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When Moving Is the Only Option: The Role of Necessity Versus Choice for Understanding and Promoting Physical Activity in Low- and Middle-Income Countries

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Abstract

Given its origins in high-income countries, the field of physical activity and public health research and promotion has broadly followed a choice-based model. However, a substantial amount of the physical activity occurring routinely in many settings, particularly in low- and middle-income countries (LMICs), is the result of economic necessity and is not due to true, free choices. We propose the "necessity- versus choice-based physical activity models" framework as a conceptual tool to ground physical activity and public health research and promotion efforts in LMICs, helping ensure

that these efforts are relevant, ethical, responsive, and respectful to local contexts. Identifying ways to ensure that LMIC populations can maintain high levels of active transport while increasing opportunities for active leisure must be prioritized. To promote equity, physical activity research, programs, and policies in LMICs must focus on improving the conditions under which necessity-driven physical activity occurs for a vast majority of the population.

INTRODUCTION

Physical inactivity is a risk factor for chronic disease incidence and mortality (43, 45) and is estimated to result in more than 5 million attributable deaths per year globally (45). Approximately one in four adults are physically inactive globally, with considerable variability across countries (29). As a whole, levels of physical inactivity are slightly higher in high-income countries (HICs) than in low- and middle-income countries (LMICs), although the observed differences are not considerably large (29, 30). As such, it might appear that the problem of physical inactivity is of similar proportions worldwide. However, such a conclusion oversimplifies a far more complex issue by ignoring the role of the various sources (and of their upstream drivers) of physical activity, commonly referred to as domains (7, 59).

High-income countries (HICs): defined by the World Bank country income classification criteria

Low- and middle-income countries (LMICs): defined by the World Bank country income classification criteria

Utilitarian physical activity: physical activity that serves a practical purpose, including occupational and transport-based physical activity

Choice: the act of selecting among at least two available and feasible options, with autonomy (freedom to decide) and without coercion

Physical activity transition: theory positing that modern life in HICs has highly reduced the need for utilitarian physical activity

For many individuals across the world, the main reason for being physically active is to make a living wage through work requiring physical labor or to travel from one place to another when car ownership is beyond one's financial possibilities (41, 44). However, to date, the field of physical activity and public health has broadly followed what we define as a choice-based model, with research and promotion efforts being commonly framed around questions of individual responsibility (e.g., "Why do people choose to be active?" or "How can we make the active choice the easy choice?"). In LMICs as well as in some HIC settings and communities, a necessity-based model of physical activity that recognizes that most physical activity is not the result of autonomous, noncoercive choices (80) may be more appropriate.

This work does not propose to rename existing concepts by referring to all utilitarian physical activity (which includes the work- and transport-based domains) as being necessity based. Our proposed classification of different types of physical activity as being the result of choice or necessity is presented in **Figure 1**. In particular, we distinguish between active transportation behaviors that are due to true choices and those resulting from economic necessity.

In this article, we provide a critical summary of (*a*) the physical activity transition; (*b*) the origins and evolution of the field of physical activity and public health research; and (*c*) evidence from LMICs on the key drivers of physical activity in these settings. Each of these elements supports the need for a research framework that recognizes the contribution of necessity (i.e., having no other option but to be active) versus choice [i.e., deciding to be active when other feasible options are also available (80)] to overall levels of moderate- to vigorous-intensity physical activity in populations. We posit that this framework is particularly salient for advancing the field of physical activity and public health research and practice in LMICs and provide examples of the types of research questions that researchers can pursue through the lens of this framework. Furthermore, we discuss its implications for ethical physical activity research and promotion efforts from a social justice perspective. Finally, we discuss the relevance of this framework for conducting research and promoting physical activity in certain settings or population subgroups in HICs.

THE PHYSICAL ACTIVITY TRANSITION

The physical activity transition was first defined by Katzmarzyk & Mason in 2009—it posits that major global and societal changes have resulted in modified physical activity patterns, with

	Choice-based physical activity		Necessity-based physical activity	
	Discretionary-time physical activity	Utilitarian physical activity		
Activity type	**Active leisure**	**Active transport by choice**	**Active transport by necessity**	**Active labor**
Activity examples	Exercise, sports, active play, dancing, leisure walking	Commuting to work or school by walking or cycling, walking to a nearby store or restaurant	Commuting to work or school by walking or cycling, walking to a nearby store or restaurant	Construction work, mining, agriculture, carpentry
Is a nonactive alternative a true option*?	Yes	Yes	No	No
Justification of choice- or necessity-based physical activity classification*	Discretionary time could be alternatively spent in sedentary activities Examples of alternative, sedentary activities: reading, watching television, playing video games, playing board games	Traveling by private car is a true alternative option* Car ownership can be afforded while meeting basic human needs (cost of food, housing, and basic services) Active transport is chosen for some or all trips as it is facilitated by supportive environments and systems	No feasible alternative to active transport* Car ownership is not affordable without jeopardizing basic human needs (cost of food, housing, and basic services) Active transport occurs regardless of whether environments and systems are supportive of it	Not many feasible alternatives to active labor are available for most people who engage in it Employment in jobs demanding physical labor is due to economic necessity and low access to education and training for higher-skilled/ professional jobs

*True choice-based physical activity is the result of an autonomous, noncoercive decision, in which other options are feasible for the person who ultimately decides to make the active choice. These alternatives are not truly feasible when necessity-based physical activity takes place.

Figure 1

Defining choice- (*blue*) versus necessity-based (*yellow*) physical activity. Determining if there is a true alternative option to different types of physical activities helps explain why discretionary-time physical activity is almost always choice based (*blue*), why occupational physical activity is usually necessity based (*yellow*), and why transport-based physical activity can be driven by either necessity or choice.

populations in HICs engineering most necessity-driven physical activity from their daily living (active labor and active transport by necessity; see **Figure 1**) (38).

Long before being characterized as a protective health behavior for chronic disease, physical activity almost exclusively served utilitarian purposes for humankind (38). For most of their evolutionary history, humans and their hominid ancestors engaged in hunter-gatherer activities (i.e., most energy expenditure occurred in the occupational and transportation domains and involved acquiring food and water, establishing shelter, and avoiding or fighting predation). The establishment of agriculture and the domestication of animals represented a significant shift in demography and physical activity patterns (50). Indeed, this shift is referred to in history books as the start of "sedentarism" (i.e., sedentary lifestyles). The transition from nomadism to sedentarism marked the first major reduction in population-wide physical activity levels, and, since then, utilitarian physical activity has been gradually removed from everyday human life (38).

As technological advances have taken place, including the agricultural, industrial, and information systems revolutions, human reliance on physical activity for utilitarian purposes has

Active labor: paid employment requiring physical activity (e.g., mining, agriculture, construction). Also known as occupational or work-based physical activity

Active transport: traveling by walking or cycling. Also known as transport-based physical activity or active travel

dramatically declined (38, 50, 60). This decrease is especially notable for active labor in HICs (7, 14, 38, 44), with few exceptions in specific population groups (e.g., immigrants engaged in low-wage and physically demanding occupations; very low-income communities without access to public transport and where many households cannot afford car ownership) (14, 41). In LMICs, high-income groups may have already undergone the physical activity transition. In contrast, lower-income groups may not yet have full access to the technological advances that have vastly reduced physical labor needs for other groups (44). While it is unreasonable to believe that all physical labor will disappear, all countries are expected to eventually undergo a major physical activity transition that will continue to reduce occupational physical activity as a major source of energy expenditure (38).

Discretionary time physical activity: physical activity occurring during free time, for leisure. Includes exercise, sport, and active play and recreation

With regard to discretionary time physical activity, evidence indicates that active play is a natural or instinctive source of energy expenditure among children. In addition, sport practice can be traced back to ancient civilizations (51). However, the relative contribution of the discretionary time domain, including active play, exercise, and sport, to overall energy expenditure at a population level was likely minimal in the early stages of human societies (38). Indeed, leisure time physical activity being a substantive contributor to overall levels of physical activity in humans is a recent phenomenon (38), which merits reflection, given that the vast majority of physical activity and public health research and promotion efforts focus on this domain.

ESTABLISHMENT OF THE CHOICE-BASED MODEL FOR PHYSICAL ACTIVITY RESEARCH: A HISTORICAL OVERVIEW

The status quo of physical activity and public health research and practice is what we refer to here as the choice-based model. That is, from a behavioral perspective, up until this point, participation in physical activity has mainly been studied as resulting from personal choice. Research aiming to identify the correlates and determinants of physical activity behaviors has typically posed (either explicitly or implicitly) the question, "What makes some choose to be active, and what makes others choose to be inactive?" (35, 39). Furthermore, when designing, implementing, and testing physical activity interventions, programs, and policies, the main goal is to provide participants or residents with the right tools to make the active choice (6). To help readers understand this approach, we summarize the evolution of the physical activity field.

Briefly, the work by Jeremy Morris in the 1950s is credited as the start of the field of physical activity and public health research—a natural experiment on coronary heart disease on conductors (active ticket takers) and drivers (sedentary workers) in the double-decker buses in London, United Kingdom (48). In today's physical activity research taxonomy, Morris's seminal piece would have been classified as a study of the effects of sedentary time (versus light-intensity physical activity) within the occupational domain (59). This reflection is worthwhile because what followed for the field was a rapid growth in studies focused almost entirely on documenting the effects of physical activity in the discretionary time domain on health outcomes, with strong involvement of fields such as exercise physiology, sports sciences, and cardiovascular epidemiology (54, 82). The general argument for this focus is that, of all the domains, discretionary time (i.e., what an individual chooses to do in their free time) is the only one where external factors (i.e., necessity to work, to get from one place to another, to do domestic duties) are not a constraint; i.e., it is by definition driven exclusively by autonomous, noncoercive choice (80) and is therefore thought to be the most modifiable domain (9, 14, 23).

In the 1990s, a scholarly interest in understanding how to get more people to become and stay physically active emerged (54, 66, 82). Thus, psychology and behavioral sciences became important pillars of the modern field of physical activity and public health research through intervention

work. Early intervention work focused on the discretionary time domain, with a stronger focus on individuals and their choices (21, 40). In the 2000s, socioecological approaches were incorporated to uncover the multilevel and upstream influences on physical activity behaviors, and a broader focus for defining health-enhancing physical activity was adopted, including other domains beyond discretionary time, such as transportation, occupational, and home-based physical activity (10, 68, 70). More recently, other disciplines that focus on examining the more distal and complex influences of health behavior by exploring multilevel systems and sectors have been incorporated into the field (population data sciences, complexity sciences, geography, sociology, economics, urban and transport planning, etc.) (65, 82).

Informal economy: nonregulated business enterprises, jobs, and workers, who are not taxed, monitored, or protected by law or government

Since the early days of physical activity and public health research, HICs have been the main knowledge generators, with the United States, Canada, the United Kingdom, Australia, and Scandinavian countries being key leaders (82). Even today, very little high-quality physical activity and public health research is being conducted in LMICs; Brazil is the only LMIC in the top 10 list of countries with the highest research contributions to the field (82). Thus, the methods, measures, and questions used to build the evidence on population patterns of physical activity, and their influencing factors, are informed largely by the contextual reality of HICs and/or are seen through the lens of researchers trained in HICs (44, 74). In these settings, per the physical activity transition model, necessity-driven physical activity has been almost entirely removed from daily living (38).

THE NEED FOR A NECESSITY-BASED MODEL OF POPULATION PHYSICAL ACTIVITY

Despite the small proportion of global physical activity and public health research emanating from LMICs, most of the global population lives in these countries (84%) (84). This research inequality has been well characterized through studies using density-equalizing cartographic analyses (a data visualization technique showing the areas of countries graded according to their population size and research output) (61, 63, 73). Entire world regions (most of Africa, vast parts of Asia, and parts of Latin America) figuratively disappear from the map when visualizing physical activity research outputs. Beyond the need for more research from these parts of the world, a more fundamental issue arises: Most of the work conducted to date in LMICs around physical activity and public health relies on adapting the research questions, frameworks, methods, and instruments of HICs (74) using the choice-based model.

As of 2022, the World Bank defines LMICs as national economies with an annual gross national income per capita lower than $12,969 (this number is adjusted every year) and further subcategorizes them by income thresholds into low-income economies, lower-middle-income economies, and upper-middle-income economies (31). The multiple social, economic, and health issues broadly affecting LMICs have been extensively described (11, 44, 49, 60, 74). Critical issues of concern include high levels of poverty, pervasive inequalities (socioeconomic, gender based, age based, disability based, etc.), a high proportion of the working population employed in the informal economy, insufficient and inadequate infrastructure for daily living, violence, political instability, and, more recently, the disproportionate projected negative consequences of climate change for these global regions and their low-income populations (72, 81). Although there is large variability across LMICs, the reality of daily living in these countries does not fit a choice-based model for understanding what drives physical activity patterns at a population level. Simply stated, in most LMICs, a vast majority of individuals in a population engage in occupational or transport-based physical activity because they have no other alternative (1, 44, 76). Indeed, research from China (upper-middle income) and Kenya (lower-middle income) demonstrates that these countries are still undergoing the physical activity transition (46, 52).

Table 1 Macroeconomic, sociodemographic, and physical activity indicators for a selection of low- and middle-income and high-income countries

Country	Passenger cars per capita (83)	% of total workforce in labor-intensive jobs[a] (34)	% of adults meeting WHO aerobic physical activity guidelines[b] (28)	GDP per capita (INT $)[c] (86)	Gini Index[d] (85)
Low- and middle-income countries					
Algeria	74	41	66	11,324	27.6
Bangladesh	2	61	72	5,139	32.4
Egypt	33	52	69	12,607	31.5
Ghana	18	49	69	5,744	43.5
India	12	68	66	6,504	35.7
Kenya	13	49	85	4,578	40.8
Mexico	191	39	75	18,444	45.4
Pakistan	13	62	66	4,813	29.6
Philippines	8	44	60	8,390	42.3
Sri Lanka	19	54	71	13,225	39.3
Ukraine	142	40	80	13,055	25.6
High-income countries					
Australia	556	23	48	53,317	34.3
Japan	454	18	65	42,390	32.9
Netherlands	466	17	55	59,267	29.2
South Korea	276	30	65	45,226	31.4
Slovenia	518	39	68	39,725	24.4
United Kingdom	456	25	64	46,483	35.1
United States	423	21	68	63,207	45.5
Uruguay	184	28	78	22,794	40.2

Abbreviations: GDP, gross domestic product; INT $, international dollars; WHO, World Health Organization.
[a]Percentage of working population employed in the agricultural, construction, mining, and manufacturing sectors.
[b]The WHO recommends that adults accrue a minimum of 150 min per week of moderate- to vigorous-intensity physical activity.
[c]GDP over total population, expressed in INT $. INT $ is a hypothetical currency that represents comparable purchasing parity to the US dollar, i.e., an INT $ in a given country would buy a comparable amount of goods and services as a US dollar would buy in the United States.
[d]The Gini index is a measure of the distribution of income across a population; a higher Gini index indicates greater inequality (range 0–100).

Choice-based physical activity: physical activity as a result of individual choices (i.e., deciding to be active over other feasible alternatives)

Necessity-based physical activity: physical activity as the only available and feasible option (e.g., active transport due to financial need)

Table 1 presents macroeconomic, sociodemographic, and physical activity indicators from a selection of HICs and LMICs. The prevalence of the population meeting World Health Organization guidelines for aerobic physical activity is relatively similar across the countries, but higher ranges have been observed in LMICs [HICs range: 48% (Australia) to 78% (Uruguay); LMICs range: 60% (Philippines) to 80% (Ukraine)]. These prevalence rates represent total aerobic moderate- to vigorous-intensity physical activity, regardless of the domain (i.e., prevalence rates are inclusive of necessity- and choice-based physical activity). However, in the selection of HICs, the percentage of the population working in physically intensive jobs ranges from 17 (Netherlands) to 39 (Slovenia), whereas the percentage among the selection of LMICs ranges from 39 (Mexico) to 68 (India). Just as discretionary time physical activity constitutes the only domain that can be understood as representing only choice-driven physical activity regardless of individual socioeconomic circumstances, the occupational domain is thought of as the only domain in which all physical activity can be broadly understood as being necessity-based. These data indicate the important contribution of necessity-based physical activity in these settings.

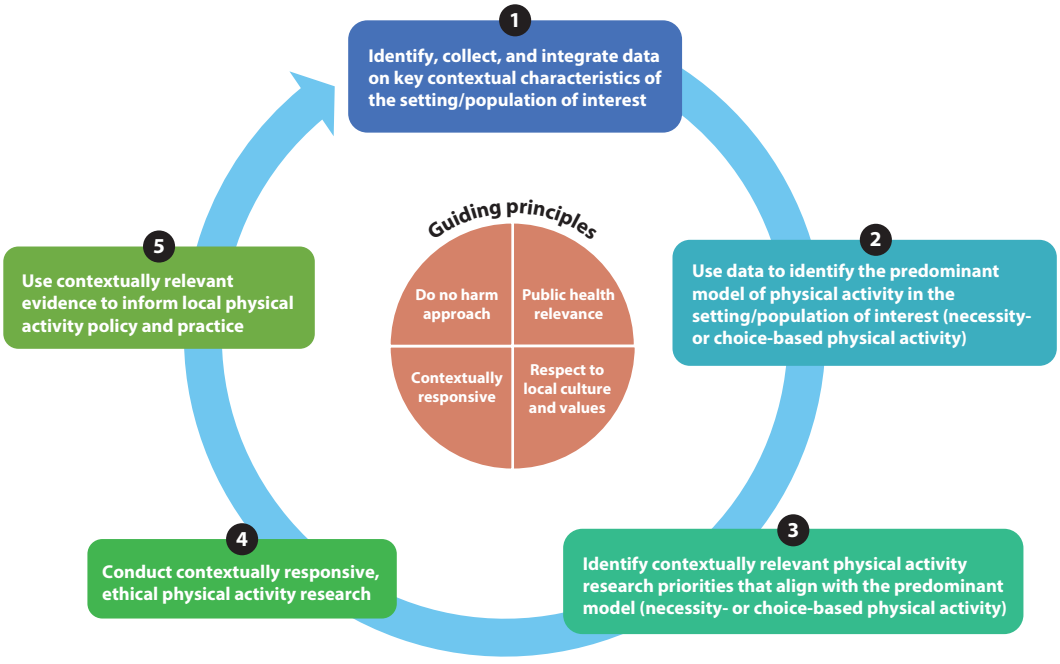

Figure 2

The necessity- versus choice-based physical activity models framework for contextually responsive physical activity research. The framework shows an ongoing research cycle, given that, as societies and economies evolve, the predominant model of physical activity may shift, which requires continuously adjusting research priorities and actions.

The much higher number of cars per capita across the selection of HICs (184–556 cars per capita) versus LMICs (2–191 cars per capita) is also noteworthy. These data, in conjunction with the macroeconomic indicators, suggest that a large portion of the population in LMICs is not opting out of car ownership (and hence, autonomously and noncoercively choosing active transportation), but rather cannot afford to have a car, supporting the notion that a necessity-based model of population physical activity is operating in these settings. The readers should keep in mind that **Table 1** presents ecological, country-level data from a nonrandom selection of countries. This selection was based on data availability and aims to demonstrate construct validity for our proposed framework.

Figure 2 presents a conceptual framework for conducting contextually responsive physical activity research across global settings. Just as not all physical activity in LMICs is the result of necessity, not all physical activity in HICs is due to personal choice. However, our proposed framework underscores that to conduct contextually relevant, culturally respectful, and impact-oriented physical activity and public health research across global settings, investigators should identify the predominant model of population patterns of physical activity in each of them and adjust research priorities, plans, measures, and protocols accordingly. Doing so will help ensure that the findings of the research are contextually responsive and can be used to inform local physical activity policy and practice. Our framework is structured as an ongoing cycle because, as societies and economies continue to evolve, the predominant operating model of physical activity in the given population may change, which would require an adjustment in research and policy priorities.

Table 2 describes the broad contextual factors that can help researchers identify the predominant model in any given global setting, including the macroeconomic context, the epidemiological

Table 2 Key contextual characteristics for identifying the predominant physical activity model in a setting or population of interest

Predominant model: necessity-based physical activity	Contextual level	Predominant model: choice-based physical activity
High poverty rates High income inequality	**Macroeconomic context**	Low poverty rates Low income inequality
High burden of infectious diseases or double burden of disease	**Epidemiological context**	Disease burden mostly due to noncommunicable diseases
Significant portion of jobs involve physical labor Long working hours Substantial portion of jobs are in the informal economy Many people work more than one job/shift	**Job market**	Most jobs do not require physical labor Short to moderate working hours The majority of jobs are part of the formal economy Most people work single jobs/shifts
Larger average household units (number of people per household) High prevalence of single-parent households Formal child care options (e.g., day care centers) not available for a large proportion of families	**Family life**	Smaller average household units (number of people per household) Low prevalence of single-parent households Formal child care options (e.g., day care centers) available for most families
Crime, violence, and/or political and social conflicts are common	**Crime and violence**	Relatively safe and politically/socially stable environments
Significant portion of the population is without access to basic infrastructure (e.g., paved roads, safe and affordable housing, drinking water, electricity) Pronounced disparities in access to safe, quality sidewalks, bicycle lanes, and public transport in cities High number of traffic-related incidents and deaths	**Infrastructure and traffic safety**	Vast majority of the population has access to basic infrastructure (e.g., paved roads, safe and dignified housing, drinking water, electricity) Equal access to safe, quality sidewalks, bicycle lanes, and public transport in cities Low number of traffic-related incidents and deaths
Significant portion of the population cannot afford private car ownership Majority of daily trips in cities involve active and/or public transport High prevalence of walking for transport Many people engage regularly in long walking trips (>20 min)	**Travel mode patterns**	Vast majority of the population can afford private car ownership Varying ratios of trips by private car, active travel, and public transport across settings Varying prevalence of walking for transport across settings Most walking trips are short (<20 min).
Significant portion of the population has limited free time available for leisure	**Discretionary time**	Vast majority of the population has sufficient free time available for leisure

context, job market characteristics, family life, crime and violence, infrastructure and traffic safety, and travel mode and discretionary time patterns in the population. Of course, not every one of these factors needs to be occurring to determine that a predominant necessity- or choice-based model is operating in a setting of interest. Instead, the list of elements provided in **Table 2** should be used as a general guideline. We anticipate that in certain settings (e.g., the wealthiest city of a LMIC) a mixed model may be operating, with both necessity and choice acting as key drivers of physical activity behaviors among relatively equally large portions of the population (e.g., a 50/50 or 40/60 ratio). However, when possible, it is helpful to identify the predominant model because this determination will help ground physical activity research within the broader social, economic, and cultural contexts in which it will take place.

Along with the characteristics described by our framework, surveillance data on domain-specific levels of physical activity and across population subgroups could provide additional

evidence of the predominant model operating in a setting. For example, the International Physical Activity Environment Network (IPEN) Adult Study collected standardized domain-specific physical activity and built environment data from representative samples in 17 cities in 12 countries (69). Of those, three were in LMICs (Cuernavaca, Mexico; Curitiba, Brazil; and Bogotá, Colombia). Not surprisingly, the three LMIC cities had the lowest levels of participation in discretionary-time physical activity and were among the highest for participation in active transportation (69, 74). However, domain-specific physical activity data are not always readily available, especially when the setting of interest is not an entire country or region, but rather a city or smaller area.

Physical activity paradox: emerging theory based on recent studies suggesting that high levels of active labor could negatively affect health

"Do no harm" principle: health professionals weigh the risk of harm by a treatment against its potential to improve health

IS ALL PHYSICAL ACTIVITY GOOD FOR HEALTH AND WELL-BEING?

Although a myriad of health benefits are known to result from regular engagement in moderate- to vigorous-intensity physical activity (45), recent findings suggest that it is not entirely clear if all types of physical activity are beneficial for human health. In particular, the role of occupational physical activity (i.e., physical labor) as a health-enhancing behavior has recently been called into question through what has been termed the physical activity paradox (32). The physical activity paradox posits that occupational physical activity, in contrast with discretionary time physical activity and some types of transport-based physical activity, does not improve health and that, in some instances, may be detrimental to health and well-being.

Evidence supporting the physical activity paradox is becoming increasingly available, but most of it is based on data from HICs. A large prospective cohort study with data from multiple countries (mostly HICs) reported evidence that supports the physical activity paradox, especially among men; those who engaged in high versus low levels of occupational physical activity experienced significantly higher premature mortality rates (16). Because HICs tend to have better working conditions and protection laws for labor-intensive jobs than do LMICs, some researchers have argued that the health burden of high levels of occupational physical activity could be more considerable in other parts of the world (17). Studies to confirm or refute this hypothesis are currently lacking, however.

Some investigators have questioned the validity of the physical activity paradox (78), although many plausible arguments could support it (15, 33). The effects could vary by context and occupation. Some jobs, although physically demanding, do not confer sufficiently high intensities to result in cardiovascular health benefits (33). Prolonged physical activity can raise blood pressure (33). Certain jobs can result in muscle and bone injury and affect posture (15). Physically demanding jobs can be stressful and cause chronic inflammation and/or can have adverse mental health consequences (20). Some occupations go hand-in-hand with exposures to other factors that are detrimental to health (e.g., heat, pollution, pesticides, coal, chemical products) (17). Indeed, when it comes to the physical activity paradox, there are currently more questions than answers. Future research on the physical activity paradox is urgently needed in LMICs because it has important implications for any setting in which the necessity-driven model of physical activity predominates.

Beyond the physiological effects of occupational physical activity, from a social justice perspective, it is worth asking ourselves, as public health scientists and practitioners invested in promoting health equity (12), if labeling occupational physical activity as a "health-enhancing behavior" is ethical. In many parts of the world, some occupations requiring physical labor are not well regulated and, hence, are not entirely safe and often include abuse and exploitation (49). Furthermore, people engaging in occupational physical activities as a direct result of economic necessity may not enjoy them. Characterizing these occupations as part of healthy lifestyles may be not only physiologically inaccurate (16, 32), but also ethically questionable. All health-related professions embrace the "do no harm" principle, requiring, for instance, health care providers to weigh the risk that a treatment will hurt a patient against its potential to improve their condition. This principle also

applies to public health. The physical activity and public health community should carefully consider its messaging and priorities, especially in LMIC settings. The definition of what constitutes "health-enhancing" physical activity must be revisited and should exclude occupational physical activity. Furthermore, physical activity within the occupational domain should not be prioritized as something to promote or maintain in any population health promotion plan or agenda.

Instead, our efforts should focus on promoting physical activity through the discretionary time and transportation domains. In the transportation domain, research and promotion efforts must emphasize improving the safety, aesthetic, efficiency, and dignity conditions in which this type of physical activity takes place, recognizing that in LMICs active transport is not due to individuals or families opting out of car ownership or use, or self-selecting into walkable neighborhoods, but rather because owning a car is not likely affordable for them. Changing social norms around car ownership, active transport, and public transit use in most parts of the world should also be addressed as an important element of the physical activity research agenda globally. Recent modeling work shows that large-scale physical activity promotion efforts might be futile in sprawling cities of HICs if policies to disincentivize car use are not synergistically enacted (72). Similarly, in LMICs, as the physical activity transition takes place, those improving their socioeconomic status are likely to resort to driving when doing so becomes a financially feasible option (72). Some physical activity and public health researchers recommend a systems approach that improves the conditions in which necessity-driven active travel and public transport use take place in cities, while reducing the social appeal of driving (65, 72).

APPLICATIONS OF THE FRAMEWORK FOR UNDERSTANDING POPULATION PATTERNS OF PHYSICAL ACTIVITY ACROSS THE GLOBE

The following two case studies demonstrate the application of our framework for understanding population patterns and drivers of physical activity in different parts of the world.

Case Study 1. Informal Urban Settlements: Cities within Cities Where Walking Is a Necessity, Not a Choice

Nearly one in four individuals on Earth (1 billion people) live in informal settlements (81). These settlements result from a complex web of social, economic, and environmental circumstances, resulting in large population displacements to urban areas with nonexistent or inadequate city planning (22). These communities often experience a lack of tenure security, high levels of poverty and crime, and poor access to services, including public transit, sanitation, and health (22). Dwellers of these areas also experience a walkability paradox as they are characterized by having a high walkability index, as defined in HICs (i.e., high street connectivity, high population density, high mix-land use), but poor street-level pedestrian conditions (e.g., low-quality or no sidewalks, lack of trees and shade, pollution, noise, obstacles, unsanitary conditions, stray animals, crime) (18).

How Do Walking Behaviors in Informal Settlements Help Us Determine Which Model of Physical Activity Is Operating?

People in informal settlements report high levels of walking. Walking is the most common transport mode, and walking trips constitute a substantial share of this population's total daily transport (67). The high contribution of walking to total daily transport-related activities is attributed largely to the inability of residents of informal settlements to afford private cars (and often the inability to fit cars through the terrain of these settlements), in conjunction with either nonexistent or poor-quality public transit, which is also often beyond their economic reach for frequent

utilization (1, 22, 67). This condition results in very long travel times and less available time for other daily activities, which affects overall quality of life. In cities such as Barranquilla (Colombia) (5), Freetown (Sierra Leone) (53), Faridabad (India) (4), and Recife (Brazil) (3), people living in informal settlements with poor microscale pedestrian infrastructure, sanitary conditions, and safety still report very high levels of walking. In the informal settlement of Moyiba in Freetown, residents indicated that walking was the main transportation mode because public transit availability is low and infrequent and fares are too high. These residents reported that walking was their means to "save money for more urgent needs" (53, p. 12). These examples highlight that walking is not an individual's choice in these settings but an imposition of unequal and exclusionary built and social environments and economic systems. In these communities, walking is a behavioral economics adaptation and an undesirable result of social and spatial inequalities in LMIC cities.

Case Study 2. Active Transport to School Among Children Across the Globe: A Tale of Two Worlds

For many children worldwide, active transport to school, via walking or cycling, represents a critical source of regular daily physical activity. Active transport is one of the most practical and feasible ways to increase daily physical activity among populations while benefiting cities (through reduced congestion, pollution, and noise) and the planet (via lower carbon emissions). Reports from HICs consistently show that walking and cycling trips to school are being displaced by car trips, even for very short distances (14, 58, 64). In those settings, urgent calls have been made to renormalize active transport to school and address the global decline in children's physical activity levels (56, 57). Of course, these statements assume that active transport can replace car trips and occur in a safe and enjoyable manner, something that is not always true in LMIC settings.

How Do Patterns of Active Transport to School and Their Associated Factors Help Us Determine Which Model of Physical Activity Is Operating?

The prevalence of active transport to school varies widely across countries, from >70% in Finland, Colombia, Mexico, South Africa, and the United Kingdom to <40% in countries such as the United States and India (25). With some exceptions, including Finland and Denmark, where more than 80–90% of children actively commute to school, this behavior is generally more prevalent in LMICs (25). In most parts of the world, the highest prevalence rates of this behavior are observed in children of low-income families and those whose mothers have low levels of education (19). Higher rates of active transport to school have also been observed for children who live in disadvantaged conditions in HICs (24).

When active transport to school does occur among children of higher-income families, or in cities with widespread infrastructure and policies promoting safe walking and cycling conditions for children, it may reflect a truly autonomous and noncoercive choice by families. Indeed, in HIC settings with good infrastructure for active transport to school, one of the main determinants of participation in this behavior is the distance from home to school. Evidence indicates that this behavior is generally more prevalent among children who live less than 5 km (a little more than 3 miles) from their school (27, 55). In contrast, a study in low-income neighborhoods in South Africa reported that although most parents stated that they felt uncomfortable with their child walking to school, they had limited options for getting their child to school safely; therefore, walking was the most prevalent form of transportation to school among children in those neighborhoods, indicating that a necessity-driven model is operating (79). In line with this study, additional research has reported that perception of safety from crime is not a significant correlate of participation in active commuting to school among children who live in deprived areas (27). Evidence from

LMIC or deprived settings also suggests that children walk through streets that lack safe street-level infrastructure and often travel excessive distances to reach their schools (2). In Colombia, 72% of children aged 7–15 years actively commute to school, and known correlates for this behavior include car ownership (inverse) and family wealth (inverse); no significant effect has been observed for factors such as perceived neighborhood safety (26). Furthermore, for 15% of children who actively travel to school in Colombia (26), one-way trips to and from school take longer than 15 minutes—a duration considered by urban designers to be the upper limit for walking trips in cities (13, 47). These data support that in these settings, active transport to school among children is driven by necessity. Why else would families allow their children to walk long distances to school, and in potentially harsh environments, risking injury from car traffic, every day?

How Can We Ethically Promote Necessity-Driven Physical Activity?

Although maintaining healthy behaviors in populations that currently engage in them is important, as public health scientists, we should be nuanced in our messaging and research priorities, especially when such "health behaviors" result from nonautonomous, coercive circumstances (e.g., necessity-driven physical activity). Under the types of scenarios described in the above case studies, the emphasis of physical activity and public health research and promotion efforts should be on maintaining regular participation in active travel, while improving the conditions under which it occurs, and on developing programs that promote active leisure. This approach may involve implementing systems-based solutions (72) that could reduce the daily duration of necessity-driven physical activity (i.e., fewer minutes per day spent walking for transport) but yield important net improvements for quality of life and well-being, which are also important public health outcomes.

For example, school busing systems serving low-income areas located more than 5 km away from the nearest public school could help improve commuting conditions for many children, increase quality of life, and free up time for leisure. Efforts should also focus on improving traffic and crime safety and coverage and quality of pedestrian infrastructure near schools so that all children residing within reasonable walking or cycling distances (<5 km) can safely travel to school each day, while accruing health-enhancing physical activity. Cable car systems as part of the public transport network in LMIC cities are another good example of systems-based solutions that improve quality of life, particularly for dwellers of informal urban settlements. In Bogotá, Colombia, implementing a cable car system connecting informal settlements located on steep hills surrounding the city core reduced commuting times by up to 43 min and improved quality of life and well-being (77). These types of approaches that help maintain daily participation in necessity-driven physical activity through safer and more equitable environments for active transport may provide more free time for residents, and, in turn, make the promotion of physical activity for leisure among these vulnerable populations a more feasible, attractive, and ethical option.

Is the Necessity-Based Model of Physical Activity Relevant to High-Income Countries?

Although for the most part, in HICs, physical activity patterns and their drivers can be understood within a choice-based model, in some instances a predominantly necessity-driven model of physical activity operates in these settings (8, 9, 14, 42). HICs with high levels of socioeconomic inequalities tend to have substantial levels of poverty and associated factors among certain population subgroups. In the United States, for instance, groups residing in areas of extreme disadvantage (e.g., low-income neighborhoods that were historically redlined and have continued to be subject to chronic systemically racist policies and disinvestments) or high-need groups (e.g., immigrants) may exhibit high levels of necessity-driven physical activity (37, 41). For example,

some immigrants may lack domestic certifications to become employed in non-labor-intensive jobs (62), may not have the financial means to purchase and maintain a car, or may not have the legal rights to obtain a driver's license (41). These factors can result in high shares of necessity-driven physical activity among these population subgroups, who then have less time and freedom for engaging in choice-based physical activity (41).

CONCLUSION AND FUTURE DIRECTIONS

In this article, we have proposed the "necessity- versus choice-based physical activity models" framework as a conceptual tool to ground physical activity research and promotion efforts in LMICs to help ensure that they are relevant, responsive, and respectful to their local contexts.

Table 3 shows our proposed research agenda for advancing physical activity and public health research by employing the "necessity- versus choice-based physical activity models" framework.

Table 3 Priority research agenda for advancing contextually relevant physical activity research in LMICs using the "necessity- versus choice-based physical activity models" framework across the five phases of the behavioral epidemiology framework by Sallis and colleagues (71)

Research phase	Examples of proposed research priorities for LMICs under the "necessity- versus choice-based physical activity models" framework
Phase I: Health effects	Etiological studies to determine whether some types of necessity-driven physical activity (e.g., occupational) have detrimental effects on health and well-being. Qualitative or mixed-methods studies to document the perceived effects of necessity- versus choice-based physical activity on health and quality of life.
Phase II: Measurement and surveillance	Studies developing and validating measures, instruments, and protocols to assess necessity- versus choice-driven physical activity in LMICs, and which allow researchers to distinguish necessity- from choice-based active transport. Surveillance systems should incorporate measures of necessity- versus choice-based physical activity.
Phase III: Correlates and determinants	Observational research (cross-sectional and cohort studies) to identify the multilevel correlates and determinants of necessity- and choice-based physical activity in settings where the predominant model is necessity based. Studies aiming to identify locally relevant, place-based facilitators of discretionary time physical activity (in LMICs, these should not be restricted to those based on the HIC research model, which tend to focus exclusively on facilitators of sport, exercise, and fitness). Studies using new technologies (e.g., Google Street View for assessing street-level pedestrian conditions) and mixed-methods approaches for identifying the multilevel factors associated with participation in necessity- versus choice-based physical activity.
Phase IV: Interventions	Multilevel interventions, natural experiments, and simulation-based approaches (e.g., agent-based models) testing the effectiveness of street-level improvements and macrolevel urban improvements on (*a*) promoting safer, more enjoyable, and inclusive transport-based physical activity in settings where it is necessity driven and (*b*) achieving long-term maintenance of transport-based physical activity as countries undergo the physical activity transition. Studies testing the effectiveness of transport physical activity interventions by targeting changes in social norms around cars, public transport, and active transport. Studies testing the effectiveness of interventions aimed at increasing leisure-time physical activity in settings with high levels of necessity-driven physical activity (e.g., by harnessing the local values and motivators, such as social interaction as a key driver of leisure-time physical activity in Latin America).
Phase V: Translation and scale-up	Use locally derived evidence from phases II–IV to guide translation and scale up research and action.

Our recommendations are organized according to the phases of the behavioral epidemiology framework by Sallis and colleagues (71), which includes five critical research phases: (*a*) demonstrating a causal link between the behavior(s) of interest and health-related outcomes; (*b*) developing measures and establishing surveillance systems for the behavior(s); (*c*) identifying correlates and determinants of the behavior(s); (*d*) designing and testing interventions to improve the behavior(s); and (*e*) translating and scaling up effective interventions into programs and policies that can benefit the population at large.

We urge physical activity researchers to invest more resources and time to conduct high-quality work in LMICs, where most of the global population resides and most of the world's poverty and inequalities concentrate and where the impacts of climate change are projected to become most dire (72, 81). Once LMICs undergo the physical activity transition, a substantial share of the daily energy currently being expended by their populations due to necessity will be lost (38). Identifying ways to help ensure that these populations can maintain high levels of transport-based physical activity, while increasing their opportunities for active leisure, must be a research priority. To identify successful strategies to increase leisure time (choice-based) physical activity in LMICs, physical activity researchers must expand the definition of factors usually considered as potential facilitators of these behaviors, which are currently based on the HIC research model (the choice-based model). For instance, research instruments from HICs assessing the place-based drivers of discretionary time physical activity assess only the role of facilities designed explicitly for sport, exercise, and fitness-enhancing activities. Evidence from Mexico, Brazil, and Colombia shows that environmental features designed and used for social interaction (e.g., public squares) can be as or more important drivers than are exercise- or sport-based facilities for the smaller share of choice-based physical activity that occurs in these countries (36, 75).

A systems approach is urgently needed to understand and promote physical activity in LMICs (65, 72). As public health scientists and practitioners, we should allow our efforts to be guided by the pursuit of health equity as a short-term to medium-term priority and social justice as the ultimate goal (12). To promote equity, physical activity promotion programs and policies in LMICs must focus on improving the conditions under which necessity-driven physical activity occurs for most of the population. To ultimately achieve social justice, the systems-wide structures responsible for physical activity inequities must be transformed through integrated, trans-sectoral, multilevel policies. These should include strategies that address the social determinants of health by promoting safe and dignified living conditions; safe, efficient, accessible, modern, and affordable public transit systems; safe, accessible, aesthetic, and climate-resistant pedestrian and recreational infrastructure; and fair working conditions, including sufficient wages and appropriate working hours that allow for vast opportunities for active, healthy leisure for all.

SUMMARY POINTS

1. High-income countries have undergone the physical activity transition, since major global and societal changes have resulted in reduced levels of physical activity for work and transportation in these settings.
2. Pervasive poverty and inequalities, conflict and violence, and the anticipated disproportionate negative impacts of climate change are among the biggest challenges that low- and middle-income countries face.
3. A large portion of physical activity in low- and middle-income countries is a direct result of economic necessity.

4. Because the field of physical activity research developed in high-income countries to date, it has followed a choice-based model, in which physical activity is understood as a consequence of individual choices.
5. A necessity-based model is better suited for understanding and promoting physical activity in low- and middle-income countries and may also be applicable to certain population subgroups in high-income countries.
6. Emerging evidence suggests that not all types of physical activity may be beneficial for health, with a new wave of studies suggesting potentially detrimental effects of occupational physical activity.
7. From a social justice perspective, it is questionable to include active labor as a component of healthy lifestyle behaviors.
8. Identifying if the predominant model of physical activity in a setting of interest is necessity based or choice based can help ensure the conduct of ethical, respectful, and contextually relevant physical activity research and promotion efforts in global settings.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review. The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the sponsors or funders.

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