Prescribing active transport as a planetary health intervention – benefits, challenges and recommendations

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Physical Therapy Reviews

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ABSTRACT

A high proportion of people are insufficiently physically active. The reasons for this are complex and in part relate to social determinants of health, lifestyle choices, and deleterious environmental conditions like climate change, loss of green and outdoor environments and a concomitant loss of biodiversity. Physiotherapists, and other health professionals, may have a positive impact on these global issues, through the encouragement of active transport, and advocacy to reduce barriers to its uptake and optimize exposure to health-giving outdoor spaces. In this paper, we demonstrate how physiotherapists can promote active transport as a planetary health intervention, and provide insight into the benefits and challenges of this planetary health intervention, with direct implications to physiotherapy practice.

Keywords: Active transport ; planetary health ; physical activity ; physiotherapy ; cycling

Introduction

Approximately 80% of adults in the United States (US) are insufficiently physically active [1], and more than half of the population of the European Union fail to meet physical activity (PA) guidelines [2]. This lack of PA is associated with greater rates of mortality and multiple co-morbidities [3,4]. To address this, graduated PA is a major behavior change suggested globally by physiotherapists and other healthcare professionals, based on guidelines that adults should participate in at least 150 min of moderate intensity PA per week, such as swimming, cycling or brisk walking [4]. However, a range of societal, sociopolitical, biological, individual, transport, and environmental factors have been identified as barriers to participation in PA, alongside identifiable economic and environmental ones [5].

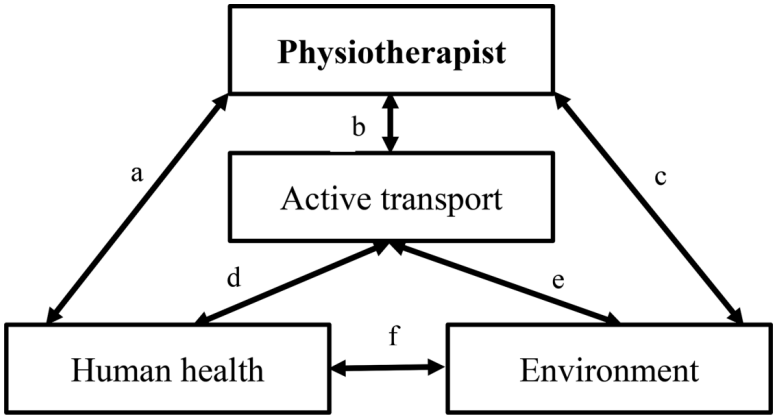
Concomitant with physical inactivity being a leading cause of disability globally [4,6], climate change and environmental degradation are now driving worsening health effects [7,8]. These health effects include increases in both communicable [9] and non-communicable diseases [10,11], which may relate to increased temperatures, malnutrition, mental and physical trauma and injury due to extreme weather events, social inequality, climate migration and conflict [10,11]. A contemporary example of how land-systems change and associated environmental degradation may impact physical and mental health is the ongoing severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pandemic, leaving millions of people with reduced physical capacity either directly, because of coronavirus disease

2019 (COVID-19), or indirectly, *via* the effects of prolonged physical isolation and potential inactivity. The global physiotherapy community has already recognized this, and is suggesting ways to support those affected [12]. Many physiotherapists are also advocating for a change in social and professional direction as this crisis clearly showed that the old 'normal' was not working for the majority of people around the world [12].

Planetary health "is based on the understanding that human health and human civilization depend on flourishing natural systems and the wise stewardship of those natural systems" [13]. While planetary health has traditionally been viewed as part of population health, it is increasingly being considered in clinical practice [14–16]. Bringing together stakeholders involved in tackling problems like climate change and physical activity can help those actors to identify their part in the broader systems needed to deliver effective interventions [17]. While physiotherapists have mainly worked in clinical settings, the role of physiotherapists in population health is internationally recognized and includes social marketing, screening, outreach, referral, advocacy collaboration and consultation at the community, system, family, and individual level, and policy development [18]. Physiotherapists are therefore well positioned to play important roles in planetary health by supporting environmental sustainability, reducing environmental impacts of the healthcare system, and increasing resilience of population and healthcare systems to global climate and environmental change [13,19].

In this article, we propose that active transport is a planetary health intervention, with gains for both human health and the environment, with physiotherapists having an influence over each of the three interlinked components: active transport, human health and the environment (both built and natural) (Figure 1). We provide insight into the benefits and challenges of active transport as planetary health intervention, with direct implications to physiotherapy practice. Promoting physically active transportation, particularly cycling, skating, scootering, jogging and walking as a planetary health intervention may be a meaningful strategy for increasing PA that simultaneously has positive impacts on the environment. The role of physiotherapists in promoting active transport as a human health intervention has not previously been explored, particularly in the broader context of planetary health. In order to use active transport as an effective planetary health intervention, we must consider complex interactions among health, environment and society [20].

Figure 1. The interaction between the physiotherapist, active transport, human health, and the environment.



Notes: The arrows in Figure 1 refer to bidirectional relationships between a. the physiotherapist and human health (e.g. a. health problem prompts the person to see a physiotherapist, and the physiotherapist supports improvements to their health), b. the physiotherapist and engaging in active transport (e.g. the physiotherapist may promote active transport, and active transport may enable some people to access physiotherapy), c. the physiotherapist and the environment (e.g. the physiotherapist may advocate for changes to build environments that promote active transport, and built environments may influence access to physiotherapy), d. human health and active transport (e.g. health problems may be barriers to engaging in active transport, and active transport may improve health), e. active transport and the (built and natural) environment (e.g. active transport benefits the natural environment by reducing greenhouse gas emissions, and the built and natural environment may impact upon a person's ability to engage in active transport), and f. refers to the bidirectional relationship between human health and the environment (e.g. biodiversity loss and

climate change adversely impact human health, and poor health impacts the environment through the use of natural resources, pharmaceuticals and medical imaging).

Individual and population health benefits and challenges

Benefits

Active transport to work has been demonstrated to improve physical fitness, and decrease body weight, fat mass, body mass index and cholesterol [21]. Cycling specifically has been shown to reduce all-cause mortality, while findings have been mixed for cause-specific mortality [22,23], when compared with using motor vehicles to get to work. Commuting *via* cycling and walking have been associated with a lower cancer incidence when compared with private motorized vehicle [22]. Furthermore, increasing PA to moderate levels improves the health of sedentary individuals and maintains the health of those achieving health promoting PA levels [1,3,5]. These benefits include reductions in pain sensitivity, improved mood, and a reduction in risk factors associated with diabetes, cardiovascular disease and hypertension [1,3]; hence active transport may be recommended by physiotherapists for a range of presenting conditions, with a range of secondary gains.

If active transport involves exposure to green or blue space (e.g. water bodies) there may be a range of health benefits, additional to those generally associated with physical activity [24,25]. For blue space exposure these health benefits may include good mental health and self-reported general health, and reduced cardiovascular disease and diabetes, although the evidence at this stage is limited [25]. Green space exposure has been associated with a wide range of conditions, including improved mental health [26,27], reductions in respiratory conditions [28], heart rate, salivary cortisol, blood pressure, type II diabetes, preterm birth, and all-cause mortality, as well as better self-reported health [24]. It has also been suggested that green space exposure may reduce pain, and the transition from acute to chronic pain [29].

The pathways linking green space exposure and human health outcomes are likely to include exposure to more biodiverse environmental microbiomes, phytoncides, negative air ions, and sunlight [30]. The role of biodiverse environmental microbiota as a key pathway is emerging. Exposure to the environmental microbiota changes the human microbiota [31–33], and understanding of the relationship between the human microbiome in a range of health conditions is receiving increased attention. There is evidence to suggest an association between the human microbiome and pain [34], fibromyalgia [35], rheumatic diseases [36], psoriatic diseases [37], multiple sclerosis [38], depression [39], anxiety [40], and cancer [41], while studies into faecal microbiota transplants have provided promising results with regards to psychiatric [42], neurological [43], and gastrointestinal conditions [44,45]. If the environmental microbiota contains microbes with human health-giving properties, then these are likely to improve human health. Green spaces are likely optimized for human health when they are more biodiverse (for phytoncides and biodiverse environmental microbiome exposure), and include water with shearing forces (for negative air ions), with additional benefits for population health and the environment should these spaces be developed (described further below). Physiotherapists may optimize their active transport recommendations by suggesting that their patients choose routes that incorporate green or blue space exposure where possible, particularly those with high levels of biodiversity.

Using active transport, such as e-biking for relatively long, cycling for moderate and walking for shorter journeys, to replace or reduce passive transport (especially private car use) yields health benefits for individuals and, if taken up on a large scale, has positive impacts on the environment, including through reduced noise, greenhouse gas (GHG) emissions, and air pollution [46,47] (discussed further below). These positive environmental impacts, in turn, are likely to have additional population health benefits [46,47]. Globally, there are 5.5 million deaths each year due to air pollution [48], and modelling for New Zealand indicates that swapping car trips of <5 km to walking or cycling may result in health gains of 1.61–25.43 quality adjusted life years per 1000 people and significant associated cost savings [46].

Challenges

The successful promotion of active transport requires comprehensive approaches that may target different socio-ecological levels, including cities, societies, individuals and transport routes [49]. The notion of a single approach to increasing active transportation oversimplifies the role of the physiotherapist in an already complex PA and active transport landscape [17]. Systems maps – often used for recommendations for policy development – have shown that

there are highly complex interactions between multiple interconnected factors including transport, infrastructure, societal, biological, individual, political and environmental factors that promote or hinder uptake of active transportation [50]. Our clinical role as practitioners who can promote active transport sits within this complex system and may not yet be fully considered. When a systems map for the promotion of PA (including active transport) was shared with stakeholders, the stakeholders had a better appreciation of the complexity of the problem, and identified that the focus had been placed on interpersonal factors, rather than the broader factors that were at play [50].

The shift towards active transport, however, comes with several challenges for the individual, some of which may be addressed directly or indirectly by physiotherapists. For example, child active transport is an important consideration, not just for the child's current health, but also for establishing health promoting behaviors for adulthood. Barriers to active transport (for children and/or parents) include distance, safety concerns (e.g. dangerous driving behavior, traffic volume and speed, bullying, and assault), convenience, lack of time, scheduling of out of school activities, child interest in walking or riding/fun, psychological and corporeal reasons (e.g. fatigue, heavy bag), and lack of social support (e.g. other children and adults walking or riding) [51,52].

Potential strategies to improve active transport for children include educational strategies [53], and providing parents with bicycles (particularly e-bicycles with trailers) [54]. Social marketing has also been suggested as a strategy to improve active transport to school, with targeted messages for different age groups [55]. For instance, fun and fitness are appealing messages for students in elementary school, the environment and social aspects for middle school, and autonomy for secondary school girls, with a positive and light-hearted approach suggested [55]. Physiotherapists may play an important role in such population health interventions through advocacy, policy development, and involvement in broad educational strategies, as well as through working with families to overcome perceived barriers in a clinical setting.

Many of these barriers to active transport also apply to adults and may include travelling distance, time, and individual levels of fitness. In addition to improvements to infrastructure (described below), new technologies, such as e-bikes and e-scooters, may also facilitate engagement for those undertaking longer journeys, older people, and individuals in early stages of PA uptake [56]. Research has shown that e-biking averages higher energy expenditure than walking and achieves the moderate intensity PA level associated health benefits while saving time [47,56,57]. These new technologies may still pose barriers for some, including the heavy weight of e-bikes [58], battery issues [58], and cost. The relatively high cost of e-bikes and e-scooters, however, clearly highlights the importance of considering barriers to prescribing active transport as a planetary health intervention associated with social determinants of health related to socioeconomic status. The cost barrier may be minimized through bike and scooter sharing, particularly dockless services that allow for additional flexibility. Financial inaccessibility will act as a barrier for many people that will keep them from taking up this form of active transport, and should be addressed by healthcare professionals and policy makers [55,59].

There may also be a role for physiotherapists working in occupational health to play a role in promoting active transport. Recent evidence suggests that workplace interventions may be effective in increasing active transport to work. Interventions included developing workplace travel plans, introducing new transport infrastructure, financial incentives, and behavior change interventions [60].

Concerns have been raised that switching to active transportation could expose walkers and cyclists to more air pollutants, especially in dense urban areas. Exposure and inhaled dose of pollutants will depend on various factors, including air pollution levels, the route taken, and individual factors. A recent systematic review concluded that motorized transport resulted in higher exposure to air pollution, but active transport resulted in a higher inhaled dosage, owing to the larger inhalation rate and longer commuting time [61]. Nonetheless, the benefits of active transport still appear to outweigh the risks associated with increases in inhaled pollution, in terms of all-cause mortality [47,61,62]. Physiotherapists may work with concerned patients and broader audiences to identify routes that may reduce exposure to air pollution (e.g. passing through greenspaces), and identify strategies to monitor the levels of air pollution so that motor vehicles can be used on higher-risk days, to minimize this barrier. Physiotherapists may also be involved in advocacy and policy development to address air pollution such that the general population feels more comfortable engaging in active transport.

Despite the many benefits of active transport, there may be a risk of injury, particularly for those riding scooters or bicycles [63–66]. Interestingly, when using e-scooters the majority of injuries were due to falling from the scooter

(84.7–91.7%), with a low percentage of injuries related to motor vehicle accidents (2.8–9.7%) [63,66]. When recommending active transport to patients, physiotherapists should assess the safety risks of active transport for the individual patient. This may include assessments of their level of fitness, but also their level of understanding of the road rules, their awareness of strategies to remain safe while engaging in active transport, and their level of confidence with active transport. For patients who do not have a good understanding of these safety elements, physiotherapists may engage with occupational therapists, local bicycle clubs, council or other services that may assist patients in safety and confidence, to assist patients in overcoming these barriers.

Finally, physiotherapists may encourage active transport by highlighting many of the benefits of active transport that have been identified by those who engage in it. These benefits include feeling better following moderate intensity exercise, but also extend to sensory stimulation, opportunities to socialize, and an increased level of control, confidence, independence and self-efficacy, including reliability regarding arrival time [67]. Some people may relate to these perceived benefits more so than the health benefits physiotherapists typically focus on, thus leading to improved uptake of active transport.

Environmental benefits and challenges (including infrastructure)

Benefits

The reported environmental benefits of active transport include a reduction in vehicle use and GHG emissions [49,68–70], but this has recently been questioned with recent evidence suggesting that active transport may actually result in GHG emissions comparable to passive transport, due to increased food intake [71].There is a large degree of variability in GHG emissions however, depending on geographical factors, whether multiple people are being transported in one vehicle, driving behaviors, characteristics of the vehicle, fuel type, and individual diets [71]. For example, plant-based diets have less of an environmental impact than meat-based diets [72]. Nonetheless, there are still environmental benefits from engagement in active transport when compared with passive transport. For example, emissions from motor vehicles is largely from non-renewable sources, while active transport, *via* dietary emissions, results from a mix of renewable and non-renewable sources [71]; hence active transport is still associated with less environmental damage than passive transport.

Active transport is also becoming more important as cities grow and struggle with traffic congestion [46,69]. For example, in Copenhagen, significant environmental and health benefits resulted from a reduction in congestion, noise and air pollution through reduced car traffic [73]. Similarly, a proposed plan of implementing ‘superblocks’ in Barcelona, as areas of cities that reclaim green spaces and reduce motorized traffic, would significantly reduce nitrogen dioxide emissions and noise pollution [74].

Engaging in active transport therefore has wide-ranging environmental benefits, in addition to the individual and population health benefits outlined above. In turn, improved human health also has secondary environmental benefits through reductions in waste and pollution involved in health treatment (e.g. medications polluting waterways [75], and GHG emissions from medical imaging [76], and anesthetics [77]).

Perhaps the most important reason for higher levels of cycling in countries like the Netherlands, Denmark and Germany is the provision of dedicated infrastructure, as well as infrastructure relevant to the integration of active transport with (passive) public transport networks [70]. In Tampere, Finland, improvements in cycling infrastructure led to a 36% increase in commuting via bicycle [68]. Similarly high cycling levels in the Netherlands are correlated with longer life expectancy and calculated to prevent 6500 deaths annually, translating into economic benefits of €19 billion per year [78]. Adding further environmental benefits, Utrecht’s train station, for example, increased the number of bike parking spaces from 7500 to 12500 to support the use of sustainable, passive transport (in this case, carbon neutral rail network) for longer commutes [79].

Local, national, and international physiotherapy organizations should work collectively to produce well-resourced information to demonstrate to politicians, city planners, and other relevant stakeholders the physical, economic and environmental benefits of safe infrastructure for active transport. This could include advocating for traffic calming actions (reduced speed limits, car-free zones, closing of designated thoroughfares to trucks and private cars) to allow cyclists to utilize the roads in safer environments [70]. Active transport can also be made more appealing through improvements in non-traffic related safety improvements (e.g. security cameras, lights) [51], art [51], and play equipment along the route [51,80].

Challenges

Despite the environmental benefits associated with switching to active transport, there are also environmental challenges that need to be acknowledged. The production of e-bikes, for example, also involves GHG emissions and other environmental degradation associated with mining for rare metals used in batteries, energy needed to charge batteries, and problems associated with battery disposal. Despite this challenge, current evidence points to a net benefit for PA levels and environmental measures resulting from the replacement of cars with e-bikes where possible [56].

Adverse weather is another environmental challenge associated with active transport that has been identified as a barrier to participation [51,52]. This is likely to worsen with climate change as hotter days result in increases in a variety of non-communicable diseases [10,13], more traffic accidents and more injuries [81,82]. Physiotherapists may not only play a role in addressing climate change by advancing the use and feasibility of active transport across populations, but also by taking broader social responsibility and engaging in, for example, advocacy and social, political and environmental activism, as well as decreasing healthcare system's contribution to climate change [83].

Where supporting infrastructure increases active transport uptake, lack and quality of the dedicated infrastructure is a major deterrent. It increases fear for personal safety and risk of injuries [56,68], for good reason, as increased exposure to traffic *without* dedicated safe spaces will indeed lead to increases in accidents [84]. In contrast with countries investing in active transport infrastructure, there has been a steady increase in pedestrian and cyclist fatalities in the USA, which focus transport infrastructure on personal vehicle use [70,84,85]. Studies investigating the impact of additional cycle tracks on cyclist-motor vehicle collisions, found increases in cyclist numbers and a decrease in collisions, including in areas surrounding the tracks [86]. Traffic volume and speed, low street connectivity, low residential density, land use mix, and features of the natural environment (e.g. hills) have also been identified as barriers to active transport [52]. Providing safe infrastructure that reduces these issues not only increases active transport uptake, but also adds to reductions in healthcare-related costs due to fewer accidents [69].

In addition to advocating for improvements to dedicated infrastructure, physiotherapists should also advocate for active transport routes to be surrounded by biodiverse, health-giving blue and green spaces. This could be supported by revegetation and restoration measures in close proximity to or along active transport routes to increase the abundance and diversity of urban and woodland soil microbiota [87], and woodland restoration to increase the relative abundance of soil microbiota with immune-enhancing qualities [88]. Such restoration measures have positive implications for individual health, for example *via* microbiome exposure, as well as population health *via* the restoration of more general ecosystem services [89].

New technologies may also assist in the uptake of active transport and its ongoing refinement to better support individual user's need and promote health. A recently developed smartphone application, for example, identifies routes with higher amounts of shade from natural and built structures [90]. Similar applications could be developed to overcome other identified barriers (e.g. hills or high vehicle traffic) and promote health through optimized green space and/or blue space exposure en route. Physiotherapists may have a role to play in highlighting the potential use of such new technologies corresponding with individual client needs. Using the combined benefits of such improvements and technologies, physiotherapists could eventually use active transport networks for structured rehabilitation programs and graded exercise participation for suitable populations.

Recommendations

As a global profession we need to:

- Encourage active transport as a form of PA to improve individual and population health while yielding, additional health-related environmental benefits;
- Educate physiotherapists and patients alike about the link between active transport, environment, personal and public health;
- Advocate for safe and better infrastructure for active transport;
- Advocate for more green spaces and less motorized streets without furthering socio-economic divides;

- Advocate for active transport routes in close proximity to biodiverse green spaces, and blue spaces;
- Advocate to make e-bikes and bike-share facilities more accessible to those populations that are unable to afford them but need them the most; and
- Advocate for better integration of active transport with sustainable public transport in a way that ensures physical and financial accessibility.

We have highlighted how the seemingly simple, yet deliberate prescription of active transport could contribute to individual and population health, as well as the health-promoting properties of the natural environment. Being more aware of the potential of active transport prescription and its challenges, will improve our ability to support patient's health and guide health administrators and policymakers to support active transportation as an effective planetary health intervention.

Conclusion

Recommending active transport as a means to engage in and increase PA presents an opportunity for physiotherapists to contribute to planetary health. Yet, the complex relationship of individual health, environment, infrastructure, economy, and societal demands that we become cognizant of context-specific challenges and limitations [91]. If we wish to use active transport as a meaningful intervention to improve the health of people and planet without jeopardizing safety, stakeholders need to recognize these challenges and find solutions that will enable us move to a 'new and better normal'. By recommending active transport and contributing to the reduction of associated barriers and challenges, we have the opportunity to reduce the global burden of disease and improve environmental integrity such that it better supports human health, consistent with a planetary health approach.

Disclosure statement

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