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Participation of people living with disabilities in physical activity: a global perspective

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Approximately 1.5 billion people worldwide live with a physical, mental, sensory, or intellectual disability, about 80% of which are in low-income and middle-income countries. This Series paper provides a global overview of the prevalence, benefits, and promotion policies for physical activity for people living with disabilities (PLWD). PLWD are 16–62% less likely to meet physical activity guidelines and are at higher risk of serious health problems related to inactivity than people without disabilities. Meta-analyses have shown that physical activity has beneficial effects on cardiovascular fitness (average standardised mean difference [SMD] 0.69 [95% CI 0.31–1.01]), musculoskeletal fitness (0.59 [0.31–0.87]), cardiometabolic risk factors (0.39 [0.04–0.75]), and brain and mental health outcomes (0.47 [0.21–0.73]). These meta-analyses also show that health benefits can be achieved even with less than 150 min of physical activity per week, and suggest that some physical activity is better than none. Meta-analyses of interventions to increase physical activity for PLWD have reported effect sizes ranging from SMD 0.29 (95% CI 0.17–0.41, $k=10$) to 1.00 (0.46–1.53, $k=10$). There is increasing awareness among policy makers of the needs of PLWD for full participation in physical activity. Physical activity action plans worldwide must be adequately resourced, monitored, and enforced to truly advance the fundamental rights of PLWD to fully participate in physical activity.

Introduction

People living with disabilities (PLWD) have poorer health than the general population.¹ PLWD are at a greater risk of injury and of developing non-communicable chronic diseases and age-related health conditions at earlier ages. These health inequities are attributable to various factors, including barriers to accessing health care, higher rates of health-compromising behaviours, and a lower likelihood of receiving disease prevention and health promotion services compared with people without disabilities.¹ As highlighted in *The Lancet*, health-care services are failing the 1.5 billion PLWD worldwide.²

Although PLWD remain underserved, the societal response to disability has shifted substantially over the past 50 years. Whereas disability was traditionally medicalised as a condition to be treated,^{3,4} disability is now recognised as a part of the continuum of the human condition¹ that can be generative, creative, affirmative, and enjoyed.⁵ New ideas on disability are challenging long-standing assumptions about the meaning of being human by questioning humanistic values of autonomy, rationality, and independence.⁵ The UN aspires to protect the rights and freedoms of PLWD through the Convention on the Rights of Persons with Disabilities⁶ and includes PLWD in its Sustainable Development Goals (SDGs), especially in SDG 3: to “ensure healthy lives and promote well-being for all at all ages”.⁷ Together, these responses are beginning to influence thought, research, and action regarding physical activity for PLWD.

In the previous *Lancet* Physical Activity Series,^{8,9} physical inactivity was associated with 5.3 million deaths and health-care systems costs of US\$53.8 billion per

year worldwide.¹⁰ PLWD are at an even greater risk of inactivity-related health consequences than the general population; yet the study of physical activity and health in PLWD has been marginalised. Between 1999 and 2019, less than 5% of all articles published in the five highest-impact medical journals focused on PLWD, and less than 7% of these addressed physical activity or health (appendix p 1). As cogently argued in a *Lancet* Physical Activity Series editorial,¹¹ physical activity for PLWD is an issue that demands better evidence, surveillance, practice, respect, and value.

To begin addressing these inequities, clinicians, scientists, exercise professionals, educators, health promoters, policy advisors, and policy makers must understand the current situation and the many benefits of physical activity for PLWD. Drawing on three meta-reviews produced specifically for the present Series paper, we provide a narrative overview of the current knowledge regarding physical activity for PLWD, identify knowledge and action gaps, and formulate recommendations to bridge gaps with the general population. Specific objectives are to provide an overview of the epidemiology of physical activity for PLWD worldwide, regarding prevalence and health benefits; to review factors related to physical activity participation and interventions to increase physical activity for PLWD; and to discuss international physical activity policy actions and recommendations for PLWD.

The epidemiology of physical activity in PLWD Prevalence of physical activity in PLWD

There are no comprehensive global estimates of physical activity in PLWD. Global physical activity surveillance

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This is the second in a Series of three papers about physical activity

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Key messages

- World-wide, an estimated 1.5 billion people live with some form of disability (ie, long-term physical, mental, intellectual, or sensory impairments which, in interaction with various barriers, can hinder their full and effective participation in society on an equal basis with others)
- People living with disabilities (PLWD) are 16–62% less likely to meet physical activity guidelines than people without disabilities, and are at even greater risk of serious health problems associated with inactivity than the general population
- PLWD can have substantial health benefits from physical activity participation; WHO recently published physical activity guidelines for PLWD, stating that meaningful benefits can be achieved from physical activity even below the 150 min per week recommendation
- Disability sport continues to grow and might play a role in promoting empowerment, social inclusion, and social participation of PLWD worldwide
- Theory-based interventions are needed to target barriers at all levels of a social-ecological model to increase both the quantity and quality of physical activity participation
- International physical activity policies and national physical activity guidelines are starting to mention PLWD, but policy makers must provide explicit plans on how to ensure and uphold the rights of PLWD to full and effective participation in physical activity; targeted, evidence-based physical activity guidelines and co-produced resources are needed
- The quantity and quality of research on physical activity in PLWD lags far behind physical activity research in the general population; virtually all of the extant data on physical activity and PLWD have been collected in high-income countries; improved data collection in low-income and middle-income countries must be a priority
- International coordinated efforts are needed to measure and monitor physical activity levels for PLWD and progress towards the UN Sustainable Development Goal of healthy lives and wellbeing for all; high-quality epidemiological studies are also needed to examine the association between physical activity and the risk of non-communicable diseases in PLWD
- The use of an integrated knowledge translation approach to physical activity research with PLWD can expedite the development, dissemination, and implementation of meaningful physical activity guidelines, policies, and programmes for PLWD

Search strategy and selection criteria

We searched PubMed, Cumulative Index to Nursing and Allied Health Literature, and Scopus for articles published from inception to Nov 15, 2019. Additional external searches included articles retrieved from Google Scholar, reference lists of systematic reviews published in 2010–19, and consultations with key experts in the field. Electronic databases were searched with search terms: “Down syndrome”, “Parkinson’s disease”, “spinal cord injury”, “intellectual disability”, “spinal dysraphism”, “sensation disorders”, “spina bifida”, “cerebral palsy”, “people with hearing impairments”, “traumatic brain injury”, “multiple sclerosis”, “stroke”, “muscular dystrophy”, “Huntington’s disease”, “disabled children”, “children with disabilities”, “developmental disabilities”, “people with disabilities”, “Down syndrome”, “exercise”, “physical activity”, “sport”, “meta-analysis”, and publications were selected according to type of review (meta-analysis or systematic review). Only articles published in English were included. Reviews were excluded if they were not peer-reviewed or included exercise interventions that were delivered as a means of rehabilitation therapy (eg, bodyweight support treadmill training or functional electrical stimulation). Specific search details are included in the appendix (pp 2–16, 26–29).

from 20.6% to 60.1%, in contrast to estimates ranging from 53.7% to 91.1% for adults without disabilities.^{17,20} For children with disabilities aged 11–15 years, estimates of those meeting physical activity guidelines vary from 8.5% to 40.4%, with girls being less active than boys.¹⁶ Although only approximately 20% of adolescents aged 11–17 years worldwide meet physical activity guidelines,²¹ physical education is compulsory in 232 countries and autonomous regions worldwide. Conversely, just 72% of children with disabilities who attend school have access to physical education,²² suggesting a lower prevalence of school-based physical activity in children with disabilities than in children without disabilities.

Approximately 80% of PLWD live in low-income and middle-income countries (LMICs), but physical activity and disability data from LMICs are scarce. This situation falls unacceptably short of the UN SDGs 3 (good health and well-being), 4 (quality education), 10 (reduced inequality), and 11 (sustainable cities and communities), which explicitly reference PLWD.⁷ The most comprehensive dataset we could find is a cross-sectional study done in 46 LMICs. Adults with various chronic physical conditions (including, but not limited to, disabling conditions such as arthritis, hearing problems, and visual impairment), particularly adults older than 50 years, were significantly less likely to meet physical activity guidelines than adults without those conditions.²³ Challenges to estimating physical activity rates of PLWD in LMICs include the inexistence of comprehensive surveillance systems,²⁴ a need for culture-specific and

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systems (eg, WHO’s “STEPwise approach to noncommunicable disease risk factor surveillance”¹²) do not include measures to assess disability, and most national and international disability surveillance systems do not include measures of physical activity. Many PLWD are excluded from population-level datasets on physical activity. Because physical activity for PLWD is not a consistently prioritised measurement within current surveillance systems, longitudinal data to estimate patterns of physical activity in PLWD over time do not exist.

Virtually all available population data on physical activity in PLWD come from high-income countries (HICs) in North America and northwest Europe (table). Prevalence estimates vary greatly across surveillance systems due to different assessment methods, but suggest that PLWD in HICs are 16–62% less likely to meet physical activity recommendations than people without disabilities.¹⁷ Estimates of the proportion of adults with disabilities living in HICs who meet physical activity guidelines range

	Country of origin	Data collection methods	Population	Disability domains*†	Proportion meeting WHO physical activity guidelines‡
National Health and Nutrition Examination Survey (2011–14) ¹⁵	USA	Face-to-face interviews with parental surrogates	Children aged 5–11 years (n=2847)	Functioning and functional limitations	Boys with no mobility limitations: 74.4%; boys with mobility limitations: 58.1%; girls with no mobility limitations: approximately 64%; girls with mobility limitations: approximately 58%§
WHO collaborative cross-national Health Behaviour in School-aged Children study (2013–14) ¹⁶	15 European countries¶	School-based surveys	Adolescents aged 11, 13, or 15 years (n=61 329)	Functioning and functional limitations	Prevalence range across all 15 countries: 14.9–37.8% for boys and 8.5–21.4% for girls with long-term illness or disability; 15.9–32.9% for boys and 7.1–22.0% for girls without long-term illness or disability
National Health Interview Survey (2009–12) ¹⁷	USA	Face-to-face interviews	Adults aged 18–64 years, (n=83 467)	Functioning and functional limitations and Washington group questions	People without disabilities: 53.7% (95% CI 53.1–54.2); people with functioning and functional limitations: 31.0% (29.7–32.2); people with vision impairments: 45.2% (42.2–48.2); people with hearing impairments: 40.9% (37.7–44.2); people with mobility impairments: 38.3% (35.6–41.1); people with cognitive impairments: 20.6% (19.2–22.1)
Behavioural Risk Factor Surveillance System (2009) ¹⁸	USA	Telephone-based, interviewer-led surveys	Individuals older than 18 years (n=357 665)	Functioning and functional limitations	People without disabilities: 70.1%; people with disabilities: 50.0%
Sport England's Active Lives Adult Survey (2016–17) ¹⁹	UK	Telephone-based survey	Individuals older than 18 years (n=198 000)	Functioning and functional limitations	People with no impairment: 65%; people with one impairment: 51%; people with 2 impairments: 45%; people with three or more impairments: 36%
Dutch Public Health Monitor (2012) ²⁰	Netherlands	Written survey	Individuals older than 19 years (n=321 656)	Functioning and functional limitations	People without physical or sensory disabilities: 91.1%; people with physical or sensory disabilities: 60.1%

Studies contained different questionnaires to assess physical activity. *Functioning and disability represent the interaction between health conditions (ie, diseases, disorders, and injuries) and contextual factors (ie, external environmental and internal personal factors). †UN Washington Group on Disability Statistics questions refers to difficulty functioning in any of the core domains of vision, hearing, mobility, cognition, self-care, and language communication.¹³ ‡The 2010 WHO physical activity guideline for adults (individuals older than 18 years) is 150 min of moderate intensity physical activity, or 75 min of vigorous intensity physical activity, per week. For children (aged 6–18 years), the guidelines are 60 min of moderate or vigorous intensity physical activity per day.¹⁴ §Values extrapolated from graphical data (not directly reported in text). ¶Armenia, Bulgaria, Czech Republic, England, Finland, France, Hungary, Ireland, Macedonia, Poland, Romania, Scotland, Sweden, Slovakia, and Wales.

Table: Estimates of prevalence of physical activity among people living with disabilities from selected countries by survey instrument

language-specific tools to screen and identify PLWD,²⁵ and a need for improved, standardised measures of physical activity. Additionally, because 98% of children with disabilities in LMICs do not attend school,²⁶ school-based assessments of physical activity are unfeasible.

The scarcity of standard measures of disability and physical activity is a challenge for both LMICs and HICs. Definitions of disability often vary across sectors (eg, social, medical, and educational), and public health surveillance systems should therefore use standardised measures of disability. Standardised measures of physical activity are necessary to facilitate comparisons between people with and without disabilities. The data shown in the table are derived from surveys that defined disability on the basis of the International Classification of Functioning, Disability and Health^{27–29} or of questions from the UN Washington Group on Disability Statistics,¹³ but not all studies consistently use these approaches. Regarding measurement of physical activity, the self-report instruments used to derive international physical activity estimates (ie, the International Physical Activity Questionnaire and the Global Physical Activity Questionnaire) have little validity and reliability data for populations with disabilities.^{30–32} Because these instruments place a heavy emphasis on measuring walking activity, alternative measures have been used to assess physical activity in people with mobility

impairments.³³ Together, these challenges have resulted in inconsistent and non-comparable physical activity and disability measures across surveys and surveillance systems.

Health benefits of physical activity for PLWD

A rapid review of international literature underpinning the new UK physical activity guidelines³⁴ reported that physical activity is beneficial for most PLWD and, importantly, no evidence suggested that physical activity is harmful to this population.³⁵ Physical activity was positively associated with cardiorespiratory fitness, muscular strength, functional skills, psychosocial wellbeing, and indicators of cardiometabolic health in people with physical or cognitive disabilities.

Similarly, systematic reviews underpinning the new US^{36,37} and WHO^{38,39} physical activity guidelines reported that physical activity was associated with improved physical function, cognition, and quality of life among people with selected disabilities (eg, related to multiple sclerosis, spinal cord injury, Parkinson's disease, schizophrenia, and stroke). However, for many other outcomes, such as mortality and non-communicable diseases, and for people with intellectual disabilities, the evidence was insufficient to draw conclusions regarding the effects of physical activity.

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See Online for appendix

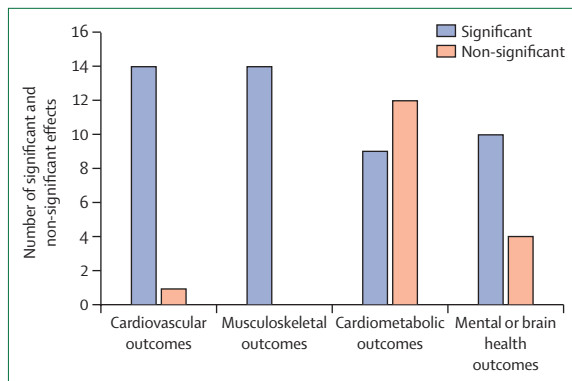


Figure 1: Number of significant and non-significant average effects reported across 36 meta-analyses of the effects of physical activity interventions on cardiovascular, musculoskeletal, cardiometabolic, and mental or brain health outcomes among children, adolescents, and adults with disabilities. Significant average effect sizes show an advantage for physical activity versus control conditions (no activity or usual care). No meta-analysis showed a significant advantage for control conditions.

For the purposes of this Series paper, we did a systematic review, identifying 36 meta-analysis studies (appendix pp 4–7) in which a physical activity prescription, programme, or intervention was implemented among children, adolescents, or adults with a disability, and one or more cardiovascular, musculoskeletal, cardiometabolic, or mental or brain health outcomes were measured (appendix pp 2–15). 33 meta-analyses reported significant effects in favour of intervention versus control groups (figure 1). Overall, the meta-analyses consistently reported significant positive effects of physical activity on cardiovascular and musculoskeletal health. More than half the meta-analyses of cardiometabolic outcomes reported non-significant effects. Results for mental or brain health were mixed. Among the 28 meta-analyses that reported a standardised mean difference (SMD), average SMD and confidence intervals were 0.69 (95% CI 0.31–1.01) for cardiovascular outcomes (11 studies); 0.59 (0.31–0.87) for musculoskeletal outcomes (ten studies); 0.39 (0.04–0.75) for cardiometabolic outcomes (one study); and 0.47 (0.21–0.73) for mental or brain health outcomes (nine studies). The mean effects did not change substantially after the removal of 18 low-quality meta-analyses.

Overall, there is evidence that PLWD can derive some of the physical activity benefits observed in the general population. The relatively small number of adequately powered studies might explain some of the inconsistencies. The reviews also show that the epidemiology of physical activity in PLWD is an under-researched area, in need of more high-quality studies to better estimate the health risks and benefits of physical activity for different populations and to identify the amounts of physical activity that maximise health benefits.

The UK and US physical activity guideline reports concluded that, for the attainment of substantial health benefits, PLWD should do 150 min of moderate to

vigorous intensity physical activity per week, and two sets of challenging strength and balance exercises twice per week.^{35–37} WHO guidelines recommend that children and adolescents living with disabilities do an average minimum of 60 min of moderate to vigorous intensity physical activity per day. Vigorous intensity aerobic activities and activities that strengthen muscle and bone should be incorporated at least 3 days per week. For adults living with disabilities, WHO recommends regular physical activity and at least 150–300 min of moderate intensity physical activity (or equivalent vigorous intensity physical activity) per week, and muscle-strengthening activities 2 or more days per week for additional health benefits.^{38,39} The guidelines emphasise that some physical activity is better than none, and that PLWD can have meaningful health benefits from physical activity even below the 60 min per day (children and adolescents) or 150 min per week (adults) threshold. The dose of aerobic physical activity prescribed in most of the adult studies reported in figure 1 was less than 150 min per week. These findings reflect that the health benefits of physical activity are graded, and the biggest benefits are reached when completely inactive people make small increases in physical activity,^{37–39} even of light intensity. Because so many PLWD are completely inactive, transitioning to even low levels of physical activity could have a major positive health effect on this population.^{37,38}

Furthermore, there is a dose-response relationship whereby all physical activity accumulated throughout the day (from light, to moderate, to vigorous physical activity)³⁷ is considered beneficial, which is especially important for PLWD who have barriers to reaching the guideline recommendations. Accordingly, disability-specific guidelines that prescribe lower, minimum amounts of physical activity required to achieve meaningful benefits^{35,40,41} might be more appropriate than generic guidelines that are often perceived as unachievable, especially for people with low mobility.^{42,43} Some generic guidelines take a more inclusive approach by specifically including PLWD and, once again, emphasising that even some physical activity is better than none.^{39,44}

There are almost no studies of sedentary behaviour for PLWD,^{38,39} which are complicated by challenges in defining sedentary behaviour for people with mobility impairments.^{45–47} Nevertheless, the recent addition of sedentary behaviour guidelines^{38,39} and messages to physical activity guidelines can be especially important for PLWD who are inactive. However, the “sit less and move more” message is considered inappropriate by many people with mobility impairments. A good example of a more appropriate message is “don’t be still for too long”, which was co-constructed by PLWD during the UK guideline development process.^{35,41,48}

Therefore, the documented health benefits of physical activity for PLWD justify recommendations for increased physical activity and reduced sedentary time. Efforts are needed, however, to tailor recommendations to the needs

and realities of the diverse population of PLWD, especially for those with very low baseline physical activity. PLWD can benefit from increases in physical activity that are much lower than those recommended in population guidelines.

Factors associated with physical activity in PLWD

Many studies have documented factors associated with physical activity participation among PLWD living in HICs. Most of these studies have been qualitative, involving participant-generated lists of barriers and facilitators of physical activity. Unlike research in the general population, relatively few studies of PLWD have quantitatively measured and compared the strength of relationships between potential correlates (eg, social support and fatigue) and participation in physical activity.

Research on factors related to physical activity in people with physical disabilities was synthesised in a systematic review of 22 review articles.⁴⁹ Qualitative information on 208 factors was extracted and catalogued. For the present paper, we augmented that analysis by systematically searching for literature reviews that addressed factors related to physical activity in people with sensory or intellectual disabilities. Six reviews were identified,^{50–55} yielding 21 additional factors (appendix pp 16–25). The aggregated 229 factors were categorised according to common themes and classified within a social–ecological model (figure 2).

Physical activity barriers and facilitators encountered by PLWD in HICs are well documented. Research efforts

must now focus on developing, testing, and delivering physical activity-enhancing interventions with and for PLWD living in these countries. Figure 2 highlights the need for interventions addressing multiple levels of influence. For example, poor knowledge or scarce information about disability-adapted physical activity is a barrier not just at the intrapersonal level (ie, attitudes, beliefs, and perceived benefits), but also at the interpersonal (ie, negative social attitudes), institutional, and community levels. A scarcity of information or knowledge limits the ability of key individuals and organisations (eg, teachers, physiotherapists, and community centre workers) to support PLWD in becoming more active. Although physical activity information and knowledge alone are insufficient to elicit and sustain behaviour change, they are often necessary elements. Figure 2 can also be used to facilitate decision making with stakeholders to design interventions that act over specific barriers (eg, policy-level interventions to address transportation barriers). A multi-level approach to physical activity intervention design and research aligns with a social-relational understanding of disability as arising from disabling and discriminatory social, cultural, and environmental conditions.^{56,57} Physical activity barriers and facilitators for PLWD in LMICs are discussed in panel 1.

Interventions to increase physical activity outside of research and clinical settings

Most physical activity-enhancing intervention studies involving PLWD have focused on increasing leisure-time

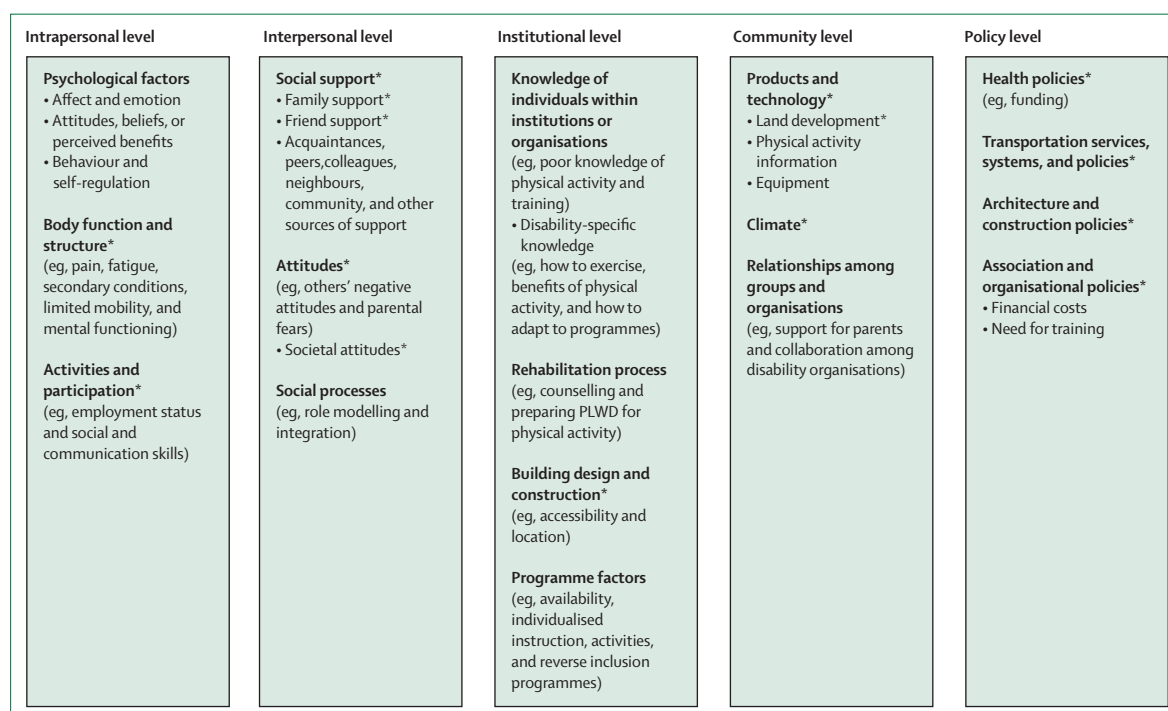


Figure 2: Social–ecological model showing factors related to physical activity participation among PLWD
PLWD=people living with disabilities. *International Classification of Functioning, Disability, and Health terminology.

physical activity, walking, or total daily physical activity. Virtually all these studies were done in HICs and targeted intrapersonal-level or interpersonal-level factors.

We did a systematic review of meta-analyses and qualitative meta-syntheses of studies that delivered a physical activity-enhancing intervention to children, adolescents, or adults with disabilities. Ten reviews were identified^{69–78} (appendix pp 26–31). The reviews consisted largely of randomised controlled trials, most of which had at least some risk of bias due to factors such as blinding, allocation concealment, and selective reporting of outcomes. Across seven meta-analyses of studies involving people with physical disabilities, the average post-intervention effect sizes for physical activity behaviour change ranged from 0.29 (95% CI 0.17–0.41, $k=10$) to 1.00 (0.46–1.53, $k=10$), median 0.64 (0.43–0.83, $k=10$). For adults, behaviour change techniques—particularly self-monitoring, problem solving, action planning, feedback on outcomes of behaviour, social support, reframing thoughts, identifying barriers, instruction on how to do the behaviour, and information about health consequences^{73–75}—were positively associated with behaviour changes.^{73,74} In a qualitative meta-synthesis,

PLWD reported that effective interventions were flexible and adaptable to individual needs, autonomy-supportive, and done in inclusive, non-judgmental environments.⁷⁵ Less is known about factors influencing intervention effectiveness for children and adolescents with physical disabilities. Interventions have been recommended to address contextual facilitators and barriers, use behaviour change theories, and incorporate behaviour change techniques (particularly self-monitoring, positive reinforcement, and monitoring and feedback from others).^{71,79}

Regarding people with intellectual disabilities, one meta-analysis of two interventions involving children (younger than 18 years) reported no significant effects on physical activity (average effect size 0.20 [95% CI 0.57–0.97]).⁶⁹ Neither intervention used behaviour change theories or targeted factors known to influence physical activity in this population. A meta-analysis of 14 studies involving adolescents and adults reported an average effect size of 0.41 (95% CI 0.19–0.63).⁷⁰ Interventions with more frequent sessions and shorter session duration were the most effective.

Interventions delivered at the institutional and community levels generally aim to change knowledge or practices of individuals and organisations. Some real-world examples include formulating guidelines for constructing accessible built environments⁸⁰ (eg, trails, recreation centres, and pools), developing inclusivity training programmes for physical education teachers,⁸¹ and establishing programmes that loan equipment for adapted physical activities.⁸² The few studies testing the effectiveness of these types of interventions have produced mixed findings. For instance, a nationwide Canadian study found that an educational intervention designed to strengthen health-care providers' intentions to discuss leisure-time physical activity with patients with physical disabilities had no long-term effects.⁸³ Conversely, a Dutch national project⁸⁴ provided training to staff in 18 rehabilitation institutions on how to deliver physical activity counselling and build collaborations between hospital staff and community-based physical activity providers. Over a 3 year period, the programme reached 5873 patients with various disabilities and substantially influenced participation in physical activity.

Policy-level interventions include efforts to change legislation, laws, codes, regulations, rules, and practices that are developed and implemented by governments, government agencies, and non-governmental organisations such as businesses and schools. Some examples include policies to fund sports programmes and equipment for PLWD, to provide accessible transportation, and to ensure built environments are accessible.^{85,86} Although some policy-level changes have proven effective for increasing physical activity in the general population,^{87,88} we are unaware of any studies testing the effectiveness of policy changes to increase physical activity for PLWD.

Panel 1: Factors associated with physical activity and physical activity interventions in low-income and middle-income countries

Factors associated with physical activity

A cross-sectional study involving people with psychosis in 47 low-income and middle-income countries (LMICs) found that low levels of physical activity were associated with being male, older, unemployed, living in an urban setting, inadequate food consumption, having depression or sleep or energy disturbances, and mobility limitations.⁵⁸ Studies from Malaysia indicate that primary barriers to people living with disabilities (PLWD) participating in physical activity include a scarcity of facilities, funding, transportation, and equipment; health concerns; age above 35 years; and negative attitudes from the public, media, and the government.^{59,60}

Physical activity interventions

Global physical activity disparities and inequities for children with disabilities reflect the scarcity of data and intervention strategies targeting this population, especially in LMICs.⁶¹ Challenges to interventions include supporting the wide range of complex needs, human resources for the delivery of interventions to families, the selection of outcomes, engagement with formal systems, the cost of interventions, and the need for more rigorous study designs.⁶² Regarding promotion of physical activity for both children and adults with disabilities, LMICs have strengths to build upon,⁶³ such as greater overall physical activity and active transportation. Areas for improvement include quality support for family and peer interaction, built environments, government investments,⁶¹ and availability of assistive devices and rehabilitation facilities.⁶⁴ Organisations in LMICs (eg, disabled people's organisations) can lend expertise and infrastructure for programme delivery.⁶⁵ There is also potential to incorporate physical activity into community-based rehabilitation⁶⁶ and improve physical literacy.⁶⁷ Emphasis on physical activity at a national level is often directed by policy, and the need for physical activity in LMICs has been highlighted.⁶¹ However, efforts to reach PLWD are not fully developed and recommendations for PLWD are often deferred to health-care providers due to the specialised care needs of this group.⁶⁸ Intervention research in LMICs should include the scalability of community-level interventions.⁶⁹

International policy actions and recommendations for PLWD

Various international treaties and policies pertain to physical activity for PLWD. For example, the UN Convention on the Rights of the Child⁸⁹ supports children's rights to participate fully in sport and other types of physical activity by advocating for non-discrimination and for a commitment to the child's best interests and development. The UN Convention on the Rights of Persons with Disabilities⁶ explicitly recognises the importance of physical activity by stating that PLWD have the basic human right to participate on an equal basis with others in recreational, leisure, and sporting activities. Panel 2 presents a discussion of disability sport as an agent of social change.

Another example of international policy is WHO's Global Action Plan on Physical Activity 2018–30 (GAPPA).¹²² With its emphasis on equity across the life course, GAPPA recognises that disparities in physical activity participation by PLWD are not because PLWD have a medical problem, but are consistent with social and social-relational models of disability,^{56,57,123,124} disparities that reflect limitations and inequities in socioeconomic determinants and opportunities for physical activity. Thus, one target of GAPPA is to ensure equal opportunities and reduce inequalities in physical activity participation by empowering the social, economic, and political inclusion of everyone. Another target is to eliminate discriminatory laws, policies, and practices, and promote appropriate legislation and action. Reflecting GAPPA's call for equity across the life course,¹²² physical activity policy development for PLWD can be found in some national, government-endorsed physical activity guidelines and in WHO's 2020 physical activity guidelines. Historically, national and international physical activity guidelines mostly ignored PLWD. However, recommendations for PLWD were included in the 2018 Physical Activity Guidelines for Americans,³⁶ in the 2019 UK Chief Medical Officer's physical activity guidelines,³⁴ and in the 2020 WHO guidelines on physical activity.³⁹

Physical activity policies, recommendations, and resources must incorporate the values, needs, and preferences of PLWD, relevant rights holders, and stakeholders. Scientists and policy makers must abide by the philosophy of nothing about us without us to co-produce research, recommendations, policy, and other knowledge products (panel 3). For example, in an integrated knowledge translation research project, people with physical, mental, cognitive, or sensory impairments, social and health-care workers, and user-led organisations (eg, Disability Rights UK) advocated the UK physical activity recommendations for PLWD and translated these to a meaningful, co-produced communication format.⁴⁸

International policies and national recommendations are beginning to result in increased awareness of the needs of PLWDs for full participation in physical activity, but much

Panel 2: Disability sport as an agent of social change

Participation in disability sport (also known as adapted sport or parasport) is growing internationally (figure 3), but remains far higher in high-income countries than in low-income and middle-income countries (LMICs). This growth is largely driven by governmental and non-governmental organisations that frame disability sport as a means to address the lived experiences of social inequity faced by people living with disabilities (PLWD).^{97–99} International disability sport events such as the Paralympics, the Deaflympics, and the Special Olympics include, in their mission statements, the use of disability sport events to promote the empowerment, social inclusion, and social participation of PLWD.^{100–104} Likewise, the UN,^{105,106} WHO,¹⁰⁷ UNICEF,¹⁰⁸ and UN Educational, Scientific and Cultural Organization (UNESCO) identify disability sport events and sport programmes as agents of social change to address social inequities, but whether they are effective is unclear. Regarding empowerment, negative stereotypes about disability can be mitigated when PLWD are characterised as sport participants, even outside the context of a sport event.^{109–114} However, the media's framing of disability sport narratives is frequently criticised for perpetuating disability stereotypes: for instance, by portraying athletes with disabilities as superhuman, or disability as a tragedy that must be overcome.^{115–118} Regarding inclusion, investments in major sporting events often improve the physical and social accessibility of physical activity facilities and venues to PLWD.¹¹⁹ Yet, unfortunately, these benefits are poorly distributed and do little to address the long-term systemic barriers faced by PLWD, particularly among non-host LMICs, which are often the focus of international physical activity policy goals. Regarding participation, although the London 2012 Paralympic Games were considered successful in terms of media coverage and increased post-Games disability sport participation in the UK,¹²⁰ participation in sports started to decline in 2017.¹²¹ Together, these equivocal findings attest to the need for greater critical consideration of how disability sport can achieve a legacy of empowerment, social inclusion, and social participation for PLWD.

more work needs to be done to advance inclusive policy and practice.³⁸ For instance, policies and planning documents must go further than simply noting the need for greater accessibility. They must include action plans empowering PLWD to participate in physical activity. They must challenge and prevent ableism; that is, favouritism and ideals associated with ablebodiedness. Most importantly, they must be adequately funded, implemented, monitored, and enforced.

Discussion and conclusion

In this Series paper, we have provided an overview of knowledge regarding physical activity in people living with disabilities worldwide. In doing so, we have highlighted important disparities, injustices, research gaps, priorities, and challenges to moving forward. There are large disparities in physical activity participation rates between PLWD and the general population. Drawing on the little available data, PLWD are estimated to be 16–62% less likely than the general population to meet the 2010 WHO physical activity guidelines. The magnitude of this disparity varies across disability types and is greatest for those with multiple impairments. The large range of estimates reflects differences in study methodologies (ie, how physical activity was assessed and how PLWD were defined), and illustrates the difficulties in obtaining

Panel 3: Nothing about us without us—integrated knowledge translation research and people living with disabilities (PLWD)

Societal shifts in attitudes towards people living with disabilities must be facilitated by universal policies and programmes that fully account for the highly diverse priorities, barriers, and circumstances of all PLWD. Concomitantly, the design of research, interventions, or policies aimed at increasing physical activity in PLWD must consider the immense heterogeneity of PLWD and the regional contexts within which they live. Integrated knowledge translation (IKT) research approaches can support the attainment of these goals.¹²⁵ IKT is a powerful, partnership-based approach to ensuring research findings are relevant, useful, and useable, allowing for the meaningful engagement of researchers with the right research users (those who will use, benefit from, or apply the research; eg, PLWD, disability-focused organisations, and policy makers) throughout the research process.

IKT approaches align with the nothing about us without us philosophy of the disability rights movement¹²⁶ because they require shared decision making by researchers and research users. Care must be taken, however, to avoid tokenistic engagement of research users, such as asking individuals or organisations to endorse a research product they have not been involved in developing.¹²⁷ Tokenism can be avoided by ensuring IKT partners can represent the interests and perspectives of PLWD, and by recognising and valuing their diverse knowledge and expertise.¹²⁸ IKT approaches shift the focus from doing research on PLWD to doing research with PLWD and are crucial to rectifying the inherent ableism in national and international physical activity policies and related resources. Although IKT can take more time and effort than traditional research approaches, IKT-based research can lead to more rapid development and revision of inclusive physical activity policies (such as WHO's Global Action Plan on Physical Activity and Health), and physical activity resources that are relevant to PLWD. As such, IKT is an invaluable tool for developing physical activity policies and programmes to drive greater physical activity participation and better quality physical activity participation experiences for PLWD.

adequate population-level physical activity estimates for PLWD.

The near-absence of population-level data on physical activity in PLWD in HICs and the total absence of such data in LMICs are serious problems. Although many countries collect data on physical activity in the general population, most do not gather data on physical activity in PLWD. Worldwide coordinated efforts are needed to address the call from WHO's GAPP to strengthen the reporting of physical activity data to monitor progress towards reducing physical activity disparities.¹²³ Population physical activity estimates are the cornerstone of national and international physical activity action plans. As laid out in Article 31 of the Convention on the Rights of Persons with Disabilities, governments and organisations must collect appropriate information, including statistical and research data, to formulate and implement policies giving effect to the rights of PLWD.

Compared with the general population, far less high-quality research has been done on the health benefits of physical activity for PLWD. The physical activity epidemiological evidence base for PLWD tends to be siloed within medicalised conditions rather than being built across all populations, and most disability-related research has focused on improving function rather than health. Furthermore, intervention studies have typically

focused on short-term outcomes and have been done in scientific or clinical settings. Consequently, the effects of physical activity, particularly on the risk of non-communicable diseases, are virtually unknown. This knowledge gap is compounded by a neglect to measure disability as part of population surveillance and by the under-representation of PLWD in prospective cohort studies. This gap can, and must, be alleviated by adjusting study inclusion and exclusion criteria and by removing the participation barriers^{129,130} that currently exclude up to 15% of the world's population (ie, PLWD) from population-level health studies.

Disability research also lags behind general population research in identifying the strongest influences on physical activity and targeting those factors in interventions. Most interventions have not been theory-based and have addressed only intra-individual or inter-individual factors, but theory-based interventions are the most effective.⁷³ Efforts should be directed to target factors at all social-ecological model levels and all physical activity types (leisure, transport, household, education, and occupational) and intensities. Reducing sedentary time will also be beneficial, especially for the least physically active. In addition, tailored physical activity messages, information, and recommendations, co-produced with PLWD, are required to address the unique challenges, preferences, and needs of PLWD.^{41,131}

Physical activity policy makers must ensure that the Convention on the Rights of Persons with Disabilities basic right to full and effective participation is upheld. Creating policies and programmes that increase the numbers of PLWD participating in (or their time spent in) physical activity is not enough. Full and effective physical activity participation means having high-quality physical activity experiences that satisfy the individual's values and needs for belonging, autonomy, challenge, mastery, engagement, and meaning in the context of physical activity.^{132,133} Research and resources co-produced by PLWD, scientists, health-care and social workers, and other stakeholders are needed, along with policies to foster optimal quality participation by PLWD in physical activity contexts.^{134,135}

There are many challenges to addressing these gaps, disparities, and priorities. First, because PLWD are a tremendously heterogeneous group (eg, in age, type of disability, level of function, and years living with disability), there are no one-size-fits-all approaches. Issues and solutions that might be relevant to one subgroup of PLWD can be irrelevant to another.⁴³ Second, there is neither consensus nor consistency on how to define and measure disability and physical activity in PLWD.¹³⁶ Resolving these measurement issues would facilitate international collaboration on large-scale studies of physical activity, health, and psychosocial outcomes. Third, editors of mainstream health journals are often biased against publishing studies of PLWD

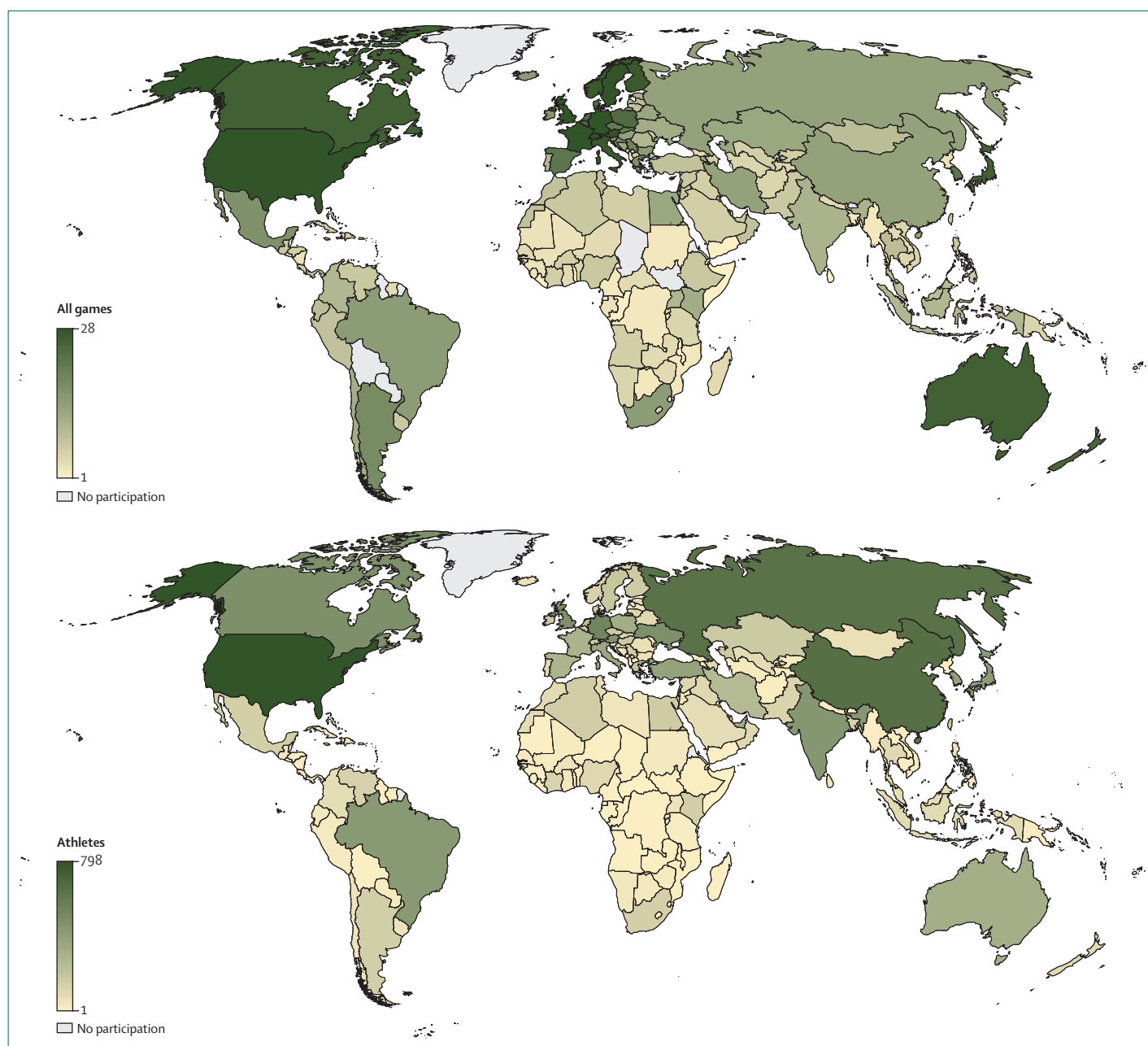


Figure 3: Countries' participation in disability sports⁹⁰⁻⁹⁶

The top panel shows countries that participated in the Paralympic Games, 1960–2018. The bottom panel shows the total number of athletes from each country who competed in the Summer and Winter Paralympics, Special Olympics, and Deaflympics, 2016–19. Russia was banned from participation in 2016–18.

because they believe their readers are uninterested in disability¹³⁷ and in the lower-incidence conditions that cause disability. These editorial practices marginalise disability research and undermine scientists' abilities to reach wider clinical and public health audiences than those typically reached by valued disability-specific journals.

Finally, improving the physical activity levels of PLWD will require more than guidelines and action plans. There

is no evidence that appropriate resources have been designed to deliver physical activity-enhancing actions across the social–ecological model for PLWD at national or global levels. Although resourcing is an issue for GAPPA in general,¹²² it is even more vital for PLWD. Given the size and needs of this population, relying solely on individualised approaches, medicalising disability to a set of clinical conditions, and deferring PLWD to specialists to help them meet their physical activity needs

is not enough. A true population and public health approach is required. Now is the time to make a serious commitment to upholding the basic human right of PLWD to fully participate in physical activity.⁶ Investing in, and appropriately resourcing, global and national physical activity action plans for PLWD are necessary steps to advance human rights, and to make progress towards the UN's SDG of ensuring healthy lives and wellbeing for all.⁷

Contributors

KAMG outlined the manuscript with assistance from HPvdP and GWH. KAMG, BL, KN, and GWH did the literature search. KAMG, HPvdP, CF, BL, CBMB, KN, CHS, BS, PMV, and GWH wrote sections. BL did figure 1. KAMG did figure 2. KN did figure 3. GWH did the table. KAMG and BL prepared the supplementary files. MP provided feedback on drafts of the manuscript. KAMG and HPvdP coedited the full manuscript and managed the submission and revision process.

Declaration of interests

We declare no competing interests.

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