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DOI: https://doi.org/10.1016/S0140-6736(12)60898-8

Posted at the Zurich Open Repository and Archive, University of Zurich
ZORA URL: https://doi.org/10.5167/uzh-69552
Published Version

Originally published at:
Kohl, Harold W; Craig, Cora Lynn; Lambert, Estelle Victoria; Inoue, Shigeru; Alkandari, Jasem Ramadan; Leetongin, Grit; Kahlmeier, Sonja (2012). The pandemic of physical inactivity: global action for public health. Lancet, 380(9838):294-305.
DOI: https://doi.org/10.1016/S0140-6736(12)60898-8

Physical Activity 5

The pandemic of physical inactivity: global action for public health

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Lancet 2012; 380: 294–305
Published Online July 18, 2012
http://dx.doi.org/10.1016/S0140-6736(12)60898-8
This is the fifth in a Series of five papers about physical activity

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Physical inactivity is the fourth leading cause of death worldwide. We summarise present global efforts to counteract this problem and point the way forward to address the pandemic of physical inactivity. Although evidence for the benefits of physical activity for health has been available since the 1950s, promotion to improve the health of populations has lagged in relation to the available evidence and has only recently developed an identifiable infrastructure, including efforts in planning, policy, leadership and advocacy, workforce training and development, and monitoring and surveillance. The reasons for this late start are myriad, multifactorial, and complex. This infrastructure should continue to be formed, intersectoral approaches are essential to advance, and advocacy remains a key pillar. Although there is a need to build global capacity based on the present foundations, a systems approach that focuses on populations and the complex interactions among the correlates of physical inactivity, rather than solely a behavioural science approach focusing on individuals, is the way forward to increase physical activity worldwide.

The pandemic of physical inactivity should be a public health priority

Theoretically, prioritisation for public health action is informed largely by three factors: the prevalence and trends of a health disorder; the magnitude of the risk associated with exposure to that disorder; and evidence for effective prevention and control. A practice or behaviour that is clearly related to a health disorder, is prevalent, and is static or increasing in its prevalence should be a primary target for public health policy for disease prevention and health promotion. Too often, however, the inertia of tradition, pressure from special interest groups, media attention, and other external forces can overcome this approach.

Key messages

- The high prevalence of physical inactivity, its harmful health and environmental consequences, and the evidence of effective physical activity promotion strategies, make this problem a global public health priority
- Physical activity and public health is a new discipline, merging several areas of specialisation including epidemiology, exercise and sport science, behaviour science, and environmental health science, among others; these different areas are needed to tackle the global pandemic of physical inactivity because multidisciplinary work is essential
- Early development of the discipline has been largely opportunistic and, as a result, physical activity has usually been coupled with other public health agendas and is often not a fully recognised, standalone, public health priority
- Capacity building, workforce training, and intersectoral approaches are needed in all regions for physical activity research, practice, policy, and advocacy and education
- A systems approach to physical activity beyond a reliance on behavioural science needs coordinated changes at the individual, social and cultural, environmental, and policy levels; building of intersectoral action is particularly needed in countries with low-to-middle incomes, where the unintended consequences of development might negatively affect transport-related, household, and occupational physical activity

Available data suggest that 31% of the world's population is not meeting the minimum recommendations for physical activity[1] and, in 2009, the global prevalence of inactivity was 17%.[2] Despite promising positive trends in leisure-time (discretionary) physical activity in some countries, incidental, transportation-related, and occupational physical activity prevalences are falling.[3–6] The global challenge of physical inactivity is further amplified by the risk it conveys. Lee and colleagues[7] presented persuasive evidence that 6–10% of all deaths from non-communicable diseases worldwide can be attributed to physical inactivity, and this percentage is even higher for specific diseases (eg, 30% for ischaemic heart disease).[8] In 2007, 5·3–5·7 million deaths globally from non-communicable diseases could have theoretically been prevented if people who were inactive had instead been sufficiently active. Most of these effects of physical inactivity are not mediated through body composition. Finally, several approaches have acceptable effectiveness for increasing physical activity across different ages, social groups, and countries worldwide.[9] In view of the prevalence, global reach, and health effect of physical inactivity, the issue should be appropriately described as pandemic, with far-reaching health, economic, environmental, and social consequences.

Moreover, the associated morbidity of health disorders related to inactivity, including health-related quality of life as well as direct and indirect economic costs, exerts a substantial burden on societies and health systems. For example, annual direct health-care costs range from US$28·4 to $334·4 per head in Australia,[10] UK,[11] and Switzerland[12] and, including indirect costs, from $154·7 to $418·9 per head in Canada[13] and the USA.[14] The magnitude of economic implications of physical inactivity is difficult to compare at present, and a more in-depth global analysis is needed.

Social and economic transitions that affect populations can have a profound effect on health and health behaviour. For example, the rapid economic development and drastic social changes in many Latin American countries in recent years have been mirrored by a rapid trend away from undernutrition and micronutrient deficiencies to overnutrition and obesity, along with an ageing population and an increase in the prevalence of non-communicable diseases.[15] That physical activity is also related to development is particularly evident and of concern in low-income and middle-income countries, where occupational, domestic, and transport-related physical activities might contribute more to overall energy expenditure than does leisure time or recreational activity.[16] Moreover, in the fourth paper in this Series, Pratt and colleagues[17] presented compelling models showing the potential effect of developing global information and communications technologies on physical activity.

Increasing urbanisation and rapid economic development in China have been linked to reductions in overall and occupational physical activity in adults[16,18] as well as increased television viewing in children.[19] Similarly, in Africa, rural-to-urban migration is associated with reductions in prevalence of physical activity.[20,21] In some cases, the urban-to-rural gradient for inactivity more than doubles. The challenge is magnified in view of the fact that, in 20 years, 60% of west Africans will live in urban areas and two-thirds of people moving into urban areas in Africa do so into poverty. Such large shifts in physical activity demand scrutiny with a public health lens to assess the population-level causes, rather than a solely clinical view, to understand the causes of inactivity among individuals.[22]

Important global progress has been made in organisation and mobilisation of efforts for tobacco and alcohol control[23,24] and promotion of a healthy diet.[25,26] Physical inactivity has begun to be recognised as the fourth type of exposure that needs to be addressed for control of non-communicable diseases.[27] However, and despite robust research on how to address physical inactivity,[9] there has been an evidence-policy gap for action. As a relative newcomer to the area, physical activity has yet to garner equal global organisation and advocacy power to receive the appropriate political recognition and investments. The effect of this tardiness has been to put physical activity in reverse gear compared with population trends and advances in tobacco and alcohol control and diet. This unacceptable situation needs to be addressed with haste if the world is to reach its goals for control of non-communicable diseases.[27] In the next sections, we summarise existing global physical activity efforts and emphasise challenges that point the way forward to address the global pandemic of physical inactivity. We argue that lasting progress needs to be built on early efforts, but that a full systems approach should be taken to fully integrate physical activity into public health.

Advancement of physical activity and public health: building on existing progress

Overview

Physical activity promotion to improve the health of populations, rather than individual behaviours, has only had an identifiable infrastructure since 2000. The reasons for this late start are myriad and complex. First, there is a perception, albeit incorrect, that the science base for physical activity and health has lagged behind other important issues such as tobacco use and diet. Second, as a result of a grafting of exercise science to public health science, the specialty of physical activity and public health has its roots in several areas. Exercise science, epidemiology, behavioural science, environmental health science, and others have each contributed to the emergence of the discipline of physical activity and public health and the absence of centralisation has resulted in diffuse and uncoordinated development. As such, early action in training and growth of infrastructure has often been opportunistic rather than systematic. Finally, physical activity has frequently been coupled with diet[28,29] to address obesity, rather than defined as a standalone public health issue, despite evidence for many independent health effects of physical activity and physical inactivity.[30] Such opportunistic approaches by coupling or integration with other health determinants might have merit for the physical activity policy agenda for some health outcomes, but they unavoidably restrict the scope of action and impede a full approach to address all aspects of physical activity and inactivity. Further, such partnering for convenience should not to be confused with building of equally footed partnerships for action.

What resources and strategies are needed to move physical activity and public health to the mainstream?[31] To harness the science for public health action, creative thinking coupled with development of partnerships for action are needed to help physical activity to become a public health priority. Global capacity building in physical activity is crucial. A systematic approach to capacity building involves an assessment of existing capacity and resources, planning and target setting, intersectoral collaboration built on a strong foundation of leadership and advocacy, workforce development in teaching, research and practice, and monitoring of progress. Global capacity building should be advanced by evolving and expanding existing assets. Figure 1 shows a timeline of major international benchmarks as the specialty has emerged in four broad areas. For each area, progress is detailed to provide direction for further development of global capacity.

Policy and planning

Two major global efforts have occurred since 2000 in policy and planning. First, in 2004, the World Health Assembly adopted the WHO global strategy on diet, physical activity, and health[28] and WHO subsequently published implementation aids in support of the

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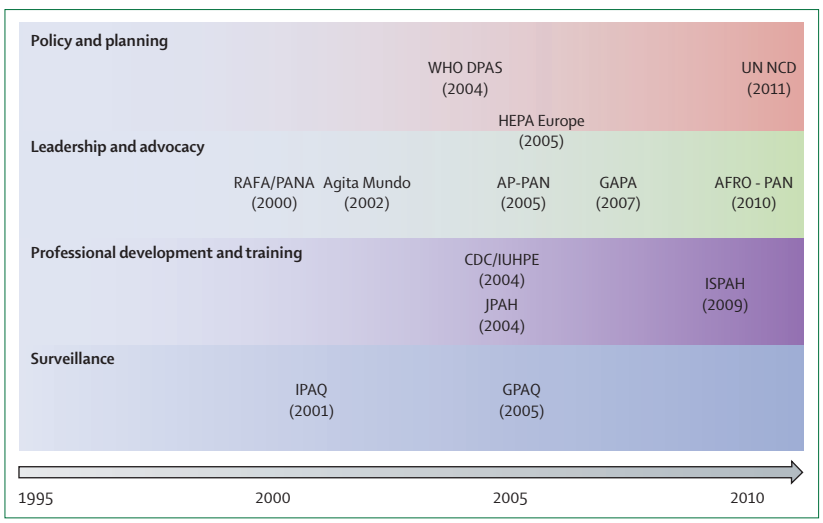

Figure 1: **Emergence of global infrastructure for physical activity and public health**
WHO DPAS=WHO global strategy on diet, physical activity and health.[28] UN NCD=UN high-level meeting on non-communicable disease.[32] HEPA=Health Enhancing Physical Activity.[33] RAFA/PANA=Red Actividad Fisica de las Americas/Physical Activity Network of the Americas.[34] AP-PAN=Asia Pacific Physical Activity Network.[35] GAPA=Global Advocacy for Physical Activity.[36] AFRO-PAN=Africa Physical Activity Network.[37] CDC/IUHPE=Centers for Disease Control and Prevention/International Union for Health Promotion and Education. JPAH=*Journal of Physical Activity and Health*.[38] ISPAH=International Society for Physical Activity and Health.[39] IPAQ=international physical activity questionnaire.[40] GPAQ=global physical activity questionnaire.[41]

strategy.[42–44] Second, a UN high-level meeting on non-communicable diseases was convened in September, 2011,[32] specifically to address prevention and control efforts of diseases that claimed 63% of global deaths in 2008. At the UN meeting, physical inactivity was identified as an important determinant of non-communicable diseases globally, but received less emphasis than tobacco, alcohol, and diet. These two efforts are obviously important in their contexts and have certainly been seminal in raising international awareness of the issues of physical inactivity. However, the absence of focus specifically on inactivity in these two initiatives in favour of coupling with diet serves to weaken efforts for broad, focused approaches to tackle physical inactivity. For example, the first version of the currently proposed global monitoring framework for the prevention and control of non-communicable diseases[45] did not contain a target or indicators for physical inactivity, although such indicators were present for tobacco, diet, and alcohol. Targets and indicators for physical inactivity were subsequently included in the second draft version of the document only after substantial advocacy efforts by many interested parties including the global and regional networks. If physical activity is not retained, the four factors that are meant to support non-communicable disease prevention (physical activity, tobacco control, diet, and alcohol) will be effectively reduced unacceptably to only three. Member states will then not have a mandate for action to address physical activity as a matter of public health urgency.

Another topic for consideration is that physical activity promotion is not only important for the prevention of non-communicable diseases, but it might also play a key part in efforts against global warming through the promotion of active transportation, improvement of social relationships, reduction of social inequities, and stimulation of the use of public spaces. Global efforts in the policy and planning area urgently need to place health promotion, in this case through physical activity practice, as much more than a risk factor for non-communicable diseases, but actually a basic human right.

One crucial approach to build capacity and infrastructure in physical activity and public health is the development and implementation of national policies and action plans.[46] A recent WHO report suggests[47] that, although 73% of member states reported having an identifiable plan, strategy, or policy to address physical inactivity, only 55% of these plans, strategies, or policies were reported to be operational. Further, only 42% were operational as well as funded. Substantial global variation exists, with reported plans, strategies, or policies less prevalent (46%) in the African WHO region, but universal (100%) in the southeast Asia WHO region. There was also a substantial difference between income groups, with 82% of countries with upper-middle incomes reporting plans relative to 68% of those with lower-middle incomes. These data provide the first global overview, but validation of these self-reported data is needed because items could have been interpreted and reported differently by different countries.

What constitutes good policy for physical activity promotion? The mere existence of a national physical activity policy or action plan does not secure its functionality or implementation. Plans are not implementation, implementation is not strategy, and strategies are not evidence of population change. Nor does the existence of a national policy necessarily produce success. Ideally, national policies and action plans are designed not for implementation solely by governments, but rather for mobilisation of both governmental and non-governmental collaboration towards advancement of physical activity and reduction of physical inactivity. The recent Brazilian experience is one from which many such lessons can be learned.[48] Similar action is needed worldwide.

A policy audit tool was developed[49] on the basis of a literature review of previous work on cross-country comparisons on physical activity policy,[46,50–53] identifying a set of 17 key attributes identified as essential for successful implementation of a population-wide approach to promote physical activity across the lifecourse. These attributes include an evidence-based, consultative approach and integration across sectors and policies, national recommendations on physical activity levels, national goals and targets, an implementation plan including several strategies and evaluation based on a national surveillance system. Successful implementation also depends on political commitment and sustainable funding, leadership and coordination, working in partnership, a network supporting professionals as well as

ensuring links between policy and practice, and a communication strategy and a clear programme branding. The policy audit tool can act as a catalyst for increased communication and joint strategic planning by identifying synergies and discrepancies among policy areas (appendix).

See Online for appendix

Leadership and advocacy

The tardy emergence of physical activity and public health as a distinct discipline can partly be attributed to disparate leadership and the fact that, to date, physical activity has not been firmly rooted in public health. As shown in figure 1, regional networks have been the foundation in this area. The first regional network in the world was Red Actividad Fisica de las Americas (Physical Activity Network of the Americas; RAFA/PANA).[34] RAFA/PANA seeks to harness substantial resources and interest in physical activity from Canada to Chile. RAFA/PANA was followed by similar efforts to coalesce several interests in Europe,[33] Asia-Pacific,[35] and most recently Africa.[37] A global physical activity network initiative, Agita Mundo,[54] has evolved simultaneously from early beginnings in Brazil.[55]

These networks all have the common goal to provide a platform for exchange of experiences, to strengthen existing initiatives, and to identify and disseminate good practice. Other goals include advocacy, dissemination of knowledge, workforce training, and the development of national networks or research collaborations. The described poor support for physical activity is also illustrated by the fact that none of these networks receives sustainable institutional support of any kind, so they all depend almost entirely on voluntary contributions of central steering bodies and member institutions. Despite scarce resources, the networks represent members from more than half the countries in each region and have produced tangible results and products. For example, through the leadership of the RAFA/PANA network, nine national networks have been formed (Colombia, Peru, Argentina, Chile, Costa Rica, Mexico, Uruguay, El Salvador, Venezuela) and, together with Agita Mundo, mass events are organised regularly, which engage millions of participants in physical activity. The European network has established working groups on national approaches, youth and elderly people, and settings such as health care, sport clubs, and working environments and on surveillance and injury prevention, which collect and analyse approaches and case studies and develop guidelines and practical tools for implementation. The Asia-Pacific network delivers a biweekly newsletter to more than 4000 readers, which has both an advocacy and scientific communication function. The most recently formed African network produces a quarterly newsletter, and provides a platform for regional collaborative research and advocacy in various African countries. Early evaluation efforts for the regional and global networks need to be formalised and expanded.

Regional networks help to support communication and common interest events. Active promotion to advance a cause needs advocacy. Encouragingly, formal advocacy efforts have more recently emerged in the field. In 2007, Global Advocacy on Physical Activity[36] (GAPA) was launched. GAPA works to strengthen advocacy, dissemination, and capacity around physical activity promotion and policy.

While these efforts proceed, additional approaches are needed to build global capacity in physical activity and public health. Although physical activity has to further establish itself as fully recognised standalone specialty on an equal footing with those of diet, tobacco control, and others, working across different silos and establishing partnerships for action specific to physical activity could be the most important advance to be made. For example, many non-governmental organisations have long been involved in sport promotion; however, only recently have networks of these organisations involved in Sports for All and Sports for Development identified health as a key outcome objective, particularly in countries with low and middle incomes.[56–58] The Health in All Policies approach[59] has emerged to integrate health concerns into policy decisions taken in other sectors. This approach needs increased health system capacity to engage other sectors effectively in adopting policies that maximise possible health gains. Success not only needs effective advocacy skills, but, more importantly, the ability to identify mutually beneficial actions that allow the target sectors to achieve their own goals while protecting and promoting health.

A successful example of this approach is an international project that was coordinated by WHO. The project developed guidance and practical tools for economic assessments of the health effects of cycling and walking.[60–62] The products were developed through a systematic review of relevant research followed by a comprehensive consensus building process[61] involving experts specifically selected to represent an interdisciplinary range of professional backgrounds and expertise (health and epidemiology, health and transport economics, a practice or advocacy perspective, policy development and implementation). The project produced aids that were transparent and easy to use. Health economic assessment tools for cycling have already been adopted by several countries for their official toolbox for economic assessment of cycling infrastructure and are applicable in countries with high, middle, and low incomes.[62,63] These projects show that use of economic arguments to advocate investments into policies that have clear sector-specific benefits is a promising strategy to win the support of these sectors and could have great potential to result in health benefits.

Training and professional development

Despite seemingly incomplete development of a global physical activity and public health infrastructure, some coordinated workforce training efforts have emerged. Although certification programmes for exercise professionals have existed for many years,[64,65] the emphasis

Panel 1: **Physical activity surveillance: if it is important, it must be measured**

Comprehensive surveillance systems are crucial to advance physical activity and public health. The development and introduction of such a comprehensive system poses challenges and is dependent on the capacities and resources available. Yet having such physical activity information will serve to improve investment of scarce resources, increase accountability, and help to make efficient and effective investments. Canada's experience provides one example of how comprehensive physical activity surveillance can be implemented. In the mid-1990s, a needs assessment was done with scholars, representatives of federal and provincial or territorial (state) governments, and national-level non-governmental organisations. Key indicators were identified at the individual, social, and physical environment levels across schools, workplaces, and municipalities (land-use, transportation, recreation systems). Results have been used for advocacy, setting targets, tracking of progress (related to capacity, policies, programmes, and services), shaping of policy and strategies, market segmentation, and evaluation of health education campaigns. Canada's system evolved over time to include many data sources including objective as well as self-report measures. Data sources have included regular specific population-based and setting-based (eg, schools, workplaces, municipalities) surveys, supplemented by population health surveys and transportation surveys. As data became available, its value in guiding policy and practice was recognised and demand for data increased. Therefore, it was important to have a long-term vision for surveillance and to implement components of the system as capacity and commitment to measurement grew. As new measures were included, existing measures were retained at least on a periodic basis. Otherwise, if methods or questions or measures had changed, trends over time could not have been assessed.

Other countries can learn from these lessons by creating their own vision of what population and sector-related data would be needed to assess changes in the conditions that affect physical activity in their country and what policies and interventions they might adopt to increase physical activity and decrease sedentary behaviour. A core set of indicators could then be identified within this framework and measured over time as commitment to surveillance strengthens. The key to implementation of a policy-relevant system is to begin with a comprehensive vision of what data are needed to inform policy and practice and then to implement the various elements of that system as feasible.

on population health has only been recent. The US Centers for Disease Control and Prevention and the International Union for Health Promotion and Education have been drivers of international training efforts, to educate public health professionals regarding the fundamentals of physical activity, its role in public health, and effective strategies for successful physical activity promotion.[9] Up to mid-2012, 25 of these international courses have been held in most WHO regions with more than 1400 participants.

In 2004, a professional journal, the *Journal of Physical Activity and Health*, was launched to help to build scientific evidence on physical activity and health[38] and the International Society for Physical Activity and Health was organised in 2009 to provide international leadership in the advancement of physical activity for health.[39] The crucial need to move physical activity into the public health mainstream involves leadership from these international organisations to further emphasise professional development of practitioners and academic training of researchers and teachers. This need is especially strong in countries with low and middle incomes facing a wave of economic and social changes that will probably reduce the physical activity demands of daily life.

This training should focus (among other things) on planning, intersectoral collaboration (including sport, health, transportation, and other key areas), implementation of evidence-based physical activity strategies and how to increase demand for access to safe places for physical activity. Social mobilisation is a crucial aspect of this training and has been successfully used in Brazil.[36] Public health should lead this effort, but other disciplines such as medicine, physical therapy, nutrition, education, psychology and behavioural science, and urban planning and design need to affiliate. Although the needed numbers of practitioners in this area is unknown, it is certainly more than are presently working. If practitioners in each of these areas were reoriented to make physical activity a priority in their work, the workforce addressing these needs would be greatly expanded.

Beyond the existing practitioner workforce, academic training should be oriented for preparation of the future generations at all levels. Graduate training specialisations in physical activity and public health should emerge and with them a broad range of core competencies that set a minimum standard of knowledge. The development of the Physical Activity and Public Health Specialist certification by the US National Society for Practitioners of Physical Activity and Public Health[66] and the American College of Sports Medicine is a major step forward. Competencies for this certification (and associated sets of knowledge, skills, and abilities) have been developed in six crucial areas: partnership development; use of data and scientific information; planning and evaluation; intervention; organisational structure; and exercise science in public health. This model can probably be adapted and implemented in other countries.

Formal academic training programmes and graduate training should also be created to guide the next generation of researchers in this area. Global capacity in exercise science, physical education, physical therapy, public health, architecture and planning, and environmental health should not only be increased, but be oriented towards integration and comprehensive approaches to physical activity and public health.

Finally, more research into effective programmes that increase physical activity and reduce physical inactivity, particularly in countries with low and middle incomes, is needed to help to further build the evidence base for their national policies and action plans.[42] To expedite this process, journals could ideally consider adopting editorial policies to support and perhaps even fast-track articles on interventions in low-income and middle-income countries.

Monitoring and surveillance

Physical activity and public health was advanced substantially by the development and implementation of standardised surveillance tools for physical activity. The

international physical activity questionnaire[40] and the global physical activity questionnaire[41] have provided ways for specific countries on a regional and global scale to gather data for the prevalence of people meeting physical activity recommendations, the prevalence of physical inactivity, and (for the global questionnaire) domain-specific behaviour estimates. However, as discussed in the first paper of this Series,[1] persistent gaps are noted in physical activity surveillance including the scarcity of continuous surveillance systems implemented at the national level (resulting in an absence of trend data), any data in a third of countries, and standardised data for active transportation, sedentary behaviours, and school physical education class attendance among indicators.

Optimum physical activity surveillance focuses on levels and behaviours, their determinants and outcomes, and indicators of proven and promising solutions to address low physical activity in various segments of the population. As such, the focus is not the traditional epidemiological disease-case finding approach to surveillance, but rather the monitoring of trends in people's physical activity behaviour and assessment of progress in changing the underlying determinants that affect physical activity. Physical activity surveillance should provide information for policies and interventions that reside in many sectors (health, education, recreation, transportation, land-use planning, etc).

Health-related measures focus on meeting physical activity recommendations and domain-specific measures—for example, walking and bicycling for transport, occupational physical activity, attendance of physical education classes at school, physical demands of chores, and participation in physically active recreation and sport. To inform the many levels and sectors needed for intervention, ecological frameworks[67] spanning determinants and correlates at the individual, social, physical environment, and societal levels are needed to organise the vast array of factors affecting physical activity. Assessment of only individual physical activity is not enough to inform policy and planning. Panel 1 describes Canada's experience with comprehensive physical activity surveillance.

Beyond behavioural science to public health

The key question is why progress in physical activity promotion as a public health issue has been less developed than that in other public health areas? The pandemic of inactivity spans the world and economic development and social transitions portend a likely increase in the prevalence of inactivity and the incidence of non-communicable diseases for years to come, particularly in countries with low and middle incomes. The response to physical inactivity has been incomplete, unfocused, and most certainly understaffed and underfunded, particularly compared with other risk factors for non-communicable diseases. The relative infancy of the specialty and absence of infrastructure might be part of the reason for slow progress. Noticeably under-represented has been leadership by global, regional, and national health-focused foundations with the means to advance this issue. Further, international leadership provided by the US Centers for Disease Control in physical activity and public health is now on the wane.

A major part of the answer could also lie in the initial approaches to solving the issue. Instead of a population-based public health emphasis, efforts have focused on individual health. A foundation of public health is the realisation that health and illness have causes that go beyond biology and behaviour.[68] For physical activity, a strong case can be made that the science of how to change individual behaviours has overshadowed efforts to understand true population change. Because of this unbalanced focus, the structural and systemic changes necessary to promote physical activity in populations (with commensurate changes in prevalence) across various sectors have not yet been addressed systematically. Although much has been learned about how individuals can change their physical activity behaviour and the determinants of those behaviours,[69] little progress in population-level changes has been documented. A similar experience occurred in global tobacco control, where initially the burden of responsibility was put solely

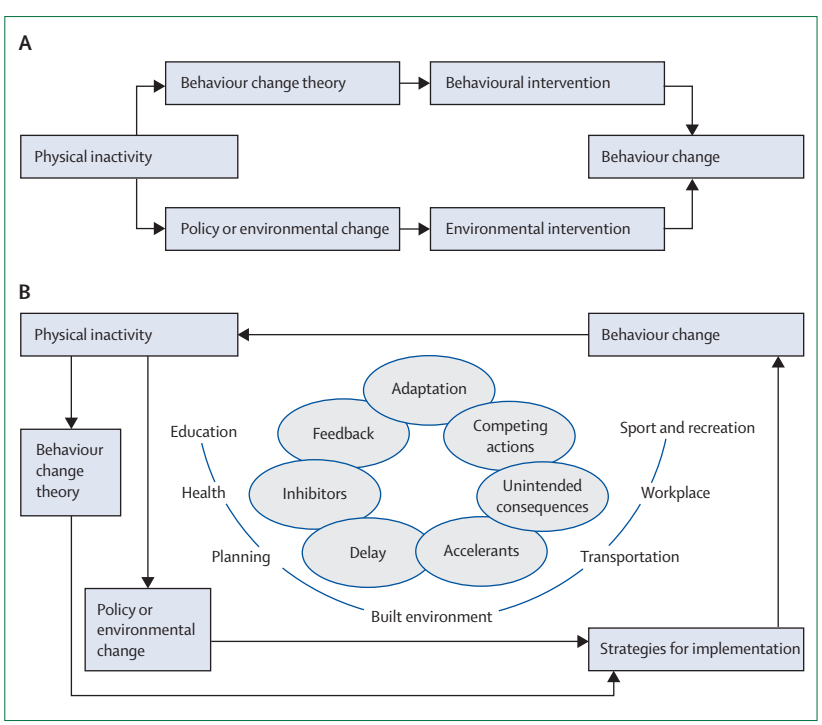

Figure 2: **Behavioural and environmental (A) and systems (B) approaches to physical inactivity**
A shows a traditional behavioural or environmental intervention strategy for physical inactivity. Various behavioural theories or environmental models are applied to address individual predisposing factors, an intervention is developed and delivered, and behaviour change (increased physical activity) is expected. B shows a complex systems perspective for physical activity, whereby there is an acknowledgment of issues, such as delay functions, adaptation, unintended consequences, competing interests, and feedback that could negatively affect an approach to increase physical activity. Various characteristics might also accelerate or inhibit the speed of the effectiveness of the strategies.

on individuals. Once that view expanded to include recognition of societal responsibility as well, population-level action and changes in smoking prevalence followed. Physical activity has to learn from these examples.

Only recently has research and promotion regarding the environmental effects that impede or support individual-level physical activity begun to blossom.[70,71] These efforts define, measure, and interpret the fundamental aspects of the physical environment in which an individual or sets of individuals live, work, and recreate and how these aspects affect physical activity. However, changing the focus of action on environmental influences would only shift the attention from one type of strategy (behavioural) to another (environmental) without full consideration of how individuals behave in given environments and how changes in the environments can affect changes in physical activity patterns.

For true change in the global action on physical activity, we have to embrace the complexity of the entire system in conceiving solutions rather than focusing only on parts of the puzzle such as an individual or an environmental approach alone.[72] A systems approach (figure 2) acknowledges the complex non-linearity of health behaviours, including the many interactions, delays in adoption, adaptations, competing actions, and unintended consequences that can occur within a system. A systems approach acknowledges such complexities and allows for planning to counteract the unintended consequences.

A key feature of such complex systems is that many inputs and levels of influence are considered to be interdependent. An attempt is made to understand the pathway towards a specific health behaviour and not only the simple, univariable or linear determinants at an individual or environmental level. Rather, systems approaches identify enablers, accelerants, synergies, and interconnectedness of multiple influences and thus have the highest potential to affect population physical activity.

As a hypothetical example, a behavioural programme to increase school-based physical activity during physical education could be very successful; however, an unintended consequence might be that physical activity elsewhere during a day for those children could decrease. Similarly, a transportation policy designed to reduce automobile congestion, improve air quality, and increase access and social equity in a population by increasing effective mass transportation options could result in increased incidental and transportation-related physical activity behaviours for one segment of that population, but could actually reduce transportation-related physical activity for other segments, resulting in a net zero gain. Improvements in the mass transit system might not immediately result in adoption (and increased transport-related physical activity) by the target population (delay). Adaptations could occur such that once the novelty of the new transport system wears off, adopters could return to their usual methods of (sedentary) transportation. Specific accelerants and inhibitors (subsidised rider fares, for example) could interact with these and other influences and ultimately affect physical activity associated with transportation choice. Traditional linear health behaviour models and theories are not designed to take these kinds of interactions into consideration. Such work is in its infancy, but wide-scale diffusion of such approaches would accelerate the effect of physical activity and public health efforts throughout the world.

Multiple levels of influence in physical activity behaviour is clearly one key aspect of a complex system. As discussed by Bauman and colleagues[69] in the second paper in this Series, there is a vast array of determinants of physical activity behaviour initiation, maintenance, and relapse. Public and organisational policy, the physical environment, the family and social environment, occupation, individual self-efficacy, and genetics among others have all been

Panel 2: **Call to action: guiding principles**

The freedom and opportunity for individuals to participate in physical activity should be viewed as a basic human right. To improve global health by increasing population levels of physical activity, we urge all organisations from the governmental (including national, regional, and local), non-governmental, and private sectors to take action in developing and supporting effective physical activity promotion strategies that embrace a systems approach and adhere to the guiding principles of the Toronto Charter, including:

- Adopt evidence-based strategies that target the whole population as well as specific vulnerable subgroups
- Address the environmental, social, and individual determinants of physical inactivity
- In addressing determinants of physical activity behaviour, embrace an equity approach to reduce the disparity in access to opportunities for physical activity
- Implement sustainable actions in partnership at national, regional, and local levels and across many sectors to achieve greatest effect
- Build capacity and support training in research, practice, policy, evaluation, and surveillance
- Use a lifecourse approach by addressing the needs of children, families, adults, elderly people, and people with disabilities as well as specific settings such as worksites and schools
- Advocate to decision makers and the general community for an increase in political commitment to and resources for physical activity
- Ensure tailoring to cultural sensitivities and adapt strategies to accommodate varying local realities, cultures, contexts, and resources
- Allow healthy personal choices by making the physically active choice the easy choice

studied with respect to their relation to physical activity. Each of these types of determinants probably has different mechanisms of action in diverse sectors. Moreover, the methods of each area differ and are quite possibly distinct in their approaches of study. It is important to study these influencers in relation to understanding of the system in which they operate. Moreover, the relative contributions of the determinants could change and become less or more prominent as systems change.

Additionally, physical activity is not solely a health sector responsibility, nor should it be. City and community planners, transportation engineers, school authorities, recreation and parks officials, private employers and the media, along with health-care workers and public health practitioners all are instrumental in promoting (or inhibiting) population levels of physical activity. Each of these stakeholders has different motivations and goals, interactions with other influencers,

***Panel 3:* Call to action: key actions necessary to advance global health through physical activity**

Specifically, we urge the UN and WHO to:

- Provide strong global leadership in promoting a systems approach to the development, implementation, and monitoring of national physical activity policies, strategies, and action plans
- Ensure targets and indicators for monitoring physical activity, physical inactivity, and sedentary behaviour are adopted and maintained as an integral part of global efforts aimed at prevention and control of non-communicable diseases
- Partner with others, including other UN organisations, to continue to provide and expand professional training on the fundamentals of physical activity, its role in public health, and public policy and effective strategies for action

We urge the World Bank, international development agencies, foundations, and other international agencies to:

- Support the work of, and coordination among, global and regional networks for physical activity promotion, particularly those consisting mainly of countries with low-to-middle incomes, to engage in regional planning, translation of research, exchange of experience, and expertise, and implement regional and national action plans
- Recognise the key role that physical activity has in the prevention of non-communicable diseases and in enhancing the health of populations, particularly in low-income and middle-income countries
- Support the development and implementation of national plans to promote physical activity, particularly in countries with low-to-middle incomes

We urge countries to:

- Develop and implement multisectoral strategies and action plans focused specifically on physical activity that are framed within a systems approach
- Assign a clear stewardship role for physical activity to a relevant government body to form a multisectoral infrastructure building on existing structures
- Adopt evidence-based national recommendations and policy guidance on physical activity for health and quantified population targets
- Allocate sufficient sustainable resources for implementation, as well as evaluation and comprehensive surveillance for accountability

We urge ministries of health to:

- Reorient services and funding at national, regional, and local levels to prioritise physical activity as a standalone area of work
- Foster partnerships including through cross-governmental implementation at all levels and gain input and engagement from all stakeholders that form a broad multisectoral constituency both within and outside government
- Make physical activity an integral part of an overall disease prevention and health promotion model, including screening for physical inactivity, counselling about physical activity in prevention and disease treatment and management strategies as well as increased investment in comprehensive physical activity promotion policies, action plans, and implementation programmes

We urge ministries of education and other education authorities to:

- Implement policies that support high-quality, compulsory physical education
- Promote and implement policies that encourage and support active travel to school
- Provide opportunities for physical activity during and after the school day as well as healthy school environments

We urge ministries of sport and other recreation sector authorities to:

- Develop and implement sport and recreation policy and funding systems that prioritise increased community access to affordable physical activity opportunities
- Develop programmes adapted to the needs of particular segments of the community that are less active than others

We urge ministries of planning to:

- Support and implement urban and rural planning policies, design guidelines and building codes that support walking, cycling, public transport, sport, and recreation with a particular focus on equitable access and safety

We urge ministries of transport to:

- Prioritise transport policies and services that promote active forms of non-motorised transport, with an emphasis on equitable access and safety
- Fund infrastructure support for walking, cycling, and public transit

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We urge employers, the private sector, and media to:

- Develop and implement programmes, facilities, and incentives that encourage and support employees and their families to be physically active
- Orient marketing, advertising, and promotional messages to encourage physical activity and discourage physical inactivity and sedentary behaviours
- Collaborate with government and non-governmental organisations in the creation and promotion of opportunities to promote and engage in physical activity

We urge academics and academia to:

- Undertake research to further clarify the open questions on physical activity and health, in particular on effective promotion strategies in all life settings and complete systems approaches
- Invest in translation of research into practice
- Create graduate training programmes that integrate and take a comprehensive approach to physical activity and public health
- Further build the evidence base for effective programmes, national plans, and on cost-effectiveness, particularly in countries with low and middle incomes

Finally, we urge individuals and organisations in civil society to:

- Advocate to decision makers and the general community for an increase in political commitment and resources to increase population levels of physical activity
- Commit to and implement plans for the development and capacity building of the physical activity and public health infrastructure that is commensurate with the magnitude, reach, and effect of the issue
- Seek ways to become and remain physically active at levels recommended for the preservation and promotion of health and wellbeing

and measures of success and priorities. If systems are not changed in a more coordinated manner, any successful programme of one single stakeholder could be offset by unexpected consequences to another stakeholder or by equal and opposite effects of different programmes. Complete understanding of all stakeholders, their interactions, and how their interactions make up the whole is crucial to understanding of the systems that impede progress on physical activity. Such a task again will necessitate coordination, communication, and partnership development across the myriad of stakeholders who can affect change.

Many previous public health solutions have been the primary responsibility of the health sector (eg, tobacco control, infection control), but meaningful progress was only made possible when inputs from several areas were taken into account. Physical inactivity is an issue that crosses many sectors and has to be addressed as such. Although the health sector, from counselling of individual patients in a medical care setting, all the way to community-based programmes for physical activity promotion, can and should play a major part, other sectors are equally, if not more, important in the systems dynamics of physical activity and public health.

Thus, many parties (governments, international organisations, the private sector, and civil society) need to contribute complementary actions in a coordinated approach. Priority actions include policies to improve the built environments, cross-cutting actions (such as leadership, healthy public policies, and monitoring), and much greater funding for prevention programmes. Increased investment in population monitoring systems would improve the accuracy of forecasts and evaluations. Based on a strong independent identity and increased evidence base, the integration of actions within existing systems into both health and non-health sectors can greatly increase the effect and sustainability of policies. Such a consideration has been recently offered for the prevention of obesity[73] and should be considered as a model to guide future work to promote physical activity globally. A systems approach might also include physical activity within a non-communicable disease programme or obesity prevention agenda (which might be very important for countries with low and middle incomes), or other opportunistic means to leverage action. Although an important launching point, actions should always be conceptualised within a larger systems approach so that additional opportunities can be identified and harmoniously implemented.

Finally, there is a heterogeneity of influences that is acknowledged in systems thinking. Given the same family environment, the same physical environment, and other physical activity determinants, why are some people very active, others intermittently active, and still others inactive? Clearly, different determinants exist and they manifest differently, resulting in a variable, incomplete, and unsatisfactory model to predict physical activity. This variability in influence, coupled with the multiple levels of influence and the multiple stakeholders, argues strongly that public health efforts for physical activity promotion cannot be expected to increase the prevalence of health-enhancing physical activity throughout the world without a complete systems approach. Behavioural science and environmental science have contributed to our understanding and definition of the issue at the individual level. By its very nature, systems thinking needs transcendence of traditional silos and boundaries to address large-scale issues. If public health is to be improved by population shifts in physical activity prevalence, those changes have to be affected by a change in thinking to embrace a systems approach. Although difficult to implement and

communicate, such an approach is necessary to address physical activity as a public health issue.

Call to action

As part of the International Society for Physical Activity and Health, GAPA[36] works to strengthen advocacy, dissemination, and capacity around physical activity promotion and policy. GAPA was instrumental in developing the 2009 Toronto Charter, a ten-point action plan for global promotion of physical activity[74] and resource materials to guide action.[75] The Charter has been translated into 17 languages with seven more forthcoming. Such products are intended to guide national agendas, to strengthen advocacy, and to incorporate lessons learned from other risk factor success stories, in particular from tobacco control.[76] In this call to action, we urge widespread adoption of the principles outlined in panel 2, which are based on and expanded from the Toronto Charter, and key actions detailed in panel 3.

Conclusions

Physical inactivity is pandemic, a leading cause of death in the world, and clearly one of the top four pillars of a non-communicable disease strategy. However, the role of physical activity continues to be undervalued despite evidence of its protective effects and the cost burden posed by present levels of physical inactivity globally. There is an urgent need to build global capacity. Although progress has been made in policy and planning, leadership and advocacy, workforce training, and surveillance, much needs to be done to fully address this global issue. Advancement of global capacity needs intersectoral collaboration, improved understanding of what works, particularly in countries with low and middle incomes, comprehensive monitoring to assess progress in implementation of policies and action plans, and momentum in development of a highly skilled workforce in physical activity and public health. New partners, an expanded leadership base, resources at the country and local level, and expanded infrastructure are crucially needed to advance physical activity as a public health issue. Furthermore, a systems-based approach is needed to address the complex interactions between the various conditions that promote or impede population levels of physical activity. Understanding and application of complex systems to affect physical activity will allow infrastructure changes that will give individuals and populations the freedom to be more physically active and healthy.

This Series in *The Lancet* is a crucial step for physical activity and public health. The physical activity research community, governments, and civil society, among others, can take advantage of the summary of knowledge presented in this report to drive action for physical activity. But our share of responsibility does not end with publication of the Series. Setting of goals and measurement of progress is crucial if the specialty is to continue to grow and evolve. As a tangible means to move forward, the Lancet Physical Activity Observatory is being launched (panel 4).

Panel 4: Lancet Physical Activity Observatory

How will we measure progress? The Working Group has prepared a list of primary goals to be monitored over time so that progress can be measured. These goals should serve as a unifying set of achievable actions that, when met, will result in a healthier world population. By 2016, the following four key goals in physical activity and public health are proposed:

1. Reduce the global prevalence of physical inactivity among adults from 31% to 28%
2. Increase the proportion of adolescents engaging in at least 1 h per day of vigorous and moderate-intensity physical activity from 21% to 24%
3. Reduce the proportions of coronary heart disease, type 2 diabetes, breast cancer, colon cancer, and premature deaths worldwide that are attributable to physical inactivity by 10%
4. Increase the proportion of peer-reviewed scientific publications on physical activity (levels, trends, correlates, consequences, interventions, and policy) that come from low-income and middle-income countries over the total number of publications by 10%

In addition to the four primary goals, an additional series of secondary goals to be tracked over time and that will need data systems for assessment are proposed. To achieve these goals, the Lancet Physical Activity Observatory will be created. In addition to keeping track of the progress, reporting on that progress through publications and meetings, the observatory will work with other entities (Global Advocacy for Physical Activity and International Society for Physical Activity and Health, Agita Mundo and regional networks) on advocacy for physical activity promotion, in particular working with governments worldwide, to help countries to achieve the physical activity goals established here. Further details about the mission, purpose, primary and secondary goals, and objectives of the Lancet Physical Activity Observatory will be made available online.

For more on the **Lancet Physical Activity Observatory** see http://www.lancetphysicalactivityobservatory.com

Contributors

HWK was responsible for conceptualisation, drafting, writing, editing, revising, figure design, communicating with the *Lancet* editorial office, and leadership of author group meetings. CLC, EVL, and SK contributed to conceptualisation, drafting, writing, editing, and intellectual contributions through participation in author group meetings. SI contributed to conceptualisation, editing, and intellectual contributions through participation in author group meetings. JRA contributed to writing, editing, and intellectual contributions through participation in author group meetings. GL contributed to conceptualisation and intellectual contributions through participation in author group meetings.

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Conflicts of interest

We declare that we have no conflicts of interest.

Acknowledgments

Input to draft versions of this report were provided by Reynaldo Martorell, Gregory W Heath, Kenneth E Powell, Fiona C Bull, Lise Gauvin, Art Salmon, Adrian E Bauman, Francesca Racioppi, Harry Rutter, Nick Cavill, and Trevor Shilton.

References

1 Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U, for the Lancet Physical Activity Series Working Group. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet* 2012; published online July 18. DOI:10.1016/S0140-6736(12)60646-1.

2 WHO. Global health risks. Mortality and burden of disease attributable to selected major risks. 2009. http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf (accessed Jan 15, 2012).

3 Brownson RC, Boehmer TK, Luke DA. Declining rates of physical activity in the United States: what are the contributors? *Annu Rev Public Health* 2005; **26:** 421–43.

4 Church TS, Thomas DM, Tudor-Locke C, et al. Trends over 5 decades in US occupation-related physical activity and their associations with obesity. *PLoS One* 2011; **6:** e19657.

5 Stamatakis E, Ekelund U, Wareham NJ. Temporal trends in physical activity in England: the Health Survey for England 1991 to 2004. *Prev Med* 2007; **45:** 416–23.

6 Knuth AG, Hallal PC. Temporal trends in physical activity: a systematic review. *J Physical Activity Health* 2009; **6:** 548–59.

7 Lee I-M, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT, for the Lancet Physical Activity Series Working Group. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 2012; published online July 18. http://dx.doi.org/10.1016/S0140-6736(12)61031-9.

8 WHO. Global health risks: mortality and burden of disease attributable to selected major risks. 2009. http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf (accessed Jan 19, 2012).

9 Heath GW, Parra DC, Sarmiento OL, et al, for the Lancet Physical Activity Series Working Group. Evidence-based physical activity interventions: lessons from around the world. *Lancet* 2012; published online July 18. http://dx.doi.org/10.1016/S0140-6736(12)60816-2.

10 Medibank Private. The cost of physical inactivity: what is the lack of participation in physical activity costing Australia? August, 2007. http://www.medibank.com.au/Client/Documents/Pdfs/pyhsical_inactivity.pdf (accessed April 24, 2012).

11 Scarborough P, Bhatnagar P, Wickramasinghe KK, Allender S, Foster C, Rayner M. The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs. *J Public Health (Oxf)* 2011; **33:** 527–35.

12 Martin BW, Beeler I, Szucs TD, et al. Economic benefits of the health-enhancing effects of physical activity: first estimates for Switzerland. *Schweiz Z Sportmed Sporttraumatol* 2001; **49:** 131–33.

13 Katzmarzyk PT, Janssen I. The economic costs associated with physical inactivity and obesity in Canada: an update. *Can J Appl Physiol* 2004; **291:** 90–115.

14 Chenoweth D, Leutzinger J. The economic cost of physical inactivity and excess weight in American adults. *J Phys Activ Health* 2003; **3:** 148–63.

15 Rivera JA, Barquera S, González-Cossío T, Olaiz G, Sepúlveda J. Nutrition transition in Mexico and in other Latin American countries. *Nutr Rev 2004;* **62:** S149–57.

16 Ng SW, Norton EC, Popkin BM. Why have physical activity levels declined among Chinese adults? Findings from the 1991–2006 China Health and Nutrition Surveys. *Soc Sci Med* 2009; **68:** 1305–14.

17 Pratt M, Sarmiento OL, Montes F, et al, for the Lancet Physical Activity Series Working Group. The implications of megatrends in information and communication technology and transportation for changes in global physical activity. *Lancet* 2012; published online July 18. http://dx.doi.org/10.1016/S0140-6736(12)60736-3.

18 Monda KL, Gordon-Larsen P, Stevens J, Popkin BM. China's transition: the effect of rapid urbanization on adult occupational physical activity. *Soc Sci Med* 2007; **64:** 858–70.

19 Cui Z, Hardy LL, Dibley MJ, Bauman A. Temporal trends and recent correlates in sedentary behaviours in Chinese children. *Int J Behav Nutr Phys Activity* 2011; **8:** 93.

20 Abubakari AR, Lauder W, Jones MC, Kirk A, Agyemang C, Bhopal RS. Prevalence and time trends in diabetes and physical inactivity among adult West African populations: the epidemic has arrived. *Public Health* 2009; **123:** 602–14.

21 Sobngwi E, Mbanya JC, Unwin NC, et al. Physical activity and its relationship with obesity, hypertension and diabetes in urban and rural Cameroon. *Int J Obes Relat Metab Disord* 2002; **26:** 1009–16.

22 Rose G. Sick individuals and sick populations. *Int J Epidemiol* 1985; **14:** 32–38.

23 WHO. Framework Convention on Tobacco Control. 2012. http://www.who.int/fctc/about/en/index.html (accessed Jan 19, 2012).

24 Lien G, DeLand K. Translating the WHO Framework Convention on Tobacco Control (FCTC): can we use tobacco control as a model for other non-communicable disease control? *Public Health* 2011; **125:** 847–53.

25 Engesveen K, Shrimpton R. Nutrition education in the context of the United Nations Standing Committee on Nutrition activities and publications, 1985–2006. *J Nutr Educ Behav* 2007; **39:** 351–56.

26 WHO. WHA46.7 WHO International Conference on Nutrition: follow-up action. May 10, 1993. http://www.who.int/nutrition/topics/WHA46.7_nut_en.pdf (accessed April 24, 2012).

27 WHO. WHO Political Declaration of the General Assembly on the Prevention and Control of Non-communicable Diseases (resolution 66/2), 2011.

28 WHO. Diet and physical activity: a public health priority, 2004. http://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf (accessed June 24, 2012).

29 WHO. European Charter on counteracting obesity. Nov 16, 2006. http://www.euro.who.int/__data/assets/pdf_file/0009/87462/E89567.pdf (accessed April 24, 2012).

30 Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee report, 2008. Washington, DC: US Department of Health and Human Services, 2008.

31 Bull FC, Bauman A. Physical inactivity: the "Cinderella" risk factor for noncommunicable disease prevention. *J Health Commun* 2011; **16** (suppl 2): 13–26.

32 UN. 2011 High Level Meeting on prevention and control of non-communicable diseases. 2011. http://www.un.org/en/ga/ncdmeeting2011/ (accessed Jan 19, 2012).

33 WHO. HEPA Europe (European network for the promotion of health-enhancing physical activity. 2012. www.euro.who.int/hepaeurope (accessed Jan 19, 2012).

34 Red Actividad Física de las Americas/Physical Activity Network of the Americas. http://www.rafapana.org/en/who-we-are.html (accessed Jan 19, 2012).

35 Asia-Pacific Physical Activity Network. http://www.ap-pan.org/modules/sections/index.php?op=viewarticle&artid=5 (accessed Jan 19, 2012).

36 Global Advocacy for Physical Activity. http://www.globalpa.org.uk/principles-strategies.php (accessed April 24, 2012).

37 African Physical Activity Network. AFPAN. http://www.essm.uct.ac.za/afpan/ (accessed Jan 19, 2012).

38 Kohl HW, Hootman JM. Reflections before moving forward. *J Phys Activ Health* 2012; **9:** 1–2.

39 International Society for Physical Activity and Health. http://www.ispah.org/ispahabout (accessed Jan 19, 2012).

40 Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003; **35:** 1381–95.

41 Bull FC, Maslin TS, Armstrong T. Global physical activity questionnaire (GPAQ): nine country reliability and validity study. *J Phys Act Health* 2009; **6:** 790–804.

42 WHO. A framework to monitor and evaluate the implementation: Global Strategy on Diet, Physical Activity and Health. 2008. http://www.who.int/dietphysicalactivity/DPASindicators/en/index.html (accessed Jan 19, 2012).

43 WHO. Implementation of the WHO Global Strategy on Diet, Physical Activity and Health: a guide for population-based approaches to increasing levels of physical activity. 2007. http://www.who.int/dietphysicalactivity/PA-promotionguide-2007.pdf (accessed Jan 19, 2012).

44 WHO. Global recommendations on physical activity for health. 2010. http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf (accessed Jan 19, 2012).

45 WHO. A comprehensive global monitoring framework and voluntary global targets for the prevention and control of NCDs. Dec 21, 2011. http://www.who.int/nmh/events/2011/consultation_dec_2011/WHO_Discussion_Paper_FINAL.pdf (accessed April 23, 2012).

46 Bull FC, Bellew B, Schoeppe S, Bauman AE. Developments in national physical activity policy: an international review and recommendations toward better practice. *J Sci Med Sport* 2004; **7** (suppl 1): 93–104.

47 WHO. Assessing national capacity for prevention and control of non-communicable diseases: the report of the 2010 global survey (in press).

48 Malta DC, Barbosa da Silva J. Policies to promote physical activity in Brazil. *Lancet* 2012; published online July 18. http://dx.doi.org/10.1016/S0140-6736(12)61041-1.

49 Bull FC, Milton K, Kahlmeier S. Health-enhancing physical activity (HEPA) policy audit tool. http://www.euro.who.int/hepapat (accessed April 25, 2012).

50 Bellew B, Schoeppe S, Bull FC, Bauman A. The rise and fall of Australian physical activity policy 1996–2006: a national review framed in an international context. *Australia N Z Health Pol* 2008; **5:** 18.

51 Daugbjerg SB, Lahlmeier S, Racioppi F, et al. Promotion of physical activity in the European region: content analysis of 27 national policy documents. *J Phys Activ Health* 2009; **6:** 805–17.

52 Craig CL. Evolution and devolution of national physical activity policy in Canada. *J Phys Activ Health* 2011; **8:** 1044–56.

53 WHO. Steps to health: a European framework to promote physical activity for health. 2007. http://www.euro.who.int/__data/assets/pdf_file/0020/101684/E90191.pdf (accessed May 5, 2012).

54 Agita Mundo. 2011. http://www.portalagita.org.br/en/agita-mundo.html (accessed Jan 19, 2012).

55 Matsudo V, Matsudo S, Andrade D, et al. Promotion of physical activity in a developing country: the Agita São Paulo experience. *Public Health Nutr* 2002; **5:** 253–61.

56 International Olympic Committee. Sport for all commission. 2012. http://www.olympic.org/sport-for-all-commission (accessed Jan 19, 2012).

57 Micheli L, Mountjoy M, Engebretsen L, et al. Fitness and health of children through sport: the context for action. *Br J Sports Med* 2011; **45:** 931–36.

58 Christiansen N, Kahlmeier S, Racioppi F. Sport promotion policies in the European Union: results of a contents analysis. *Scand J Med Sci Sports* (in press).

59 Council of the European Union. Declaration on "Health in all Policies". Dec 18, 2007. http://www.salute.gov.it/imgs/C_17_primopianoNuovo_18_documenti_itemDocumenti_4_fileDocumento.pdf (accessed June 18, 2012).

60 Kahlmeier S, Cavill N, Dinsdale H, et al. Health economic assessment tools (HEAT) for walking and for cycling: methodology and user guide. Copenhagen: WHO Regional Office for Europe. 2011.

61 WHO Regional Office for Europe. Health economic assessment tool (HEAT) for cycling and walking. 2011. www.euro.who.int/HEAT (accessed Dec 21, 2011).

62 Kahlmeier S, Racioppi F, Cavill N, Rutter H, Oja P. "Health in All Policies" in practice: guidance and tools to quantifying the health effects of cycling and walking. *J Phys Activ Health* 2010; **7** (suppl 1): S120–25.

63 Montes F, Sarmiento O, Zarama R, et al. Do health benefits outweigh the costs of mass recreational programs? An economic analysis of four ciclovía programs. *J Urban Health* 2012; **89:** 153–70.

64 IDEA Health and Fitness Association. http://www.ideafit.com/fitness-certifications (accessed April 24, 2012).

65 American College of Sports Medicine. http://certification.acsm.org/ (accessed April 24, 2012).

66 National Society for Physical Activity Practitioners in Public Health. http://www.nspapph.org/new-acsm-nspapph-physical-activity-in-public-health-specialist-paphs-certification (accessed Jan 19, 2012).

67 Sallis JF, Cervero RB, Ascher W, Henderson, KA, Kraft MK, Kerr J. An ecological approach to creating more physically active communities. *Annu Rev Public Health* 2006; **27:** 297–322.

68 Midgley G. Systemic intervention for public health. *Am J Public Health* 2006; **96:** 466–72.

69 Bauman AE, Reis RS, Sallis JF, Wells J, Loos RJF, Martin BW, for the Lancet Physical Activity Series Working Group. Correlates of physical activity: why are some people physically active and others not? *Lancet* 2012; published online July 18. http://dx.doi.org/10.1016/S0140-6736(12)60735-1.

70 Sallis JF, Bowles HR, Bauman A, et al. Neighborhood environments and physical activity among adults in 11 countries. *Am J Prev Med* 2009; **36:** 484–90.

71 Ding D, Sallis JF, Kerr J, Lee S, Rosenberg DE. Neighborhood environment and physical activity among youth a review. *Am J Prev Med* 2011; **41:** 442–55.

72 Hammond RA. Complex systems modeling for obesity research. *Prev Chronic Dis* 2009; **6:** A97.

73 Gortmaker SL, Swinburn BA, Levy D, et al. Changing the future of obesity: science, policy, and action. *Lancet* 2011; **378:** 838–47.

74 Global Advocacy Council for Physical Activity. The Toronto Charter for Physical Activity and Health. *J Phys Activ Health* 2010; **7** (suppl 3): S370–73.

75 Global Advocacy for Physical Activity. Investments that work. 2012. http://www.globalpa.org.uk/investments/ (accessed May 5, 2012).

76 Shilton T. Creating and making the case: global advocacy for physical activity. *J Phys Activ Health* 2008; **5:** 765–66.