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Scaling up physical activity interventions across the globe: stepping up to larger and smarter approaches to get people moving

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1. Background

Since the publication of the first Lancet series on physical activity in 2012, which recognised physical inactivity as a global pandemic and urged all sectors of governments and societies to take immediate action, the demand for effective strategies to increase population physical activity levels has grown.[1, 2] A substantial body of evidence, resulting from decades of

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research in the fields of exercise physiology, public health, epidemiology and the behavioural sciences, has demonstrated that physical activity has broad economic and health benefits[1] and that under scientifically-controlled circumstances, behaviour change is achievable for increasing physical activity in diverse groups.[3] Until recently, most of this evidence came from High-Income Countries (HICs),[3] but during the past five years, the number of interventions developed, implemented, and evaluated in Low and Middle-Income Countries (LMICs) has grown significantly.[4]

Despite the many convincing arguments and global calls for action to reverse the physical inactivity pandemic,[1] practitioners and policy makers have limited access to knowledge about existing physical activity programs that can be effectively implemented at scale. So-called “effective physical activity interventions” have too often been conducted only in small, controlled settings.[2] This is not to say that there have been no efforts to bring these findings into ‘real world’ programs. In fact, the scientific literature contains abundant examples of researcher-led translation and dissemination trials, implementing evidence-based physical activity interventions in a variety of real-world settings.[3] Unfortunately, for the most part, these initial translation attempts have not thrived in the real world (i.e. in becoming embedded in a system) once the research funds for translation have expired. Further expansion to reach more people and places (scaling-up) and achieve program maintenance and sustained health benefits requires extensive knowledge of strategies for implementation, adoption and sustainability.[5, 6]

On the other hand, there are well-known examples of fast-growing programs which arise from the ‘real world’, often reflecting common civic sense. These forms of ‘practice-based evidence’, are often implemented at scale and replicated in many settings around the world. Many times there is no budget for evaluation, but in the best of cases, these programs are later evaluated by researchers to estimate their effectiveness in promoting physical activity.[3, 74] However, an exhaustive inventory of these cases is not available to researchers, practitioners and stakeholders, and the internal and external validity of the evaluations have been questioned.[3, 74]

In our view, scaling up is not simply achieved by researchers leading the implementation of a translated program at a larger scale (e.g. at city or state level), although in some cases this could represent the first step. It is only when an intervention ‘outgrows’ the research setting and becomes embedded in a system, thereby ensuring maintenance and sustainability of its health benefits, that successful scale-up can be considered to have been achieved. Likewise, in some cases, practice-based evidence can also ‘outgrow’ its local context to improve external validity and be embedded in its local system. Although other researchers have used varying definitions for *scalability* and *scale-up*, our approach is pragmatic and responsive to the urgent call to action to reverse the pandemic of inactivity. In essence, by seeking effective strategies for scaling up physical activity interventions around the world, we are aiming to find ways of re-integrating active living into the realms of government and society where it used to reside: in city planning, transport, education, culture, leisure, environmental sustainability (and, of course, health). ‘Scalable interventions’ in these wider areas of public policy are likely to be needed to shift societies towards a more active way of life.

In this paper, we provide an overview of factors that could help to increase the ratio of success to failure in scaling up physical activity interventions around the world. We have four aims: (a) to summarize the available peer-reviewed, scientific evidence on scaling up physical activity interventions; (b) to integrate the knowledge and experience of senior researchers and key stakeholders on the factors influencing the scalability of physical activity interventions in High and LMIC countries; (c) to identify case studies of scaled-up physical activity interventions from around the world; and (d) to develop a framework to guide researchers, practitioners, policy makers and civil society in selecting, implementing and evaluating scaled-up physical activity interventions.

2. What can we learn about scaling up physical activity interventions from the scientific literature?

We conducted a systematic review of the peer-reviewed, English-language literature to summarise the available scientific evidence on scaling up physical activity interventions. An 'intervention' was defined as "a set of actions with a coherent objective to bring about change or produce identifiable outcomes."[8, 9] Therefore, the review included not only traditional researcher-driven interventions proven to be efficacious in increasing physical activity in a controlled research setting (evidence-based practice),[10] but also programs, strategies, policies or initiatives that originated outside the scientific realm, but have been evaluated by researchers and shown to be effective (practice-based evidence).[11, 12] The search was conducted using the PubMed and Scopus databases, without any restriction on date of publication given the anticipated dearth of sufficiently detailed accounts of the scale-up process in the literature. Publications with a 'scalability' search term — from an extended list based on that used by Milat et al. in a similar review for scaled-up public health interventions[9] — in the title, and a 'physical activity' term in the title or abstract, were reviewed. The search terms used to define 'scalability' were centred around the objective of identifying truly scaled-up interventions, defined for this study as those which had outgrown research dependency and become embedded into a system. Therefore, we purposely excluded search terms reflecting researcher-driven and -funded translational studies. (See Online Web appendix 1 for a full list of search terms and criteria.)

Publications were eligible for further abstraction if they reported an intervention implemented at scale and embedded in a system, for which physical activity was an intended outcome, and if they included sufficient detail of the scaling-up process. We used an adapted version of the External Validity Assessment Tool (EVAT)[7] developed by project GUIA (Guide for Useful Interventions for Physical Activity in Brazil and Latin America).[13] Interventions were classified by theme, using the 'seven investments that work for physical activity' outlined in the Toronto Charter for Physical Activity,[14, 15] and by scalability category, using the World Health Organization's (WHO) ExpandNet Framework for Scaling Up.[16] Where available, information was abstracted on any process evaluation, key actors and partnerships, and cost-effectiveness relating to scaling-up. We also abstracted information on the geographic setting (country, world region, and World Bank income category[17]), the target population, and whether the scaled-up intervention was an example of 'evidence-

based practice' or of 'practice-based evidence.' Further details of the review methods are available in Web appendix 1.

The search yielded 547 unique articles. Among these, eighteen peer-reviewed articles were identified in which physical activity was either the main outcome or a co-benefit of a scaled-up intervention, and for which sufficient detail of the scalability process was reported.[18–35] Sixteen unique scaled-up physical activity interventions were identified (with more than one publication for some interventions), of which 14 were from high-income countries,[18–30, 32, 34, 35] one was from a middle-income country (Brazil)[31] and one was from a low-income country (Uganda).[33] Thirteen of the cases represented evidence-based practice.[18–22, 24–30, 32, 34, 35] Two of the three practice-based evidence cases were from LMICs.[31, 33] Fourteen of the cases described an intervention that fit into one of the seven categories of investment in physical activity (Figure 1), with the most frequently represented categories being those of community-wide programs (n=6),[20, 22, 24, 31, 32, 34] 'whole of school' programs (n=3),[23, 26–28, 30] and physical activity promotion or NCD prevention integrated into the health care system (n=3).[18, 25, 29] No cases relating to the categories of transport systems prioritising active travel, or urban design policies and infrastructure, were identified. The remaining cases involved health education delivered by telephone or text message.[19, 21] Six cases described interventions targeting children or youth,[18, 23, 25–28, 30, 33] while four focused on adults,[19, 24, 29, 35] one on older adults,[32] and another one on both adults and older adults.[34] Two cases related to all age groups[21, 22] and two were not specific about age groups.[20, 31]

Scalability was most commonly defined exclusively as extending the reach of an intervention by replicating it in other localities, cities or states (horizontal scale-up)[16] (n=6),[20, 24, 25, 30, 34, 35] as institutionalising the intervention at government level so it could reach all citizens within a given jurisdiction (vertical scale-up)[16] (n=5),[22, 23, 29, 31, 32] or as a combination of horizontal and vertical scale-up (n=4).[18, 19, 21, 26–28] Most of the monitoring and evaluation activities pertaining to scalability assessed whether the program was reaching the specified target population and whether the intervention was being properly implemented, with several cases reporting deficiencies in these regards. Public or private health-sector entities were the most commonly reported key actors, while partnerships with other sectors (schools, urban planning, sports and recreation, or academia) were reported in over half of cases. Further details of the 18 scientific publications, representing 16 unique scaled-up physical activity interventions found in the peer-reviewed literature, are available in Web Tables 1, 2 and 3.

The review provides important insights into the processes, key actors and partnerships involved in scaling up physical activity interventions. Demonstrated efficacy in controlled settings, partnerships beyond the health sector, and institutionalisation from an early stage of program development emerged as key factors for success. However, the exercise also highlighted some shortcomings of the evidence in this area. First, we found little information in the scientific literature —only 18 publications, representing 16 unique interventions — outlining the steps and processes involved in successful scale-up of physical activity interventions. Second, the great majority of this literature relates to interventions being taken to scale in HICs. Third, we found few examples of practice-based evidence. Fourth, we

found no examples corresponding to transport systems or urban design policies and infrastructure, two of the ‘seven best investments for physical activity’.

3. Painting a larger picture: drawing from the knowledge and experience of key researchers and stakeholders from around the globe

To complement the literature review in building a fuller picture of the factors influencing the scalability of physical activity interventions, we sought to integrate the knowledge and experience of senior researchers and key stakeholders from all continents. We used an adapted Delphi methodology,[3637] combining email and telephone contacts as this hybrid approach has been shown to outperform the traditional paper-based Delphi design.[37, 38] We recruited participants from the Global Physical Activity Observatory (http://www.globalphysicalactivityobservatory.com), comprised of key researchers and practitioners from around the world. Among the country contacts of the Global Physical Activity Observatory Network with full contact information available, at least one person per country (its primary contact listed in the Network database) was invited to take part. This entailed completing a two-round online survey using the Qualtrics platform (http://www.qualtrics.com).

After testing all electronic contacts, 139 eligible participants (each from a different country) were identified. Among them, 45.0% were from HICs (N=62), 28.6% from Upper Middle-Income Countries (U-MICs) (N=40), 20.0% from Lower Middle-Income Countries (L-MICs) (N=28) and 6.4% (N=9) from Low-Income Countries (LICs). Of these, 74 (36 from HIC, 17 from U-MIC and 21 from L-MIC or LIC) responded to the first round of the survey, which included open-ended questions on key factors that should be considered when deciding to scale up a physical activity intervention, as well as examples of any such intervention that had been scaled up in their country or region. More details on the questionnaire and sample characteristics are available in the online Appendix. Following our definition of scalability, we identified 56 unique interventions that were cited as having been scaled up in the participants’ own regions and were not found in our literature search (Figure 1 and Web Tables 4a and 4b). A search for information on content, reach, effectiveness, and scalability, was conducted for each regional intervention cited by the key informants, based on published references and web-links provided, and additionally, through targeted internet searchers based on the country, setting and program name (Web Tables 4a and 4b). Scaled-up interventions were more frequently cited by key informants from HICs (38 interventions) than by their counterparts (14 from U-MIC, 4 from L-MIC or LIC). The most frequently reported categories of intervention were those of community-wide programs (n=12) and public education (n=11), whereas that of urban design policies and infrastructure (n=2) was the least frequent. Examples of all seven ‘best investments for physical activity’ categories were cited by HIC informants, whereas examples of urban design policies and infrastructure and of primary health care systems were not cited by any of our U-MIC, L-MIC and LIC informants.

We identified a variety of factors regarded as important for scaling up physical activity interventions. A total of 94 statements were provided and grouped by similarity into 16

unique factors. In order to assess the relative importance and feasibility of these factors, we invited all 74 initial respondents to complete the second round of the survey, of whom 67 did so. They were asked to rate each factor for importance and feasibility relative to the other factors on a 10-point scale (from 1, relatively unimportant or infeasible, to 10, extremely important or feasible). We also conducted pattern matching, which creates a series of graphs representing clusters in the data in order of importance and/or feasibility (based on the average rating of the statements in each cluster). We used this to assess the correlation between importance and feasibility among our key informants (Figure 2), between researchers and practitioners (Web appendix 2), and by country income level (Web appendix 3). We also assessed the correlation between groups using Spearman rank correlation.

Overall the scores attributed to importance were higher (Median=8.27; IQR=0.53) than those attributed to feasibility (Median=6.82; IQR=0.49) (Figure 2), suggesting that it remains a significant challenge to put what is considered to be important into practice. This mismatch was confirmed by the low and non-significant correlation of the importance and feasibility scores (r_S=0.24; p=0.37). However, 'needs of the community' and 'fit with the setting' showed relatively high scores for both importance and feasibility, suggesting that these might be particularly important to consider when prioritising actions for scale-up. The large number of responses citing community-based interventions reinforces the importance of adapting and localising an intervention within a community setting. Conversely, the most important factors (sustainability and political support) had relatively low scores for feasibility, indicating a gap that might impede taking effective action. Previous research has found differences between responses from key informants from research and practice backgrounds in rating priorities for action on physical activity,[39, 40] which our data support (Web figure 1). However, the pattern of mismatch did not change when comparing responses from key informants with practice and research backgrounds, suggesting that our overall findings may be fairly consistent regardless of the background of the participants. Finally, in analysis stratified by country income level, "sustainability" emerged as being equally important regardless of the country income level, whereas "content and delivery" and "multilevel collaboration" seemed to be more important in L-MICs and LICs than in their higher-income level counterparts. However, these factors — along with "capacity building" — were given lower feasibility scores by L-MIC and LIC informants (Web appendix 4).

4. Effective strategies aren't always scaled up, and scaled-up strategies aren't always effective: lessons in finding the right balance

Our mixed-methods approach included a traditional systematic literature search complemented by an adapted qualitative Delphi process to obtain comprehensive information on scaled-up interventions worldwide. With this approach, we examined where, why and how physical activity interventions are being scaled up around the world, and confirmed that the science of scalability in the realm of physical activity interventions remains a nascent field of research. The fact that the adapted Delphi process yielded 56 examples of scaled-up interventions, which were not found through the systematic review of the peer-reviewed literature, highlights the importance of searching both peer-reviewed and grey literature to achieve a better understanding of the types of physical activity

interventions being scaled-up around the globe. This mixed-methods approach also allowed us to identify case studies covering a variety of geographical and country-level income settings, and a range of strength of evidence of effectiveness.

In terms of the ‘where,’ our findings suggest that evidence-based practice seems to be mainly a ‘practice’ of HICs. It is also the predominant type of scaled-up intervention reported in the peer-reviewed literature. Apart from reflecting the obvious — that evidence is more likely to be used for policy development in more highly developed nations — this could also reflect the significantly larger research capacity available in HICs to conduct and publish studies documenting all steps of the knowledge-to-practice process.[41, 42] A good example of this is CATCH (the Coordinated Approach To Child Health) (Panel 1), which followed a clear linear progression from a controlled efficacy trial,[43] to researcher-led dissemination efforts,[28] to demonstrating effectiveness in researcher-led translation trials,[26] to achieving institutionalisation in more than half of Texas schools plus several other areas of the United States.[44, 45] In spite of its success, the case of CATCH also serves to highlight how long it takes for knowledge to become available to the population at large through ‘real world’ programs — over 20 years have elapsed since the first efficacy trial of CATCH.

On the other hand, it seems that LMICs seldom rely on the ‘evidence-based practice’ approach for scaling up physical activity interventions. In addition to lacking (or only emerging) research capacity,[41] the dearth of examples of effective physical activity interventions appropriate to the context of these settings may contribute to the “why.” Interventions designed, implemented and evaluated in LMICs have only fairly recently begun to appear in the peer-reviewed literature.[4] As for the “how,” scaling-up efforts in LMICs have primarily emerged from the ‘real world,’ with practice moving faster than research.[42] In these settings, the lack of knowledge or local applicability of existing evidence, together with the urgent need to find streamlined solutions to large-scale problems, seem to be important in moving practice agendas forward, as such factors are more highly valued than measures of effectiveness. These large-scale problems are not limited to health issues. Rather, the need to alleviate traffic congestion, air pollution, environmental injustice, social inequalities and other societal challenges is resulting in the scaling-up of interventions that may promote physical activity as a co-benefit.[42] For the most part, initial scaling-up occurs with little consideration of the potential effectiveness of these programs for increasing physical activity in populations.[42] In some instances in U-MICs, researchers are catching up to practice by conducting well-designed evaluation studies of practice-based interventions such as bus rapid transit systems (BRT) (Panel 2).[46–49] In L-MICs and LICs, competing priorities and a lack of resources, and in some cases research capacity have resulted in few instances of rigorous evaluations of scaled-up interventions. An example of this is the case of Sports for Development (S4D) (Panel 3). Currently, there is insufficient evidence to deem S4D as either effective or ineffective in increasing physical activity, but the few available studies point out that the programs may be failing to reach those most in need (i.e. the most inactive)[33] in spite of their popularity and widespread adoption in African nations and other regions worldwide.[50–52]

It is clear that not every intervention implemented at scale is effective for increasing physical activity in populations, and that not every effective, researcher-led intervention is scalable.

This highlights the need for more and better research, and calls into question the role that the research community should play if we are serious about reversing the global pandemic of inactivity. Is it necessary to continue conducting RCTs in HICs to demonstrate that positive health behaviour change is achievable in small, selected samples under controlled conditions? In LMICs, where more evidence of effective, contextually-appropriate strategies is needed, should research funds be allocated if no clear potential for rapid, cost-effective scale-up is demonstrated? Should we be not be learning more about scaling up successful ventures, and how opportunities for dissemination can be strategically brokered to reduce the lag in scaling up evidence–based practice? How could we better understand the policy processes involved across varying settings, contexts and political systems to facilitate the more streamlined adoption and implementation of evidence-based practice? Currently, much of the evidence describing the scaling-up process of physical activity interventions, and in some cases of their impacts on population health, lies in government databases, reports, or websites, and not in the scientific peer-reviewed literature. This raises important questions about the methodological rigour and internal and external validity of such evidence. Why does the research community not focus more on systematic documentation and evaluation of already scaled-up innovations from around the world, using the best available methods to evaluate their reach and effectiveness, and why are there still such limited opportunities for funding and publishing natural experimental studies of innovations that are being scaled up without clear evidence of effectiveness?

5. Tying it all together: developing a framework for scaling up physical activity interventions

Taken together, the analytical steps described above suggest that successfully scaled-up physical activity interventions are not just those that are implemented at a large scale, but should also be effective in increasing population physical activity levels, and become fully embedded into a system. To further advance this field and improve efforts to develop, implement and evaluate such interventions, we have developed a framework for action.

The scaling up of physical activity interventions can be better understood and enhanced by the use of systematic planning frameworks, logic models, and theory.[53] The main purpose of a planning framework is to map the key linkages, stages and conditions that are likely to affect scaling up and on which inferences about effectiveness may be made. A framework can help ensure that researchers focus on the most critical factors in the scaling-up process, and that policy makers and practitioners understand its staged nature (for example, that effectiveness is a prerequisite for sustainment).

We used a two-step process to develop the framework. We searched for existing frameworks. We then reviewed these together with the results of the literature review and Delphi survey, with the aim of either identifying one or more existing frameworks that could be adapted to create a scalability framework, or building one from scratch if necessary.

We identified over 60 possible frameworks for translational research,[9, 54–56] many of which could potentially apply to scaling up physical activity interventions.[9] There is a small number of published frameworks for scaling up public health programs and policies.[6, 57–61]

After our three-step process, the RE-AIM framework emerged as the one that best framed the core elements. RE-AIM takes a staged approach to measure Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance.[62] In RE-AIM, reach refers to the participation rate within the target population and the characteristics of participants versus non-participants; i.e., does the scaled-up intervention reach those at highest risk for inactivity? Effectiveness refers to the impact of an intervention on specified outcomes; i.e., does the scaled-up intervention increase population physical activity levels? Adoption applies at the system level and refers to the percentage and representativeness of organizations that will adopt a given program or policy; e.g., for a school-based intervention: how many states within a country, municipalities within a state, school districts within a municipality, and schools within a school district, adopted the intervention as an official school program to be implemented within their jurisdiction? Implementation refers to intervention integrity, or the quality and consistency of delivery when the intervention is replicated in real-world settings; i.e., is the real-world, scaled-up version of the intervention being delivered properly? And finally, maintenance describes the long-term change at both individual and system/organizational levels, which are fundamental concepts for scaling up; i.e., have all of the implementation activities of the intervention been maintained at ‘full gear’ throughout the years, thus ensuring that the health benefits of the intervention continue to occur through time? RE-AIM has been applied across numerous risk factors, diseases, and settings.[63] Its usefulness in evaluating the impact of public health policies and physical activity scale-up efforts has also been documented.[6465, 66] In Figure 3, concepts from RE-AIM are supplemented by two additional frameworks: the ExpandNet Framework for Scaling Up,[61] and the Framework for Disseminating Evidence-Based Health Promotion Practices.[67]

In addition, our framework accounts for the importance and relevance of both evidence-based practice (the “push”: interventions developed and tested through research that might be scaled up[68]) and practice-based evidence (the “pull”: real-world practitioner experience to inform intervention approaches[12]) in informing the scaling up of physical activity interventions. Therefore, this framework can be used both by those in the ‘research world’ and in the ‘real world’ (including public health practitioners, stakeholders and policy makers) to optimize the scaling up process in many stages across the research-to-practice or practice-to-research spectra. For instance, it can be used by stakeholders and policy makers to select a contextually appropriate intervention for scaling up, which has been proven to work at scale in similar settings in reaching the target population and in promoting physical activity. In such cases, the framework stresses that for successful scale-up, evaluation of adoption, implementation and maintenance is needed. Similarly, our framework can be used by researchers to evaluate innovative strategies being implemented at scale, without sufficient existing evidence to demonstrate one or more of the stages of RE-AIM.

6. Conclusions

Despite facing a global pandemic of similar proportions to that of smoking,[1, 2] our response to the public health challenge of inactivity has not been as strong as is needed.[1, 2] The successful scaling up of interventions that result in increased population levels of physical activity is challenging but feasible, across varying cultural, geographic, social and economic

settings. It is crucial to draw on the best available evidence from both the traditional ‘evidence-to-practice’ pathway and the ‘practice-to-evidence’ route. Using a mixed-methods approach, we have comprehensively examined both researcher-led and practice-based insights into the factors affecting scalability around the world. Active policies across society — particularly outside the healthcare sector — are urgently needed, as demonstrated by some of the successful examples of scale-up identified in this paper. Researchers, research funding agencies, practitioners in public health, transport, leisure, recreation and other sectors, policymakers and civil society should embrace this challenge of taking action to a larger and more sustainable level.

The research community should shift the balance of its efforts from designing and testing small-scale interventions to change individual behaviour towards expanding the evidence on strategies for translating, disseminating, implementing, and scaling-up effective policy and practice for physical activity promotion worldwide. In LMICs, more evidence is needed on effective interventions, which are contextually appropriate. The science of scalability will be greatly advanced by research that systematically identifies the key steps and processes needed for successful scale-up of interventions. While this may require more robust and standardised measures and indicators for tracking, assessing and reporting all stages of scaling-up, many of which might be developed at comparatively low cost using geographic information systems, it will also entail examining how political, cultural, and economic contexts influence the potential to adopt and scale-up evidence-based practices. Researchers from all regions of the world should conduct more program evaluation studies to strengthen the global practice-based evidence base. This can be achieved by using rigorous research methods to determine the impact of “real world” scaled-up interventions of which the reach and effectiveness remain unknown.

However, the success of these proposed actions for the research community is highly dependent on existent and future mechanisms for research funding, particularly for the rapid evaluation of natural experiments. Research funding agencies should provide faster and more flexible mechanisms to allow researchers to develop more practice-based evidence through natural experimental studies or evaluations of programs that have already been scaled up. The complexity of these research projects is likely to require transdisciplinary teams, sometimes with expertise in fields such as systems science, network analysis or policy analysis. For LMICs, where more evidence on effective interventions is needed, funding agencies should prioritise the evaluation of projects with clear potential for fast and cost-effective scale-up. Likewise, scientific journals should facilitate and prioritise the dissemination of this type of research.

Although more and stronger research is important, public health action in the face of a global pandemic responsible for over five million deaths each year should not wait for the outcomes of future studies. We urge all sectors of government and society to take immediate, bold actions to help make active living a more desired, affordable and accessible choice for all population groups. Getting people moving should become a priority of all sectors – not just health – in all entities and countries. In light of the limited scientific evidence of what works at scale and how to scale-up most strategies, we encourage governments and society to adopt and adapt strategies already used to address other public health issues such as

smoking and sugar-sweetened beverage consumption.[69, 70] International organizations such as the United Nations, the World Health Organization, and the World Bank should provide strong leadership for accelerating the scaling-up of evidence-based physical activity interventions worldwide, by setting targets and indicators for tracking countries' progress. Governments should integrate active living into policies across sectors. National policies and action plans are particularly important to overcome scalability challenges in countries where decentralisation of power has led to devolved authority. Ministries of health should have a multilevel and multi-sectoral physical activity plan, with specific strategies to scale up physical activity interventions. Physical inactivity should become an actively monitored risk factor in clinical medical practice and in national and regional surveillance systems, and health care systems should provide physical activity counselling and support for the prevention and treatment of chronic diseases. Ministries of education should adopt whole-of-school approaches for promoting physical activity among children and youth. More graduate-level programs to train researchers in physical activity and public health are critically needed worldwide, and specially in LMICs. Sports authorities should prioritize sports-for-all approaches and harness the potential co-benefits of sport participation. Similarly, environmental policies should be linked to the promotion of active living to maximize their opportunities for adoption, implementation and scale-up. Urban planning and transportation policies should prioritise actions that promote safe, equitable, and environmentally-friendly active mobility options for all citizens, including improved infrastructure for walking and cycling for transport and recreation, as well as accessible and convenient public transport. Civil society should demand better policies, programs, systems and places enable people to lead more lives. We encourage practitioners, policy makers and researchers to consider our framework and the catalogue of examples of scaled up interventions from around the globe presented here (Web Tables 1–4) for selecting contextually-appropriate, evidence-based strategies for scaling-up, prioritizing evaluation across all RE-AIM stages. Likewise, we encourage them to use our framework to guide the evaluation of scaled-up interventions that are already in place, using the findings to modify program delivery as needed to optimize the health benefits.

Even if taken to scale, unilateral efforts will not be enough to shift populations to a more active way of life. A shift in the focus of researchers will not help if funding agencies do not facilitate this type of research, and an increase in the quality of evidence to support scaling-up will achieve nothing if is not translated into practice and effectively scaled up by policy makers and practitioners in multiple sectors. Large-scale problems require large-scale solutions, and we need the committed and joint efforts of all sectors of government and society to tackle the global public health challenge of inactivity.

Panel 1. Scaled-up interventions from around the globe: Coordinated Approach To Child Health (CATCH)

Overview

The Coordinated Approach To Child Health (CATCH) is a multilevel programme, based on CDC's 'Whole School, Whole Community, Whole Child' model.[44, 72] It is designed to

promote a healthy school environment through five modules: physical education, nutrition and cafeterias, the classroom, families and communities, and sun protection.

Where did the intervention originate?

California, Louisiana, Minnesota and Texas, U.S. (High-Income)

How has the intervention been scaled up?

Through horizontal (replication) and vertical (institutionalization) scale-up. Over 10,000 sites worldwide have adopted CATCH, mostly in the U.S.[45] In Texas, researchers led dissemination efforts by engaging health and education authorities and subsidizing initial distribution of materials for schools.[73]

Did the intervention originate from the 'research world' or from the 'real world'?

CATCH originated from the 'research world' via the first trial in the early 1990s: the Child and Adolescent Trial for Cardiovascular Health.[43] The intervention was later renamed for translation, implementation and scale-up in the 'real world,'[73] which has been facilitated by the CATCH Global Foundation, a charitable organization founded in 2014.[45]

Which of the seven investments for physical activity does it fit best?

Whole-of-school programs.

Is physical activity promotion the main purpose of the intervention, or is it a co-benefit?

Physical activity is one of its main intended outcomes, along with healthy eating and preventing obesity.

Has the scaled-up intervention been adopted by target staff, settings or institutions?

Education and health authorities at various levels from school to state across the U.S. have provided legislative, economic, organizational and administrative support for CATCH,[44, 73] but not all sites that could benefit have adopted it.

How has the scaled-up intervention been implemented?

Variably. In some cases (e.g. Dallas School District, Texas, U.S.), CATCH has become institutionalized, with strong multi-sectoral involvement (including principals, teachers, physical educators, administrative and catering staff, parents and the wider community) in schools.[45] Elsewhere, discontinuous funding, or the lack of institutionalization or a local champion, have impeded optimal implementation.[27, 73]

Does the scaled-up intervention reach the target population?

CATCH is currently used in YMCAs in 32 U.S. states and more than half of Texas schools, but access varies by region.[45]

Is the scaled-up intervention effective?

Yes. A substantial body of evidence demonstrates that CATCH is effective in increasing physical activity in school-age children, both in controlled trials and in 'real world' studies.[26, 43]

Have the effects of the scaled-up intervention been maintained over time?

In controlled trials the effects have been maintained for up to three years,[74] and evaluations in some 'real world' settings (e.g., New Jersey, U.S.) also report maintained health effects.[75–77] Evidence also shows that CATCH is cost-effective for preventing childhood obesity.[78]

To what extent is this an example of successful scaling-up?

CATCH is one of few good examples of the successful translation, dissemination and scaling-up of an evidence-based (research tested) physical activity programme, when it is institutionalized and given full school, health and other governmental support. It also exemplifies the time taken for the first scientific evidence, published over 20 years ago, to be widely translated into practice.

Panel 2. Scaled-up interventions from around the globe: Bus Rapid Transit systems

Overview

Bus rapid transit systems (BRTs) provide high-speed, mass public transport, using buses running on segregated lanes and stopping at stations spaced further apart than traditional bus stops.[46, 79]

Where did the intervention originate?

Curitiba, Brazil (Upper Middle-Income).

How has the intervention been scaled up?

Through horizontal scale-up (replication in other settings). Over 150 cities worldwide have BRT systems,[46] most in middle-income countries.

Did the intervention originate from the 'research world' or from the 'real world'?

BRT originated from the 'real world' of transport planning.

Which of the seven investments for physical activity does it fit best?

Transportation systems that promote walking, bicycling or public transit use.

Is physical activity promotion the main purpose of the intervention, or is it a co-benefit?

Physical activity is a co-benefit of BRTs,[48] which were primarily designed to improve mobility and reduce carbon emissions in cities, more economically than by building Metrorail or light-rail systems.[4679]

Has the scaled-up intervention been adopted by target staff, settings or institutions?

City mayors in several middle-income countries have provided strong political, economic and structural support for BRT, which offers high-capacity, fast, modern and environmentally sustainable public transport.[48] Nonetheless, not all cities that could benefit have adopted BRT.

How has the scaled-up intervention been implemented?

In some cities (e.g., Bogota, Colombia), BRT implementation has been accompanied by new supportive infrastructure including improved routes for pedestrians and cyclists, and full integration with other transit systems (e.g., feeder bus systems).[49] In other settings (e.g. Istanbul, Turkey), station and bus overcrowding, lack of integration with other urban transit systems, or lack of supporting infrastructure around some stations, may have limited the overall benefits by rendering active travel less attractive or safe.[80]

Does the scaled-up intervention reach the target population?

Studies assessing BRT's reach are scarce, and indicators vary between cities. In Cali, Colombia, for example, BRT is more accessible to residents of middle-income neighborhoods than to those in high or low-income neighborhoods.[81] In Delhi, India, BRT has increased the accessibility of destinations that were previously difficult to reach without a car.[47] In Cambridge, UK, there is no evidence of a socioeconomic gradient in use of a new BRT.[82] Further evaluation is needed to determine the extent to which BRT reaches those at highest risk for inactivity.

Is the scaled-up intervention effective?

Emerging evidence suggests that BRT can promote physical activity through transport: living closer to BRT is associated with higher levels of physical activity in adults in Bogota, Colombia and Curitiba, Brazil,[48, 49] and with shifting from car-use towards active transit in Cambridge, UK.[82]

Have the effects of the scaled-up intervention been maintained over time?

Stable or increasing prevalence of BRT use indicate potential for sustained effects, but further and more rigorous evaluations are needed to establish if any physical activity benefits are maintained over time.

To what extent is this an example of successful scaling-up?

While BRT exemplifies the complexity involved in scaling up innovative urban public transport systems, it has been successfully scaled up in some settings (e.g. Bogota, Colombia). Key factors for success have included having a committed champion (often the mayor), providing supportive infrastructure as outlined above, and implementing complementary measures to limit car use.[48]

Panel 3. Scaled-up interventions from around the globe: Sport for Development (S4D)

Overview

Sport for Development (S4D) is an umbrella term for a variety of programs that promote sport participation as a vehicle for 'development' —understood broadly to include outcomes like gender equity, economic development, access to education, health improvement (e.g. HIV prevention) and peace.[50]

Where did the intervention originate?

The idea can be traced back centuries, and the date of the first 'S4D program' is unclear.[51] Several S4D programs emerged in (mostly Low-Income) African nations in the 1990s, facilitated by financial and logistical support from high-income countries and international humanitarian organizations.[51]

How has the intervention been scaled up?

Mostly through replication (horizontal scale-up), and sometimes also through institutionalization (vertical scale-up).[83] The United Nations (UN) has contributed to recent accelerated expansion through the establishment of its own S4D office in 2001.[84]

Did the intervention originate from the 'research world' or from the 'real world'?

From the 'real world,' mainly through humanitarian efforts in disadvantaged settings.

Which of the seven investments for physical activity does it fit best?

Sports systems and programs that promote 'sport for all.'

Is physical activity promotion the main purpose of the intervention, or is it a co-benefit?

Mostly a co-benefit, in that most S4D programs have prioritized other outcomes as outlined above.

Has the scaled-up intervention been adopted by target staff, settings or institutions?

Worldwide, S4D programs have been adopted by governments and non-governmental organizations (NGOs): mostly by those in high-income countries to aid development in low- or lower middle-income countries, but sometimes fully based in higher-income countries.[52] The UN's adoption of S4D in 2001 has enhanced the credibility, and probably the scaling up, of these initiatives.[50, 84]

How has the scaled-up intervention been implemented?

Mainly through international partnerships between an international or high-income country government or agency (e.g. the UN) and a local NGO for delivery.[52, 83] 'Top-down' approaches with funder-led program design and implementation are common, but have been criticized for being paternalistic and not accounting for local nuances.[83] Other programs

have used a more ‘horizontal’ approach with substantial local involvement and autonomy.[83] For the most part, comparative evidence from process evaluation is lacking.[33]

Does the scaled-up intervention reach the target population?

Rigorous evaluation is scarce, and reach probably varies by setting. For example S4D in Gulu, Uganda was found to reach mostly those who were already sufficiently active, owing to its voluntary enrolment policy.[33]

Is the scaled-up intervention effective?

There is insufficient evidence to support S4D’s effectiveness, or lack of it, for increasing populations’ physical activity levels.[33] More rigorous evaluation is needed.

Have the effects of the scaled-up intervention been maintained over time?

This is not known.

To what extent is this an example of successful scaling-up?

S4D exemplifies how the ‘real world’ may be driven by factors other than evidence-based practice. In spite of weak evidence of effectiveness for physical activity, S4D has become very popular worldwide and therefore extremely successful in terms of being scaled up to multiple settings, and becoming embedded in systems. Rigorous outcome and process evaluation could assess its impacts on physical activity and other outcomes, and contribute important learning on how other interventions might be scaled up.

Panel 4. Key messages

- The existing scientific literature has identified several key factors for the scaling up of physical activity interventions: demonstrated efficacy in controlled settings, partnerships beyond the health sector, and institutionalization early in program development
- Drawing on input from researchers and stakeholders across the globe, over 50 unique physical activity interventions were identified that have been scaled up but not reported in the peer-reviewed literature
- Not every intervention implemented at scale is effective in increasing population physical activity levels, and not every effective, researcher-led intervention is scalable
- More, more rigorous and more useful scalability research is needed: researchers, research funding agencies, and scientific journals should prioritize studies for evaluating the impact of ‘real world’ physical activity interventions
- An action-oriented framework will help researchers to focus on the most critical factors in the scaling-up process, and will aid policy makers and practitioners in understanding its staged nature

- International organizations (e.g., United Nations, World Health Organization, World Bank) should provide leadership for scaling up evidence-based physical activity interventions worldwide, by setting targets and indicators for countries
- Ministries of health should have a multilevel and multi-sectoral plan to raise population physical activity levels.
- Physical inactivity should become an actively monitored risk factor in clinical medical practice and in national and regional surveillance systems, and health care systems should provide physical activity counselling and support for the prevention and treatment of chronic diseases.
- More graduate-level programs to train researchers in physical activity and public health are critically needed worldwide, and especially in LMICs.
- Sectors outside of health are critical to scaling-up (schools, urban planning, transportation, sports and recreation, environmental sector); to reach these sectors more fully, medical and public health practitioners need to highlight and emphasize the benefits beyond health effects (economic benefits, quality of life).
- Policy makers, stakeholders, and city and state planners should focus on scaling up approaches with the highest face validity:
  - Ministries of education should adopt whole-of-school approaches for promoting physical activity among children and youth.
  - Sports authorities should prioritize sports-for-all approaches and harness the potential co-benefits of sport participation.
  - Environmental policies should be linked to the promotion of active living to maximize their opportunities for adoption, implementation and scale up.
  - Urban planning and transportation policies should prioritise actions that promote safe, equitable, and environmentally-friendly active mobility and leisure options for all citizens.
- Civil society should demand better policies, programs, systems and places to enable people to lead more active lives.
- Greatest progress is likely through interventions that are effective in promoting physical activity, are implemented at scale, regularly evaluated and are fully embedded in a system.

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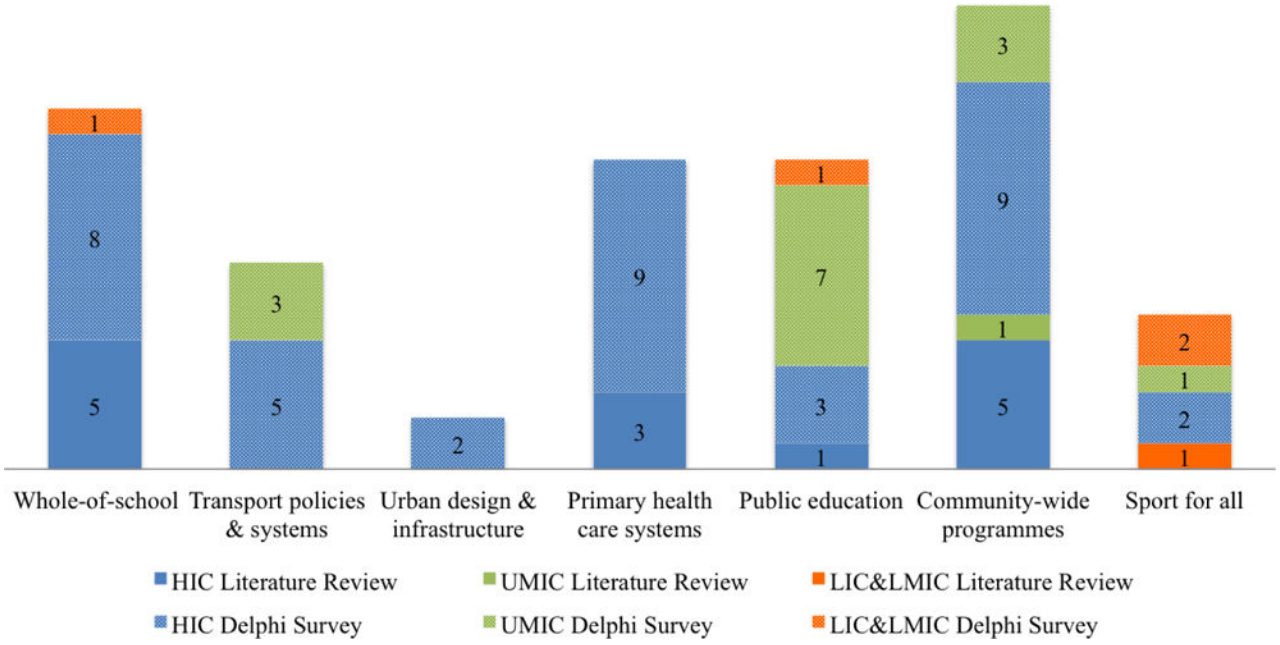

Figure 1.

Number of scaled-up physical activity interventions identified in the literature review and in the Delphi study.

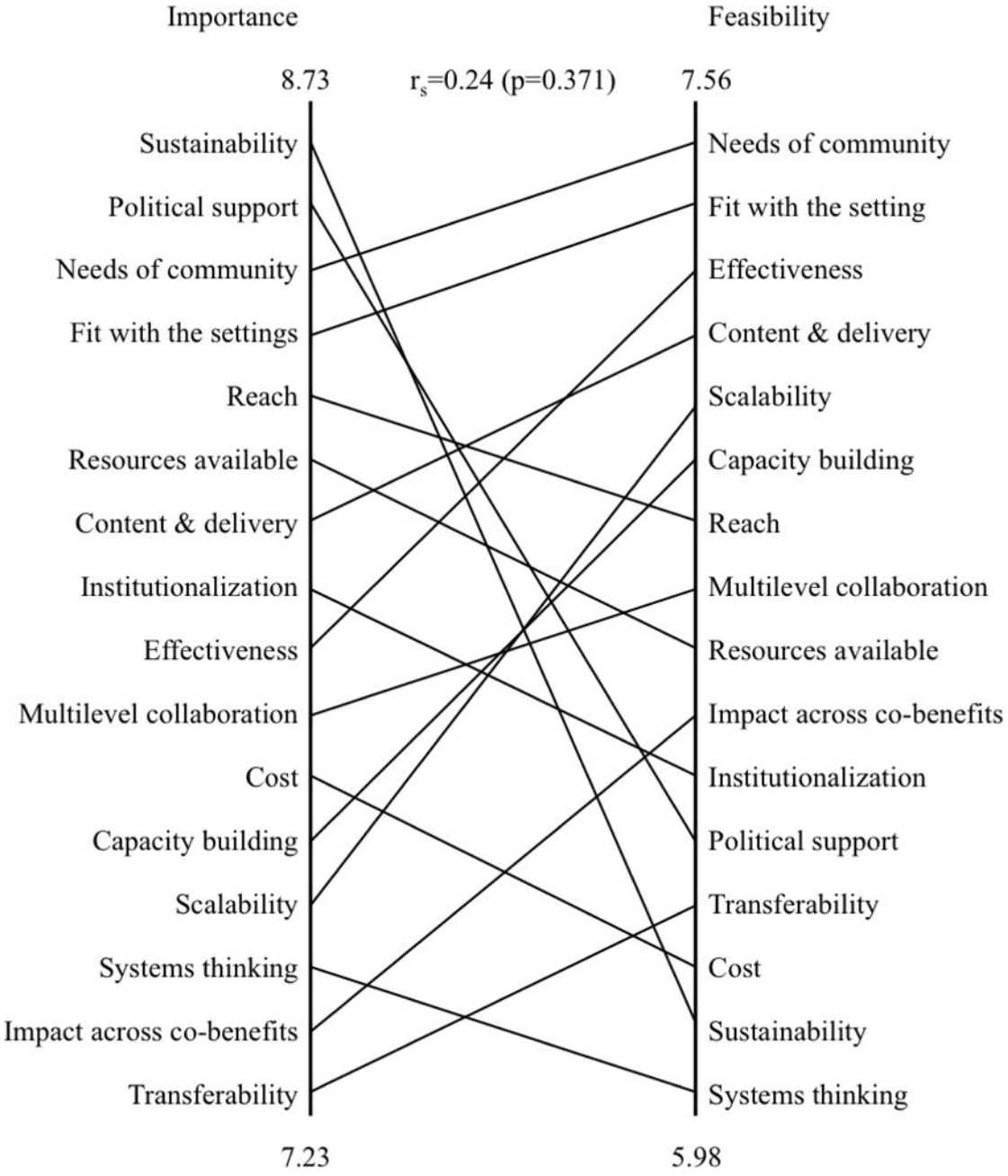

Figure 2.
Pattern matches for importance and feasibility of scalability factors for physical activity interventions among key informants

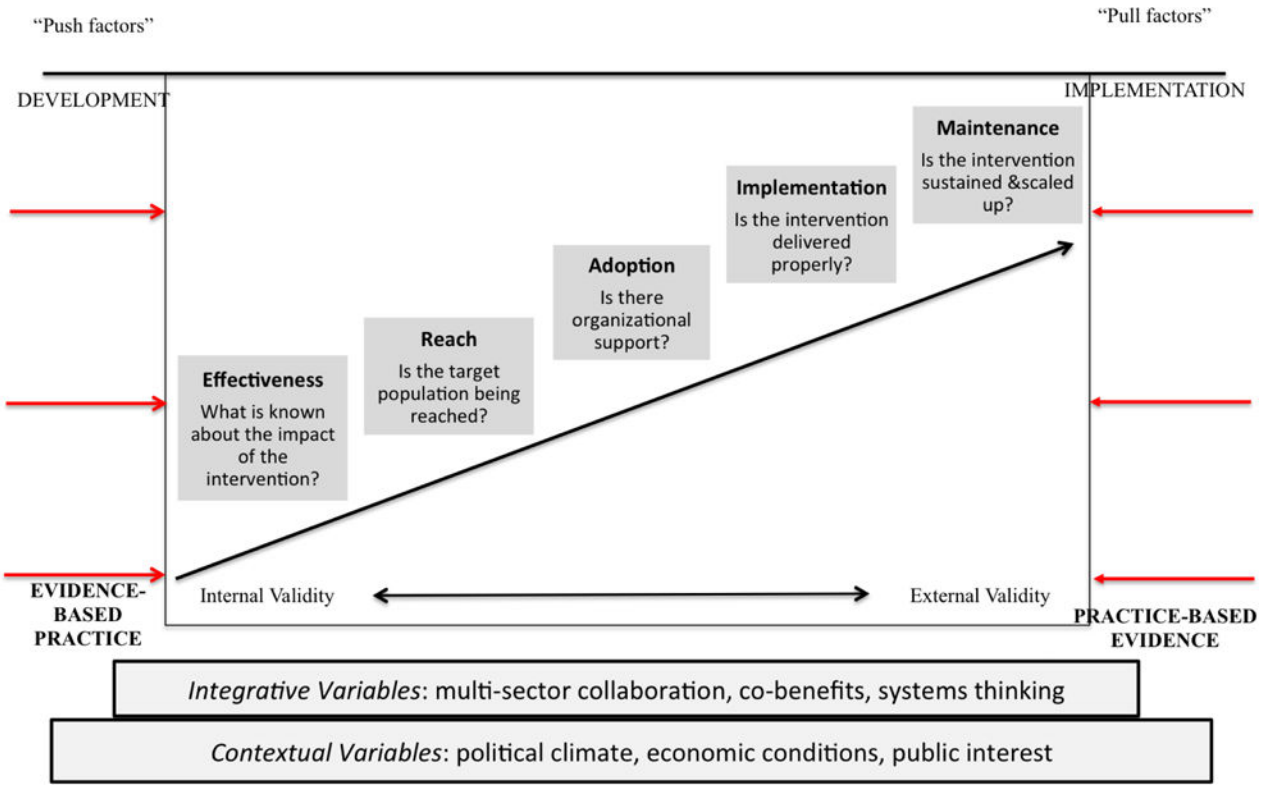

Figure 3.
Framework for scaling up physical activity interventions