

NONCOMMUNICABLE DISEASES AND RISK FACTOR SURVEILLANCE

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INTRODUCTION

The reduction of inequities should be a component of every PAHO technical cooperation program. To be effective in the area of disease control and prevention, the following steps should be undertaken:

1. Identifying and selecting equity-oriented indicators to measure the burden of morbidity and mortality in the Region.
2. Analyzing existing data to identify and quantify the main social inequalities in health (including self-perceived health, morbidity, and mortality) and access to health care, both within and between countries in the Region.
3. Putting information systems in place to monitor health equity as well as trends within and between countries.
4. Developing equity-oriented technical cooperation programs.
5. Conducting periodic evaluations in member countries to assess progress in reducing health inequities as demonstrated by socioeconomic position.

The particular activity that should be undertaken in a given program will depend on

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the data and technical cooperation that already exists with regard to equity for that program.

MAGNITUDE OF THE PROBLEMS AND TRENDS

Outside of information from the United States and Canada, data from the Region on the relationship between health and the absolute or relative socioeconomic position are scarce, with the possible exception of infant mortality studies (Hollstein et al., 1998; Casas and Dachs, 1998; Paim and Costa, 1993; Victora et al., 1992). Few studies on socioeconomic health inequality, and even fewer that assess time trends or analyze information by causes of adult mortality, have been published. In most Latin American and Caribbean countries, social and economic transformations of the last decades have led to changes in the mortality and morbidity patterns, with an overall decrease in mortality rates and an increase in life expectancy. Noncommunicable diseases (NCDs) now predominate (Murray and Chen, 1993); they account for two-thirds of the mortality in the Region and their proportion is increasing. Fifty percent of these deaths are premature deaths in persons under 65 years of age, which means that they could be prevented or postponed.

Several behavioral and biological factors have been identified in the scientific literature as risk factors for NCDs, of which the most important are cigarette smoking, a sedentary lifestyle, a high fat diet, obesity, hypercholesterolemia, and hypertension (DHHS, 1991; Stamler, 1987; WHO, 1990). Excessive alcohol consumption is associated with chronic liver disease and is also a major risk factor for disability and death associated with motor vehicle related injuries (DHHS, 1991). Psychosocial factors, including social support, characteristics of the work environment, and depression, have been shown to be related to cardiovascular disease (Marmot, 1982; Berkman, 1982; Rosenman, 1982; Theorell, 1992). Although they are not risk factors in the traditional sense, selected preventive services have proven effective in reducing mortality from cancer of the breast and cervix. There is general agreement that screening by mammography and clinical examination in women 50–69 years of age or older reduces breast cancer mortality (The Canadian Task Force, 1994; US Preventive Services Task Force, 1996), and early detection through PAP smears and other screening methods can decrease mortality from cervical cancer (The Canadian Task Force, 1994; US Preventive Services Task Force, 1996). Similarly, the use of seat belts and helmets has been found to be effective in reducing deaths and disabilities resulting from motor vehicle related injuries (The Canadian Task Force, 1994; US Preventive Services Task Force, 1996). In industrialized countries, improvements in these behavioral risk factors have been associated with marked reductions in the incidence and mortality of the respective NCDs.

Several surveys of NCD risk factors have been conducted in Latin American and the Caribbean, although only Barbados, Colombia, Cuba, and Saint Kitts have conducted these surveys country-wide (Lessa et al., 1996; Martins et al., 1993; Piccini and Vitoria, 1994; de Lolio et al., 1993a, 1993b; Rego et al., 1990; Llanos and Libman, 1995; Duncan et al., 1993; Litvak et al., 1987; Ordúñez, 1998; Jadue et al.,

1999; PAHO, 1997; Ministry of Health of Barbados, 1992). Most studies have been cross-sectional surveys and have not been repeated over time. The exception are the recent efforts in surveillance of tobacco conducted by a few countries, in which increased prevalence of smoking has been described among females and adolescents. Existing evidence suggests that many of these factors are highly prevalent or are becoming highly prevalent in Latin American and Caribbean countries. The prevalence of smoking in adults in those countries has been estimated to range from 30% to 50% in men and from 10% to 30% in women (PAHO, 1992; Lessa et al., 1996; Duncan et al., 1993; de Lolio et al., 1993; Ordúñez et al., 1998; Jadue et al., 1999). Paradoxically, infant malnutrition may coexist with a high prevalence of obesity in some adult populations, reaching as high as 30%–55% in some groups (PAHO, 1998; Foster et al., 1993). The prevalence of hypertension has been estimated to range between 8% and 30% (Lessa et al., 1996; Duncan et al., 1993; Rego et al., 1990; Piccini and Vitoria, 1994; de Lolio et al., 1993b; Berrios et al., 1990; Alvarez Perez et al., 1992). Even higher prevalence of hypertension (more than 40%) has been documented in some Caribbean countries (Foster et al., 1993; Ordúñez et al., 1998). High prevalence of hypercholesterolemia (as high as 30%–40%) also has been documented in some areas (Lessa, 1996). The few studies that have quantified physical activity also have documented high prevalence rates of sedentary lifestyle (as high as 50%–90%) (Duncan et al. 1993; Rego et al., 1990; Berrios et al., 1990; Ordúñez et al., 1998; Jadue et al., 1999). Even diabetes, which used to be relatively uncommon in many developing countries, appears to be growing in importance (Vaughan et al., 1989; Phillips and Salmeron, 1992; PAHO, 1998; Llanos and Libman, 1995), with prevalence estimates for Latin American countries generally ranging between 5% and 10% (Llanos and Libman, 1995). Much higher prevalence—as high as 18%—has been documented in some Caribbean countries (Foster et al., 1993). No system-

atic information on the prevalence of psychosocial factors potentially related to NCDs and injuries exists for the Region.

As with mortality, data related to trends in prevalence and incidence of risk factors according to socioeconomic variables are scarce in the Region, with the exception of some studies conducted in the United States and Canada. In the U.S., studies have shown that most of these risk factors, including perception of health, smoking, physical inactivity, obesity, hypertension, and poor diet, are clustered among individuals in the lower socioeconomic groups. These risks are higher in the most disadvantaged communities, even after adjusting for the individual risk factors, indicating that both individual and contextual characteristics contribute to a person's risk. All of these factors are correlated with an increased risk of mortality over the years (Yen and Kaplan, 1999).

Although some health outcomes are consistently more prevalent in the lower social strata—including, for example, tuberculosis mortality and alcoholism—some of the diseases and associated risk factors evolve over time through social epidemiological transitions. In the first phase of this transition, risk factors are positively associated with socioeconomic position; that is, risk factors are more prevalent in higher socioeconomic groups, although overall incidence of disease may still be low. In the second phase, risk factors become less prevalent in upper social strata, but the incidence of disease increases, while the prevalence of risk factors within the lower social strata remains stable or begins to increase. During this phase, an inverse u-shaped mortality curve might be seen. In the third phase, after the transition is completed, the typical inverse relation between socioeconomic position and risk factor prevalence is observed. Later, due to the time lag between risk exposure and the development of the disease, incidence and premature mortality from NCDs become higher in low socioeconomic groups. For example, the tobacco consumption epidemic may begin in the upper socio-

economic groups, who have the economic resources to purchase cigarettes, and eventually reveal a positive correlation between lung cancer and socioeconomic level. However, over time, persons in lower socioeconomic strata smoke more, while persons in upper socioeconomic groups begin to lower their smoking rates and resort to better technology in the treatment of the disease. Consequently, socioeconomic strata and morbidity/mortality become inversely related.

LIMITATIONS OF THE MEASUREMENTS

In order to measure the strength of the relationship between socioeconomic strata and disease—and thus measure socioeconomic health inequalities—we need to identify and use appropriate indicators, and we must gather sufficient and high-quality data on specific subpopulations.

The Limitations of Measures

Several methods are available for measuring socioeconomic inequalities in health outcomes associated with NCDs. A major methodological issue is the quality of the indicators being used to classify individuals in terms of social position. Another methodological issue concerns the methods used to quantify health inequalities. There is some agreement that in examining social inequalities in health the joint distribution of both health and socioeconomic status should be considered, as should average and dispersion measures. Some of the range measures for mortality and morbidity data for NCDs include comparisons of health between groups at the extremes of the socioeconomic spectrum using rate ratios (RR) or rate differences (RD). The limitation of these measures is that they overlook the intermediate group. Inequalities in health outcomes between the upper and lower socioeconomic groups might, for example, remain unchanged, while inequalities between the in-

intermediate groups and the upper or lower groups might be diminishing or increasing (Wagstaff, 1991).

Several measures of economic inequalities have been developed based on the Lorenz curve, including the Gini coefficient and concentration index. All have the drawback that they measure inequality in relative terms. Other measures have been developed to summarize differences among several groups, taking into account the average level, the differences between groups, and the relative sizes of the groups. One of the most commonly used is the slope index of inequality (SII), which compares the distribution of health outcomes across subgroups; these subgroups are ordered by socioeconomic position by calculating the slope of the (weighted least square) linear regression as a summary measure of health inequality. The result can be interpreted as the rate difference between those at the bottom of the hierarchy and those at the top.

Another issue, especially relevant to NCDs, is that when considering the underlying reasons for the observed differentials in health outcomes in a population, there is a growing consensus that systematic differentials play a prominent role in *exposure to health hazards and risk conditions*. However, depending on the etiologic period, the time interval between exposure and health outcomes can vary, as occurs with changes in mortality associated with changes in prevalence of risk factors for diseases such as cancer, cardiovascular diseases, diabetes, and others. NCDs are characterized by long latency periods between some risk factor exposures and health outcomes, such as with smoking and lung cancer.

Finally, indicators of morbidity may show very different patterns from those in mortality rates, and, therefore, the ranking of countries or communities according to prevalence of diseases will not necessarily match rankings for mortality for those same diseases. Morbidity from NCDs commonly shows much steeper social gradients than mortality, and sex differences are almost always reversed when morbidity is compared to mortality.

Availability and Quality of Data

A serious limitation of all routinely used measurements is that they are based on averages and do not take into account differences among groups—the essence of inequity. Properly designed behavioral risk factor surveys can address this important limitation by collecting and analyzing the information according to different categories of potential inequities (income, education, occupation, gender, race/ethnicity, geography, etc.).

Another limitation of routinely collected data is the fact that information about socioeconomic position for the numerator and denominator of specific rates usually comes from different sources, for example calculating death rates for manual laborers by using death certificates (for the numerator) and census data (for the denominator). This difference can lead to numerator-denominator biases, in which the classification by socioeconomic position indicators varies systematically according to the source. This numerator-denominator problem has been widely discussed in the literature and usually leads to an underestimation of the relationship between socioeconomic position and health risk. The probability of bias can be minimized using aggregated categories (Schkolnikov, 1998) and eliminated using linked registries.

Mortality statistics for NCDs are, on average, fairly reliable over the Americas. However, there are still some countries where coverage and quality of registries need to be improved (PAHO, 1998). A few countries have specific registries for selected problems, for example, cancer registries to provide information about the incidence of malignant neoplasms. One serious limitation of the existing data, however, is that most come from vital statistics registries, which do not always contain information about socioeconomic position, such as income, occupation, and education. When the information is collected, it is usually of poor quality, for example, data on occupational status of the deceased.

The best data for program planning and that can function as an early predictor of the potential benefits of equity-oriented interventions would come from risk factor surveillance through health surveys repeated over time. Experience in some industrialized countries shows that these surveys can give accurate information about the prevalence of risk factors for NCDs, including the differential risks by socioeconomic groups, as well as trends. In these countries, the survey questions have been validated and changes are being monitored over time. A standardized methodology is currently being developed to produce valid and reliable estimates of the prevalence of risk factors in the Region of the Americas. In carrying out behavioral risk factor surveys, questions must be validated to ensure that they are well-understood and will be answered honestly by the respondent in a given environment. Additionally, sampling must be representative, surveyors must be well-trained, and standardized quality control and quality assurance mechanisms at the data collection and data entry levels should be in place. Currently, the lack of standardization of methodologies used across surveys and differences in the information collected makes it difficult to ensure the validity of the results and the comparability among countries and within countries.

INEQUALITIES THAT MAY CONSTITUTE INEQUITIES

Kunst and Mackenbach (1994) argue that an inequality can be measured, while an inequity cannot. However, it does appear possible to measure and study the *perception* of such an inequity in a population or in subgroups of that population.

Evans (1994) uses the term "heterogeneity" and MacIntyre (1997) uses "social patterning" as synonyms for "inequality." These authors clarify that inequalities/heterogeneities/social patterns can refer to differences between groups that are not necessarily socioeconomically determined, but that do have a social

influence, for example, age, gender, marital status, and race/ethnicity. In the framework being presented here, it is assumed that "health inequities" refers to differences in health status related to differences in socioeconomic position (income, education, occupation, race/ethnicity, and gender). Krieger (1997) notes that most measures of socioeconomic position reflect both availability of material and social resources, as well as social status or an individual's rank in a social hierarchy. From this point of view it is important to study and intervene to address the socioeconomic inequities, including gender and race/ethnicity in different geographic settings. The study of gender inequities in NCDs is particularly important, because it is known that some associations between risk factors and disease are not the same in men as in women (Barrett Connor, 1997). Mortality rates associated with NCDs are almost always lower among women than men, and have a lower socioeconomic gradient, but these gender differences are reversed for morbidity and self-perception of disease (women show more morbidity than men, and often show steeper social gradients).

THE INFLUENCE OF DIFFERENT DETERMINANTS

Both the socioeconomic context and health outcomes associated with NCDs can be measured with reference to magnitude and time. It is important to try to clarify the links between health and socioeconomic position, because they are powerful clues about a given society's forms of discrimination which may generate health inequities. Also, in measuring inequities, individual and aggregate-level variables can be used. Aggregate measures for NCDs should mainly be used to compare countries. Mortality comparisons within country, however, should be based on small-area analyses (such as counties) or subpopulations, and survey data is more appropriately analyzed at the individual level.

There is currently little data in the Region about the influence of one determinant on others and about the direct and joint effects of individual and contextual variables. Again, risk factor surveillance can be a key instrument for identifying such influences. The scarce data available have shown some interesting findings. In Valparaiso, Chile, for example, the combined effect of low socioeconomic status and female gender results in higher rates of many risk factors for NCDs.

Additionally, it is important to examine the social context in which a particular risk factor or group of risk factors occurs. Most measurements and interventions currently used for NCD risk factors tend to focus on bringing about behavioral changes in a person, but it is important not to ignore the individual's social environment. The compelling evidence that the lower socioeconomic groups tend to have poorer nutrition, be less physically active in leisure, have greater prevalence of smoking, and have more damaging patterns of alcohol use is only half of the story. It is of critical importance to understand why this is so. The growing literature from qualitative studies on the daily circumstances of people experiencing disadvantages, highlights the greater restrictions on the choice of a healthier lifestyle, due to practical constraints of time, space, and money, as well as psychosocial mechanisms (WHO, 1998). From a methodological perspective, this represents a challenge, since epidemiological studies and surveillance have focused mainly on the individual, and, therefore, assume that personal choice determines behavior. Nonetheless, recent discussions and conceptual approaches have led to new proposals that include both individual and contextual effects—that is, collective characteristics on individual-level outcome measurement and interventions (Diez-Roux, 1998; Van Korff et al., 1992; Hox, 1994). From a public health perspective, this implies that control of risk factors is much harder among the most disadvantaged groups and therefore the interventions should be deliberately tailored towards the worst-off.

HOW TO REDUCE THE GAPS

1. Identifying inequities between and within the Region's countries by implementing monitoring systems.

In the case of routinely collected information, it is crucial to recognize the growing need to supplement vital statistics (such as mortality and birth) and other health data (such as hospital discharge and notification data) with appropriate socioeconomic data that can serve as a foundation for contemporary public health knowledge about patterns and trends of social inequalities in health. This information also can be used to help allocate resources and plan public health interventions at the regional, country, and local levels. Routinely collected mortality data should then be analyzed (at least) by socioeconomic position between countries and ideally for different smaller geographical units within countries. Socioeconomic measures should be included in all health surveys routinely carried out, including risk factor surveys, DHS (Demographic and Health Surveys), and LSMS (Living Standards Measurement Surveys). PAHO could support a line of action that would include validation, standardization, and quality control of risk factor surveys in member countries to facilitate the identification of inequities and create the basis for an ongoing surveillance system for NCDs.

2. Developing a framework to continuously monitor and evaluate progress in countries in achieving health equity for NCDs by taking into account not only the average level of health indicators but also the distribution of health among socioeconomic groups.
3. Collaborating with countries to set health objectives and priorities for NCDs that consider the distribution of health across the population; in other words, set equity targets for the NCD prevention and control health agenda.
4. Working with countries to implement health interventions that address health inequities.

The NCD intervention programs to be developed may not be equally effective in all socioeconomic groups, but efforts should be made to ensure they reach the most disadvantaged. Monitoring of progress should include the extent to which these interventions have been successful in addressing needs and in decreasing health inequities.

5. Reorganizing technical cooperation programs based on an equity-oriented approach.

AN EXAMPLE OF THE USE OF RISK FACTOR SURVEYS TO MONITOR HEALTH INEQUALITIES IN NCDS

The behavioral risk factor survey carried out in Valparaiso, Chile, in 1996 showed several areas of inequalities (Table 1). Surveillance of behavioral risk factors should provide guidance for program planning and maintenance, leading to the reduction of inequities where they exist.

Smoking was highest among males of low socioeconomic status, and overall prevalence was higher among males than females. Among males, no significant differences were observed in the prevalence of obesity, as mea-

sured by body mass index, whereas females exhibit higher rates than males. Further, females in the low socioeconomic group exhibit rates significantly higher than females in the middle/high socioeconomic group. Lack of physical activity and the prevalence of hypertension were higher among females than males, and in both groups there was a socioeconomic gradient, with those in the lower end having higher risk. On the other hand, the ratio of total cholesterol to high-density lipoprotein, which indicates the risk of a lipid profile, was higher among the middle/high socioeconomic group among males and females than among the low socioeconomic group. However, when the use of preventive services was analyzed, a higher proportion of males and females in the middle/high socioeconomic group had been tested for cholesterol and glycemia. Further, in spite of the high proportion of women who had had Pap smears, the rate was still lower among those in the low socioeconomic group than in the middle/high group. Further investigation may explain why these differences exist and point to technical cooperation initiatives to address them. Repeated measurement of these risk factors will provide information on trends and on how these differences persist or change.

TABLE 1. Prevalence of risk factors and use of preventive services, by gender and socioeconomic status, Valparaiso, Chile, 1997.

	Gender and socioeconomic status			
	Male		Female	
	Low (%)	Middle/high (%)	Low (%)	Middle/high (%)
Risk factors				
Regular smoker	50.2	45.5	36.4	34.6
Body mass index (≥ 25)	62.0	59.5	67.9	60.7
No physical activity	76.5	68.1	97.0	92.1
Hypertension	13.9	10.0	15.7	10.2
Ratio of total cholesterol/ HDL (≥ 4.5)	47.6	50.0	35.8	39.0
Use of preventive services				
Ever tested for cholesterol	10.9	27.7	18.3	30.5
Ever tested for glycemia	20.4	37.1	43.1	53.6
Ever had a Pap smear	-	-	74.6	81.4

REFERENCES

- Alvarez Pérez J, Debs Pino J, Quintana Setién C et al. Comportamiento urbano y rural de factores de riesgo coronario en un estudio comunitario. *Rev Cubana Med Gen Integral* 1992; 8:33-38.
- Barbados, Ministry of Health. Barbados Risk Factor Survey; 1992. (Internal report.)
- Berkman L. Social network and coronary heart disease. *Adv Cardiol* 1982; 29:37-49.
- Berrios X, Jadue L, Zenteno J, et al. Prevalencia de factores de riesgo de enfermedades crónicas: estudio en población general de la región metropolitana. *Rev Med Chile* 1990;118:597-604.
- Casas JA, Dachs N. Economic, social and health inequalities in Latin America and the Caribbean; 1998. Printed document.
- Casas JA, Dachs JN. Infant mortality and socioeconomic inequalities in the Americas; 1998. Submitted for publication.
- de Lolio CM, Pacheco de Souza JM, Hasiak Santo A, Buchalla CM. Prevalência de tabagismo em localidade urbana da região sudeste do Brasil. *Rev Saúde Pública* 1993a; 27:250-61.
- de Lolio CM, Rodrigues Pereira JC, Lotufo PA, Pacheco de Souza JM. Hipertensão arterial e possíveis fatores de risco. *Rev Saúde Pública* 1993b; 27:357-62.
- Department of Health and Human Services. (1991). *Healthy people 2000: National health promotion and disease prevention objectives*. Washington, DC: Department of Health and Human Services; 1991. Publication No. (PHS)91-50213.
- Duncan BB, Schmidt MI, Achutti AC et al. Socioeconomic distribution of noncommunicable disease risk factors in urban Brazil: the case of Pôrto Alegre. *Bull PAHO* 1993; 27:337-349.
- Evans RG, Barer ML, Marmor TR (eds). *Why Are Some People Healthy and Others Not? The Determinants of Health of Populations*. New York: de Gruyter; 1994.
- Glanz K, Lankenau B, Foerster S, Temple S, Mullis R, Schmid T. Environmental and policy approaches to cardiovascular disease prevention through nutrition: opportunities for state and local action. *Health Educ Quarterly* 1995; 22:512-527.
- Hollstein RD, Vega J, Carvajal Y. Desigualdades Sociales y Salud: Nivel Socioeconómico y Mortalidad Infantil en Chile, 1985-1995. *Rev Méd Chile* 1998; 126:333-340.
- Kennedy BP, Kawachi I, Glass R and Prothrow-Stih D. Income distribution, socioeconomic status and self rated health in the United States: A multilevel analysis. *BMJ* 1998; 317:917-921.
- Krieger N, Williams DR and Moss NE. Measuring Social Class in US Public Health Research. Concepts, Methodologies and Guidelines. *Annu Rev Public Health* 1997; 18:341-78.
- Kunst A, Mackenbach J. Measuring socioeconomic inequalities in health. World Health Organization Regional Office for Europe; 1994. (Document).
- Jadue L, Vega J, Escobar M, Delgado I, Garrido C, Lastra P, Espejo F, Peruga A. Factores de riesgo para las enfermedades no transmisibles. Metodología y resultados globales de la encuesta de base del programa CARMEN. *Rev Med Chile*; 1999.
- Lessa I, Mendoca GAS, Texeira MTB. Doenças crônicas não-transmissíveis no Brasil: dos fatores de risco ao impacto social. *Bol Of Sanit Panam* 1996; 120:1-25.
- Litvak J, Ruiz L, Restrepo H, McAlister A. The growing noncommunicable disease burden, a challenge for the countries of the Americas. *PAHO Bull* 1987; 21:156-171.
- Llanos G, Libman I. La diabetes en las Américas. *Bol Oficina Sanit Panam* 1995; 118:1-17.
- MacIntyre A. The Black Report and Beyond: What Are the Issues? *Soc Sci Med* 1997; 44:6:723-45.
- Markovic N, Bunker CH, Ukoli FA, Kuller LH. John Henryism and Blood Pressure Among Nigerian Civil Servants. *J Epidemiol Community Health* 1998; 52(3):186-190.
- Marmot MG. Psychosocial factors and cardiovascular disease: epidemiological approaches. *Europ H J* 1988;9:690-697.
- Martins IS, Coelho LT, Mazzilli RN et al. Doenças cardiovasculares ateroscleróticas, dislipidemias, hipertensão, obesidade e diabetes melito em população da área metropolitana da região sudeste do Brasil. I-Metodologia da pesquisa. *Rev Saúde Pública* 1993; 27:250-61.
- Murray C, Chen L. In Search of a Contemporary Theory for Understanding Mortality Change. *Soc Sci Med* 1993; 36(2):143-155.
- Nobak M, Pikhart H, Hertzman C, Rose R, Marmot M. Socioeconomic Factors, Perceived Control and Self-reported Health in Russia. A Cross-sectional Survey. *Soc Sci Med* 1998; 47(2):269-279.
- Ordúñez PO, Espinosa A, Cooper R, Kaufman J, Nieto J. Hypertension in Cuba: evidence of narrow black-white difference. *J Hum Hypertens* 1998; 12: 111-116.
- Pan American Health Organization. *Annual Report of the Director, 1998: Information for Health*. Washington, DC: PAHO; 1999. (Official Document No. 293).
- Pan American Health Organization. Report Risk Factor Survey in St. Vincent. PAHO, Caribbean Program Coordination; 1997. (Document).
- Pan American Health Organization. *Health in the Americas, 1998 Edition*. vol. 1. Washington, DC: PAHO; 1998. (Scientific Publication No. 569).
- Pan American Health Organization. *Tobacco or health: Status in the Americas*. Washington, DC: PAHO; 1992. (Scientific Publication No. 536).
- Paim J, Costa MC. Decline and Unevenness of Infant Mortality in Salvador, Brazil, 1980-1988. *Bol Of Sanit Panam* 1993; 27(1):1-14.
- Phillips M, Salmeron J. Diabetes in Mexico—A serious and growing problem. *World Health Stat Quart* 1992; 45:338-346.

- Piccini RX, Vitora CG. Hipertensão arterial sistêmica em área urbana no sul do Brasil: prevalência e fatores de risco. *Rev Saúde Pública* 1994; 28:261-267.
- Rego RA, Berardo FAN, Rodrigues SR, et al. Fatores de risco para doenças crônicas não-transmissíveis: inquérito domiciliar no município de São Paulo, Brasil. Metodologia e resultados preliminares. *Rev Saúde Pública* 1990; 24:277-285.
- Robles S, White F, Peruga A. Trends in Cervical Cancer Mortality in the Americas. *Bol Of Sanit Panam* 1996; 30(4):290-301.
- Rosenman RH. Role of type A behavior in the pathogenesis and prognosis of coronary heart disease. *Adv Cardiol* 1982; 29:77-84.
- Shkolnikov VM, Leon DA, Adamets S, Andreev E and Deev A. Educational Level and Adult Mortality in Russia: An Analysis of Routine Data 1979 to 1994. *Soc Sci Med* 1998; 47(3):357-69.
- Stamler J. Epidemiology, established major risk factors, and the primary prevention of coronary heart disease. In: Parmley WW, Chatterjee K (eds). *Cardiology* Vol. 2. Philadelphia: Lippincott; 1987.
- The Canadian Task Force on the Periodic Health Examination. *The Canadian Guide to Clinical Preventive Health Care*. Ottawa, Canada: Canada Communication Group; 1994.
- Theorell T. The psychosocial environment, stress, and coronary heart disease. In: Marmot M, Elliot P (eds.). *Coronary heart disease: from etiology to public health*. New York: Oxford University Press; 1992.
- United States Department of Health and Human Services. *The health benefits of smoking cessation: A Report of the Surgeon General*. Rockville: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 1990. (DHHS Publication No. CDC 90-8416).
- US Preventive Services Task Force. *Guide to clinical preventive services: report of the U.S. Preventive Services Task Force*. 2nd ed. Baltimore: Williams and Wilkins; 1996.
- Vaughan P, Gilson L, Mills A. Diabetes in developing countries: its importance for public health. *Health Policy and Planning* 1989; 4:97-109.
- Victora C, Barros F, Hutley S, Teixeira AM, Vaughan JP. Early childhood mortality in a Brazilian cohort: The roles of birthweight and socioeconomic status. *Intern J Epidemiol* 1992; 21:359-65.
- Wagstaff A, Paci P, van Doorslaer E. On the measurement of inequalities in health. *Soc Sci Med* 1991; 33(5):545-57.
- Whitehead M. The health divide. In: Townsend P, Whitehead M, and Davidson N (eds.). *Inequalities in Health. The Black Report and the Health Divide*. London: Penguin; 1992.
- World Health Organization. *Diet, nutrition, and the prevention of chronic diseases*. Geneva: WHO; 1990. (Technical Report Series No. 797.)
- Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socio-economic status and health: How education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health* 1992; 82(6):816-820.
- Yen IH, Kaplan G. Neighborhood social environment and risk of death: Multilevel evidence from the Alameda County study. *American Journal of Epidemiology* 1999; 149(10):898-906.