
【Review Article】

Environmental and Policy Research on Physical Activity is Going Global

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ABSTRACT International groups have recommended environmental and policy changes as central strategies in efforts to increase physical activity worldwide. Research is needed to guide policy actions, but built environment and physical activity is a relatively new research topic that initially was conducted in just a few countries. The generalizability of findings cannot be assumed across countries with distinct environments and cultures. Initial findings, mainly from studies of North America and Australia, indicated that "walkable" community designs were related to active transportation, and proximity to parks was related to active recreation. In recent years, those general findings have mainly been supported in studies from Japan, Europe, and South America. Evidence to date indicates there may be generalizable principles about how to build communities that facilitate people being active for transportation and recreation purposes. Country-specific studies are needed to inform local decision making in city planning, transportation, parks, education, and health departments/ministries. Coordinated international studies are needed to guide international actions to reduce the epidemics of physical inactivity and chronic diseases.

Key words: exercise, international, built environments, walking

The epidemic of physical inactivity is one of the leading problems in international health. Not only is physical inactivity the fourth leading cause of death worldwide, but most of those deaths are in low and middle income countries.¹⁾ Hundreds of millions of people are leading inactive lifestyles and putting themselves at risk for numerous chronic diseases. Though we have very limited international data on trends in prevalence of physical activity over decades, there is a strong consensus that changes in technology are making profound alterations in people's activity patterns. It seems obvious that mechanization and computerization at work over many years have dramatically reduced occupational physical activity. Automobiles have become the dominant form of transportation in most countries, severely reducing

active modes of transportation. Many homes are filled with labor saving devices, largely eliminating another historical source of daily physical activity. Electronic entertainment has replaced dancing and walking as frequent leisure time activities. Globalization is taking these technologies into every country, and perhaps eventually into every town and village.

Most people welcome these technological advancements because they are associated with economic progress and improved standards of living. Though difficult to document, it appears that most people avoid physical activity whenever they can. For example, they avoid hard physical labor, pay to ride vehicles instead of walk, and in some countries watch 3-4 hours of television per day. One can imagine people of 100 years ago would be very pleased to live in a society like ours in which physical activity is no longer required. They would consider it the lifestyle of royalty. The only problem is that inactive lifestyles are one of the world's biggest killers.

If physical inactivity is a global problem, how do we find a global solution? The World Health

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Organization (WHO)²⁾ has recommended strategies for increasing physical activity in populations. Some of the strategies are designed to motivate and educate individuals to be more active by implementing educational interventions in schools, worksites, and through the mass media. However, most of the WHO global strategy is designed to counter some of the technological and societal trends believed to be the main forces behind the epidemic of inactive lifestyles. In contrast to interventions targeting individuals, which tend to have weak and short-term effects, changing environments and policies can affect entire populations on a relatively permanent basis.

Given that environment and policy changes are the dominant approach to physical activity promotion worldwide,^{2,3)} it is the responsibility of the scientific community to provide evidence that can inform and guide such interventions. Because environments, policies, and cultures can vary dramatically across countries, it cannot be assumed that findings from one country or region can be generalized to other countries. The purpose of the present paper is to summarize the international research on built environments and physical activity, identify findings that may be a sufficient basis for interventions, and to recommend priorities for next steps in research.

Built environments and physical activity research: Conceptual background and early studies

The research has focused mainly on built environments because physical activity is done in specific places, and most of those places can be affected by people and by policies. Environment and policy research is guided by ecological models of behavior change. The main principle is that because behavior is affected by influences at the individual, social/cultural, organizational, community environment, and policy levels, to be effective, interventions should operate at multiple levels. Ecological models are needed because more traditional psychological models of behavior do not provide guidance about environments and policies.⁴⁾ Ecological models must be specific to the behavior. In physical activity, models need to be specific to the major activity domains of occupational, transportation, leisure/

recreation, and household.⁴⁾

Most of the early environmental research was conducted in a few high-income countries, mainly the United States and Australia. This literature mainly relates to environmental correlates of recreation and transportation activity domains, because these domains seem the most promising intervention targets. The literature has been reviewed numerous times, and there are some consistently supported associations, especially for adults.⁵⁻⁹⁾ Neighborhood walkability refers to an environment that supports walking and bicycling for transportation. Walkable neighborhoods have high residential density, mixed land use that places destinations near homes, and connected streets that provide direct routes. Walkable neighborhoods and their components have consistently been associated with active transportation and total physical activity, and the effects can be substantial. For example, our study conducted in two regions of the USA found a difference of 35-49 minutes per week of physical activity between residents of high- compared to low-walkability neighborhoods, based on accelerometer monitoring.¹⁰⁾ An Australian study using similar methods found a strong association of walkability with reported walking for transportation.¹¹⁾ Among children and adolescents, mixed land use is the component that is most often related to physical activity.⁵⁾ Presence and quality of sidewalks, bicycle facilities, and street designs that slow traffic are not convincingly related to physical activity.

A different set of environmental attributes is related to recreational physical activity. There is good evidence that living near recreation facilities, like parks and trails, is positively related to use of those facilities and recreational physical activity for adults and youth.^{5,8,9)} There is emerging data that the design of parks and trails can affect physical activity. For example, people were most likely to be active in parks with trails,¹²⁾ and urban trails that were used most had a variety of views, amenities like cafes and restrooms, and vegetation that was not too thick.¹³⁾

The main limitation of these studies is that they are cross-sectional, so it possible that findings could be explained by self-selection bias. Other limitations include inconsistent definitions of environmental attributes and reliance on self-report measures. The

literature on built environments and physical activity has been widely accepted.⁷⁾ A critical question is how do these findings, derived mainly from studies in the USA and Australia, apply to countries with different environments and cultures?

International studies on built environments and physical activity

Built environment studies conducted in diverse countries are now appearing in the literature, and this section gives examples of studies relevant to active transportation and active recreation. The USA and Australia are two of the least walkable countries, so it has been questioned whether findings in these countries would be similar to results in countries with much higher walkability, such as in Europe. Two studies of adults that used similar study designs and methods to the USA study cited earlier¹⁰⁾ suggest findings tend to generalize across countries. A Belgian study reported differences of about 49 minutes per week across high- versus low-walkability neighborhoods in accelerometer-measured physical activity, very similar to USA results.¹⁴⁾ A Swedish study found only about half the walkability effect (21 minutes per week comparing high- and low-walkability neighborhoods).¹⁵⁾ Both European studies and the USA study found strong associations with active transportation. Though there were some differences in findings across continents, European studies to date support the principle that neighborhood walkability is related to active transportation and total physical activity in the context of mostly high-walkable environments.

A recent study in Japan used different methods to examine similar study questions. Inoue and colleagues¹⁶⁾ recruited adults in four cities with diverse built environments and studied perceived environment characteristics in relation to reported physical activity for transportation and recreation purposes. Components of walkability were related to walking for transportation, as were walking/cycling facilities (such as sidewalks) and aesthetics. Walking for recreation was related to walking/cycling facilities, aesthetics, and perceived safety from traffic. The Japanese findings were generally supportive of results

from Western countries, in spite of clear differences in built environments and culture.

A study of adults in Thailand had a limited assessment of built environment variables, consisting of distance from home to a few destinations.¹⁷⁾ Reported active transportation was related to distance to shopping but not to distance to work or a religious establishment. Active recreation was not related to distance to the nearest recreation facility. This study partially supported findings from prior studies.

Built environment studies have been conducted in Latin America as well. A study in Bogota, Colombia examined a wide range of environmental variables among adults and reported walking for transportation was related to street connectivity and proximity to public transit stations, but not to mixed use and residential density as in other countries.¹⁸⁾ One interpretation was that almost all of Bogota is densely populated and has mixed land use, so there is little variation in those attributes. As in other countries, recreational physical activity was related to proximity to parks, but in a new finding, was also related to proximity to public transit. Because the vast majority of people in Bogota do not have access to automobiles, public transit may support several domains of physical activity. Reis and colleagues¹⁹⁾ conducted a study of adolescents and park use in Curitiba, Brazil. They found being active in parks was related to having sufficient space to be active, opportunity for a variety of activities, and equipment available. Some associations varied by sex, and it is difficult to compare to studies from other countries, but findings generally supported that built environment features are important correlates of physical activity.

There is one published built environment study conducted in Africa. This study of Nigerian university students found several significant associations of perceived environmental variables with physical activity, but about half of the associations were in the unexpected direction.²⁰⁾ This is the only study that does not support the overall pattern of international results. However, this study had an important limitation that all participants lived on the same university campus, so there was very little variation in environments. The environmental measure used may not have represented well the African context.

Particularly strong evidence of the international relevance of built environments comes from an 11-country study of adults that included countries from Asia (Hong Kong/China, Japan, New Zealand), Europe (Belgium, Lithuania, Norway, Sweden, United Kingdom), South America (Brazil, Colombia), and North America (Canada, USA).²¹⁾ All countries had 7 common items assessing perceived environment attributes as well as the same self-report measure of total physical activity. Five of the seven environment variables were related to meeting physical activity guidelines: mixed land use, access to transit, sidewalks, bicycling facilities, and low cost recreation facilities. Only residential density and safety from crime were not significant correlates. When an index of favorable built environment attributes was constructed, those living in a neighborhood with the most supportive environments were twice as likely to meet physical activity guidelines as those without any supportive features. This study conducted in extremely diverse environments and cultures demonstrated that built environments are strongly related to physical activity.

My own interpretation of these international studies is that they provide strong support for the general principle that built environments are important contributors to physical activity. A second conclusion is that several of the associations of specific built environment attributes with physical activity domains verified in systematic reviews⁵⁻⁹⁾ are often supported by international studies. There are certainly some inconsistencies across countries, especially when analyzing by subgroups defined by sex and socioeconomic status. However, findings related to walkability and its components, and access to parks and recreation facilities, tend to be confirmed in international studies.

Next steps in international research on built environments and physical activity

There are two categories of next steps that I recommend at the present time. One is to improve the international data base, and the other is to use the research to inform changes in policy and practice. Two important aspects of improving the evidence base

are to tailor measures and studies to optimize country-specific results and to use international studies to identify the most generalizable findings.

It is understood that behavioral research needs to be specific to the context. Built environments differ greatly across countries, and measures should assess the most relevant attributes in each country. A good example is the ALPHA project in which European investigators identified the most promising attributes that facilitated and hindered physical activity in Europe that were not represented in existing built environment surveys. Then they developed and evaluated a survey that was appropriate for the European context, building on measures validated elsewhere.²²⁾ It would be useful for groups of investigators to collaborate on regional built environment measures tailored for Asia, Latin America, Africa and other regions. Current concepts and measures of activity-supportive built environments are relevant to urban and suburban settings, but not to rural areas. Thus, additional measurement development is needed within each region to develop measures appropriate for rural areas. This work has begun²³⁾ but needs to be expanded.

Use of built environments for physical activity may be moderated by a variety of factors, such as sociodemographic variables and social environments. For example, people are likely to use parks differently depending on their age, sex, and family composition. Perceptions of crime safety and traffic safety may affect the extent to which people take advantage of supportive environments. Despite worldwide variations in climate, there has been little study of how extremes of heat, cold, and precipitation affect the relation of built environments to physical activity. Studies that identify effective strategies for adapting to extreme climates would be particularly valuable. More country-specific studies that examine social and physical contextual factors of particular local significance should improve both the science and the policy relevance of the studies.

Studies to date have confirmed that built environment features are related to physical activity, but they have not provided specific data that could be useful in designing communities that are optimally supportive of physical activity. Studies need to answer

questions related to the best range of walkability, how many destinations are needed to stimulate walking for transport among a variety of population subgroups, how close do parks need to be to substantially increase use, and what types of amenities of parks and trails are most likely to stimulate active use?

There is value in studies that use common methods across countries and attempt to identify generalizable principles of environmental influences on physical activity. If it can be demonstrated that low-walkable community designs, lack of sidewalks, and lack of access to parks are contributing to epidemics of physical inactivity and chronic diseases in many countries, that would increase the policy relevance of the data. The goal of the International Physical Activity and Environment Network (IPEN) is to support a coordinated set of international studies to advance knowledge on built environment correlates of physical activity (www.ipenproject.org). In addition to encouraging use of common study designs and a common core of measures to enhance comparability among the hundreds of network members, IPEN is conducting a study of adults in 12 countries using detailed objective and perceived measures of built environments as well as objective and domain-specific reported physical activity measures in most countries. Because within-country studies have limited environmental variation that underestimates true associations, a major goal of IPEN is to represent the worldwide variation in built environments. Coordinated international studies of other age groups are underway or planned, and the Council on Environment and Physical Activity (CEPA) is also supporting advancements in research and its application to policy and practice (<http://www.ispah.org/ispah-groups/ispah-groups/council-on-environment-and-physical-activity>).

As stated at the beginning of the present paper, international efforts to use environmental and policy strategies to increase physical activity worldwide^{2,3)} are a major rationale for placing high priority on built environment research. However, merely conducting the research and reporting it in scientific journals is likely to have little or no impact on built environments or public health. Built environment research on physical activity is relevant to policies made in city

planning, transportation, parks and recreation, sports, housing, education, and health departments and ministries. The research indicates likely consequences of decisions made, but the decision makers do not read the scientific papers. Thus, specific efforts need to be made to communicate the results of the research to those who can use the information in their decision making process. Though research is only one source of influence in policy decision making, it can be influential at times.

Efforts are being made to encourage and prepare researchers to communicate findings to those who can put it into practice, and the approach to communication needs to be quite different from that used with scientific audiences.^{24,25)} Though scientists can be credible and effective spokespersons, they may not be motivated to act in this capacity, and there are alternative approaches. For example, most countries will have advocacy groups interested in influencing policy in the multiple sectors relevant to physical activity. Those groups tend to be skilled in communicating research to policy makers and are motivated to find and use research. Thus, sending research to advocates may be an efficient way of inserting research into the policy process.

There is growing evidence that decisions made in several sectors of society whose mission is not health do have substantial impact on physical activity.⁵⁻⁹⁾ Because city planners, transportation engineers, and park designers usually do not consider the effect of their decisions on physical activity, research on built environments is needed to provide insights into likely health consequences of the environments they build. Based mainly on research in the USA and Australia, there is a consensus that walkability and access to recreation facilities is consistently, and perhaps strongly, related to physical activity.⁵⁻⁹⁾ Though questions have been raised about the extent to which these findings apply to very different environments and cultures, there is recent confirmatory evidence from diverse countries in Asia, South America, and Europe. Built environment associations with physical activity are largely replicated across countries, suggesting there are generalizable principles about how to build communities that facilitate people being active for transportation and recreation. Built

environment interventions are promising approaches to combating the epidemic of inactive lifestyles, but country-specific research is needed to inform national actions, and international research is needed to inform international action.

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【要旨日本語訳】

身体活動環境・政策研究の世界的な広がり

国際的なグループは、身体活動推進対策の中心に環境・政策的な対策を据えるように推奨している。政策実行をガイドする研究が求められている。しかし、2～3の国から始まった環境と身体活動の研究は、比較的新しい研究分野である。これまでの研究成果を、明らかに異なる環境、文化をもつ国に一般化できるかどうかは分からない。初期の研究成果（主に北アメリカとオーストラリアで実施された研究）によると、walkableな地域のデザインは「身体活動を伴う移動（歩行や自転車利用）」と関係しており、公園への近くに住んでいることは「身体活動を伴う余暇活動（運動など）」と関係している。最近では、このような知見は、日本、ヨーロッパ、南アメリカなどにおける研究によっても支持されている。これまでの研究で示されていることは、「人々の活発な移動、活発な余暇活動を推進するような地域をつくるための、一般的な原則があるかもしれない」ということである。都市計画、交通、公園、教育、健康部門における意思決定・政策決定に情報提供できるような、各国に特異的な研究が必要である。また、蔓延している身体的不活動、慢性疾患の国際的な対策をガイドするような国際共同研究が必要である。

（この日本語訳は、読者の利便性を考慮して著者の許可のもとに編集委員会が作成したもので、論文の一部ではありません。日本語訳が著者の意図にあっていない可能性もありますので、正確な意味を確認するためには原文をご覧ください）