

Additional File 3. Results from the literature review.

Psychological aspects

Most psychological models and theories applied to physical activity define it as an intentional behavior, *i.e.*, that people deliberately engage in it [1], especially in the leisure domain. Intention may be interpreted as a construct that reflects the level of effort that someone would employ to perform a behavior [1-3].

Two meta-analyses have shown intention as the most proximal and strongest construct associated with the adoption and maintenance of leisure-time physical activity (LTPA) [4,5], having found effect sizes of 1.01 and 0.51, respectively. Other three meta-analyses [6-8], not limited to the leisure domain, have also found effect sizes varying from moderate to high, respectively 0.65, 0.51, and 0.43.

Models and theories predict that intention is preceded by attitude, perceived behavioral control (equivalent to perceived competence or self-efficacy [2]), and subjective norms. Attitude expresses the belief that the behavior will lead to certain desired results. Perceived behavioral control represents the belief and capacity to execute the behavior, as well as overcoming barriers using one's own resources. Subjective norms reflect the motivation to behave in conformity with what others expect [1-3].

Two meta-analyses suggest that attitude and perceived behavioral control are predictors of the level of intention to practice LTPA [4,5]. The effect sizes were, respectively, 1.07 and 0.60 for attitude, and 0.90 and 0.57 for perceived behavioral control. As for subjective norms, the effect sizes were smaller: 0.59 and 0.32, respectively. A third meta-analysis, not focused on LTPA, has shown similar results: 0.60 for attitude, 0.55 for perceived behavioral control, and 0.38 for subjective norms [8]. Additionally, during our review, past behavior stood out due to

its strong influence on intention, having similar effect sizes: 0.58 (only LTPA [5]) and 0.55 (several physical activity outcomes [8]), respectively.

Possible predictors of attitude, perceived behavioral control and subjective norms are less explored in literature, especially when referring to physical activity. However, theoretical assumptions [3] and a systematic review of studies carried out in the United Kingdom [9] indicated that the process of turning a casual behavior into habit influences attitude and perceived behavioral control. Further details regarding subjective norms can be found in the next topic.

Additionally, studies of Ding and collaborators [10] and Rech [11], both with LTPA, indicate that perceived behavioral control may also be influenced by one's perceived environment. Some authors, such as Lee and Cubbin [12] and Kamphuis and collaborators [13], also point out that socioeconomic status plays an important role on the levels of attitude and perceived behavioral control.

Finally, at least one meta-analysis [6], three systematic reviews [14-16] and one longitudinal study [17,18] indicated that among people with strong habit (*i.e.*, strong intention to maintain the behavior), the intention of keeping practicing physical activity seems to be less influenced by relapses, as well as other external factors, such as the physical and social environment. However, only one of these works (Rhodes and de Bruijn' systematic review [14]) specifically referred to LTPA.

Social environment

Several theories and models on the adoption and maintenance of health-related behaviors include constructs that represent the influence of the social environment on individual behavior [19]. The influence of the social environment may take place through norms regarding expected behaviors, social support (*e.g.*, enabling access to resources, information, and material for practice), having a companion during practice, encouragement and positive reinforcement from

others, and social learning and role modeling (*e.g.*, observing other people practicing and their means to overcome barriers) [9,20-22].

At least three meta-analyses [4,5,8] – the first two on LTPA – have shown that subjective norms seem to influence people’s intention to practice physical activity, although to a smaller degree than attitude and perceived behavioral control (median value of effect sizes: 0.38 vs. 0.60 and 0.57, respectively). A systematic review by Weldel-Vos and collaborators [23] confirms these results, suggesting a positive association between LTPA and social support or companionship for practice in adults. Allender, Cowburn and Foster [9], in a systematic review of qualitative studies undertaken in the United Kingdom, have also concluded that the lack of social networks and realistic role models are barriers for participating in sports and general LTPA among adults.

Our review also revealed that the source of the social influence is important. Carron, Hausenblas and Mack [24] have observed, in their meta-analysis, that the effect size of social influence on the adoption of physical activity (usually LTPA) is, in general, greater when the source of the influence are people close to the individual (0.36-0.44 vs. 0.25-0.32).

A meta-analysis [6] and systematic review [16] have shown that social influence has a higher impact during the adoption than the maintenance stage. However, none of these works have assessed LTPA separately. On the other hand, at least three original studies that have used mediation analysis [25-27] have shown that attitude and perceived behavioral control mediated at least part of the effect related to the social influence on intention to practice LTPA.

Built environment

In order to present the results of this topic more easily, we organized them following the Aytur and collaborators’ [28] conceptual framework on physical activity in outdoor community recreational environments. The first domain is access, representing how easily people can reach,

use and leave the place, including factors such as traffic, safety, geographical proximity, cost, and ease of transportation. The second domain is quality, reflecting features such as maintenance, conveniences offered, aesthetics, lighting, safety, and layout. The third is usability, referring to features that restrict or support people's engagement with the environment for a specific purpose, such as the amount and diversity of facilities and activities offered.

Access is the most investigated domain. However, only one meta-analysis could be found on the subject. Duncan, Spence and Mummery [29] have reported that adults who informed to have a place for physical activity practice in the neighborhood have shown 20% higher odds (IC95%: 6%-34%) of practicing physical activity, compared with who reported not having such a place in their surroundings. Despite not being restricted to the leisure domain, 73% of the studies included in this meta-analysis have investigated LTPA. At least four systematic reviews of quantitative [23,30-32] and one of qualitative [33] studies also reported a positive association between LTPA practice and objective or subjective measures of access, which involve the distance to or density of places where physical activity can be practiced. One of these reviews [23], however, suggested possible weak associations. Moreover, a systematic review focused on studies conducted in European countries [34] have not observed association between access, density or proximity to places where physical activity can be practiced and levels of LTPA.

As for quality, two systematic reviews have pointed out that the perception of conveniences offered, maintenance, overall condition, aesthetics, and safety were positively associated with LTPA [33,35]. On the other hand, Wendel-Vos and collaborators [23] have not observed association between physical activity practice and perceived aesthetics and safety, although observed positive association with conveniences offered.

Regarding the usability of recreational places, the amount and diversity of facilities and opportunities to practice physical activity have consistently shown positive associations to

LTPA practice in at least four systematic reviews [23,32,33,35], one of which dedicated to qualitative studies [33].

A review of reviews [36] found during our research has pointed out that social inequalities also seem to affect the access and quality of places for practice. In general, people living in more disadvantaged areas have reported more difficulties to access recreational places, as well as lower quality of these places. Moreover, access to these places seemed to influence the total physical activity level among these people in a much higher extent than it does among people living in richer areas.

A review conducted by Yang [37] has shown consistent evidence of an interaction between built environment and psychological attributes influencing LTPA practice. Based on the selected original studies, the author suggested that the built environment has a moderating effect, which influence is smaller on people with very positive or negative psychological attributes, resulting in a less powerful effect of the built environment on the likelihood to practice physical activity in such situations.

Finally, at least one original study [38] suggested that the perceived environment mediates the environment's influence on LTPA, and also that the subjective assessment of the built environment depends on its objective features. Another two original studies corroborate these findings, although they have investigated total [39] and transport-related [40] physical activity. On the other hand, one study did not observe this mediating effect of the perceived environment when investigating leisure walking [40].

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