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A systematic review of published evidence on the determinants of physical activity habit strength

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ADMINISTRATIVE INFORMATION

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Conflicts of interest - The authors declare that there are no conflicts of interest regarding the publication of this systematic review and metaanalysis. We wish to affirm that we have no financial, personal, or professional interests that could potentially influence our objectivity or the integrity of the research presented in this work. This includes, but is not limited to, financial relationships, affiliations, or involvement with organizations or entities that could be perceived as having a vested interest in the outcome of this study.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 February 2024 and was last updated on 24 February 2024.

INTRODUCTION

Review question / Objective Summarizing the published evidence, the following six questions are proposed to be addressed: (1) What are the determinants that identify the habit strength of physical activity? (2) In which theoretical frameworks are these determinants typically considered alongside habits? (3) What is the methodological quality of the current evidence? (4) What study designs have researchers used? (5) In which countries are current studies primarily conducted? (6) What gaps remain in the field that warrant further research in the future?

Condition being studied In the fields of health psychology, exercise psychology, and social psychology, international researchers have made significant strides in studying the habit strength of physical activity. Studies in these domains focus on how individuals form, modify, and maintain physical activity habits, as well as the impact of these habits on health and psychological well-being.

Researchers employ various theoretical frameworks and methodologies to explore factors influencing physical activity habits, including individual psychological processes, social environments, and cultural differences. This research not only enhances our understanding of the mechanisms behind the formation of physical activity habits but also provides a theoretical basis

for developing interventions to promote healthy behaviors.

METHODS

Search strategy After two rounds of pre-search testing, we decided to eliminate the search term restrictions on “study design” in order to improve the recall ratio. Four sets of search terms were specified; search terms standing for physical activity, habits, and determinants were combined. We excluded some lifestyle-related interfering words such as sleep, diet, beverage, and nutrition from the Pubmed’s Medical Subject Headings (MeSH) with the aim of improving the precision of the search results. When physical activity habits were considered in these contexts, habits were rarely assessed through tools capturing automaticity. Rather, habits tended to be replaced by physical activity levels (e.g., the Baecke Questionnaire of Habitual Physical Activity).

The search covered the period from 2000 to December 2023. The fields used in each database varied slightly, nevertheless, because the selected databases offered different field options. Taking the Web of Science database as an example, the search formula is: (((((((physical activity[Title/Abstract]) OR (exercise[Title/Abstract])) OR (fitness[Title/Abstract])) NOT (((((((sleep*[Title/Abstract]) OR (screen[Title/Abstract])) OR (diet*[Title/Abstract]) OR (food[Title/Abstract]) OR (nutriti*[Title/Abstract]) OR (eating[Title/Abstract])) OR (beverage*[Title/Abstract]) OR (drink*[Title/Abstract])) OR (fruit[Title/Abstract])) OR (vegetable[Title/Abstract])))) AND (((habit*[Title/Abstract]) OR (automaticity[Title/Abstract])) OR (habit strength[Title/Abstract])))) AND (((((((determinant*[Title/Abstract]) OR (control*[Title/Abstract])) OR (interven*[Title/Abstract])) OR (correlat*[Title/Abstract])) OR (associat*[Title/Abstract])) OR (mediat*[Title/Abstract])) OR (predict*[Title/Abstract])) OR (relat*[Title/Abstract])))) AND (“2000”[Date - Publication] : “2023”[Date - Publication])) AND (English[Language]).

Participant or population Human participants.

Intervention Not Applicable.

Comparator Not Applicable.

Study designs to be included Studies were classified as (1) randomized controlled trials (RCTs), including experimental studies with a randomized design and a control arm; (2) quasi-experimental studies, including experimental studies with a control group but without a randomized design; (3) uncontrolled intervention

studies, including studies with only one (experimental) arm or an RCT-study of which only an intervention arm was analyzed; and (4) observational studies, including prospective longitudinal studies.

Eligibility criteria In order to be included, studies must have (1) been published in peer-reviewed journals between 2000 and 2023; (2) been written in full text using the English language; (3) focused on human participants; (4) used a longitudinal (observational) or experimental design; (5) focused on established habits or the process of habit development, using PA habit strength as a mediator or outcome variable; and (6) measured psychological habits using specified tools (i.e., SRHI and its variants). Qualitative studies and various types of reviews were excluded. Cross-sectional studies do not provide sufficient evidence of causal inference for associations between underlying factors and habits, so this type of design was not considered in the current review. In addition, studies that inferred the development of habits from behavioral frequency alone were excluded. Because this measure fails to distinguish between reasoned and automatic behavior, both deliberation and habit may produce patterns of behavior with the same frequency.

Information sources From January 25 to February 8, 2024, we identified potentially relevant published literature by searching five English-language databases (i.e., PubMed, Web of Science, PsycArticles, PsycINFO, and SPORTDiscus with Full Text). Meanwhile, we retrieved the reference lists of seven relevant reviews (Feil et al., 2021; Fritz et al., 2020; Gardner et al., 2011; Gardner, 2015; Hagger, 2018; Ma et al., 2023; Rebar et al., 2016) to avoid omissions.

Main outcome(s) Physical activity habit strength.

Quality assessment / Risk of bias analysis A modified version of the Uijtdewilligen et al. (2011) quality assessment tool was utilized for the quality assessment. Four dimensions of the methodological quality were assessed by the criteria list: (1) study attrition and follow-up duration; (2) assessment of determinants; (3) assessment of PA habit strength; and (4) data analyses.

The methodological quality score of each study was assessed by calculating the percentage of items that were scored positively, relative to the number of applicable quality items. Each criterion may be scored 0 or 1, for a total of 10 points per article. If the quality score was $\geq 70\%$ the study was considered to be of high methodological

quality. A score <70% was considered as low quality.

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Strategy of data synthesis The visual display of the determinants was performed by using a doughnut chart in Hplot Pro (<https://hiplot.com.cn/>), a comprehensive web service for biomedical data analysis and visualization. In line with other reviews (Uijtdewilligen et al., 2011; van Stralen et al., 2009), the determinants of PA habit strength were categorized into five groups: (1) demographic and biological determinants (e.g., age, gender); (2) behavioral determinants (e.g., past behavior, consistency of exercise); (3) psychological determinants (e.g., intention, self-efficacy); (4) social determinants (e.g., social support, social norms); and (5) physical environment determinants (e.g., PA facilities, traffic safety).

To evaluate the evidence level for each determinant, we integrated the study quality in which the determinant was measured with the consistency of the association's direction for each determinant. We applied a best evidence synthesis incorporating the following three tiers (Uijtdewilligen et al., 2011): (1) strong evidence, derived from consistently convergent results in multiple (≥ 2) high-quality studies; (2) moderate evidence, derived from generally consistent findings in one high-quality study and one or more low-quality studies, or in multiple (≥ 2) low-quality studies; and (3) insufficient evidence, with only one available study or inconsistent findings in multiple (≥ 2) studies. It is important to emphasize that when at least 75% of the results showed a consistent direction, we considered these results to be in agreement. If there were two or more studies with higher methodological quality, we ignored studies with lower methodological quality in the evidence synthesis.

Subgroup analysis Not Applicable.

Sensitivity analysis Not Applicable.

Country(ies) involved China.

Keywords Physical activity; Habit; Determinants; Dual-process theory; Habit formation Theory.

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