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YEARS OF LIFE EXPECTANCY LOST TO AIDS IN THE AMERICAS *

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A. INTRODUCTION

Over the past decade, health conditions have been steadily improving in the Region of the Americas, according to several average national indicators such as increased life expectancy at birth and lower mortality rates (PAHO/WHO, 2002a). By 2000, 37 of the 48 countries and territories of the Americas have exceeded a 70-year life expectancy at birth for both sexes; only Haiti has a life expectancy at birth of less than 60 years. Crude mortality has also decreased about 25% to a low of 6.9 deaths per 1,000 population compared to 1980. This progress in the Region has been associated with improvements in social, environmental, cultural, and technological factors as well as the expanded coverage of selected health care services and public health programs. At the same time, countries are also experiencing the aging of their populations, lower fertility and population growth rates, and high urbanization rates (PAHO/WHO, 2002a).

In spite of the overall improvements in the Region, there are still major health and social disparities that need to be addressed to advance Regional policies for poverty reduction and human development. The Region has the highest level of inequality in terms of per capita income distribution of any region in the world, both between and within countries. In 1990, the wealthiest 20% of the population in Latin America earned 52.4% of the Region's income, while the poorest 20% earned only 4.5%, for a ratio of 11.6:1 (Alleyne et al., 2002). These social differences are reflected by persistence of communicable diseases in deficient living conditions, including absolute poverty and progressive environmental degradation, in the least favorable health situations. At the other end of the spectrum, chronic diseases related to lifestyles, urbanization and population aging are also found in a large segment of the population (PAHO/WHO, 2002a). In those circumstances, life expectancy at birth in North America reached 76.9 years in 2000, but only 69.8 years for the subregions of Latin America and the Caribbean. Furthermore, the gap between the highest and lowest life expectancy at birth by country (79.2 years in Canada and 54.1 in Haiti) is 25.1 years. Notably, in all subregions of the Americas, women enjoy on average 6.3 years of life expectancy at birth longer than men.

In these scenarios, the Americas, and especially Latin America and the Caribbean, continue to experience a demographic transition and an epidemiological polarization of varying degrees, generating new demands for the social and health services. Childhood communicable diseases, such as measles, poliomyelitis and dehydration due to acute diarrhea have been recently controlled or eliminated as health problems in the Region; however, others, like the acquired immunodeficiency syndrome (HIV/AIDS), diabetes and injuries have emerged to take their toll on the population (PAHO/WHO, 2002a).

The health situation and trends of AIDS in the Region of the Americas is a matter of great concern among policy makers, civil society and public health workers and needs to be continuously addressed, analyzed and monitored. Traditionally, the magnitude and impact of AIDS have been assessed using mortality and incidence rates and rate ratios, respectively. However, it is sometimes difficult to translate such information to the decision-makers for priority setting, policy formulation and better program planning. This paper presents a methodological approach that analyzes the impact of AIDS mortality on the overall health of the population. In particular, this analysis provides important information about the effects of AIDS on life expectancy at birth and highlights the need to take this effect into consideration when preparing life tables and population projections. Also, since it is well known that health disparities are closely associated with the economic level of populations, it further analyzes the results according to this social determinant taking into account income level and its distribution in the population.

B. MATERIALS AND METHODS

a. Data and information sources

The health information for this analysis comes from the publication of the "Regional Health Situation Analysis" of *Health in the Americas, 2002 Edition*. The morbidity data come from the Pan American

Health Organization (PAHO/WHO), Regional Technical Program on AIDS and Sexually Transmitted Infections and from the Joint United Nations Program on HIV/AIDS (UNAIDS), that collect the data directly from the Member Countries (PAHO/WHO, 2002b, UNAIDS/WHO, 2002). Mortality events and data on underlying causes of death were extracted from PAHO/WHO's Mortality and Population Database of the Technical Information System (TIS). Each country reports its mortality data directly to the Health Analysis and Information Systems Area of PAHO/WHO, where it is validated and checked for consistency, prior to its release in the TIS. To analyze the impact of underlying causes of death on life expectancy, deaths were sorted by country. If their causes belonged to codes 279.1, 279.4-279.6 or 042-044 according to the International Classification of Diseases, 9th Revision (ICD-9) (WHO, 1978) or to codes B20-B24 according to ICD-10 they were considered as death due to AIDS (WHO, 1994). If the underlying cause codes were different, these deaths were grouped as "other causes".

The United Nations Population Division is our main source for demographic data estimates (UN, 2001, 2000). In addition, the United States Bureau of the Census International Programs Center provides estimates for countries with less than 150,000 population (US Census Bureau, 2000). Population estimates were used as denominators for calculating age- and sex-specific death rates.

Economic data to assess income level and distribution are provided by the World Bank (World Bank, 1997, 2001), the United Nations Development Program (UNDP, 2000), the Inter-American Development Bank (IADB, 1998), and the PAHO Core Health Data Initiative (PAHO/WHO, 2001).

Data were grouped and presented by subregions according to the following definition: 1) Andean Region: Bolivia, Colombia, Ecuador, Peru, and Venezuela; 2) Brazil; 3) Central American Isthmus: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama; 4) Latin Caribbean: Cuba, Dominican Republic, Haiti, and Puerto Rico; 5) Mexico; 6) Caribbean: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Dominica, French Guiana, Grenada, Guadeloupe, Guyana, Jamaica, Martinique, Montserrat, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, and U.S. Virgin Islands; 7) North America: Bermuda, Canada, and United States of America; and, 8) Southern Cone: Argentina, Chile, Paraguay, and Uruguay.

b. Procedures for Estimating and Standardizing Mortality Data

Registered mortality data in the TIS are subject to standardized procedures for data validation. This includes consistency and integrity checks as suggested by PAHO/WHO (2003). The following criteria was applied: a) Death certificates that did not specify sex, age, or cause are proportionally redistributed based on the actual frequency distributions observed in each country and period, assuming that deaths from unknown causes did not include deaths from external causes. b) The data were also adjusted by the level of under-registration and the proportion of deaths registered as ill-defined causes, using previously published correction algorithms. c) To reduce the potential instability of mortality estimates for simple calendar years, the mortality indicators used in the analysis represent annualized values estimated from information of at least three consecutive years for each five-year period and country.

Also, to account for differences in population composition when comparing countries, the direct method was used to estimate and standardize mortality rates, by age and sex using the standard population proposed by the World Health Organization for the calculations (PAHO/WHO, 2003).

c. Measurements of AIDS Impact on Life Expectancy at Birth

Since the seminal work of Dempsey (1947) in the measurement of years of life lost attributable to premature mortality, several methods to analyze changes in life expectancy over time and measures of life lost have been developed. Andreev (1982), Pollard (1982, 1988), Arriaga (1984) and Pressat (1985), among others, have focused on the discrete difference in life expectancy at two moments in time.

The Arriaga and the Pollard methods can estimate the contribution of changes in age-specific mortality rates due to specific mortality causes and changes in life expectancy. This property is very attractive for identifying losses in life expectancy in age-specific groups attributable to leading mortality causes for formulating policy and targeting specific interventions for high-risk population groups, such as children and young adults, as in the case of AIDS.

The Arriaga method takes into account the reciprocal relationship between life expectancy at birth to summarize changes in a population's mortality and vice versa. The method makes it possible to measure the specific attributable contribution that each cause (or group of causes) of death, in each age group, has on observed changes in life expectancy at birth for that age-specific group, in a defined period of time. By definition, a reduction or an increase in mortality due to a specific cause, such as AIDS, will make a positive or negative contribution to the change in life expectancy, respectively. This contribution is expressed in Years of Life Expectancy Gained (YLEG, positive and negative as would be the case), attributable to observed changes in the absolute risk of dying from that specific cause.

This partition method has three important properties: 1) it reflects that comparable changes in mortality rates at different ages have a different effect on life expectancy; 2) it offers information about the substitution of competing causes of death; 3) it gives a quantitative measure that is easily interpreted. The method is sensitive to extreme values of the base mortality level for that cause. In other words, if mortality from a cause has already achieved a very low level, its subsequent reduction will represent only a small contribution to YLEG. In contrast, if the base level is very high, any reduction will produce a large contribution to YLEG.

This analysis incorporates a measure of the mortality level from AIDS, expressed in Years of Life Expectancy Lost (YLEL). The YLEL correspond to the difference (gap) between a biologically achievable life expectancy (in this analysis estimated as 85 years of age) and the life expectancy actually achieved. This gap is partitioned in a similar manner to that described for the change in YLEG, in order to isolate the specific contributions (expressed in YLEL) of each cause of death or age-specific group (or both) to that life expectancy gap. Consequently, the contribution in YLEL of AIDS and other causes of death reflects the mortality level from those causes. In other words, the YLEL represent the potential gain in life expectancy at birth if AIDS mortality were totally eliminated (assuming no competing risks).

For analyzing the impact of AIDS mortality on life expectancy using the Arriaga method, country-specific abridged life tables were constructed (PAHO/WHO, 2002a). These tables were internally consistent with the mortality experience by country, sex, and time period, which was estimated using PAHO/WHO's TIS and based on the life tables and projections of the U.S. Bureau of the Census International Programs Center. It should be noted that life expectancy estimates, the number of survivors at exact age and the total number of person- years lived beyond exact age x functions in the mortality tables constructed for this analysis may differ slightly from those generated by the United Nations Economic Commission for Latin America and the Caribbean using five-year life tables (ECLAC, 2001).

d. Income level and distribution and inequalities

It is well known that a population's health level is determined by its economic development (PAHO/WHO, 1998, 2002a), which in turn is a reflection of the resources available for the social sectors. Income level, as measured by the country's per capita gross national product (GNP per capita), is usually the indicator of choice for economic assessments. This monetary value of the GNP per capita in United States dollars is adjusted for Purchasing Power Parity (ppp) to allow for comparisons (World Bank, 2001).

Income distribution may be evaluated from the 20% Highest/20% Lowest Income Ratio or the Gini coefficient (PAHO/WHO, 2002a). These two indicators are numerical expressions of income equity level distribution in a specific population. In a perfect equity income distribution situation, each individual would have the same share or portion of income. The 20% Highest/20% Lowest Income ratio is the quotient of extreme income distribution quintiles in a population, and defines the magnitude of the gap

that separates the wealthiest 20% from the poorest 20% of the population. Theoretically, this indicator can have values between 1 (perfect equality) and +∞ (complete inequality, as the poorest income tends to 0).

The actual income distribution is usually represented by a cumulative curve (Lorenz curve), which indicates the percentage of total income that corresponds to each population percentage, ordered by income level (Castillo-Salgado et al., 2001). The perfect equity distribution is represented by a diagonal line, where for each percentage of the total income there is a similar share of the percentage of population. In the case of the Americas, the Lorenz curve shows the income distribution inequalities, where the poorest 20% of the population (the poorest quintile) has less than 5% of the total income; in contrast, more than 45% of the total income is concentrated in the wealthiest quintile. The Gini coefficient corresponds to the area between the Lorenz curve and the diagonal line of equality, expressed as a proportion (or percentage) of the total area located beyond that line of equality. Theoretically, this indicator can have values between 0 (perfect equality) and 1 (or 100) (complete inequality).

One important observation regarding income distribution indicators is that the 20% Highest/20% Lowest Income ratio and the Gini coefficient generate highly correlated results and, therefore, both are valid indicators of the income gap. This permits the use of different sources of information to estimate values using regression analysis when some of them are missing.

In this analysis, a country's socioeconomic status has been defined in terms of both components: **income level** and **income gap**. Countries with low income levels do not necessarily have wide income gap, while countries with high income levels do not always have narrow gaps (PAHO/WHO, 2002b). The magnitude of one variable does not explain the other; they are complementary attributes. Thus, a more comprehensive representation of this socioeconomic health determinant will be achieved by considering both attributes simultaneously. To classify countries based on their income level and income gap into four clusters, the median values are used here as cut-off points.

C. RESULTS

1. Characterization of the AIDS Epidemic in the Americas

e. Current HIV/AIDS/ Morbidity Situation in the Americas

AIDS morbidity indicators by subregion of the Americas and year are summarized in Table I. As it may be observed, the epidemic of human immunodeficiency virus infection and AIDS (HIV/AIDS) in the Americas remains at a high level (PAHO/WHO, 2002b). Up to 2002, approximately 1.2 million cumulative cases of AIDS in the Region and 70 thousand new cases for 2001 were reported: 811,497 cumulative and 42,568 new cases correspond to North America, 390,650 and 26,194 to Latin America, and 19,338 and 1,789 to the Caribbean, respectively. From the total cumulative cases in the Americas, 22,667 are pediatric (<15 years old), equivalent to 1.89%. Regarding HIV in the Region, it is estimated that approximately 2.5 million people were infected in late 1999: around 900,000 in North America, approximately 1.3 million in Latin America, some 360,000 in the Caribbean (PAHO/WHO, 2002b). However, differences are evident in the speed of the epidemic and its transmission trends. The relative increase in the number of new infections between 1995 and 2000 is higher in the Caribbean (16%), followed by Latin America (10%) and North America (5%) (PAHO/WHO, 2002c). In some countries like Brazil, the availability of antiretrovirals to all HIV-infected persons, regardless of their ability to pay, is expected to have an important beneficial effect on the AIDS morbidity trends in the coming years.

Regarding AIDS prevalence, the Caribbean is the second most affected region on the World, with an estimated 2.4% of the adult population, after Sub-Saharan Africa (8.8%) (UNAIDS/WHO, 2002). The countries with the highest prevalence rates in adults are Haiti (estimated >6%) and Bahamas (3.5%). At the other extreme, Bolivia and Ecuador have the lowest prevalence of less than 0.3%, at the moment.

Twelve countries in the Americas (including Dominican Republic, Haiti, Suriname, Guyana in the Caribbean, and Belize and Honduras in Central America) have an estimated HIV prevalence of 1% or more among pregnant women (data not shown).

PAHO/WHO and UNAIDS estimate that 600 to 700 new HIV infections occur in the Region of the Americas every day (PAHO/WHO, 2002b). The number of adults and children living with HIV/AIDS in the Americas represents 7% of the World total and the number of adults and children newly infected with HIV is 5% of the World total.

f. Current AIDS Mortality Situation in the Americas

Since the beginning of the epidemic until 2001, AIDS has taken the life of 653,825 people in the Region of the Americas (Table I) (PAHO/WHO, 2002b), representing 21% of the total number of deaths over the World due to this syndrome (estimated as 3.1 millions deaths). More recent estimates of the average number of deaths in the Region for the last available years (1990-2002 period) indicate that around 42,230 deaths have occurred yearly (Table II). This total does not include: Aruba, Bolivia, French Guiana, Guatemala, Honduras, Jamaica, Martinique, Montserrat, Netherlands Antilles, and Suriname, countries where no data for mortality is available. The distribution of AIDS deaths by subregion shows that an estimated 15,467 average annual deaths occurred in North America (37%), 25,834 (61%) in Latin America, and 929 (2%) in the Caribbean. The countries with the highest average number of annual deaths due to AIDS for that period are the United States (14,915 deaths), Brazil (12,622), and Mexico (4,171).

Country AIDS-specific estimated mortality rates for the 1990-2000 period are also shown in Table II. The average mortality rate due to AIDS in the Region is 6.4 per 100,000 population. A disaggregation by subregions shows a rate of 5.0 per 100,000 population for North America, 7.3 per 100,000 for Latin America, and 29.7 per 100,000 for the Caribbean (subregional average rates were weighted by population size, and are used throughout the this paper unless otherwise indicated). The countries with the highest age-adjusted mortality rates (AMR) are Haiti with 105.9 deaths per 100,000 population, (118.9 for males and 93.9 for females), Bahamas with 93.7 per 100,000 (121.4 and 68.6 for males and females) and Turks and Caicos Islands with 53.5 per 100,000 population (43.2 among males and 62.4 among females). In spite of having the highest average number of annual deaths due to AIDS for that period, mortality rates in the United States (AMR of 4.6), Brazil (10.6), and Mexico (5.1) are considerably lower than those in other countries with smaller populations.

According to age groups, the worst situation regarding the risk of dying from AIDS in the Region occurs in the population group between 25 to 44 years of age, with an estimated average AMR of 14.2 deaths per 100.000 (Table III). Subregionally, the highest mortality rate of 69.5 is observed in the Caribbean (the highest country rate being in Bahamas with 206.4), followed by Brazil with 26.9, the Latin Caribbean with 19.83 (the highest being Haiti with 170.3) and Central America with 15.6 (with the highest rate of 36.0 in Panama. It should be mentioned, however, that in this subregion there is evidence that a higher mortality occurs in Honduras although the data was not available). Regarding deaths among children less than one year of age, the average mortality rate in the Americas Region is 3.7 per 100,000 population. The Caribbean presents the worst situation with 28.6 deaths per 100.000 (highest rate of 64.3 in the Bahamas), followed by the Latin Caribbean with 16.7 (highest rate in Haiti with 238.0), Brazil with 12.0, and Central America with 6.3 (highest rate of 15.7 in Panama).

The above information on age and sex AIDS mortality distribution confirms that there are several different epidemic patterns in the countries of the Americas. Those patterns have been associated with varying risk factors including sexual behavior, intravenous drug use, accessibility to blood screening services and to drug treatment (PAHO/WHO, 2002b). These are also associated with other health macrodeterminants such as socioeconomic factors.

g. General description of changes in life expectancy due to AIDS in the Americas

For the specific case of this analysis 29 countries of the Americas were selected (which together account for around 90% of the Region's population and 90% of its estimated deaths for 2001), based on data availability for the study period. Table IV shows the data years available during the 1990-2002 period in each country included in the analysis, their observed life expectancy at birth, the years of life expectancy lost (YLEL) by countries from overall causes of death and from AIDS mortality, and the proportion that they represent from the total YLEL.

Estimated life expectancy at birth is highest in Canada (79.5 years) and lowest in Haiti (57.3 years), the difference between them being around 22 years. Considering the losses in life expectancy due to all causes of death (assuming a life expectancy at birth of 85 years), the corresponding figures were 5.5 and 27.7 for total YLEL for Canada and Haiti, respectively, indicating the largest disparities.

The distribution pattern of YLEL by age in the Region of the Americas shows a bimodal curve with peaks in early childhood and later in life among the elders (Figure I). Among infants (less than one year of age), YLEL are highest accounting for almost 2 years, descending sharply during early adolescence to less than 0.25 YLEL. Thereafter, the slope of increase continuously rises up to 1.5 YLEL when reaching 60-70 years of age. Although the pattern for the Region represents a mixture of countries, the sharp decrease in childhood has been generally attributed to the success of immunization and oral-rehydration therapy programs and overall improvements in living conditions (PAHO/WHO, 2002a), while the increase later in life is associated with chronic and degenerative processes stemming from changing life-styles and behaviors.

The impact of AIDS mortality on life expectancy, as measured by YLEL, by country (Table IV) shows that the most affected counties are not necessarily those with the lowest life expectancy at birth. Such is the case of the Bahamas, the country with the highest AIDS mortality toll with 2.8 YLEL, where YLEL to AIDS are almost one fourth (24%) of the overall YLEL. Other countries with more than 1 YLEL include Haiti (1.67) Saint Vincent and the Grenadines (1.32) and Barbados (1.12), all of them in islands of the Caribbean. In contrast other countries with high life expectancy at birth and low YLEL due to AIDS mortality involve Saint Lucia (0.02), Canada (0.04), Cuba (0.04) and Chile (0.09). Others with low life expectancy at birth and low YLEL from AIDS mortality include Nicaragua (0.03) and Ecuador (0.07). The proportion of YLEL from AIDS is also important in Barbados (10%), Saint Vincent and the Grenadines (8%), Puerto Rico (6%) and Haiti (6%). These findings suggest that the epidemic has been in place for a longer period of time and that adoption of preventive measures has not been successful in the most affected countries. The impact and relative importance of AIDS should assist in the definition of priorities for this health problem.

In contrast to the overall cause mortality, the pattern of the impact of AIDS on life expectancy shows a different bimodal curve distribution (Figure II). In this case, there is a small peak in the childhood period (up to 10 years of age), with a steep slope of increase until young adulthood (before 40 years of age). The largest magnitude of YLEL due to AIDS mortality in this age group represents around 0.1 YLEL, compared to the overall cause mortality impact for that age group around 0.6, meaning that nearly 17% of the YLEL among young adults are from AIDS. This helps to put into perspective the relative importance of the AIDS problem. Early in childhood, AIDS mortality is associated with vertical transmission from HIV-infected mothers to off-springs, while in adulthood the AIDS mortality impact is associated with sexual behaviors and intravenous drug-use with needle-sharing (PAHO/WHO, 2002a, 2002b).

h. Changes in life expectancy due to AIDS in the Americas by socioeconomic groups

Income level and distribution were used to identify four clusters of countries, using the median values of the GNP per capita for income level and the 20% Highest/ 20% Lowest Income ratio for income distribution as cut-off points (Figure III). The GNP per capita varied from a low of less than $2,000 in Cuba to a high of near $40,000 in the United States, representing a 20-fold difference. In turn, the 20% Highest/ 20% Lowest Income ratio varied from 5 in Cuba to 45 in Colombia, a disparity 9 times larger in the latter country. The median calculated values were US$5,515 and 14.2 for the GNP per capita and the 20% Highest/ 20% Lowest Income ratio for income level and distribution, respectively. As may be seen from the graph distribution most countries are clearly classified (Figure III); however, there are a number of countries that are in the margins of the cut-off points and, thus, could confound the interpretation of results if they were missclassified. Table IV shows the clusters of countries with Low Income/Narrow Gap (LN), the Low Income/Wide Gap (LW), the High Income/Narrow Gap (HN) and the High Income/Wide Gap (HW) groups.

The distributions of YLEL due to AIDS mortality by country socioeconomic cluster according to age and sex showed a similar pattern to the one observed for the Region as a whole (Figure IV). However, there are some important distinguishable features between them. Low-income countries tend to have lower YLEL due to AIDS mortality overall, particularly among women. Among high income clusters, countries that have a more equitable distribution of income (i.e. narrow gap), tend to also have lower YLEL from AIDS mortality and the peak of age tends to be later in life (35-39 years vs. 30-34 years of age) than in the wider gap group. Similar findings have been observed with other health indicators in association with the level and distribution of income (PAHO/WHO, 2002a). This may also suggest that intervention and investment health policies and programs have to be adjusted to respond to this polarized epidemiological pattern.

D. DISCUSSION

The mortality analysis of the impact of causes of death in populations to identify public health policies and targets is an excellent tool for use by the local and national level authorities. This paper presents a simple and more-specific methodological approach to assess the impact of AIDS on life expectancy at birth. Results have shown that AIDS is an important health problem in the Region of the Americas. It affects dramatically the life expectancy of certain populations, especially in countries of the Caribbean. This trend must be reverted to avoid further decreases in life expectancy in the future. This analysis also showed major disparities in the impact of AIDS according to age groups, gender, and socioeconomic status.

It is important to highlight that this powerful analysis may be carried out at the country level using routinely collected data, including vital statistics and socioeconomic and demographic indicators. It is also important to bear in mind factors such as under-diagnosis, and under- and delayed reporting may affect the accuracy and completeness of the analysis. These factors should be considered when analyzing the data.

The methodology described by Arriaga has several advantages. It is simple, requiring only mortality and population data, usually available at the local and regional levels. It allows for a description of the mortality patterns and relative importance of causes of death, either as individual diseases (as in the present case) or from a larger list of priority diseases. In addition, it is very informative about the effects of mortality and for orienting target health interventions. The Arriaga method is appealing because the procedures for calculation are straightforward and can be carried out using a simple spreadsheet, knowledge that is readily available in most places. PAHO/WHO is collaborating with the Direccion de Xeral de Saude of the Xunta de Galicia, Spain, to develop a computer tool, EpiDat 3.0, that will include a

routine for the calculations of YLEL; this software will be released in Spanish in October and shortly thereafter in other languages.

Other alternative approaches to assess the effect of mortality on life expectancy are also available. Keyfitz (1977) derived a formula that relates the time-derivative of life expectancy to the entropy of the life table survivorship. Other authors have followed the proposal by Sanders (1964) of combining population health state prevalence data with mortality data in a life table to generate estimates of expected years of life in various health states (Sullivan 1966, 1971). More recently, Murray, Salomon and Mathers (WHO, 2003) have developed a typology for summary measures of population health based on their relation with a survivorship curve, divided into two families: a) *Health Expectancies, which* are measures of the life expectancy at birth taking into account (adjusted by) the years lived in health states worse than full health, and b) *Health Gaps, which* quantify the difference between the actual health of a population and some stated norm or goal for population health. This norm or goal could be expressed as a constant value or as a counterfactual survivorship curve.

The use of the Arriaga method in health situation analysis is gaining momentum as a tool to assist epidemiologists and decision-makers at the local and national levels to use available valid data for health policy formulation and program planning, particularly to address important health problems such as AIDS, as documented in this analysis.

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Table I. Summary of main AIDS indicators by subregions of the Americas, 1999-2002

	No. of reported AIDS cases by year				Cumulative No.		Incidence and distribution by sex and age**				
SUBREGION	**1999**	**2000***	**2001***	**Unknown**	**Cases**	**Deaths**	**Both**	**Men**	**Women**	**Male-Female Ratio**	**Pediatric cases (%)**
REGIONAL TOTAL	81,618	68,762	27,675	5,301	1,202,147	653,825	111.8	167.3	54.0	3.1	1.89
NORTH AMERICA	46,609	42,568	18,780	7	811,497	470,496	173.4	272.8	77.0	3.5	…
LATIN AMERICA	35,009	26,194	8,895	5,294	390,650	183,329	73.2	101.7	39.5	2.6	3.54
MEXICO	3,919	2,489	837		51,017	28,283	41.3	35.3	6.0	5.9	2.39
CENTRAL AMERICA	3,368	2,538	2,279	238	28,614	7,283	86.2	29.4	15.9	1.8	4.24
ANDEAN AREA	2,168	1,349	1,024	3,005	32,273	14,276	20.4	28.6	6.5	4.4	2.47
BRAZIL	20,009	15,013	3,024		215,810	105,595	127.9	88.2	39.7	2.2	3.53
SOUTHERN CONE	2,599	2,329	971	139	26,986	8,546	47.3	73.8	21.0	3.5	5.71
LATIN CARIBBEAN	671	687	628	867	16,612	8,526	47.3	29.4	15.9	1.8	2.43
CARIBBEAN	2,275	1,789	132	1,045	19,338	10,820	248.1	287.3	172.5	1.7	5.34

a) Total number of cases and deaths reported by Puerto Rico has not been included in the Latin Caribbean totals.
(b) Total number of cases and deaths of United States of America includes data from Puerto Rico and The Virgin Islands (USA).
(c) The increase of cases in the Latin Caribbean is a consequence of the inclusion of the reported cases for Haiti from the period of 1993-1997 in the 1998 report.
** Incidence = cases per one million population for 2001.
* Data are provisional due to delayed reporting.
… Data not available
SOURCE: Pan American Health Organization. AIDS Surveillance in the Americas, Biannual Report, June 2002. http://www.paho.org

Table II. Average number of AIDS deaths, population, AIDS-specific estimated and age-adjusted mortality rates per 100,000 population by selected country and subregion of the Americas, around 1990-2002 (estimates based on last available years).

COUNTRY/SUBREGION	Years	No. deaths	Population	Estimated rate	Age-adjusted rate
REGIONAL TOTAL		**42,230**	**663,557,409**	**6.4**	
NORTH AMERICA		**15,467**	**306,612,888**	**5.0**	
Bermuda	1992-1994	28	58,947	47.5	36.5
Canada	1997-1999	514	30,235,294	1.7	1.4
United States	1997-1999	14,915	276,203,704	5.4	4.6
Virgin Islands (USA)	1997-1999	10	114,943	8.7	8.5
LATIN AMERICA		**25,834**	**353,820,174**	**7.3**	
MEXICO	**1998-2000**	**4,174**	**83,480,000**	**5.0**	**5.1**
CENTRAL AMERICA		**942**	**12,511,839**	**7.5**	
Belize	1996-1998	19	215,909	8.8	10.2
Costa Rica	1999-2001	124	3,875,000	3.2	3.2
El Salvador	1997-1999	320	4,000,000	8.0	8.2
Nicaragua	1998-2000	23	2,300,000	1.0	1
Panama	1998-2000	456	2,120,930	21.5	18.8
ANDEAN AREA		**3,659**	**71,960,478**	**5.1**	
Colombia	1996-1998	1,463	29,260,000	5.0	4.6
Ecuador	1998-2000	219	8,111,111	2.7	2.4
Peru	1999,2000	758	11,147,059	6.8	6.3
Venezuela	1998-2000	1,219	23,442,308	5.2	5.3
BRAZIL	**1996-1998**	**12,622**	**113,711,712**	**11.1**	**10.6**
SOUTHERN CONE		**2,401**	**52,394,048**	**4.6**	
Argentina	1997	1,829	32,660,714	5.6	5.2
Chile	1997-1999	422	14,066,667	3.0	2.9
Paraguay	1994-1995	24	2,666,667	0.9	1
Uruguay	1996,99,00	126	3,000,000	4.2	4.2
LATIN CARIBBEAN		**2,036**	**19,762,098**	**10.3**	
Cuba	1998-2000	122	11,090,909	1.1	1
Dominican Republic	1996-1998	808	4,488,889	18.0	16.6
Haiti	1997,1999	383	336,555	113.8	105.9
Puerto Rico	1997-1999	723	3,845,745	18.8	17.4
CARIBBEAN		**929**	**3,124,347**	**29.7**	
Anguilla	1993-1995	0	11,846	0	0
Antigua and Barbuda	1993-1995	8	65,574	12.2	11.8
Bahamas	1995-1997	274	287,815	95.2	93.7
Barbados	1993-1995	91	262,248	34.7	33.3
Cayman Islands	1998-2000	1	37,037	2.7	2.8
Dominica	1992-1993	6	72,289	8.3	10
Grenada	1994-1996	6	92,308	6.5	8.4
Guyana	1994-1996	195	741,445	26.3	26.5
Saint Kitts an Nevis	1994-1996	5	39,370	12.7	16.7
Saint Lucia	1993-1995	1	100,000	1.0	1
Saint Vincent	1997-1999	39	111,748	34.9	40.4
Trinidad and Tobago	1994,95,98	293	1,268,398	23.1	22.7
Turks and Caicos Is.	1998-2000	9	17,544	51.3	53.5
Virgin Islands (UK)	1996-1998	1	28,571	3.5	3.4

SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.

Table III. Estimated age-specific mortality rates due to AIDS per 100,000 population by selected country and subregion of the Americas, around 1990-2002 (estimates based on last available years).

COUNTRY/SUBREGION	Total	<1 yr.	25-44	45-64
REGIONAL TOTAL		**3.7**	**14.2**	**7.6**
NORTH AMERICA		**0.4**	**10.4**	**7.2**
Bermuda	36.5	0.0	109.9	39.5
Canada	1.4	0.3	3.6	2.0
United States	4.6	0.4	11.1	7.8
Virgin Islands (USA)	8.5	0.0	21.6	13.7
LATIN AMERICA		**6.5**	**17.3**	**7.9**
MEXICO	**5.1**	**2.3**	**12.2**	**6.5**
CENTRAL AMERICA		**6.3**	**15.7**	**12.6**
Belize	10.2	11.2	21.2	13.3
Costa Rica	3.2	1.4	6.8	6.2
El Salvador	8.2	5.8	17.5	11.6
Nicaragua	1	0.0	2.4	1.1
Panama	18.8	14.7	36.0	36.0
ANDEAN AREA		**3.1**	**11.5**	**6.0**
Colombia	4.6	2.8	10.9	5.9
Ecuador	2.4	3.8	5.6	2.9
Peru	6.3	4.8	14.2	8.2
Venezuela	5.3	2.8	13.2	6.1
BRAZIL	**10.6**	**12.0**	**26.9**	**11.4**
SOUTHERN CONE		**4.8**	**11.5**	**3.5**
Argentina	5.2	6.4	14.2	3.3
Chile	2.9	1.0	7.1	4.0
Paraguay	1	0.0	2.6	1.1
Uruguay	4.2	3.3	10.9	4.5
LATIN CARIBBEAN		**16.6**	**19.8**	**10.3**
Cuba	1	0.9	2.3	0.6
Dominican Republic	16.6	26.1	32.9	22.8
Haiti	105.9	238.0	170.3	195.7
Puerto Rico	17.4	1.7	44.7	25.3
CARIBBEAN		**28.6**	**69.5**	**47.0**
Anguilla	0	0.0	0.0	0.0
Antigua and Barbuda	11.8	0.0	25.6	17.7
Bahamas	93.7	64.3	206.4	155.5
Barbados	33.3	55.0	64.2	62.0
Cayman Islands	2.8	0.0	0.0	0.0
Dominica	10	0.0	13.7	29.7
Grenada	8.4	0.0	20.1	8.8
Guyana	26.5	9.4	62.8	33.4
Saint Kitts an Nevis	16.7	0.0	26.9	50.9
Saint Lucia	1	0.0	0.0	0.0
Saint Vincent	40.4	45.5	82.9	62.0
Trinidad and Tobago	22.7	31.4	49.5	31.1
Turks and Caicos Is.	53.5	0.0	87.2	58.4
Virgin Islands (UK)	3.4	0.0	0.0	0.0

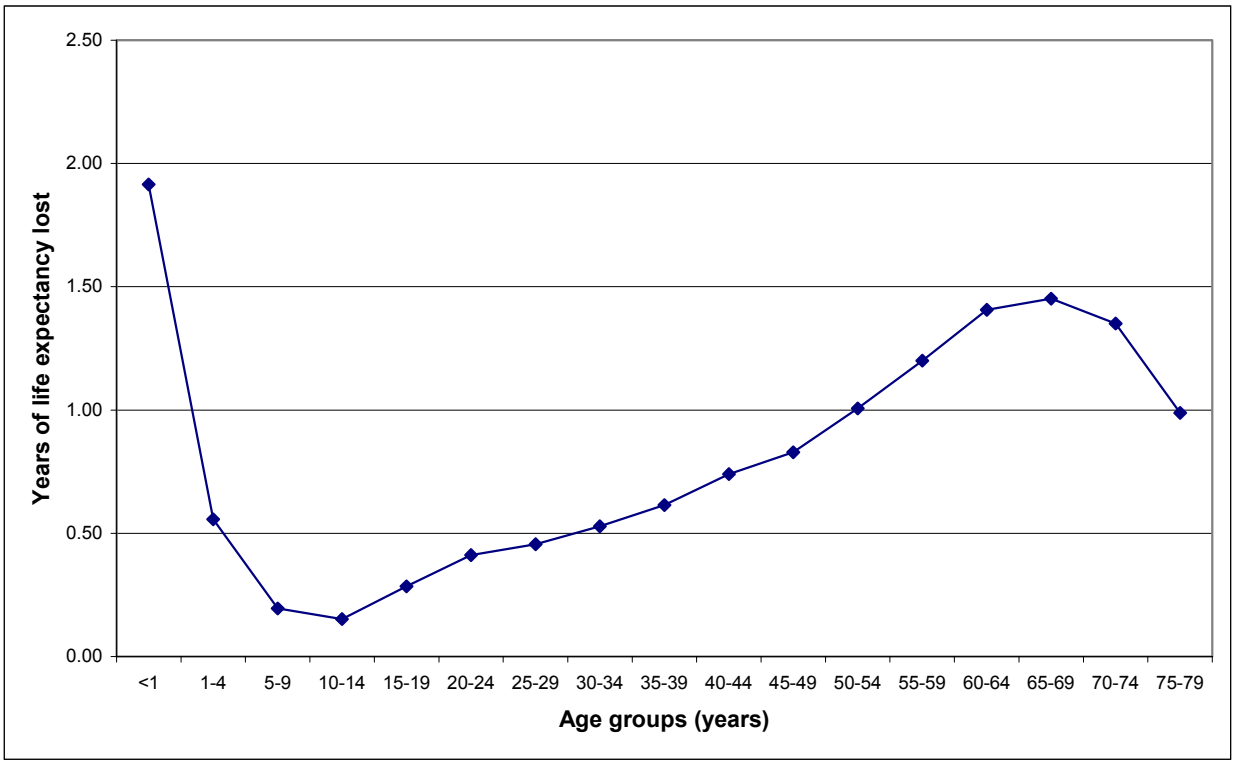
SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.

Table IV. Life expectancy at birth, overall years of life expectancy lost (YLEL) and lost to AIDS and proportion of YLEL in selected income level and distribution gap country clusters of the Americas, around the 1990-2002 period.

Country cluster	Period	Life expectancy at birth	Years of life expectancy lost	Total YLEL due to AIDS	Proportion YLEL due to AIDS (%)
Low income/Narrow gap					
Belize	1998-2000	68.2	16.8	0.70	4
Cuba	1999-2001	76.0	9.0	0.04	0
Guyana	1994-1996	66.8	18.2	0.86	5
Peru	1999,2000	68.3	16.7	0.17	1
Saint Lucia	1993-1995	70.3	14.7	0.02	0
Saint Vincent & Grenadines	1997-1999	69.0	16.0	1.32	8
Low income/Wide gap					
Ecuador	1998-2000	69.8	15.2	0.07	8
El Salvador	1997-1999	69.5	15.5	0.22	1
Haiti	'1997,1999	57.3	27.7	1.67	6
Nicaragua	1998-2000	68.2	16.8	0.03	0
Panama	1998-2000	74.0	11.0	0.56	5
Paraguay	1998-2000	69.7	15.3	0.05	0
High income/Narrow gap					
Argentina	1999-2001	73.2	11.8	0.14	1
Bahamas	1997, 1999, 2000	73.3	11.7	2.80	24
Barbados	1993-1995	73.7	11.3	1.12	10
Canada	1998-2000	79.5	5.5	0.04	1
Dominican Rep.	1996-1998	70.9	14.1	0.46	3
Granada	1994-1996	73.0	12.0	0.35	3
Puerto Rico	1998-2000	75.9	9.1	0.52	6
San Kitts & Nevis	1994,1995	69.3	15.7	0.60	4
Trinidad & Tobago	1994,95,98	70.0	15.0	0.76	5
United States of America	1998-2000	77.1	7.9	0.14	2
Uruguay	1998-2000	74.3	10.7	0.12	1
High income/Wide gap					
Brasil	1998-2000	67.9	17.1	0.25	1
Chile	1997-1999	75.3	9.7	0.09	1
Colombia	1997-1999	70.7	14.3	0.15	1
Costa Rica	2000-2002	77.3	7.7	0.10	1
México	1999-2001	72.5	12.5	0.17	1
Venezuela	1998-2000	73.7	11.3	0.17	2

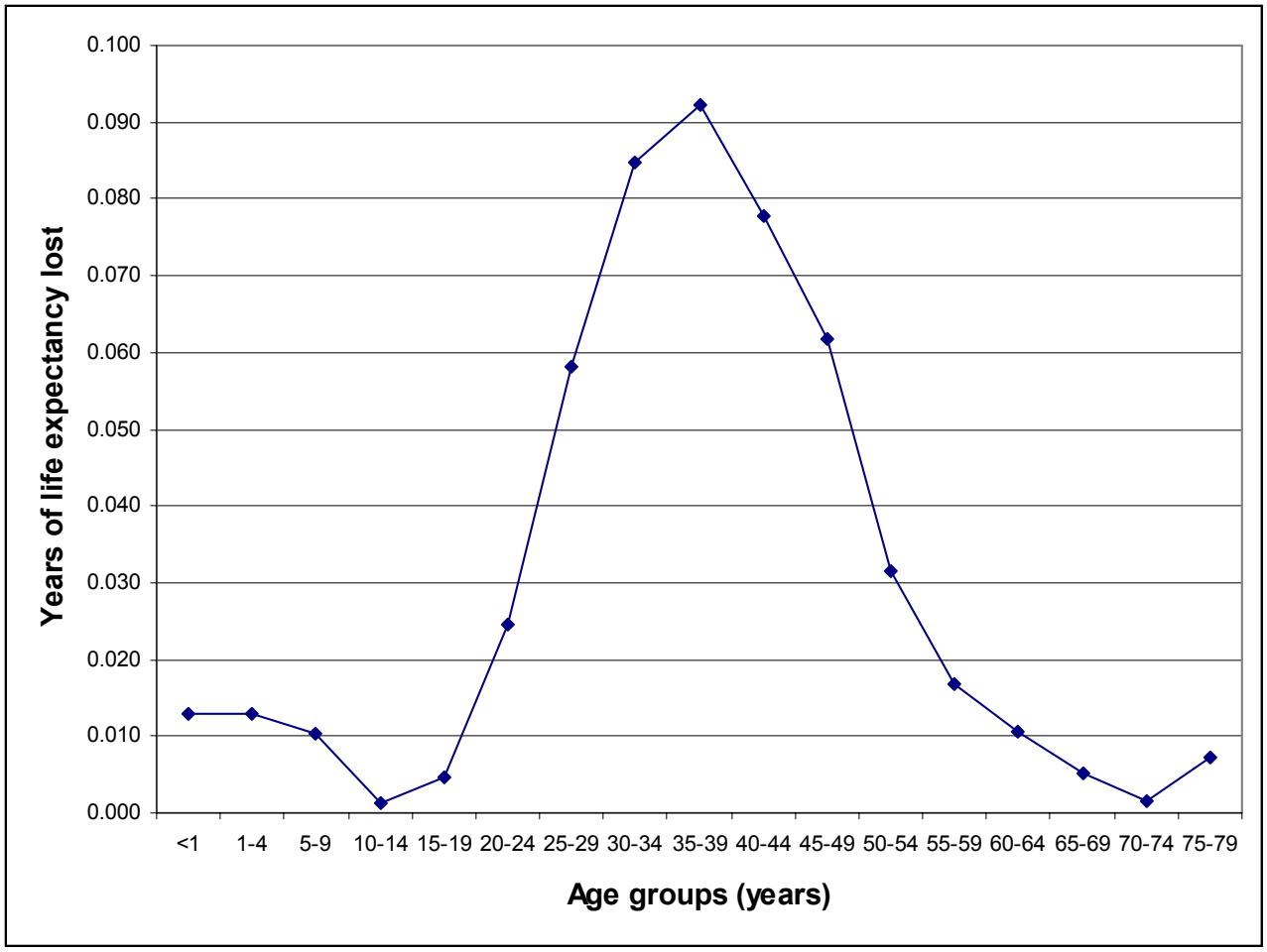
SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.

Figure I. Years of life expectancy lost due to overall mortality by age groups in selected countries of the Americas, around the 1990-2002 period



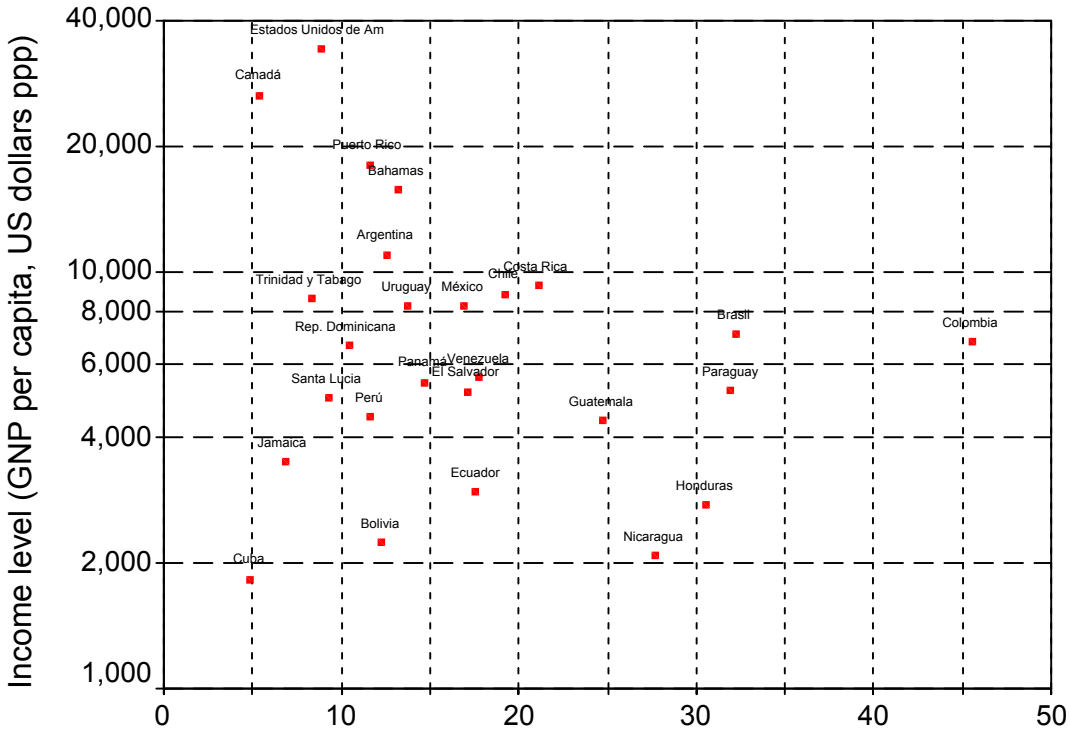
SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.

Figure II. Years of life expectancy lost due to AIDS mortality by age groups in selected countries of the Americas, around the 1990-2002 period



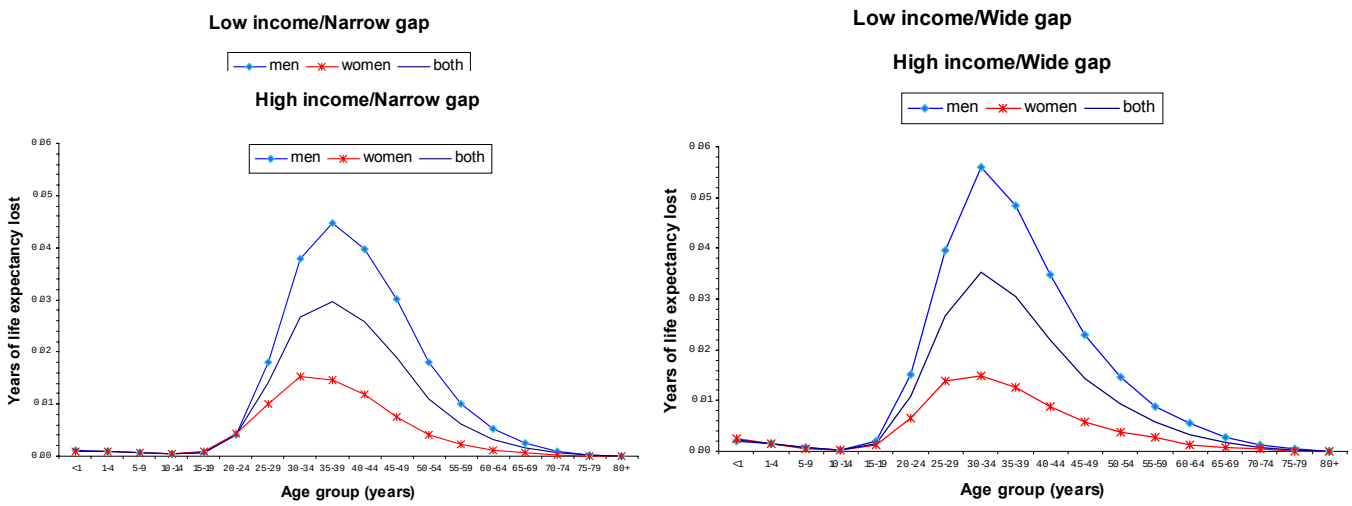
SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.

Figure III. Income level (GNP per capita) and distribution (20% Highest/20% Lowest Income ratio) in selected countries of the Americas, 2002



Source: World Bank, 2002; UNDP, 2002.

Figure IV. Years of life expectancy lost due to AIDS mortality by age and sex groups in selected income level and distribution gap country clusters of the Americas, around the 1990-2002 period



SOURCE: Pan American Health Organization. Mortality and Population database. Technical Information System, 2002.