Therefore the effect of birth interval, adjusted by the child care variable (especially breast feeding), suggests that only intervals of over 36 months reduce the risk of mortality during the first year.

The survival of the preceding child was considered, as a control variable, due to the effect it might have on the preceding birth interval. In other words, if the preceding birth interval is short because the previous child died, this could generate a spurious relationship between the length of the interval and infant mortality. Although the result is not significant, it indicates that the mortality risk is about 30% lower if the previous child is alive when the child analyzed is conceived.

The inclusion of the fifth hierarchy, the sex of the child, model 5, improves adjustment of the model at a 5% significance level. The coefficient has the expected sign: the risk of a male child dying in infancy is 1.7 times that of a female child. However, this effect diminishes when the child care factors are included. This would suggest that there is no preference for male children in terms of child care and therefore the variable is more associated with the biological differences between the sexes.

The sixth hierarchy, perinatal factors, model 6, suggests an important and significant effect of weight at birth. This variable also indirectly reflects conditions and care during pregnancy. The higher the weight at birth, which implies a healthier child at birth, the lower the probability of dying during the first year.

The inclusion of the seventh hierarchy, which includes the variables of child care, significantly improves adjustment of the model. It is the set of variables which contributes

most to explain child mortality. The effect of the variable breast-feeding[3], adjusted by the effect of previous hierarchies, is highly significant and with the expected sign: the longer the duration of breast-feeding, the lower the mortality risk.

The final model (7) in general indicates that the place of residence, the education of the mother, the access to water and sanitation, the age of the mother at the birth of the child, the order of birth, the sex of the child, birth weight and breast-feeding are the most significant determinants. Of these, sanitation (water and sewerage) has the greatest effects, and an even greater one among the less educated groups. The next most important is breast-feeding, as child care, and the variable of birth weight, an indicator of perinatal factors.

### 4.2 The implications of inequities in infant mortality

The contribution of a determinant to the inequities observed in infant mortality depends not only on its effect on mortality, but also on its inequity in itself. For example, as noted in the previous section, the previous birth interval has no significant effect on the risk of dying during the first year. Therefore, its distribution between socioeconomic groups is of no importance to equity.

This section discusses the determinants which significantly affect child mortality in order to infer their contribution to the inequality in infant mortality. However, in order to measure the impact of each determinant, it must be remembered that the interpretation of the coefficients is not direct, since the scale of coefficients varies very widely and the dependent variable was not observed (the relative rate of risk). Therefore elasticities are calculated on the basis of the parameters estimated in Table 3. In the case of categorical variables the elasticities indicate the impact of increasing the particular category by a given percentage and proportionally reducing the participation of the other categories. The elasticities obtained and the averages for each variable are shown in Table 4.

Among the statically significant variables in the model, those with greatest effect (elasticity) are the child care factors (breast-feeding), socioeconomic level (years of education of the mother) and perinatal factors (birth weight), whose elasticities are all greater than 1.

The impact of breast-feeding on infant mortality is particularly remarkable. Next, there is sanitation (water supplies, floor material). However, as mentioned, the effect of floor material is opposite to that expected. Finally, there is the variable sex of the child, a control variable, which has an important effect (elasticity) despite the fact that it is biological and cannot be controlled by social policy. The others have no statistically significant net impact.

The relevant question is therefore, how inequitably distributed in the population are these determinants, which have major effects on infant mortality? The answer will enable us to identify the main determinants through which the inequities observed in infant mortality are transmitted. Table 4 also presents the mean and two indicators of inequity (absolute differences and ratio of extremes) for each of the determinant variables used in the infant mortality model estimated in the previous section.

Breast-feeding, a variable indicative of child-care, is the determinant with the greatest impact on infant mortality. Unlike the other variables, the months of breast-feeding indicate

[3] Breast-feeding was included in the model as a time-varying variable.

inequities favorable to lower strata children; children from higher strata have a shorter duration of breast-feeding than poor children (or no breast-feeding at all).

This implies that the inequities in infant mortality are being countered, or reduced in relation to what would otherwise be observed. Thus a social policy and a health policy addressed to the poor which encourages longer duration of breast-feeding will lead to a reduction in the inequities in infant mortality.

The education of the mother is the second most important variable for infant mortality, since it has direct and indirect positive and significant effects on child survival. This variable is also highly inequitable, however, for poor children, whose mothers tend to have less schooling that those of the upper strata. This implies that the mother's lack of education contributes to the inequity observed. A policy designed to increase the educational level of low-strata mothers would have a positive impact on survival of the child and on equity.

Weight at birth, a perinatal factor, is the third most important variable. But it does not show an important inequity. This implies that although birth weight affects the rate of infant mortality, the small difference shown by socioeconomic level does not generate inequities.

Sanitation, access to water supplies and sewerage have gross effects which are significant, important and positive to survival, although only access to water supplies has a high net impact of statistical significance. However, these are highly inequitable variables, to the disadvantage of the poor. Higher socioeconomic levels usually have water supplies and the poor often have to resort to other sources (wells, tanks, rainwater, tanker truck).

At the same time, the richer groups have connections to the sewerage system, while the poor tend to have nothing, or just a latrine. Therefore, sanitation factors, especially access to water, contribute to the inequities in infant mortality. Social and health policies designed to provide water supplies and sewerage to the lower socioeconomic groups would lead to a reduction in infant mortality and inequities.

The variable place of residence (urban/rural) in the context hierarchy, showed positive and important gross effects on survival, but they were channeled through child care. Distribution by socioeconomic level indicates that this variable is highly inequitable to the poor. The upper strata tend to live in major cities while the poor are to be found largely in rural areas. This means that place of residence contributes indirectly to the inequities observed in infant mortality: better access to health services, infrastructure, transport, etc in the urban areas favors the upper socioeconomic levels.

If the elasticities calculated from model 7 are taken together to include all variables, and they are associated with the inequities observed for each variable, it can be said that the inequities in the educational level of the mother, access to water supplies and sewerage, the age of the mother at the birth of the child, the number of children and the place of residence contribute to the inequities observed in infant mortality; while the inequities in the duration of breast-feeding lead to a reduction in infant mortality inequities.

## 5. Conclusions and Policy Recommendations

Trends in health indicators for the period 1990-2000 show an important improvement in potential access (enrollment in the health system), evident from average levels and equity. Likewise, the use of maternal health services has increased and the related inequity has decreased, especially in rural areas.

Changes towards greater coverage and equity of access and use of health services by area and socioeconomic level can be associated with the effects of the health subsidy

introduced by the 1993 reform to the social security system, which help the lower strata and have received important promotion in rural areas.

The record for vaccination coverage is important. The use of full immunization services for children has declined in coverage and in equity in socioeconomic terms, across the country.

However, the analysis of each of the indicators of access to health services and health status confirms an inequity which is constant throughout the decade, in almost all cases in favor of urban areas and the higher socioeconomic groups.

A conclusion of this study is that rural zones are in a worse situation both for their results in health status and in capacity for access and use of health services. However, and although the results in health status are unfavorable to them, the differences between individuals are substantially lower than those found in urban areas, showing a greater equity within rural areas. Thus, inequity related to socioeconomic level is much more marked in urban areas even though city dwellers have a better health status.

By contrast, in terms of access to and use of health services, inequity is to the disadvantage of the rural population, with lower average cover and greater differences between individuals. Since access to health services is not defined only by their supply but also by conditions of infrastructure and transport, due to greater availability in urban areas and higher socioeconomic level, these factors are among the determinants for equity.

Also, the analysis of the indicators of health status shows that the progress made in this decade has been very modest (only observable in infant mortality) and has been accompanied by an increase in inequities, especially in the cities.

The analysis of the causes of the inequities in infant mortality (indicator of health status) shows that the number of months of breast-feeding help to counter the inequities in infant mortality, and this suggests that this favors the reduction in inequities which would otherwise be observed. The educational level of the mother, access to water supplies and sewerage (sanitation), the age of the mother at the birth of the child and the number of children are all variables which contribute to the inequities in infant mortality.

For several reasons, the findings of this project may act as a frame of reference for the design and formulation of social policies: (1) because the results of indicators analyzed suggest priorities in the improvement of the level of health; (2) because it identifies the indicators in which the inequities are most present, so that action can prioritize the most unprotected groups; (3) because it permits an evaluation of some of the results of the social security reforms in health, and proposes some corrective actions to improve levels of health and equity; and (4) because it confirms the way in which progress in this area are not the results of isolated action in the health sector, but require ongoing inter-sector work, involving at least infrastructure and education.

In the case of vaccination coverage, there should be an urgent call for strategies to recover and increase past levels achieved, both due to the risks of preventable epidemics implied by the lower coverage and the negative effects on equity.

The positive changes observed in coverage and equity by geographical zone and socioeconomic level, associated with the effects of the health subsidy brought by the 1993 health reform, call for more universal coverage. Much of the improvement observed may be attributed to the progress in enrollment which rose from 20% to 58% of the population in this decade; but further changes would be almost impossible without an increase in coverage. Until the system reaches 100% of the population, health indicators will always be marginal and inequities will increase, to the disadvantage of the poor.

The development of the basic service networks for water supplies and sewerage, basic sanitation, appropriate sanitary installations and the promotion of education addressed to the lower socioeconomic groups and the rural population, would lead directly to a reduction in infant mortality and its inequities. The following are proposed as policy actions which could be effective in reducing levels and inequities in infant mortality:

- Health campaigns address to the poorest groups to stimulate longer duration of breast-feeding;
- State effort to improve basic infrastructure and the availability of public services in less urbanized areas;
- Actions to postpone the reproductive activities of women and reduce family size in the lower socioeconomic strata.

**References**


Braveman, Paula (1998), *Monitoring Equity in Health: A Policy-Oriented Approach in Low-and Middle-Income Countries*, Geneva, WHO (Division of Analysis, Research and Assessment).

Castaño, Ramón *et al.* (2000), *Evolución de la equidad en el sistema colombiano de salud*, s. l., Final report to ECLAC.

Casterline, John; Cooksey, Elizabeth, y Fattah, Abdel (1989), "Household Income and Child Survival in Egypt", in *Demography,* vol. 26, No. 1, February, pp. 15-36.

Céspedes, Juan E.; Jaramillo, I., y Castaño, R. (2001), *Impacto de la reforma del sistema de seguridad social sobre la equidad en los servicios de salud en Colombia*, Preliminar article.

CIE, Universidad de Antioquia. (2001), *Observatorio de la seguridad social*, Medellín, Grupo de Economía de la Salud (GES), December, Year 1, No. 3.

Dachs, Norberto (2001), "Inequidades en salud. Cómo estudiarlas", in Restrepo, Helena y Málaga, Hernán (edits.), *Promoción de la salud. Cómo construir vida saludable*, s. l., Panamericana.

Evans, T. *et al.* (2001), "Introduction", en *Challenging Inequities in Health. From Ethics to Action,* s. l., Oxford University Press.

Flórez, C. E. y Nupia, O. (2001), *Inequidades en el acceso a salud. Estado de salud y utilización de los servicios de atención a la salud*, Final report to PAHO, Estudio multicéntrico, Bogotá, CEDE, Universidad de Los Andes.

Flórez C. E. y Tono, T. (2002), *Determinantes del acceso y uso de los servicios de salud y del estado de salud*, monografías 1 y 3, Final report to Fundación Corona, Bogotá, CEDE y Centro de Gestión Hospitalaria.

_____ y Nupia, O. (2001), *Tendencias en las inequidades en el acceso a los servicios de salud en la población colombiana. 1990-2000*, Monografía 1, Final report to Fundación Corona, Bogotá, CEDE y Centro de Gestión Hospitalaria.

Giedion y Acosta (1998), "Cómo reorientar el sector salud. Retos y desafíos para los próximos 4 años", en *Debates de Coyuntura Social*, No. 11, Fedesarrollo-Fundación Corona.

Goldman, Noreen (2001), "Social Inequalities in Health. Disentangling the Underlying Mechanisms", in *Annals of the New York Academy of Sciencies*, No. 954, pp. 118-139.

Gwatkin, Davidson R. *et al*. (2000), *Socioeconomic Differences in Health Nutrition, and Population in Colombia*, s. l., HNP Poverty Thematic Group of the World Bank.

Lelievre, Eva y Bringé, Arnaud (1998), "Méthodes et Savoirs No. 2", in *Practical Guide to Event History Analysis,* s. l., Institut National D'études démographiques.

Leslie, Joanne (1987), "Interactions of Malnutrition and Diarrea. A Review of Resarch", en en Price Gittinger, J.; Leslie, J., y Hoisington, C. (edits), *Food Policy. Integrating Supply, Distribution and Consumption*, s. l., EDI Series in Economic Development. The Johns Hopkins University Press.

Mackenbach, J. y Kunst, A. (1997), "Measuring the Magnitude of Socioeconomic Inequalities in Health. An Overview of Available Measures Illustrated with two Examples from Europe", in *Social Science and Medicine*, vol. 44, No. 6, pp. 757-771.

OPS (2001), *Hoja Resumen sobre desigualdades en salud,* s. d.

Oróstegui, M. (1990), "Situación de salud", en Yepes, F. (edit.), *La salud en Colombia. Estudio Sectorial de Salud*, Bogotá, Ministerio de Salud, Departamento Nacional de Planeación.

Pabón, A. (1991), *Demanda y utilización de servicios de salud. Encuesta nacional sobre conocimientos, actitudes y prácticas en salud*, Bogotá, Ministerio de Salud, Instituto Nacional de Salud.

_____; Rodríguez, E., y Rico, J. (1984), *Demanda y utilización de servicios de salud. Estudio nacional de salud*, Bogotá, Ministerio de Salud, Instituto Nacional de Salud.

Palloni, Alberto y Tienda, Marta (1986), "The Effects of Breastfeeding and Pace of Childbearing on Mortality at Early Ages", en *Demography*, vol. 23, No. 1, February, pp. 31-52.

Pebley, Anne y Stupp, Paul W. (1987), "Reproductive Patterns and Child Mortality in Guatemala", in *Demography*, vol. 24, No. 1, February, pp. 43-60.

Profamilia (2000), *Salud sexual y reproductiva en Colombia. Encuesta nacional de demografía y salud*, Bogotá.

República de Colombia, Ministerio de Salud (2000), *Guías alimentarias para los niños y niñas colombianos menores de 2 años. Bases técnicas,* Serie documentos técnicos No. 004, Bogotá.

República de Colombia, Ministerio de Salud, Instituto Colombiano de Bienestar Familiar (ICBF) (2000), *Guías alimentarias para la población colombiana mayor de 2 años. Bases técnicas,* Bogotá.

República de Colombia, Ministerio de Salud y Econometría (2001), *Evaluación y reestructuración de los procesos, estrategias y organismos públicos y privados encargados de la afiliación, pago y recaudo de aportes al sistema,* Report - manuscript.

República de Colombia, Ministerio de Salud y Ascofame (1972), *Methods and Results. Study of Human Resources for Health and Medical Education in Colombia*, Bogotá.

Rodríguez, Germán (2001), *Generalizer Linear Statistical Models,* Notes, s. l., Princeton University.

Tono, T. (2000), "Acceso a salud en Colombia. Uso de consulta médica y hospitalización en siete ciudades", in *Coyuntura Social*, No. 23, pp. 143-167.

_____ y Londoño, J. L. (2000), "Afiliación al sistema de salud. Niveles y percepciones", in *Salud sexual y reproductiva en Colombia. Encuesta nacional de demografía y salud 2000*, Bogotá, Asociación Probienestar de la Familia Colombiana, Profamilia.

Victora, C. G. *et al.* (1997), "The Role of Conceptual Frameworks in Epidemiological Analysis. A Hierarchical Approach", in *Int J Epidemiol*, No. 26, pp. 224-227.

Vivas, J. *et al.* (1998), *El sistema nacional de salud*, Bogotá, Fedesarrollo, Organización Panamericana de la Salud.

Wagstaff, Adam (2002), "Poverty and Health Sector Inequalities", Theme papers, in *Bulletin of the World Health Organization*, No. 80, pp. 97-105.

_____ (2001), *Poverty and Health*, s. l., Comission on Macroeconomic and Health Working Paper Series, Paper No. WG1.

_____ (2000), *Unpacking the Causes of Inequalities in Child Survival. The Case of Cebu, The Philippines*, s. l., The World Bank Working Paper.

_____ (1999), *Inequalities in Child Mortality in the Developing World. How Large are They? How can They be Reduced?,* s. l., Working Paper of the World Bank.

_____; Kakwani, N., y Doorslaer, E. van (1997), "Socioeconomic Inequalities in Health. Measurement, Computation and Statistical Inference", in *Journal of Econometrics*, No. 77.

Wagstaff, Adam; Doorslaer, E. van, y Watanabe, N. (2001), *On Decomposing the Causes of Health Sector Inequalities with an Application to Malnutrition Inequalities in Vietnam*, s. l., The World Bank Working Paper.

Whitehead, M. (1992), "The Concepts and Principles of Equity and Health", in *Int J Health Serv*, No. 22, pp. 430-445.

## TABLES AND FIGURES

**Figure 1. Conceptual framework for the Determinants of health status**

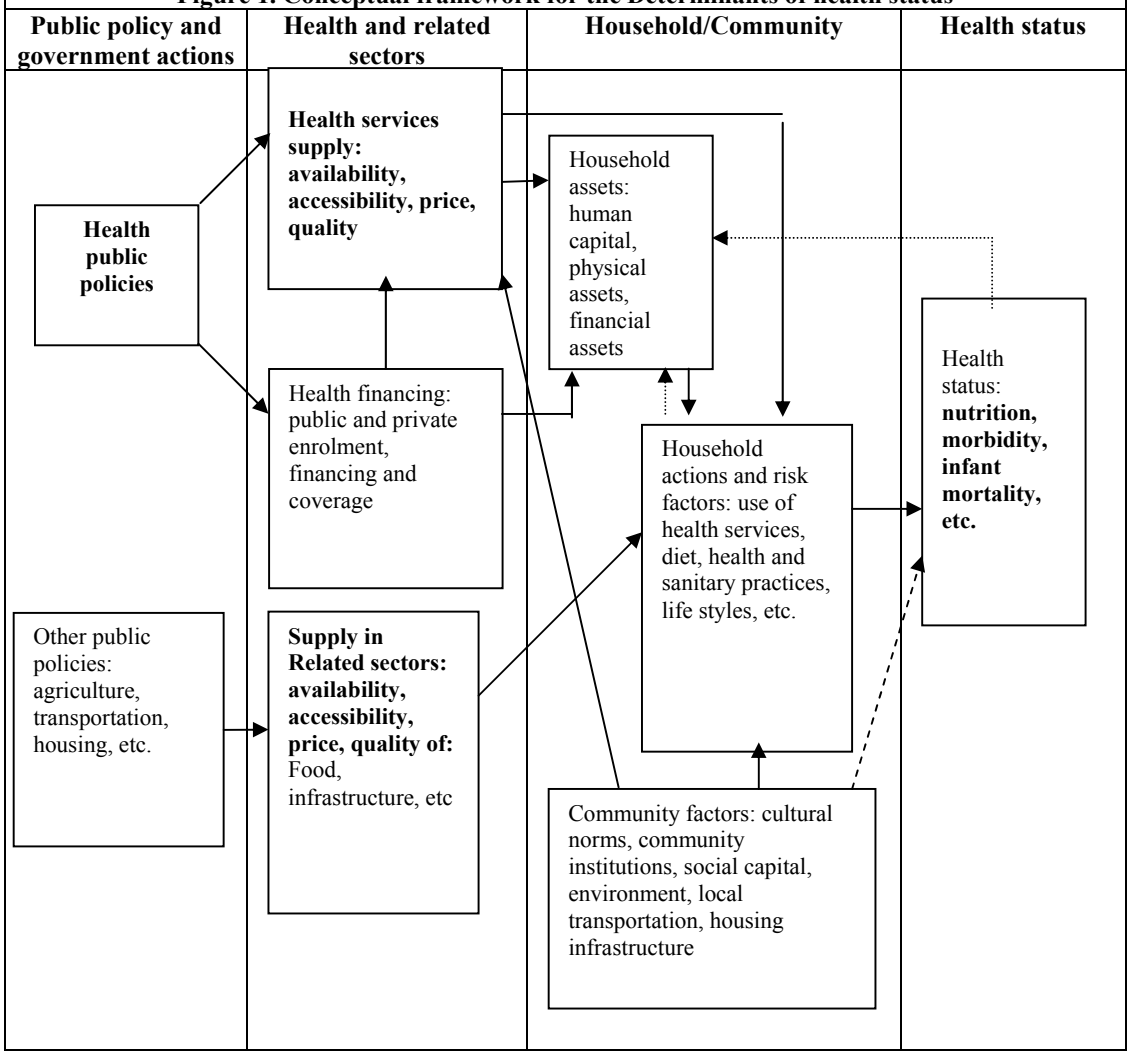

**Table 1: Health indicators by access component**

| Access component | Health variable | DHS | Category | Definition |
|---|---|---|---|---|
| Capacity | Health insurance coverage | 1995<br>2000 | yes/no | For all household members |
| Need | Illness in the last 30 days | 2000 | yes/no | For all household members |
| Use of health services | Medical assistance | 2000 | yes/no | For all household members who were ill |
| | Adequate prenatal care | 1990<br>1995<br>2000 | yes/no | >4 prenatal visits during pregnancy, for children born in the last 5 years (last child) |
| | Medical assistance at delivery | 1990<br>1995<br>2000 | yes/no | For children born in the last 12 months |
| | Complete vaccination scheme | 1990<br>1995<br>2000 | yes/no | For children aged 12 - 23 months |
| Health status | Infant mortality | 1990<br>1995<br>2000 | yes/no | Age at death for children born in the last 5 years |
| | Height for age (stunting) | 1995<br>2000 | Below/above | 2 z-scores<br>For surviving children less than 5 years-old |
| | Acute Diarrhea | 1990<br>1995<br>2000 | yes/no | For surviving children less than 5 years-old: Diarrhea |
| | Acute respiratory infection | 1990<br>1995<br>2000 | yes/no | For surviving children less than 5 years-old: |

FIGURE 2: AVERAGE LEVEL AND INEQUITIES IN HEALTH. 1990 - 2000

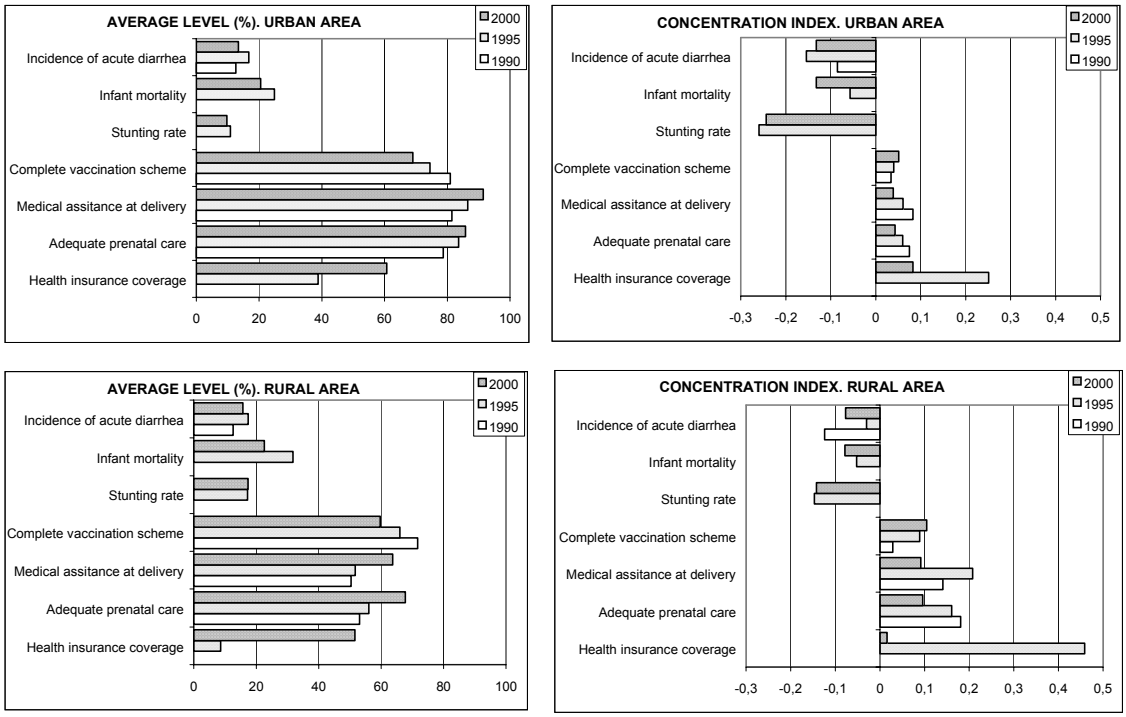


**Table 2: Trends in level and inequities in health variables by area of residence. 1990-2000**

| ACCESS COMPONENT | HEALTH VARIABLE | LEVEL (%) | | | CONCENTRATION INDEX | | |
|---|---|---|---|---|---|---|---|
| | | 1990 | 1995 | 2000 | 1990 | 1995 | 2000 |
| ***URBAN AREA*** | | | | | | | |
| Capacity | Health insurance coverage | | 38,8 | 60,7 | | 0,251 | 0,083 |
| Use of health services | Adequate prenatal care | 78,7 | 83,6 | 85,8 | 0,075 | 0,060 | 0,043 |
| | Medical assistance at delivery | 81,5 | 86,5 | 91,5 | 0,083 | 0,061 | 0,039 |
| | Complete vaccination scheme | 81,0 | 74,5 | 69,0 | 0,034 | 0,04 | 0,051 |
| Health status | Stunting rate | | 10,8 | 9,7 | | -0,260 | -0,244 |
| | Infant mortality | | 24,9 | 20,5 | | -0,057 | -0,132 |
| ***RURAL AREA*** | | | | | | | |
| Capacity | Health insurance coverage | | 8,6 | 51,6 | | 0,459 | 0,016 |
| Use of health services | Adequate prenatal care | 53,1 | 56,1 | 67,7 | 0,181 | 0,161 | 0,096 |
| | Medical assistance at delivery | 50,4 | 51,7 | 63,7 | 0,141 | 0,208 | 0,092 |
| | Complete vaccination scheme | 71,7 | 66,0 | 59,7 | 0,029 | 0,089 | 0,105 |
| Health status | Stunting rate | | 17,2 | 17,4 | | -0,147 | -0,142 |
| | Infant mortality | | 31,8 | 22,6 | | -0,052 | -0,078 |

**Figure 3: Concentration curves for health insurance coverage by area of residence**

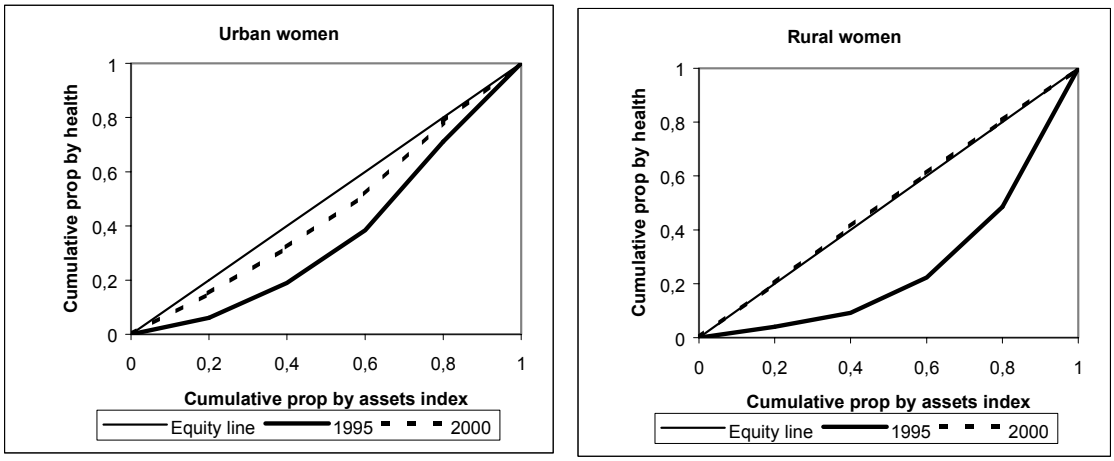


**Figure 4: Concentration curves for adequate antenatal care by area of residence**

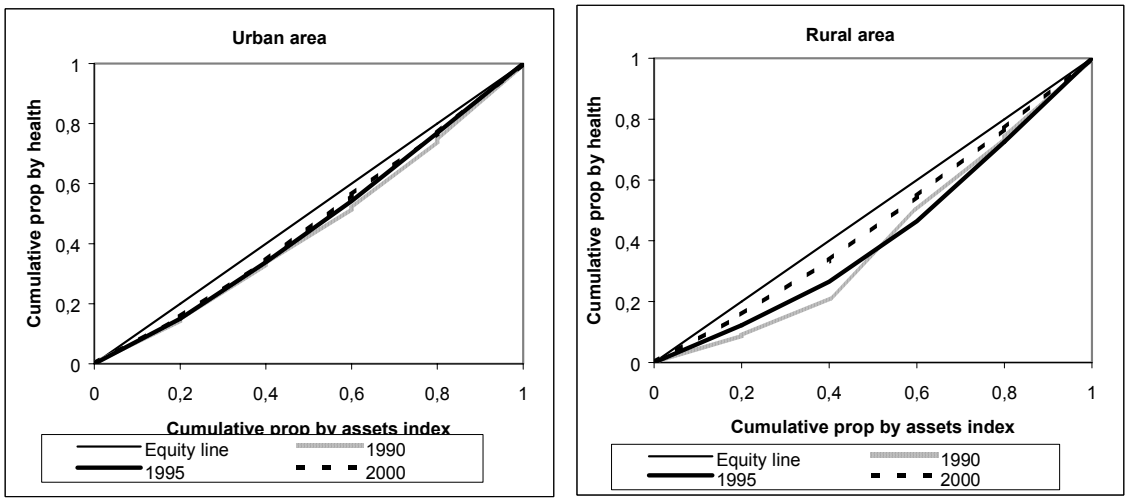

**Figure 5: Concentration curves for complete vaccination eschemes by area of residence**

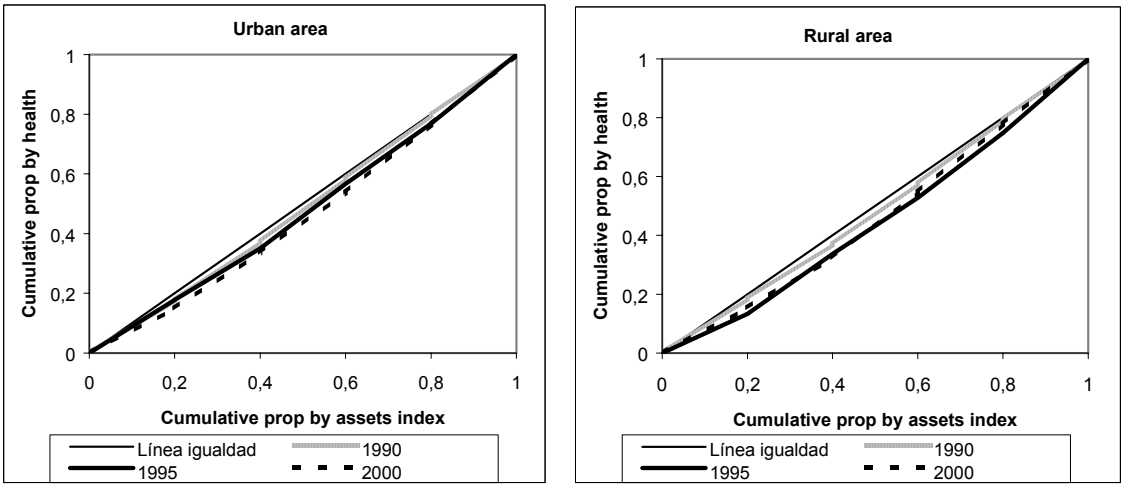


**Figure 6: Concentration curves for infant mortality by area of residence**

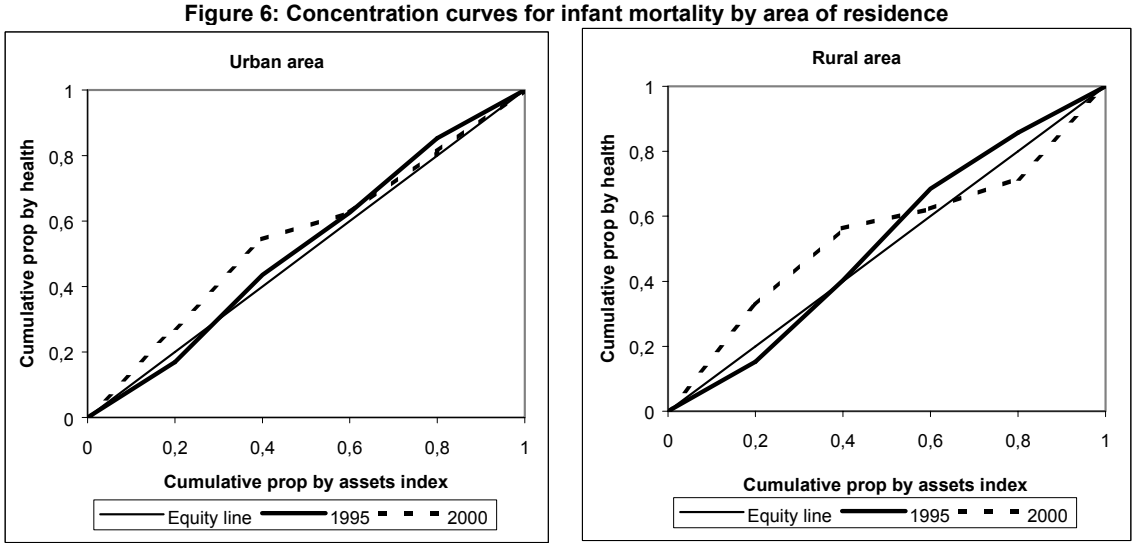

**Figure 7: Concentration curves for stunting by area of residence**

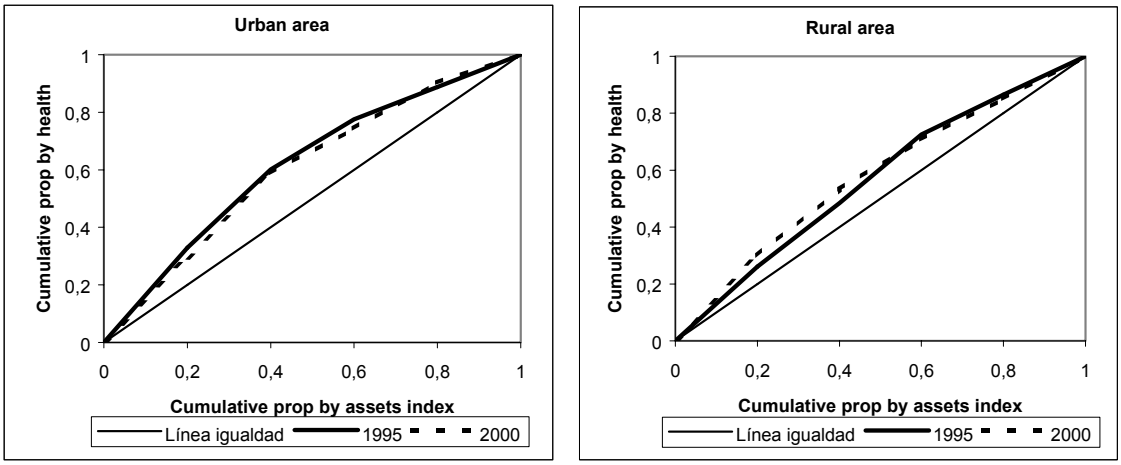


**Figure 8: Risk factor hierarchy for the survival model using infant mortality as the outcome**

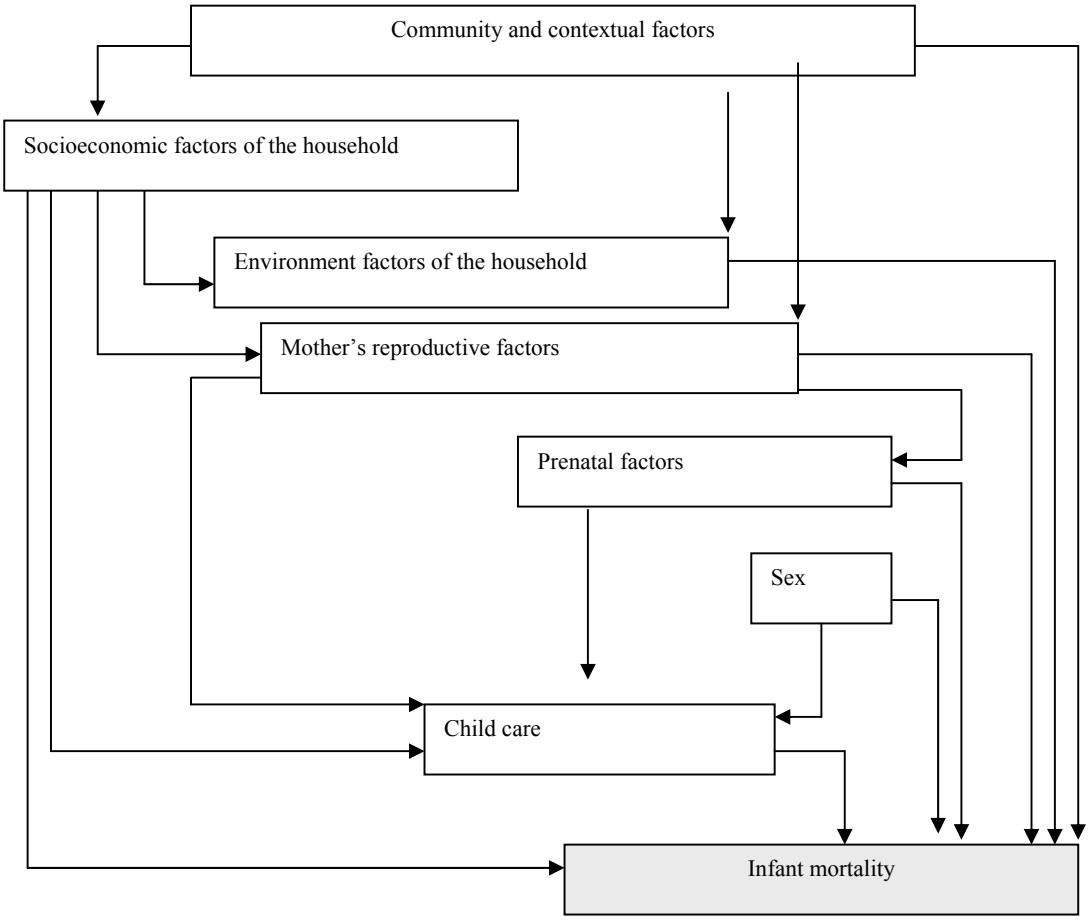

**Table 3: Estimaded relative risk from the proportional hazard Cox model for infant mortality Colombia 2000**

| Variable | Mod1 | Mod2 | Mod3 | Mod4 | Mod5 | Mod6 | Mod7 |
|---|---|---|---|---|---|---|---|
| **Level 1: Contextual factors** | | | | | | | |
| Region of residence: | | | | | | | |
| Atlántica | 0,797 | 0,793 | 0,750 | 0,788 | 0,795 | 0,897 | 1,275 |
| Oriental | 0,686 | 0,665 | 0,636 | 0,648 | 0,658 | 0,707 | 0,980 |
| Central | 0,565 | 0,541 | 0,558 | 0,568 | 0,573 | 0,622 | 0,775 |
| Pacífica | 1,025 | 0,986 | 0,971 | 1,010 | 1,007 | 1,101 | 1,672 |
| Bogotá (se omite) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Place of residence | | | | | | | |
| Capital city | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Small city | 2,015 ** | 2,021 ** | 2,017 ** | 1,976 ** | 2,016 ** | 2,049 ** | 1,537 |
| Town | 1,894 | 1,901 | 1,932 | 2,042 * | 2,080 * | 2,138 * | 1,798 |
| Rural area | 2,167 ** | 1,864 * | 1,547 | 1,619 | 1,661 | 1,619 | 1,602 |
| **Level 2: Socioeconomic level** | | | | | | | |
| Mother's education (years) | | 0,949 * | 0,799 ** | 0,802 * | 0,800 * | 0,802 * | 0,784 * |
| Square of years of education | | 0,990 | 0,985 * | 0,988 | 0,988 | 0,989 | 0,987 * |
| **Level 3: Environment factors** | | | | | | | |
| Source of drinking water: | | | | | | | |
| Aqueduct | | | 0,340 ** | 0,316 ** | 0,310 ** | 0,316 ** | 0,310 * |
| Other (base) | | | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Type of toilet facility: | | | | | | | |
| Flush toilet (base) | | | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Latrine | | | 2,798 | 2,923 | 2,748 | 2,682 | 1,470 |
| No facility | | | 2,626 ** | 2,653 ** | 2,660 ** | 2,596 ** | 1,491 |
| Earth or sand floor | | | 0,171 *** | 0,161 *** | 0,165 *** | 0,163 *** | 0,271 *** |
| Aqueduct*years education | | | 1,215 * | 1,233 * | 1,235 * | 1,224 * | 1,246 * |
| Latrine*years education | | | 0,855 | 0,857 | 0,860 | 0,866 | 0,966 |
| No facility*years education | | | 0,887 | 0,897 | 0,893 | 0,896 | 1,081 |
| Sand floor* years education | | | 1,408 *** | 1,392 *** | 1,386 *** | 1,389 *** | 1,251 *** |
| **Level 4: Reproductive factors** | | | | | | | |
| Mother's age at childbirth | | | | 0,969 | 0,968 | 0,968 | 0,973 |
| Square age | | | | 1,007 *** | 1,007 *** | 1,007 *** | 1,006 *** |
| Birth order | | | | 1,424 * | 1,442 * | 1,459 * | 1,288 |
| Square birth order | | | | 0,869 *** | 0,868 *** | 0,867 *** | 0,882 *** |
| Preceding birth interval | | | | | | | |
| First birth (base) | | | | 1,000 | 1,000 | 1,000 | 1,000 |
| Less than 15 months | | | | 1,581 | 1,522 | 1,495 | 1,435 |
| 15-23 months | | | | 0,812 | 0,787 | 0,787 | 1,377 |
| 24-35 months | | | | 0,630 | 0,634 | 0,643 | 1,144 |
| 36 months and more | | | | 0,537 | 0,530 | 0,553 | 0,846 |
| Survival previous birth | | | | 0,686 | 0,706 | 0,726 | 0,679 |
| **Level 5: Sex** | | | | | | | |
| Sex (male) | | | | | 1,643 *** | 1,701 *** | 1,608 *** |
| **Level 6: Prenatal factors** | | | | | | | |
| Weight at birth | | | | | | 0,520 *** | 0,645 *** |
| **Level 7: Child care** | | | | | | | |
| Breastfeeding (time-varying) | | | | | | | 0,365 *** |
| Log Likelihood | -845,63 | -843,06 | -834,91 | -821,079 | -818,122 | -812,2 | -621,567 |
| Wald chi2 | 8,4 | 13,7 | 36,7 *** | 78,6 *** | 83,9 *** | 114,7 *** | 317,2 *** |
| d.f. | 7 | 9 | 17 | 26 | 27 | 28 | 29 |

***p=<0.01 **p=<0.05 *p=<0.10

**Table 4: Definition, means and inequity for variables used in the Cox model of infant mortality. Colombia 2000**

| Variable | Elasticity | Mean o % in the category | (Q5-Q1) | Extrem ratio Q5/Q1 |
|---|---|---|---|---|
| **Jerarquía 1: Factores contextuales** | | | | |
| Region of residence: | | | | |
| Atlántica | 0,067 | 23,1 | -20,74 | 0,39 |
| Oriental | -0,003 | 19,9 | -2,76 | 0,88 |
| Central | -0,067 | 25,9 | 9,44 | 1,43 |
| Pacífica | 0,081 | 16,6 | -5,83 | 0,72 |
| Bogotá (se omite) | | 14,6 | 19,90 | 19900,00 |
| Place of residence | | | | |
| Capital city | | 30,6 | 48,34 | 17,55 |
| Small city | 0,101 | 23,1 | 31,17 | 6,11 |
| Town | 0,088 | 14,9 | 1,63 | 1,23 |
| Rural area | 0,148 | 31,4 | -81,13 | 0,03 |
| **Jerarquía 2: Nivel socioeconómico** | | | | |
| Años Educación de madre | -1,727 * | 7,1 | 7,10 | 2,70 |
| **Level 3: Environment factors** | | | | |
| Source of drinking water: | | | | |
| Aqueduct | -0,960 * | 82,4 | 57,89 | 2,37 |
| Other (base) | | 17,6 | -88,30 | 0,00 |
| Type of toilet facility: | | | | |
| Flush toilet (base) | | 81,2 | 58,92 | 2,43 |
| Latrine | 0,028 | 6,8 | -18,04 | 0,00 |
| No facility | 0,046 | 12,0 | -40,88 | 0,00 |
| Earth or sand floor | -1,168 *** | 12,8 | -42,78 | 0,00 |
| **Level 4: Reproductive factors** | | | | |
| Mother's age at childbirth | -0,701 | 25,9 | 1,81 | 1,07 |
| Square age | 0,248 *** | | | |
| Birth order | 0,593 | 2,4 | -1,39 | 0,54 |
| Square birth order | -0,348 ** | | | |
| Preceding birth interval | | | | |
| First birth (base) | | 37,5 | 24,90 | 1,88 |
| Less than 15 months | 0,014 | 3,5 | -3,10 | 0,30 |
| 15-23 months | 0,041 | 13,0 | -12,85 | 0,29 |
| 24-35 months | 0,018 | 14,0 | -13,01 | 0,33 |
| 36 months and more | -0,052 | 32,0 | 4,24 | 1,14 |
| Survival previous birth | -0,007 | 1,8 | -0,6 | 0,74 |
| **Level 5: Sex** | | | | |
| Sex (male) | 0,243 *** | 51,4 | 1,6 | 1,03 |
| **Level 6: Prenatal factors** | | | | |
| Weight at birth | -1,427 *** | 3,3 | 0,0 | 1,01 |
| **Level 7: Child care** | | | | |
| Breastfeeding (months) | -7,564 *** | 7,8 | -1,96 | 0,77 |

***p=<0.01 **p=<0.05 *p=<0.10