Nutrition and an Active Life

From Knowledge to Action

Wilma B. Freire, Editor
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TRANSPORTATION, URBAN DEVELOPMENT, AND PUBLIC SAFETY IN LATIN AMERICA: THEIR IMPORTANCE TO PUBLIC HEALTH AND AN ACTIVE LIFESTYLE

Enrique R. Jacoby, Ricardo Montezuma, Marilyn Rice, Miguel Malo, and Carlos Crespo

INTRODUCTION

The headline read: "88% do not feel safe on the streets of Lima." With that eye-catching opening, in November 2003, Peru's El Comercio newspaper reported the results of a public opinion poll, together with another no less alarming finding: "53% do not even feel safe in their own home" (1). "The streets belong to us," declared an editorial appearing in Puerto Rico's El Nuevo Día one year later, which called for a national civic crusade "to make sure that people feel safe on the streets and to take back our cities" (2).

In November 2004, Chico Buarque, a well-known Brazilian singer, referred to life in Rio de Janeiro with these words: "The social differences of old were not what they are today. When I was little, I played soccer with the kids from the slums. Today's social isolation, with people more and more afraid of violence and withdrawing into their own bullet-proof world, makes that type of contact almost impossible now" (3).

For the majority of Latin Americans, this kind of story is very familiar, and Buarque hits the nail on the head by reminding us—especially those of us who are now going gray—of what we've left behind: those times when we enjoyed a sense of community, when we had freedom of movement and the streets belonged to all of us (or almost all of us). Will this be our unavoidable destiny? Probably not. As the saying goes, "Nothing lasts forever." And then there's the case of the city of Bogotá, which seems to confirm that.

The tale of Samuel Sotomayor is illustrative. When Samuel returned to the streets of Bogotá in 2001 after 17 years in prison, he felt "wonderment: on the one hand, Bogotá had changed tremendously; it was more orderly, parks and green areas had sprung up in the neighborhoods, the transportation system had been modernized, and everywhere people were coming and going, to school or to work, riding along on bicycle paths... a city that was no longer a crazy, irresponsible teenager, but now a keen young person searching anxiously for his or her own destiny."

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Samuel, a fictional character from the novel *Cobro de Sangre*, by Mario Mendoza (4), tells a story with which anyone who had been away from this city during the 1990s could identify. Indeed, in that period Bogotá emerged from the chaos of the streets and rampant violence to collectively embrace a life-affirming perspective and a respect for one’s neighbor that, among other things, turned public places back over to pedestrians and cyclists, set up parks, and created a good public transportation system. In the eight years since this experiment began, the rate of deaths from violence had fallen 42%.6

From a public health perspective, the situation in a majority of cities throughout the Region of the Americas presents a series of common problems, including a lack of security, violence, stress, social disintegration, and physical inactivity, all of which are recognized health risk factors leading to epidemics in cardiovascular diseases, mental health problems, and obesity, which together cause almost 60% of the deaths in the Region today (5). Yet from the perspective of both urban planners and elected political authorities, the diagnosis is commonly that of a sick city, characterized by symptoms of rampant delinquency, unsafe streets, social segregation, chaotic transportation, a shrinking of public spaces, and environmental pollution. Unlike the public health approach, which focuses on the individual, the urban planning mindset seeks to address existing ills from a collective perspective, setting as priorities the improvement of urban quality of life, securing a healthy environment, and providing efficient public infrastructure, such as transportation and appropriate urban land use, among others.

Yet even if public health authorities and urban planners take disparate and unarticulated approaches, it is nonetheless worthwhile to question whether these viewpoints are necessarily irreconcilable, and more specifically, if there might not be some link between the environmental quality of the city, the availability of options for public transportation, and the status of health and physical activity of the city’s inhabitants. These considerations are the central questions that this chapter will address, and the reader will discover numerous responses within the two main sections of this chapter.

First, the history of sedentary lifestyles in developed countries is addressed, followed by a description of the current situation in Latin America, which now confronts the dilemma of whether or not to take the same road as the nations of the Northern Hemisphere. The final section and the conclusions identify urban and transportation policies that could become part of public health efforts to promote the importance of adopting an active lifestyle. This broader scope in the field of urban planning policies could prove to be vital, especially now that the World Health Organization (WHO) has placed among its highest priorities the adoption of a population-wide, prevention-based strategy to combat the global epidemic of non-communicable diseases (6).

### The City and Public Health: A Historical Relationship

Despite their common historical roots, urban planning and public health have followed separate pathways for more than half a century. The influential report of Edwin Chadwick on the health and living conditions of the working classes in the British Isles during the mid-nineteenth century laid the foundation for the public health focus by pointing out that substandard and overcrowded housing and labor conditions, as well as the unhygienic state of the streets, were associated with the large-scale cholera and typhus epidemics then ravaging the population. Influenced by civil engineering, his report’s proposals for health sector reform consisted of adopting strict measures for the disposal of solid wastes and excreta, as well as for rodent

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6 A detailed description of Bogotá’s transformation is found in the Ricardo Montezuma chapter in this book.
control. Widespread propagation of these measures curbed the epidemics then rampant, years before the microorganisms that caused them were identified.

Curiously, scientific progress and the theory of germs shifted the public health focus from the city to the microscope. Hence, attention passed from the population’s health to the health of the host—the affected individual—and the functions of the physician became more prominent. The major change in public health in the twentieth century was the emphasis on individual health risks versus social or environmental considerations, and the predominant strategy was aimed at identifying individual risk factors and modifying them by changing personal behavior.

Nevertheless, the relationship between the city and public health has once again gained importance. In the last century, the promotion of collective health in urban metropolises—a relatively new specialty—helped to reconfirm the close relationship between the quality of urban life and human health and well-being (7). Also, within the urban context, theories such as “new urban planning” and “a return to the traditional city” have emerged, which contend that the quality of city life can be improved through transportation policies that promote commuting on foot or by bicycle and discourage and/or restrict the use of personal vehicles (8). A growing body of empirical findings, descriptive observations, and social critiques has fueled the notion that the current rate of uncontrolled growth in large cities and the constant increase in motor vehicle traffic are two of the principal culprits in the deteriorating quality of life and health of urban populations.

Indeed, traffic accidents, poor air quality, stress, the loss of social cohesion, and physical inactivity are found in almost all twenty-first century large metropolises. Echoing these observations, in 1999 WHO published the report Healthy Cities and the City Planning Process (9); later, in 2001, along these same lines, the U.S. Institute of Medicine published its report on Rebuilding the Unity of Health and the Environment: A New Vision of Environmental Health for the 21st Century (10). Despite the fact that the recommendations included in these reports have merited special attention at the community and municipal levels in countries throughout the Region of the Americas, they have received only a lukewarm reception on sectoral and national political agendas (11).

THE PARADIGM OF CHANGING INDIVIDUAL BEHAVIOR

After having being applied for nearly a quarter century, the prescription of behavioral change at the individual level does not seem to have led, in and of itself, to significant results in terms of controlling the epidemics of obesity and diabetes, nor in controlling cardiovascular diseases and certain cancers. This can be seen in the United States and in other high income countries and may also be the case in certain developing countries. In the United States, for example, not only is it currently recognized that the health objectives for the year 2000 were not met, but it is entirely likely that the new and ambitious objectives set for 2010 will similarly not be achieved (12). Among them are eliminating exposure to environmental pollution, increasing by 100% the number of adults who participate in moderate physical activity (from 15% to 30%), and reducing the adult obesity rate from 23% to 15% (13). To date, the greatest progress made with respect to these indicators has occurred principally among those groups with the highest income and educational levels. In Latin America, where a coherent plan to combat chronic diseases has yet to be implemented, those individuals who follow proper guidelines for eating and undertake some degree of physical activity belong to the most comfortable social groups (14–16). This finding and the limitations it suggests are most likely due to poor practical implementation of the scien-
tific knowledge generated experimentally—both in the clinical and population contexts.\textsuperscript{7} In other words, under controlled conditions many research projects have documented that changes in behavior may produce positive health effects, but when put into practice—if this occurs—whether within the health services setting or at the population level itself, the results nonetheless have left a great deal to be desired (17, 18).

After carrying out an extensive and detailed review of social marketing campaigns aimed at encouraging proper eating habits and increased physical activity, Alcalay and Bell (19) indicate that, in controlled clinical and personalized trials, positive effects from controlling health hazards can be achieved in 10% to 20% of the cases, but it is unlikely that these effects can be achieved with population-based interventions, even when the project’s economic resources are not a limiting factor. The authors conclude that it is necessary to rethink intervention strategies based on mere information dissemination and to place more emphasis on the role of environmental factors and social norms. Nevertheless, it should be recognized that in addition to this particular challenge, and especially in Latin America, the general public has limited direct access to scientific information, as well as difficulty in putting that information into practice.

The only modest results obtained in terms of behavioral change may also be explained by the fact that epidemics such as obesity and diabetes are not deemed to be a critical situation that demands significant social changes (20). Along this same line, Alfred Sommer, Dean of the Johns Hopkins University School of Public Health, recently pointed out that “it is a lot easier to avoid risky behavior when everyone else does as well, and when the environment doesn’t support it” (21). Christopher Caldwell, a writer with The New Yorker, observed that the lower rates of smoking achieved in the United States in the last 40 years are attributable more to “societal self-binding”—the social commitment (and political will) to combat the habit or put an end to it—rather than to access to new information (22).

Public health recommendations to change lifestyle habits have focused on the individual’s cognitive and behavioral processes, dissociating them in the majority of cases from their social and cultural determinants. This perspective was based on such theories as reasoned action and planned behavior and the Transtheoretical Model (23), which share a common postulate: that people learn to surmount risks and overcome obstacles for the benefit of their health, but without any fundamental modification of those risks and obstacles. The logical sequence would be: informed individual $\rightarrow$ change of attitude $\rightarrow$ behavior change.

These considerations should not lead us to conclude that educational activities, information provision, and social marketing are totally ineffectual. On the contrary, they are essential starting points for reaching consensus and developing new health paradigms, as well as for recruiting the first wave of innovative individuals willing to attempt behavior change. However, these actions are insufficient in and of themselves if we consider the vast majority of the population. Anti-smoking campaigns exemplify how information was vital for that first group to initiate changes, but it was not until after instituting public standards (regarding advertising and the sale of tobacco to minors), restrictive measures (such as smoke-free public places), and economic deterrents (higher taxes) that a substantial drop in the number of smokers was noted in the population, at least in those societies where such types of actions were implemented. The use of safety belts in automobiles is another example of how the combination of information, incen-

\textsuperscript{7}This type of research refers to controlled clinical trials in which the researcher randomly assigns individuals to one of two groups: one that receives the intervention (or treatment) and another that receives a placebo and serves as an observer.
tives, and coercion succeeded in securing widespread compliance, especially in developing countries.

With regard to promoting physical activity, the interventions that have been studied to date indicate three possible results: only short-term effects, little effect, or no effect at all (24). This has led some experts to conclude that the principles of individual behavioral change alone are an inadequate response to the epidemic dimension of sedentary lifestyles and that more attention needs to be focused on the complexity of this behavior, as well as on the possibility of responding to the epidemic with interdisciplinary actions (25).

A SEDENTARY LIFESTYLE IN THE NORTHERN HEMISPHERE

The Paradox of Little Demand for the “Best Buy”

In the last quarter century, countless studies have shown the usefulness of physical activity for both physical and mental health. Among the principal public health benefits are a reduction in mortality and prevention and control of obesity, hypertension, diabetes, and cardiovascular diseases. It has also been established that physical activity decreases stress and facilitates positive social interaction (26, 27). It is not an exaggeration, then, to claim that this abundance of benefits qualifies as “today’s best buy in public health” (28).

The quantity and intensity of physical activity needed to obtain these benefits has been well documented. The recommendations, furthermore, have gone from more to less: from practicing aerobics and other types of systematic exercise, as was advised in the 1970s and 1980s, to today spending a mere 30 minutes daily in moderate forms of physical activity, such as walking, bicycling, dancing, or going up and down stairs. These 30 minutes a day help to ensure a healthy outcome with a minimum investment in physical effort, time, and money and also hold the potential for increased social interaction among large and diverse groups of people who have incorporated a gamut of physical activities into their daily routine (29).

In the United States and other developed countries, however, the scientifically proven benefits derived from following recommendations on physical activity did not translate into higher active lifestyle rates or into a reduction of obesity rates. The Centers for Disease Control and Prevention’s statistics indicate that physical inactivity rates remained almost constant (at approximately 55%) during the 1990s (30). At least with respect to the U.S. population, this finding cannot be attributed to a lack of available information, especially in light of the fact that there is almost universal recognition of the benefits of an active lifestyle. The reason for this incongruity, then, must lie beyond the existence of information and awareness.

U.S. Suburbia, Personal Vehicles, and Technological Innovation

Those who have studied physical activity, particularly in the United States, pay close attention to the possible influences exerted on human behavior by the urban environment and the available means of transportation in large cities, particularly as these relate to physical exercise. This relatively new interest stems in part from discoveries made by transportation experts and urban planners over the past 30 years through their studies of “human mobility,” which indicate that certain characteristics of the organization and layout of cities influence people’s daily commuting practices—with or without motor vehicles—as well as the degree to which they lead a sedentary life (31).

During the second half of the twentieth century, U.S. economic growth and continuous improvement of the middle class’s standard of living led to a progressive abandonment of collective dwellings in traditional
urban centers and to migration to individual dwellings located on the periphery of those centers, thus creating low density suburbs. One of the reasons for this migration was the expectation of recovering that lost sense of peace and harmony to be found only in the countryside without having to sacrifice the benefits and conveniences of city life. Urban growth’s new direction was fueled by the large-scale construction of expressways and turnpikes and a parallel and growing dependency on private automobiles.

The suburban model in the United States consists of an extensive spread of single-family homes with a scattering of commercial centers and other activity and services centers, each at some distance from the others. This segregation and parceling of the land—unlike the traditional European model consisting of a diverse, compact city—results in a situation in which the majority of the inhabitants’ typical destinations are far from one another and poorly interconnected, so that some type of motorized transportation is needed to get from one place to another in a reasonable amount of time. Some believe that this suburban model discourages walking, reduces available public spaces, decreases human contact, and creates a dependency upon automobiles. At the center of some of the theories advanced in several North American urban doctrines, such as the New Urbanism (8, 32), is the need to reverse this trend and to improve people’s quality of life, an idea which has attracted the attention of public health experts interested in turning the tide against the growing tendency toward physical inactivity.

The influences of mass versus individual transportation have contributed to the formation of two opposite systems of urban structure and space utilization. For example, in the majority of European cities, the space allocated for mobility represents around 20% of the urbanized land surface; on the contrary, in some U.S. cities this percentage is above 70% (33). In Paris, space allocated for traffic circulation represents only 23%, while in Los Angeles it is more than 70%. The differences in these two urban mobility models not only have to do with space utilization, but are also manifested in well-defined and dissimilar social characteristics, which most likely preceded the present urban realities. In the case of Paris, mass transportation has contributed to the development of what is public, what is community, and what is social, while in the case of Los Angeles, where mobility in one’s own automobile is both a priority and a majority value, the principles are much more related to what is private and individual.

In developed countries where urban planning has favored mass transportation, concentric, dense cities have been fused—the European cities.8 “The Stockholm subway is a good illustration of the densifying effect induced by urban rail transportation: the 1954 transportation plan, which proposed the subway, was conceived around the same time as the 1952 urbanization plan; and the subway stations opened at the same time—or even before—completion of construction of the new neighborhoods surrounding the stations” (34). In developing cities, there is only the case of Curitiba, Brazil, in which urban planning has been based on a system of mass transportation. On the other hand, in places where urban planning has given priority to individual transportation, the presence of highways and automobiles has given

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8The majority of European cities, “enormous urban concentrations, dense and well covered by mass transit, seem to discourage motorization or at least the use of automobiles.” Dupuy C, L’auto et la ville, Flammarion, Paris, Collection Domus, 1965, p. 21. There exist other cases in the world where mass transit has played an even more central role in urban life, but this appears to be related to such characteristics as space availability or the particular type of city planning. For example, in Asian cities such as Tokyo and Hong Kong, the active role of mass transit has been influenced by the lack of space, and the new cities of the former Soviet Union have been deliberately designed on the basis of mass transit.
way to dispersed, low density agglomerations similar to the residential suburbs so typically found in the United States.

There are also other factors that help to explain the contemporary tendency toward a sedentary lifestyle and its pervasiveness. Among these, the most obvious factor involves the evolving nature of the working world that accompanies rapid urbanization. Here we see growth in the services sector, automation in the manufacturing sector, and an economy increasingly dominated by computers and computer technology. Domestic life, as well, has been "liberated" from physical labor, and the growing mechanization of household tasks is ubiquitous. Promoting increased physical activity appears to be not only impractical within this context, but anachronistic, since the idea would be at cross-purposes with the sign of our times: productivity and the ability to do more things in less time. Even our entertainment preferences and how we spend our free time have changed: a predilection for walking, versus electronic games and television, has been relegated to the category of "a thing of the past," in much the same way as has the idea of children going to play in the "great out-of-doors" from morning to dusk. According to economist Darius Lakdawalla, rapid assimilation of technological innovations in the marketplace and in domestic life is alone responsible for some 60% of the increase in obesity in the United States (35).

**How Does the Urban Physical Environment Influence Physical Activity Levels?**

The previous section's discussion is not only logically persuasive and supported by significant econometric estimates, but is further bolstered by important empirical corroboration indicating just how certain physical, functional, and cultural characteristics of a city and its transportation system (in other words, the urban physical environment) impact on human health through their influence on physical activity, air quality, and personal and traffic safety. For example, an ecological study conducted by Ewing and colleagues (36) has linked suburban life in the United States with hypertension and obesity. With even more refined study methods, these same authors have shown, in the city of Atlanta, that in neighborhoods where land use is more diversified (i.e., includes a mix of residences, commercial businesses, entertainment and recreational centers, and public parks, for example), the obesity rates recorded are lower than those in the type of suburban neighborhoods described earlier in this chapter. The authors found, furthermore, that the city-obesity relationship was affected by the frequency with which people walked (37).

In a study conducted in eight provinces in China, where a group of adults was monitored between 1989 and 1997, the results at the end of that period showed that automobile ownership was correlated with developing obesity. Among the male subjects who had acquired a car (14%) during the eight years that the study lasted, an average weight increase of 1.8 kg was observed, along with an increased risk of obesity, in comparison with those who had not acquired an automobile during that same period (38).

At a more detailed level, studies carried out by experts in urban affairs and road safety—mainly in Europe and the United States—show how specific characteristics of urban space design and transportation systems influence the population's level of physical activity. The most studied factor has been urban density and non-motorized transportation; i.e., walking and bicycling. It is currently recognized that higher population and urban building densities promote the habit of walking. This effect can be increased even more with a highly diversified land use plan that includes residences, businesses, entertainment sites, and schools all located within a relatively close distance.
to one another (39). In a study by Frank, Andresen, and Schmid, it was found that obesity risk decreased 12.2% in each successive quartile of mixed land use and declined by 4.8% for each additional kilometer walked. They also observed that every additional hour of using an automobile increased the obesity risk by 6% (37).

The second-most-studied aspect dealt with transportation systems and street networks. The traditional urban grid layout represented by the typical city block provides high “connectivity,” in contrast with the characteristic curvilinear layout of U.S. residential suburbs. In the traditional layout, there are any number of viable options for interconnecting two given geographical points (high connectivity), while in the suburban layout, the “streets” are not intended to connect pedestrian destinations, but rather, follow the logical flow of motor vehicle traffic.

Furthermore, low connectivity and long distances between daily destinations, while increasing the functionality of the automobile for a U.S.-type lifestyle, at the same time hinder the appeal and profitability of public transportation because of the long distances that must be traveled as a result of the distinctly segregated use of public space. In the United States, 90% of the total number of daily trips are made in an automobile, and in more dispersed urban suburbs, such as those of Atlanta, for example, every resident travels an average of 55 kilometers a day, while in Philadelphia and San Francisco, cities with higher population densities, the averages are 27 and 34 kilometers, respectively.

The third element that characterizes a city’s physical environment and has been extensively studied is urban space design. Factors such as degree of street cleanliness, pavement condition, the presence of natural greenery, and personal and traffic safety all influence a person’s decision to walk, although it has been noted that these elements have only a modest impact, basically on recreational walking rather than walking to and from the workplace (29).

**From Scientific Evidence to Public Policies**

The issue of urban design and its relationship with physical activity, as just presented in a brief overview here, has generated two responses in the United States. On the one hand, there are those who maintain that the influence of transportation policies on health is conclusive, especially with regard to traffic accidents, environmental pollution, and physical inactivity (40, 41); consequently, the proponents of this response propose that attention be focused not on highway construction, but rather on promoting investments in various forms of commuting, whether by public transportation, on foot, or by bicycle. This investment—according to this group—could have a multiplier effect if it were to be accompanied by parallel changes in city designs, thereby making metropolitan areas more varied, dense, compact, and stimulating to pedestrians (42, 43).

On the other hand, a group of experts recently brought together by the U.S. Institute of Medicine and the Transportation Research Board, after having evaluated the scientific evidence available to date, concluded that most of the existing information has come from cross-sectional studies, which makes the establishment of a cause-and-effect link more difficult, even though the group did, at the same time, recognize the possibility of an associative link between a city’s physical environment and its people’s health, including physical activity. In light of these findings, the experts maintained that it would be premature to adopt public policy decisions based on this accumulated data and instead recommended conducting new studies with better conceptual preparation and more rigorous designs (44).

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9This refers to studies conducted at a particular point in time (surveys, for example) in which the final result—physical activity or obesity—is evaluated at the same time as explanatory variables, such as the physical environment and the socio-demographic characteristics of the participants.
PHYSICAL ACTIVITY, WALKING
HABITS, AND MASS TRANSIT USE
IN LATIN AMERICA

Walking for Utilitarian and Recreational Purposes

Until a few years ago, public health experts depended on surveys related to the practice of sports in order to determine the level of sedentary lifestyle among a given population. In Latin America, those surveys—usually administered by sports authorities—showed that only some 15% to 20% of adults engaged in sports activities, usually men and individuals at a high socioeconomic level, and that this activity tended to decline with age (45, 46). In the absence of a more refined means of study, around 80% of the population was classified as “inactive.”

The recent development of standardized methods for measuring physical activity, such as the International Physical Activity Questionnaire (IPAQ) (47), has improved those measurements. This new instrument now makes it possible to analyze all domains of physical activity (i.e., domestic chores, work-related, recreational, and transportation), as well as their duration and intensity. Unfortunately, the IPAQ, in its short format, does not make a distinction between the different activity domains.

Figure 1 shows the results of surveys conducted in a selection of Latin American cities that used the short version of the IPAQ questionnaire (48–52). In general, the participants (men and women combined) were classified as “active” if they had undertaken at least 30 minutes of moderate physical activity in five out of the last seven days prior to the survey, or if they performed vigorous physical activities 10–20 minutes a day at least three times per week. However, the different city surveys presented variations in their definition of what constituted an “active” person. Despite these variations, which may need to be adjusted to make the survey results fully comparable, it may be observed that between 37% and 75% of the survey participants were classified as active. These rates are two to four times greater than the results reported from the earlier-described sports surveys. How can this difference be explained? Is it due to the inclusion of physical work carried out around the home and walking? And as regards walking, how much is attributable to walking for recreational purposes versus walking for utilitarian purposes (e.g., domestic chores, transportation on foot as part of the regular workday)? The answers to these questions are relevant to the extent that they might help define and further refine intervention options.

The authors of the physical activity study conducted in Pelotas, Brazil, in 2002 (Figure 1) point out that even though recreational physical inactivity was reported as being inversely proportionate to socioeconomic levels, there is a direct correlation between socioeconomic level and overall inactivity level. In other words, overall physical activity among individuals in the lower socioeconomic strata was greater than that of groups at higher socioeconomic levels. The same authors postulate that “the results reflect the probability that occupational activities are a more important component than physical recreational activity in developing countries.”

10Vigorous physical activity is activity that accelerates respiration (and heart rate) and causes the individual to sweat more than with moderate physical activity. In metabolic terms, the first represents a minimum expenditure of 6 MET (metabolic equivalents) while the second represents from 3 to 6 MET. More information is available regarding these concepts at http://www.cdc.gov/nccdphp/dnpa/physical/measuring/met.htm.
11In the case of the Brazilian cities of Manaus, Belém, Rio de Janeiro, and São Paulo, the definition of “active” mentioned in the text adds a further option: the combination of moderate, vigorous, or walking activities performed at least five days a week for at least 150 minutes weekly. In the case of the city of Pelotas, the authors of the study used a broader definition of “active”: people who performed 150 minutes of moderate or vigorous physical activity, without considering the weekly frequency.
Given the importance of walking as a utilitarian and recreational activity, in 2003 Halal and colleagues conducted a second survey in Pelotas (53)—this time for the purpose of studying the pattern of recreational walking in order to be able to compare these results with the previous study, in which they examined all the walking domains: occupation, transportation, and leisure. According to this study, 73% of the respondents (71.8% of the men and 74.3% of the women) had walked to some extent during the previous week. Among those adults who followed the recommendation to walk ≥ 150 minutes per week in all the walking domains (regardless of weekly frequency), the participants belonging to the lower socioeconomic strata walked more than those in the higher socioeconomic groups (50.8% versus 38.4%). And among those who met the same requirement to walk ≥ 150 minutes, but this time taking into account only recreational walks, the higher socioeconomic groups reported higher rates than the poor (25.5% versus 11.6%). Thus, walking for utilitarian reasons by the poor seems to be almost four times more important than for groups belonging to higher socioeconomic classes (Figure 2).

According to a survey conducted by the FES Foundation in Colombia with the IPAQ questionnaire (48), the case of Pelotas is similar to that of Bogotá: of the 36.8% of the latter city’s residents—both men and women—who met the minimum requirements of physical activity, 60% reported that they walk, 20% participated in regular recreational activities, 11% utilized a bicycle as a means of transportation, and 9% performed much of their physical activity as part of household tasks and/or physically demanding occupational tasks.

The physical activity profiles for Pelotas and Bogotá may very well resemble those of many other Latin American cities, in the sense that the local economies typically are based largely on manufacturing concerns and there is widespread use of mass transportation. Use of a private automobile continues to be the exclusive domain of a select minority. But this dynamic is changing, and utilitarian physical activity will tend to decline as economic development increasingly incorporates automated and computerized production systems that are less dependent on physical work and the demand for private automobiles and mechanization in the home increases.

Walking is both a form of transportation and a widespread leisure-time activity throughout the Region of the Americas whose practice should be encouraged and facilitated within the context of physical activity’s contribution to optimum health and well-being (54). This relationship draws attention to the nature of transportation systems and mobility itself: according to experts, on average, two-thirds of the urban population in developing countries move about by means of walking or riding a bicycle; i.e., for utilitarian reasons (55). Given this situation, the reinforcement and ensured sustainability of these forms of mobilization seems advisable, before motorcycles and private automobiles become the transportation option of choice. Indeed, in many large cities in developing countries, the motorcycle has already become the stepping stone to complete motorization for the populace; it has succeeded in replacing taxis and buses in terms of personal preference, with a corresponding impact on accident rates and noise and air pollution levels.

In developed countries where the dependence upon private automobiles is very high, interventions aimed at promoting physical activity by discouraging frequent vehicular use have yielded merely modest results, and mainly only among highly motivated individuals (56). Experience indicates that an efficient mass transit system and widespread bicycle use are achieved only in the presence of proactive government policies favoring public transportation and energy conservation, as is the case in Germany, Japan, the Netherlands, and the Scandinavian countries. In these societies, travel by foot or
FIGURE 1. Minimally active population rates (men and women) measured with the short version of the IPAQ questionnaire.


FIGURE 2. Recreational physical activity (PA) and overall physical activity rates (including recreation, transportation, work, and miscellaneous) among those who walk ≥ 150 minutes per week, by socioeconomic level, in Pelotas, Brazil.

bicycle is feasible and convenient not only because travel by these means within certain areas takes the same amount or less time than the same trip would take by automobile, but also because automobile use implies additional costs (e.g., fuel, parking, licensing, taxes). In other words, walking and bicycling from one point to another in the city, instead of being viewed by residents as a stigma, are viewed positively as a viable, efficacious, and economical means of urban mobility.

Mass Transit Systems

In Latin America, a minority of the population—yet a rapidly growing one—uses the private automobile as a means of daily transportation. The average number of vehicles per family in this region was 0.15 during the 1990s (47), compared to 1.8 in the United States in 1995 (57).

Transportation studies in five Latin American metropolitan centers have shown that between 55% (São Paulo) and 83% (Mexico City) of the total number of daily trips are made using public transportation, with intermediate levels being 66% in Buenos Aires, 78% in Rio, and 82% in Lima (58). Throughout the developing world, the average number of trips on public transportation represents between 70% and 85% of the total number of daily trips (55). In comparison, the Nationwide Personal Transportation System survey in the United States indicated that 86% of the total amount of commuting by urban dwellers is via private automobile, contrasted with only 3% via mass transit systems (Figure 3) (29).

The impact of public transportation use on walking habits can be explained by the fact that passengers are usually required to walk to and from the bus (or train) station, and to and from their final destinations; thus, each trip has two components: one “motorized” and one “non-motorized.” In Bogotá, a series of surveys conducted by the organization Bogotá, Cómo Vamos (Bogotá: How Are We Doing?) (2002) show that mass transit passengers walk for 18.5 minutes a day, on average, which represents almost two-thirds of the recommended 30 minutes a day of moderate physical activity for health pur-

**FIGURE 3. Percentage of total daily trips made using mass transportation systems in Latin America and the United States.**

poses. In other words, daily use of mass transportation for commuting purposes could serve as an effective, wide-reaching public health intervention.

The bus systems in Bogotá and Curitiba are examples of how public transportation and pedestrian walkways (or bike paths for cyclists) can function synergistically, especially when access to public transportation stations is directly connected to pedestrian or bicycle path networks, as may be seen particularly in cities with high-density buildings (59). This is precisely the idea behind the concept of “transportation-oriented development,” which seeks to stimulate the growth of urban density and diversity alongside mass transportation corridors. The synergy between public transportation and walking habits can be made even greater if transportation systems are fast and efficient, and directly accessed by pedestrian walkways and bicycle paths. In other words, if conceived and managed with these strategic concepts in mind, public transportation systems have the capacity to become catalysts for the development of a city’s physical environment and can help to create a more favorable urban infrastructure for moving around on foot or by bicycle (60, 61).

On the other hand, the situation that prevails in many Latin American cities today involves a series of unregulated, decentralized options driven by demand. In Lima and Mexico City, for example, where the means of public transportation are controlled by thousands of private enterprise providers, the ubiquitous private automobile has invaded major thoroughfares, connecting side streets, and even public spaces, thereby creating inefficiencies and stimulating further demand for individual forms of motorized transportation.

The precarious organization and management of public transportation today in Latin America stem from the inability of city governments to effectively oversee and control transportation distributional patterns and volume, at the same time that transportation providers from the more or less informal sector have scant capacity or incentives to improve their own services. This latter group has created—whether out of financial need or convenience—a series of cooperatives, unions, committees, enterprises, and other types of similar arrangements in order to ensure their continued operation and sustainability. In fact, the collective number and size of these ventures have in many cases transformed them into the only (albeit de facto) urban transportation service provider, following the disappearance or weakened state of their public sector counterparts. Despite this, the day-to-day basic operations of these improvised arrangements lack the structural solidity and rational, broad-based scope and vision that might characterize for-profit, centralized enterprises of the formal sector. In Mexico City, for example, taxis represent 74.7% of the overall vehicle fleet allocated to public transportation, yet they make up only 6% of the total daily trips, while the corresponding rates for buses and minibuses are 22.2% and 73%, and the subway rates are 2% and 18% (62).

It is a fact of life that higher income levels and enhanced purchasing power increase the desirability of personal automobile and/or motorcycle ownership for the relative independence and convenience they offer as compared with other forms of transportation, in addition to their serving as symbols of economic well-being and prestige (63). The goal of securing access to individualized means of transportation stems not only from a function of lifestyle, but is also driven by public policies that fail to take into account the negative and costly effects of automobile transportation—in terms of energy consumption, environmental damage, risk of collision and injury, and increased tendency toward physical inactivity and developing obesity—resulting in an ironic situation that, in effect, only further reinforces the appeal and legitimacy of personal vehicle ownership. Examples of this de facto subsidizing of automobile use include the creation of new
residential communities increasingly distant from large metropolitan centers, public policies that favor investments in new highway construction over those aimed at improving mass transportation infrastructure, the development of incentives to boost automobile imports, and the establishment of only moderate gasoline taxes. In these cases, the rationale of a transportation policy becomes one that is centered on moving the largest number of vehicles possible in the shortest amount of time with a minimum of traffic congestion (64). In low and middle income economies, this situation often translates into a cross-subsidization by the poor for the benefit of the most economically well-off, a phenomenon which has attracted the scrutiny of diverse experts questioning the long-term sustainability of today’s status quo (65).

One of the greatest problems facing the Region of the Americas, from the perspectives of both transportation and public health experts, is the increasing number of private vehicles in circulation and the deterioration (deregulation, decentralization, privatization, and equipment aging and disrepair) of mass transportation, a situation which has wrought significant social, environmental, energy, and health consequences (66, 67). The increasing number of trips made in private automobiles is still limited in Latin America in comparison with the United States, but that trend is changing. For example, in Chile, which has experienced significant economic growth over the past 15 years, there is a growing predilection toward use of private automobiles and living away from the city in distant suburbs that increasingly resemble the U.S. model. Between 1991 and 2001, the number of trips made on public buses in Santiago decreased from nearly 60% to 42%, while the number of trips made in automobiles increased from 18.5% to 38% (Figure 4). The effects of this trend on environmental pollution and health have already become clear, and some measures—including restricting the volume of vehicles in simultaneous circulation and improving fuel and quality—have already been adopted.12 Although these measures have not solved the problem, there is at least some consensus between political authorities and public opinion polls recognizing the relationship between automobiles, transportation systems, and health. Hopefully in the future, this recognition will extend to other health problems, such as sedentary lifestyle, stress, and quality of life of the population, creating a favorable synergy for public health actions in this area.

Policies for Sustainable Urban Transportation

There is no doubt that transportation fulfills an important function in economic development by promoting efficiencies in the labor market, providing access to goods and services, and fostering urban growth, both nationally as well as internationally. Hence, some 16% of the World Bank’s total annual loans go to this sector (66). This same institution, however, points out important challenges threatening the sustainability of transportation systems, especially in the developing world. Among these are increasing motorization, emerging transportation needs related to world trade, vehicular congestion, environmental pollution, limited access by the poor to means of transportation, and users’ expectations that road systems should be safer and of better quality (68). To cope with these challenges, a sustainable transportation policy has been taking shape in recent years, a key element of which is the notion that a higher demand for transportation services might very well not reflect legitimate demands from passengers, but could be strongly influenced instead by factors such as physical distances created by urban dispersion, deficient public transportation systems, and a false sense of the real costs of driving (41).

12Recently, Chile’s transportation authority launched a new surface public transportation system known as Transantiago with the goal of discouraging private automobile use and similarly helping to reverse the other trends noted.
Sustainable transportation, from the World Bank's perspective, consists of three central elements: economic sustainability, to allow for efficient use of physical resources and their maintenance; social sustainability, so that the benefits of transportation may be available to all groups within society; and environmental sustainability, which should be taken into account in order to avoid the external effects of both public and private transportation in terms of health and the environment, when making decisions aimed at improving overall socioeconomic development. Aside from the financing and management strategies that are an intrinsic part of this proposal, the policy of sustainable transportation points to three specific actions that have a synergistic effect from the sustainability standpoint: addressing environmental problems, ensuring road safety, and promoting alternative transportation, which includes better pedestrian infrastructure and promoting bicycle transportation.

The foregoing discussion constitutes an excellent opportunity to establish linkages between public health and transportation interventions. Many of the public health concerns that have been raised in response to growing urban motorization have now been reinforced. The fact that the current trend in road policies is to emphasize people mobility, and not vehicle mobility, has placed the human dimension at the very center of the debate, along with the issue of health (particularly the importance of physical activity); as a result, the well-being of the population—both city and suburban dwellers—might very well come to the forefront and occupy a preferential place on the public agenda. The social impact of public transportation is no less important, inasmuch as it facilitates increased social contact and interaction. In contrast to the isolation inherent in private automobile use, mass transportation breaks down social barriers by bringing together passengers of all socioeconomic strata who take the train, bus, or ferry on a daily basis. This exchange can create more social confidence and stimulate the implementation of other types of social policies seeking to im-
prove living conditions across a broad spectrum of society.

ROAD SAFETY

The Impact on Health

Traffic accidents were one of the first problems related to transportation issues to capture the attention of political leaders around the world. As early as 1974, WHO World Health Assembly resolution 27.59 declared that traffic accidents constituted a major public health problem. Today it is estimated that every year 1.2 million people lose their lives and nearly 50 million are wounded in traffic accidents (69). According to WHO, in 1990, transportation-related injuries ranked ninth place among factors contributing to the world disease burden, and it is estimated that if the current trend continues, by 2020 traffic accidents will have risen to third place. In Latin America and the Caribbean, the number of deaths attributable to traffic accidents will increase by 48%; in Asia, by 144%; while in high income countries, it will diminish by 26%. The problem’s dynamic indicates that deaths on public thoroughfares tend to rise as the income level of the affected countries increases; when the latter is high, the trend goes down. On the other hand, when one considers the ratio of the number of deaths to the number of motor vehicles (deaths per 10,000 vehicles), as a country’s income level increases, there is a steady decline in these rates. The latter is explained mainly by the progressive application of measures at several levels: automobile design and transit management systems, traffic safety education, the establishment of speed limits, the use of safety belts, and the prohibition against driving under the influence of alcohol (Figure 5). In the majority of poor countries, on the other hand, implementation of these life-saving measures poses an enormous challenge in and of itself.

Lack of safety on the roadways involves other health problems as well. Nearly two-thirds of all traffic accident victims are pedestrians, and of that group, one-third are children. In Latin America and the Caribbean, the majority of victims are between 15 and 30 years of age, and three-quarters of the victims are men.

FIGURE 5. Public roadway deaths per traffic volume and population for various income levels.

which is consistent with greater exposure by this group. Pedestrians and cyclists are the most vulnerable users of public thoroughfares; of the total number of deaths, pedestrians represent 25% in Trinidad and Tobago, 40% in Mexico, and 62% in El Salvador; and cyclists represent 3% in Saint Lucia and 10% in Jamaica (70). On the other hand, in Canada and the United States, pedestrians represent 16% and 11%, respectively, of traffic accident victims; nearly 90% of the victims are either drivers or passengers in vehicles.

The danger that streets and highways entail for pedestrians and cyclists also has a negative impact on people’s mobility and physical activity (71). It is estimated that this problem could be more acute for the elderly, who, aware of their fragility, tend to avoid the streets (72).

The economic costs of the lack of road safety represent approximately 1% of the gross national product in low income countries and 1.5% in middle income countries. In low income countries, those costs translate into US$ 65,000 million annually, which is a higher figure than what those countries receive in development assistance during the same period (68).

New Prospects for Road Safety

In the 1970s, the introduction of the Haddon matrix—still widely in use today—represented the first systematic approach to the problem of traffic-related injuries. This model suggested that accidents have three time phases: before, during, and after the injury incident. Each one of these phases, in turn, can be examined within the context of three principal factors: the injury victim, the vehicle and its equipment, and the physical, social, and/or cultural environment (73). This perspective offered public health authorities and specialized personnel—particularly epidemiologists—the opportunity to apply basic public health principles to traffic safety and injury prevention policies and programs. Specifically, Haddon’s compelling framework facilitated a new focus on mechanical energy exchange and the human body’s injury threshold to this force and contributed to the subsequent adoption of such measures as vehicle speed controls and the prohibition against driving while under the influence of alcohol. Thus, the traditional thinking that placed blame for collisions on driver behavior (e.g., failure to perceive and/or react to danger in a timely manner) has, over time, given way to a more etiological, systemic perspective in which all forces at play on public thoroughfares—including the structural design of the vehicles and roads themselves—are considered as potential causal factors and responsibilities are more equally shared between transportation system providers and users (73).

More recently, a report by the WHO’s Regional Office for Europe has attempted to go beyond the Haddon matrix by developing a road safety concept that incorporates the macro-scale aspects which affect vehicle traffic risk exposure, such as land use, urban design, and transportation policies. In other words, it proposes that road safety plans take into account the specific preferences and policies of transportation and urban development, since these policies determine to a large extent the scope and magnitude of road safety problems. Thus, an urban development policy that favors mass transit and non-motorized means of commuting facilitates the implementation of safety measures on all public thoroughfares (i.e., not just on highways) and helps ensure the efficiency of these measures, in contrast to a scenario in which the dominant preference is transportation by private automobile (74). Without a doubt, this option increases the synergy between road safety and urban design policies, strengthening their public health component.

CONCLUSIONS

This chapter seeks to call attention to the influence exerted by urban development de-
sign and public transportation structure and options on public health and the level of physical activity of city dwellers. Table 1 offers a brief summary of the positive effects that various urban interventions could produce on physical activity.

The rapid urbanization of Latin America, as we have seen in this chapter, has, in many cases, produced a negative impact on the quality of life of inhabitants of large metropolitan areas, and has favored the adoption of individualized modes of motorization (motorcycle or private automobile) and the use of urban public space in a manner resembling the U.S. suburban model, thereby compromising opportunities for fulfilling the current recommended levels of physical activity, especially walking. There is an emerging need to restrain and discourage these trends now and in the future, not only because of their negative impact on human health, but also because of their negative economic, environmental, and social effects, and the need to improve public transportation efficiency and to responsibly address the citizenry’s quality of life concerns. New and creative approaches to urban zoning codes, including densification and mixed-use communities, coupled with measures to improve road and personal safety and mass transit systems, can provide the crucial underpinning for adequately responding to all of the above challenges and at the same time help to dispel the notion that socioeconomic development and prosperity are inextricably related to and/or dependent upon the availability and ownership of individualized forms of motorized mobility.

Public policies currently enjoy a prominent place on the international agenda, with particular focus on those related to sustainable transportation systems and road safety, as well as on such public health issues as combating a sedentary lifestyle, injury prevention, clean air, and quality of life of the population. The convergence of these public health and urban planning priorities indicates that at least some municipal govern-
ments in the Region of the Americas are showing increased sensitivity to the problems of urban quality of life and suggests that the groundwork for implementing the proposals set forth in this chapter is now being laid.

The health and physical activity data on urban life in Latin America presented earlier in this chapter lead to the following conclusions and preliminary recommendations:

- Information gathered from applications of the IPAQ questionnaire indicates that walking is an important part of everyday life for those individuals whose physical activity levels are sufficiently adequate to enable them to derive health benefits. Furthermore, walking for utilitarian purposes is more common than recreational walking, particularly among low income groups.
- Data from transportation studies are consistent with the above finding. In the majority of the Region’s large cities where there is widespread use of public transportation and fewer private vehicles on the streets, there are indications that a large part of people’s daily commutes is undertaken on foot or by bicycle, and not via privately owned automobiles, as in the United States and other areas that have adopted the U.S. residential/suburban model.
- This suggests that public health policies and strategies should promote the importance of walking and bicycle-riding, in addition to advocating for better infrastructure and safety for individuals who participate in these activities. Due to the potential scope of the target population, this approach should be accorded preferential attention and be complemented by similar strategies aimed at increasing participation in a variety of other recreational activities requiring physical exertion.
- Research findings need to be consolidated concerning the impact of inter-
TABLE 1. Impact of transportation, road safety, crime control, and public space on physical activity of urban inhabitants.

<table>
<thead>
<tr>
<th>Area of Intervention</th>
<th>Physical Activity Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td></td>
</tr>
<tr>
<td>Public transportation</td>
<td>Accounts for a large portion of non-motorized mobility (walking or bicycling) to reach mass transportation means in areas not covered by motorized means of feeder/ connecting transportation</td>
</tr>
<tr>
<td>Alternative transportation</td>
<td>Riding a bicycle and walking are the most widespread alternative means of mobility and provide users with the opportunity to incorporate physical activity as part of their daily routine.</td>
</tr>
<tr>
<td>Clean air</td>
<td>Can be a persuasive factor in encouraging people to spend more time out-of-doors and on the street and engage in sports and other types of recreational physical activity</td>
</tr>
<tr>
<td>Road Safety</td>
<td>Promotes greater use of public thoroughfares for walking, biking, and traveling via automobile to sports, exercise, and recreational centers</td>
</tr>
<tr>
<td>Crime Control</td>
<td>Promotes use of public thoroughfares for recreational or utilitarian purposes</td>
</tr>
<tr>
<td>Public Space</td>
<td></td>
</tr>
<tr>
<td>Structures designated specially for pedestrian use (sidewalks, crosswalks, etc.)</td>
<td>Ensure personal protection and safety. While important for all population age groups, these structures are particularly important for older adults.</td>
</tr>
<tr>
<td>Parks/recreational facilities</td>
<td>Open-air parks encourage walking and bicycling, while recreational facilities (indoor or outdoor) stimulate physical exertion and social interaction in sports such as baseball, basketball, football, tennis, and swimming.</td>
</tr>
<tr>
<td>Preservation/conservation of historical, architectural, and cultural centers</td>
<td>The presence of these centers in areas with restrictions on vehicular traffic and parking promotes physical activity.</td>
</tr>
<tr>
<td>Closing streets for recreational purposes</td>
<td>Events such as bike rides, street festivals, block parties, special sports and dance competitions, etc., solidify community sense of identity and stimulate collective interest in participating in recreational and physical activities.</td>
</tr>
</tbody>
</table>

In the programmatic and public policy areas, public health in Latin America is facing important challenges, which can be summarized as follows:

- the need to forge closer ties and synergy between the public health sector and those responsible for urban transportation systems, road safety, environmental protection and municipal land management, preservation of public spaces, providing incentives for non-motorized forms of transportation, and designating physical structures primarily for pedestrian and cyclist use (Table 2
TABLE 2. Effect of various urban development interventions on health.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Physical activity</th>
<th>Prevention of trauma/deaths</th>
<th>Respiratory diseases</th>
<th>Social interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass transit</td>
<td>+ +</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Alternative transportation (bicycling)</td>
<td>+ +</td>
<td>+</td>
<td>+ +</td>
<td>+ +</td>
</tr>
<tr>
<td>Clean air</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Safety on the streets</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Crime control</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Public space</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities and structures designated for pedestrian use</td>
<td>+ +</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Parks/recreational centers</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Preservation/conservation of historical, architectural, and cultural centers</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Closing streets</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Urban design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density of population and buildings</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Diversity of urban land use and attractive urban design</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

*Important effect.

Moderate effect.

shows the impact on health and the synergy potential of various public policies;\(^{13}\) and

- supporting the efforts and sustaining the achievements made to date in all of the aforementioned areas.

The community of public health professionals can play an important leadership role in promoting priority actions in all of the identified areas by showing the magnitude and health consequences of a sedentary lifestyle and its relationship to urban development choices, advocating public policies that favor physical activity and the highest possible quality of life for all sectors of urban residents, and monitoring population changes with regard to physical activity level and overall health status.

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\(^{13}\)This idea is also found in WHO's Global Strategy on Diet, Physical Activity, and Health, endorsed by WHO member countries in 2004 in World Health Assembly resolution WHA57.17.


