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TRENDS AND CHALLENGES IN HEALTH RESEARCH IN LATIN AMERICA: A PERSPECTIVE

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ANNEX A - Available upon request

**TRENDS AND CHALLENGES IN HEALTH RESEARCH
IN LATIN AMERICA: A PERSPECTIVE**

1. Current Situation in Health and New Trends for the Future

1.

1.1 Just as humanity has developed at a precipitous pace in this century, with a rate of growth and modernization that increased after World War II, so has human health undergone profound changes and new challenges and paradigms have arisen to challenge the effectiveness of health systems in all countries.

The changes and advances that have occurred in health and health systems began with the industrial revolution as a result of improvements in people's living conditions (McKwen, 1968) and great scientific discoveries. McKwen was able to demonstrate that declines in mortality from TB and various other communicable diseases were to a great extent the result of better conditions in nutrition, housing and basic sanitation in England, even more so than progress in health actions themselves. This situation was corroborated and it was established that per capita income was the variable that showed the highest correlation with the principal health indicators in Latin America (Belmar, 1980).

Modern medicine, the outgrowth of the fundamental contributions of Pasteur, Jenner, Koch, and other researchers, has developed immunization techniques, treatments, surgical procedures, pregnancy, childbirth and postpartum care, and improvements in environmental sanitation. These have changed the course of diseases and health problems. This situation, in addition to improvements in the quality of life, has produced a notable reduction in mortality, especially from communicable diseases (Sigerist, 1948).

This worldwide situation has also developed in the Americas, although it is recognized that there is a wide variance between the countries with better levels of

health and those with low achievements in public health. Great inequities have been identified from country to country and within the same country. Factors that explain this inequity are per capita income, ethnic segregation, gender discrimination, rural conditions, marginality, and segregation by social class.

1.2.1 - In the Americas, the effects of these processes mean that the traditional challenges of the countries' health systems are now associated with emerging and currently developing situations, such as: demographic and epidemiological transition; changes in lifestyles; increased social marginality; the maintenance of significant groups living in poverty and extreme poverty; the situation faced by ethnic groups in the Americas, persistent discrimination against women in society, community, labor markets, and within the family; the growing and sustained development of the megalopolis with the consequent risks of marginality and health problems associated with living with high population densities; the maintenance of scattered rural, and underserved communities; market conditions unfavorable to countries that export raw materials and food; and changes in the environment (GEOPS/IDRC, in press).

1.2.2 - These changing and interrelated trends caused the International Development Research Centre (IDRC) of Canada to create a working group to identify, weigh, and establish the gaps in knowledge about these situations, so as to guide governments, academia, and health system authorities in the task of predicting the future of health and social development in the Region and countries of the Americas, based on the challenges that might result from these trends. This important undertaking was entrusted to the GEOPS research center in Uruguay, under the coordination of Dr. Delia Sánchez and Dr. Roberto Fazzani, which would communicate its findings in a book, publications, and other communications under the title "Future Challenges for Health Research in Latin America." (GEOPS, 1997, in press)

1.2.3 - These multiple challenges to the health systems determine the need for organizations like the Pan American Health Organization (PAHO) to identify these social problems and their relation to people's health and health systems, establish their specific weight in health problems, and determine the most cost-effective mechanisms to prevent or mitigate their deleterious effects on human health and the environment.

1.2.4 - Aside from these problems that have systematically ravaged the Americas, there is the emerging problem of low efficiency and effectiveness in the countries' health systems, making it more difficult to deal with people's health problems, particularly among the poor, isolated communities, workers, women, young people, and older adults. The situation also calls for PAHO to analyze, weigh, and provide guidance based on global, regional, and country-by-country studies and research.

1.2.5 - Profound environmental changes occurring in the as a resulting from human activity and the evolution of the planet itself represent another emerging situation. This also determines PAHO's task of analyzing changes in ecosystems, establishing and weighing their effects on human health, and identifying and qualifying the effectiveness and efficiency of preventive methods or methods to mitigate the risks and damage associated with environmental changes.

Another challenge is the fact that health systems in the Americas have not evolved from the "flexnerian" health models, still preferring to repair the damage or provide rehabilitation and not giving priority to empowerment, specific prevention, and environmental protection.

1.3 These three previously identified dimensions—health risks and damages, inadequacies in the health systems, and the deleterious effects of environmental changes—allow us to better direct an analysis and its resulting specific proposals for the studies and research for which PAHO is responsible.

Health Determinants and Problems

2.

The first group of specific health problems and risks can be organized into determinants that are significantly associated with:

- Demographic and epidemiological transition;
- New lifestyles;
- The increase in the megalopolis and social marginality;
- The continuation of groups living in poverty and extreme poverty;
- The situation of American ethnic groups and immigrant groups;
- The situation of women due to discrimination in society, labor, community, and the family;
- The maintenance of dispersed rural groups;
- Unfavorable market relations for the continent's products; and
- Changes in the environment.

These categories will allow us to conduct a brief analysis of each specific situation and establish priority areas in PAHO's study and research efforts.

Demographic and Epidemiological Transition in the Americas

2.1

Positive determinants of health are linked to the following factors: a rise in people's standard of living, progress in prevention (vaccines, checkups for prenatal care and growth and development); professional and institutional care for childbirth; new therapeutic tools (antibiotics and chemotherapy); innovative procedures in medical care (anesthesia and surgical advances), labor and social security laws, and improved emergency services are associated with progressive reduction in general and infant mortality. These factors, together with a decline in birth rates and fertility, have contributed to the progressive aging of the population. This began in the developed countries of the continent, and later appeared in cities and high-income sectors in the remaining countries of the Americas.

Thus, this is a heterogeneous process among and within the countries of the continent. In addition, the process was not anticipated by any of the countries, with the result that no precautions were taken either in terms of social security or health in order to deal with the elderly and their particular pathologies and changes in the evolution of diseases. The best example is the current crisis in the U.S. health system which has not been able to comprehensively serve the elderly and their unique problems such as loneliness, low capacity for self-care, low self-esteem, and the pathologies of extreme old age.

2.1.1 - The challenges that must be confronted in order to significantly improve the quality of life and prevent specific health risks and repair the damage done to health are as follows:

Suggestions for the central level of PAHO:

- Select research and studies to improve the quality of life, appropriate to the reality of the Americas, and make them available to the PAHO/WHO Representative Offices in the countries;
- Conduct a study to establish a protocol for systematic health examinations of adults and the elderly, according to different ages, in order to detect pathologies and health risks, evaluate nutritional status and provide education on self-care and improvements in the quality of life;
- Advise the countries regarding their own initiatives to improve the quality of life for the aging;
- Identify possible sources of funding for research on improving the quality of life for the aging;
- Study cataracts resulting from increased exposure to ultraviolet radiation in the southern hemisphere; and
- Study changes in the immune system as an effect of loss in the ozone layer in the southern hemisphere.

2.1.2 - Suggestions for Representative Offices in the countries:

- Set up, with the Ministry of Health in each country, a working group to analyze research and studies and to promote complementary local studies that aim at achieving as much independence as possible for the aging. For example, identify groups of elderly for whom it is feasible and sustainable financially to offer health actions aimed at a better quality of life, even including a possible copayment, such as an cataract operations, dental plates, lenses, supplements and micronutrients, family assistance, vaccines, etc.
- Study the sociology of loneliness in the elderly in countries where there are large groups of senior citizens.

2.2 ***Change in Lifestyles***

The great influence that changes in people's and families' lifestyles have on mortality and morbidity has been demonstrated. This is true for both positive and negative effects. Positive effects that have been studied include changes in diet and physical activity associated with reduced cardiovascular disease, the vital protective value of systematic use of safety belts in automobiles, and changes in sexual behavior that have decreased the incidence of AIDS in specific groups.

However, destructive lifestyles have demonstrated their negative influence on health. This includes increasing numbers of women who smoke, the association of obesity with eating junk food, and domestic violence in family relations involving child or spousal abuse.

2.2.1 - It is recommended that, at the regional level, PAHO direct its research and studies to lifestyle changes:

- Review the literature on studies and research on healthy lifestyles, particularly those that aim toward modifying health risks in cardiovascular diseases, cancers, and accidents;

- Identify the factors that facilitate healthy lifestyles from the point of view of the individual and family;
- Define a health education model, at the country level, in order to develop healthy lifestyles in basic education;
- Identify healthy lifestyles associated with the development and severity of pathologies such as coronary ischemia, stroke, most prevalent cancers in men and women, hypertension, diabetes, traffic accidents, labor accidents, pesticide poisoning, cataracts, bronchial asthma, psychosis, gastro-duodenal ulcers, alcoholism, and drug addiction; and
- Study the factors that contribute to the development of deleterious lifestyle such as smoking, alcohol abuse, drug abuse, consumerism, domestic violence, social violence, sexism, ethnic discrimination, and obsessive personality.

2.2.2 - It is suggested that, at the country level, PAHO develop the following research activities regarding lifestyles:

- Advise the Ministries of Health to form "task forces" to conduct studies so as to see the local feasibility of promoting healthy lifestyles among the population, as a result of the recommendations, studies and research developed by PAHO's central level;
- Promote studies on lifestyles related to the health problems of each country or subregion in the Americas with local academic institutions; and
- Evaluate education programs on healthy lifestyles and their potential impact on the population.

2.3 *Increase in the Megalopolis and Social Marginality*

It has been possible to demonstrate the sustainable development of urban populations in large population centers with over one million inhabitants. The population of the Americas has grown from 332 million (1950) to 714 million (1989). In particular, the population of Latin America and the Caribbean has grown during the same years from 165 million to 441 million, and a population of 523 million is projected for the year 2000. The growth rate for Latin America and the Caribbean for the period

1980-90 was 2.1%, and a decline in the rate to 1.9% is projected for the period 1990-2000. This growth has occurred primarily in large urban centers with over one million inhabitants, which have increased from 300 million (1950) to 532 million (1980), and it is projected that by the year 2000 one out of every two people will live in such a megalopolis. It will thus be essential to identify the health risks associated with living in such large urban centers including domestic and social violence, air and household pollution, drug abuse, traffic and household accidents, mental health problems, loneliness and especially social marginality. This latter phenomenon, marginality, is shown to be one of the factors that determines violence in all its forms, poor quality of life and poverty (PAHO/ECO,1990).

2.3.1 - In light of this growing challenge, PAHO could guide studies and research in the following areas:

- Identify the demographic, economic, and social factors that determine the formation and shape of the megalopolis;
- Study health care models to improve the quality of life in large cities;
- Establish recommendations for housing, labor, transportation, and recreation sites to offset the health risks of the megalopolis. These areas are identified because people spend more than 95% of their time there; and
- Study the factors that foster marginality in order to establish actions to prevent or reduce or it.

2.3.2 - It is recommended that the representatives at the country level promote the following actions:

- Conduct demographic studies to identify the cities that would become megalopolises in order to mitigate the factors that represent health risks for the people and help create cities, following the "healthy cities" policy of PAHO;
- In already established megalopolises, the current health risks specific to each city should be studied so as to mitigate or prevent them and to identify intersectoral actions to help establish healthy development policies in such cities; and

- Identify the characteristics of marginality in the megalopolis of the country in order to propose measures that would reduce the health risk of marginality.

Health problems potentially associated with marginality could be:

- Alcoholism and drug addiction;
- Child or spouse abuse, as the result of drug use, alcoholism, promiscuity, "machismo", domestic and social violence and ethnocentrism;
- Communicable diseases associated with poor sanitation, overcrowding, vectors, deficient dwellings, lack of health services and poor nutrition;
- Domestic violence, as a result of family disintegration, substance abuse, overcrowding, "machismo", and mental health problems;
- Teen pregnancy;
- Psychosis and behavioral problems;
- Malnutrition;
- Cardiovascular diseases;
- Domestic and traffic accidents;
- Respiratory diseases associated with household contamination; and
- Ectoparasites such as scabies, pediculosis, or *Pthirus*.

2.4 Poverty

Despite advances in some sectors and increased productivity, it has been established that there are still large groups of the poor and that in some countries the gap between the upper and lower quintiles has increased; this is associated with development and with continued health risks and problems.

2.4.1 - It would be advisable for PAHO to guide studies and research in the following areas in order to reduce poverty or its effects on health and the quality of life:

- Continue efforts to identify health care models that contribute to equity in health, as a way to focus health actions on the poor both to improve health and to improve the quality of life for these families;

- Identify the mechanisms for action in scattered rural communities to improve sanitation, health, and quality of life;
- Identify actions with indigenous groups to preserve their health and incorporate their traditional practices in the process of improving their health and quality of life; and
- Study alternatives for maintaining the Local Health Systems strategy as a factor in local development to improve living conditions, the production of small enterprises, and environmental protection.

2.4.2 - The following are recommendations for the country level:

- Conduct studies to identify local factors associated with development and continued poverty and extreme poverty, including variables such as illiteracy or lack of job training, ethnic isolation, extreme rural location, and isolation, deterioration of the environment, lack of appropriate technology, disintegrated families or women as heads of families;
- Identify and characterize poverty groups in the country; and
- Identify the appropriate technology for eliminating or reducing poverty and its effects on health in areas such as improved basic sanitation, development of household and medicinal gardens, development of healthy household fuels, development of low-cost thermal insulation techniques, production process models at the family or community level and the use of alternative energy such as wind or solar energy.

American Ethnic Groups

2.5

The deteriorated situation of ethnic groups in the Americas is a result of social isolation, racial discrimination, limited governmental support for their economic and social development, the lack of a policy to maintain their culture, the collision of cultural traditions and development policies and their displacement from good land for agriculture, livestock or forests. This situation has affected their health levels. This means that it has been possible to observe low health indicators, endemic diseases, malnutrition and even extinction.

2.5.1 - Given this situation, it would be advisable for PAHO to direct its studies and research to the following:

- Conduct a census of the ethnic groups now living on the entire continent, gathering all existing information on health and health indicators;
- Identify the health problems that are more prevalent among these ethnic groups and establish their epidemiological description; and
- Identify processes for integrating the beliefs and health practices of their cultures, which can be supplemented with prevention, promotion or health recovery activities.

2.5.2 - The following actions are recommended to complement locally the studies suggested above, at the level of PAHO's country representatives:

- Identify the ethnic groups in each country to establish the beliefs and practices related to health in their cultures and to identify areas for epidemiological study of the most prevalent problems of ethnic groups;
- Stimulate academic groups in the country to develop epidemiological studies on health problems of ethnic groups in the country; and
- Promote and support studies aimed at preventing or reducing the problems identified and epidemiologically weighted.

Gender Dimension of Health Problems and Practices

2.6

A woman's status has been clearly identified as that of a "second-rate citizen" because of gender segregation, labor and wage discrimination, and "machismo". This situation is repeated in the health system, although women are in the majority on health teams. This has a demonstrated negative impact on health.

2.6.1 - This situation demands that measures be taken to develop studies and research on the following subjects:

- Identify the social determinants of domestic violence and spousal abuse;
- Conduct studies based on the behavioral sciences to identify factors that determine gender discrimination; and
- Establish the characteristics and determinants of incest.

2.7 *Widely Dispersed Rural Populations*

Although the urban population is increasing in Latin America and the Caribbean, particularly in the megalopolis, there is still a significant percentage of people living in widely dispersed rural areas. This situation is due to the presence of groups of displaced ethnic groups, the complex geography of the continent, the inadequate road and communication network in different countries, and limited social and economic progress in Latin America and the Caribbean. Significant health risks can be identified among this scattered rural population such as inadequate basic sanitation, housing and energy sources; presence of wild vectors; low school attendance; subsistence economy; exposure to pesticides; poor road networks frequently cut off by natural phenomena; and an inadequate and limited health care network.

2.7.1 - These health risks should be weighed more accurately. It is thus suggested that studies and research be directed to the following areas:

- Identify programs that solve problems regarding basic sanitation, access to health and education services, access to appropriate production technologies for scattered

rural populations, and development of model dwellings for this scattered rural population in keeping with the environment;

- Study “healthy” systems to control wild vectors, agricultural and forest pests and technologies for housing and energy; and
- Study the development of low-cost communication systems for the rural health system since communication in the widely dispersed rural environment is the fundamental factor for safeguarding health and is a highly suitable technology the rural environment.

2.8 *Development of New Free Market Models and the Export Market*

The prevalence of the free market model has had a significant effect on the health situation of Latin America and the Caribbean, both positively by increasing production, accelerating modernization and increasing the income of some social sectors, and negatively by increasing the gaps in income between the upper and lower quintiles, accelerating changes in the environment, increasing the number of megalopolises, and promoting destructive lifestyles.

2.8.1 - This situation should be studied to promote the positive effects so as to diminish or eliminate the negative effects from this economic picture. It is thus recommended that research and studies focus on the following areas:

- Establish models for “accompanying work” which the health sector can provide for productive development in each country in order to define models of “healthy” production, preserve the environment and ensure in the future an environment that not only sustains production but life and society as well;
- Establish such studies, with respect to urban development, to help the development and modernization of cities that ensure people’s health and quality of life;
- Conduct studies to show the economic world that health is an investment and not an expenditure, when “empowerment,” prevention and healthy development are emphasized; and

- Conduct studies to identify appropriate technologies for making a house a habitat, directing it toward quality of life, both in the urban and rural environments.

3. The Health Systems

In general, health systems of the Western countries have been influenced primarily by the Flexner report and the writings of Henry Sigerist, and constructed to respond to infectious/contagious diseases and to maternal-child health problems. This position has established health system models in which the hospital appears as the basic instrument for health and specialties develop in response to health problems. This modality could be effective for infectious/contagious diseases and in managing delivery and maternal/child health problems. However, it has proven to be inadequate for facing the real health problems of today and the next millennium such as:

1. Epidemiological change of the transition, with problems such as diseases associated with aging of the population (tumors, degenerative diseases and diseases of the aging);
2. Health problems associated with changes in lifestyle, with problems associated with food, smoking, work style, addictive behavior;
3. Health problems related to changes in the environment, such as diseases associated with air and household pollution, exposure to ultraviolet radiation, exposure to non-ionizing radiation, exposure to pesticides, exposure to heavy metals from open cut mining (As, Pb, Hg, Cd, Mn, Cu, and Fe), exposure to solvents (toluene, cycle-hexane), and exposure to carcinogenic hydrocarbons such as the benzopyrenes; and
4. New styles of work required by modern production, generating health problems associated with stress such as mental illnesses, cardiovascular disease, substance abuse. New types of work days, such as 12 hour days for 4 or 7 days followed by an equal period of rest, or mining at altitudes of 3,000 to 5,000 meters above sea level, or low temperatures in refrigeration plants for agriculture or the fishing industry.

These new challenges have not yet been addressed by current health systems involved primarily with repairing the damage done to a person's health. Changes or

reforms of the health systems are needed for the reasons identified above, not only in response to the demand for improved management and efficiency, but also to effectively face these new challenges with strategies such as:

- Training people to be principal actors in maintaining and enhancing health and preserving the environment, with the “power through knowledge” process, fostering and promoting “healthy” lifestyles;
- Develop the epidemiology of “populations,” considering health problems from the point of view of society and not just as individual health risks;
- Involve social forces in local health systems to establish local participatory and intersectoral development processes, making health an active component in improving the quality of life, environmental protection, and social economic development; and
- Make the health system society’s primary tool for safeguarding the preservation of life by caring for the living heritage and a life-sustaining environment.

3.1 The process of health system reform should be supported by studies and research such as the following:

- Study subsidizing demand and subsidizing supply as tools for the health system, identifying the strengths and weaknesses of both in order to help governments in their discussions on health reform;
- Identify models to implement decentralization of health actions;
- Identify different health care models and experiments with new models of care developed in other countries;
- Identify and analyze social participation in order to include social organizations of users and suppliers in the discussion on reform of the health system; and
- Identify different types of health insurance, including basic health package, basic insurance, guaranteed insurance, etc.

4. The Environment

This presentation has assigned a greater role to the environment as a health determinant because it is an emerging subject and because it has been suggested that more than 50% of the health problems in the next millennium would be associated with changes in the environment. Thus, we will analyze the environment in more detail than the other health determinants.

There is general agreement that development is based on a preserved and protected environment, which is expressed as "environmental equity," meaning biologically and chemically clean water, unpolluted air, soils with nutrients and without heavy metals and pesticides, a stress-free workplace without noise, biological and chemical pollution, and a macro-environment with normal development of the species and harmonious human culture, in physical terms (temperature, radiation and atmospheric composition that supports life), chemical terms [creation of new compounds (Commener, 83)], biological terms (wastewater treatment and byproducts of the development, suitable final disposal of pesticides), psychological terms (control of domestic and social violence, international legislation on the macro-environment), and in social terms (equity and human rights).

4.1 The previous paradigm of "environmental equity" is constantly being challenged by great problems in the global macro-environment and in the local environment (Commener, 83, World Development Report 1992, Dubos, 82). In summary, the principal problems threatening the macro-environment of the planet are:

- Global warming;
- Loss of the ozone layer;
- Creation of deserts;
- Decreased fresh water due to salinization of water;
- Progressive destruction of tropical rain forests and cold rain forests;
- Loss of arable land;
- Rapid disappearance of animal and plant species; and
- Rapid urbanization and development of the megalopolis.

In the **local environment** specific to countries and regions, serious processes that harm the environment and eliminate the possibility of the desideratum of environmental equity have also been identified. Currently, the most severe processes of deterioration identified in the local environment are:

- Physical, chemical, and biological contamination of air, both in the atmosphere and within dwellings and work and recreation sites;
- Specific chemical and biological pollution of water for human use;
- Contamination from heavy metals (Pb, As, F, Cr, Al) in water, work areas and soils;
- Pesticides, herbicides, and fungicides in water and soils;
- Increased human contact with solvents;
- Increased solid wastes from cities and industrial processes; and
- Lack of a solution for final disposal of radioactive waste.

4.2 This long list at the global and local level tends to grow longer, particularly in poor countries. For example, it has been seen that air pollution from inhalable particles and gases (SO₂) has increased in these countries, while declining in the more developed countries, indicating that this type of increase can be controlled with current technology (World Development Report, 92).

4.3 **There are various trends in Latin America and the Caribbean** that tend to make problems in the macro-environment and the local environment more complex. These trends within current Latin American reality include the tendency of the population to migrate to larger cities (megalopolis), as previously indicated (2.3). Some of these trends are:

4.3.1 - Changes in climate caused by the El Niño current, which has led to increased temperatures in the Pacific Ocean. The hypothesis regarding this heating of the Pacific has been attributed not only to the effect of human activity but also to increased rainfall in the central Pacific (Monastersky, March/95).

4.3.2 - The loss of the ozone layer in the southern part of the South America (ECO, Environmental epidemiology, 92; Lipkin, 95) is causing an increase in ultraviolet

radiation with the resulting effect on human health and other animal and plant species. This effect on the protective ozone layer (12 to 50 kilometers from the surface) would be due to increased fluorocarbons and molecules with highly stable chlorine and bromine that destroy the ozone. The thinning of the ozone layer is more obvious in the Antarctic and the southern area of the American hemisphere, creating what is known today as the "Ozone Hole." This process is progressive, with this protective layer diminishing in each decade by 2 to 4 percent. (Monastersky, May/95) Studies have demonstrated that between 1979 and 1995 the ozone layer was reduced by 20% to 35%. It has also been demonstrated that a loss is occurring in the Arctic, with a reduction in the ozone of 35% as compared with 1979 measurements. (World Meteorological Organization, 94 and NASA's Upper Atmosphere Research Satellite, 94)

4.4 *Health Problems as a Result of Environmental Deterioration*

Changes in the environment occurring in Latin America and the Caribbean have negative effects on human health. In order to define these effects on health, we must address each environmental factor and identify the health risks and damage and the effects identified in the health of those living in the region under study.

In Annex A, deterioration in the environment will be analyzed in terms of contamination or changes in water, housing sanitation, in the atmosphere and in household air, in soil, and in labor environments.

4.5 *Questions and Challenges for Environmental Research*

The questions and challenges involving problems that represent serious and growing deterioration for the Region should be addressed not just by weighing the damage but by seeking interventions that limit or reverse this deterioration and its effect on human health. To facilitate the analysis, these questions and challenges will be established for each previously studied area.

4.5.1 Warming Atmosphere and Seas

As mentioned previously, from a health perspective, the appearance of new vectors due to ecological change is significant for Mexico, Argentina, Chile and Uruguay. Study should be directed to habitat, household infestation and factors controlling the spread of *Aedes aegypti*, *Anopheles maculipennis*, *Triatomae infestans* and *redubidius* and *Triatomae spinolais*. In addition, studies should be done on the situation of plankton infested with *Vibrio cholerae*. There should also be study on including dengue, yellow fever, malaria, and Chagas' disease in epidemiological surveillance mechanisms, in order to monitor their status and establish the presence of "native" cases in non-endemic areas for these pathologies.

Another area for research is parasites with part of their cycle in the environment when modifications in temperature would alter these cycles. This is true of:

- *Ascaris lumbricoides*, that requires moisture and high temperatures to complete the cycle and make the infesting eggs, and
- *Necator americanus* and *Ancylostoma duodenale*, which also require a moist environment and higher temperatures to develop the infesting larva.

Another area of development is to study or establish epidemiological monitoring systems in the area of 16°C isotherms, which is the ceiling for development of vectors and parasites with cycles in the environment. These parasites could include *Schistosoma haematobium*, since it has been reported that when there were changes in climate as a result of the Aswan dam in Egypt, this parasitic disease was seen to appear in non-endemic areas.

4.5.2 Increase in Ultraviolet Radiation (UR)

The result of loss of the ozone layer is an increase in ultraviolet radiation of 2% for every 1% lost from the protective layer. As a result, the questions emerging in the area of health relate to weighing the impact of this ultraviolet radiation on tissues that respond negatively to radiation such as skin, eyes and the immune system. Chile and

Argentina should handle these studies, establishing high-risk populations, the signs of greater exposure and factors aggravating exposure to radiation. In addition to seeking models for life in the open air in order to reduce exposure, especially for children who will run the risk of more years of exposure to UR.

Chile and Argentina should have joint interventions to produce educational policies in the southern areas of both countries, to limit the exposure of students to UR, by limiting physical education and sports activities or conducting them inside. Similarly, the population might have to be educated in the use of UR protective glasses to prevent cataracts. Studies should be promoted to study the effects of UR on people's immune systems, both general immunity and local immunity.

4.5.3 Air Pollution

In the corresponding sections, health hazards from atmospheric pollutants have been projected. The many questions that arise from the studies done in Latin America and from general information are as follows:

4.5.3.1 - Although research in Latin America and the Caribbean is very limited, the general information indicates that inhalable particles are associated with respiratory irritation, bronchial obstruction and pneumonias. In the association with pneumonia, the physical-pathological basis of the deleterious action has not been elucidated and it is important to know these pathological processes. Nor is there any knowledge as to the reason for synergistic action with SO₂. In addition, in all episodes with high mortality from contaminated air, the presence of both pollutants, PM10 and SO₃, have been found. This situation should be explained in terms of pathogens. There should also be study on the effects of particles smaller than 2.5 microns on the respiratory tract and human health.

Another aspect where research is needed is the reason for the latent period of two to three days to establish the association of total mortality and the continued increase of inhalable particles. Like the "adsorption" on the surface of inhalable

particles, this is a phenomenon that merits greater research because it is the mechanism whereby heavy metals enter the bloodstream.

4.5.3.2 - In addition, the action of secondary oxidants (O_3 , NO_2 and oxidized derivatives of sulfur), which are increasing in locations where they have been measured, should be studied in terms of their possible, although not substantiated, association with pneumonia.

4.5.3.3 - The accumulation of obstructive harm caused by long exposure to particles and polluting gases, as observed in California, is an area for study in cities such as Santiago, Mexico, Sao Paulo, Bogota, Buenos Aires and Rio de Janeiro, which have been exposed to pollutants for a long time.

4.5.3.4 - In addition to these questions being asked to generate knowledge, it is the responsibility of the countries to study the situation and the effects of pollution on their cities. It is recommended that an epidemiological study be conducted with the advantages of the ecological epidemiological research model and the degree of exposure model, as in the epidemiological study of Santiago.

4.5.3.5 - In addition to questions regarding aspects of respiratory diseases, we must define the effects on health with respect to cardiovascular diseases, particularly in coronary ischemic disorders associated with CO. Hypertension and its connection with lead should also be studied.

4.5.3.6 - Other pollutants such as aldehydes represent a type of contamination whose effects on human health should be better defined. Ethanol and by-products from the combustion of natural gas, energy sources being developed in Latin America, are pollutants whose effects on health should also be defined.

4.5.4 Indoor Air Pollution

In this place where people spend more than half of their day, it is important to know the pollutants more precisely and their effects on health in Latin America. Areas for investigation could be:

- Introduction of air pollution in housing, spread of contaminants in different rooms and insulation of areas where pollutants are issued (kitchen);
- Research on domestic fuels, especially fire-wood, in terms of the types of pollutants being produced and their association with the type of stove or heater;
- Radon and other pollutants in housing and their effects on health;
- Liquefied gas and its possible pollutants, since it is the fuel most frequently used and its use is spreading; and
- Morbidity and mortality associated with household pollutants.

4.5.5 Pesticides and Similar Products

Areas that warrant investigation are:

- More precise knowledge regarding actual rates for pesticide poisoning since current information is limited. Study a national epidemiological surveillance system that is coordinated inter-regionally to monitor these poisonings, particularly from pesticides banned in other countries and used in Latin America.(ECO. 93);
- Study and confirm the development of "biological markers." For example, confirm ethylene-thiourea as a marker for exposure to EBCD, in order to weigh its teratogenic, carcinogenic and neurological effects. Standardize the cholinesterase test for people exposed to organophosphorus compounds (ECO, 93); and
- Develop study of groups of people chronically exposed to pesticides in order to learn about the chronic effects of different pesticides.

4.5.6 Solvents

Subjects to be studied in-depth in Latin America are the following:

- Study reproductive risks from specific solvents in exposed populations;
- Studies of groups of workers in industries that continually use solvents such as glue and paint factories and refineries.(ECO, 93);
- Study the chronic biological and psychological effects of solvents when used as narcotics (inhaling glues with toluene); and
- Apply the concept of "sentinel events in occupational health" to study. Appearance of diseases, disabilities, or unnecessary deaths in the work area. Suggested pathologies include silicotuberculosis, brucellosis, tetanus, hepatitis A, leptospirosis, cancer of the nasopharynx, mesothelioma, bone cancer, acute leukemia, aplastic anemia, toxic encephalitis, ataxia, cataracts, tinnitus, renal insufficiency and infertility in men. (ECO, 93)

4.5.7 Water Pollution

The area of sanitation and safe water has been intensely analyzed in Latin America. However, severe environmental changes represent new challenges for research such as:

- Progressive shortage of fresh water suggests the need to study the age of the water being used, when this water is not renewable and above all if it will be used in mining work, with the risk of contamination from heavy metals;
- Establish group study on exposure of people who ingest water contaminated by heavy metals such as As, Cr, Pb, FI and others; and
- Study the water salinization process and look for mechanisms to prevent this harm to an irreplaceable natural resource.

Principal Recommendations

4.6

Studies have demonstrated that scientific output in Latin America and the Caribbean is limited and that most research is concentrated in a few countries (Pellegrini 1996). Thus, priority should be given to developing a research policy based on three broad guidelines:

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- Identify the gaps in knowledge with respect to population and individual risks of health problems on the continent, prioritizing by Region and country;
- Help the countries to train and maintain a critical mass of researchers capable of developing research and studies in accordance with the state of the art in scientific research; and
- Help to identify sources of bibliographic support and resources to support and finance necessary research at the level of PAHO and specific countries.

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