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Psychological mediators of relations between socio-structural variables and physical activity: A proposed mechanistic model

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ABSTRACT

Regular participation in moderate-to-vigorous physical activity has been associated with adaptive physical and psychological health benefits including lower risk of non-communicable disease and reduced incidence of mental health conditions. However, a substantive majority the global population does not participate in sufficient physical activity to confer these health benefits, and inactivity levels are particularly high in underrepresented and disadvantaged minority groups, as indicated by negative associations between physical activity participation and socio-structural variables (e.g., socioeconomic status, income, education, health literacy). In addition, evidence suggests that participation in health behaviors such as physical activity partially mediates the association between these sociodemographic variables and health outcomes. We propose a process model specifying a candidate mechanism that may explain the association between socio-structural variables that represent disparity and health behaviors such as physical activity. Specifically, we propose a model in which beliefs such as attitudes, subjective norms, risk perceptions, and self-efficacy mediate associations between socio-structural variables and physical activity participation. After proposing the basic tenets of the model, we provide several examples illustrating the proposed effects for socio-structural variables including socioeconomic status and income, education, and health literacy in Asian contexts, and outline how these effects should be interpreted. We conclude by outlining the theoretical and practical relevance of these findings, and how they may inform interventions aimed at having adaptive effects on health outcomes by promoting physical activity participation and assisting in reducing health behavior disparities in Asian populations.

Physical activity has been linked with reduced risk of non-communicable disease (e.g., heart disease, diabetes, cancer) and mental health conditions (e.g., depression, anxiety) that have high prevalence in many global regions, including Asia (Biddle et al., 2003; OECD/WHO, 2023). Despite the established links between better physical and psychological health and regular participation in moderate-to-vigorous physical activity, a substantive proportion of individuals worldwide do not participate in sufficient physical activity to confer these health benefits. Globally, 1.4 billion adults are insufficiently active and there has been no discernible improvement in global physical activity levels since 2001 (WHO, 2022). In the Asian region, there is substantial within- and between-country variation in physical activity levels (Ranasinghe et al., 2013). For example, estimates of the percentage of the population that is physically inactive in India vary substantially, and range from 18.5 % and 88.4 % (Ranasinghe et al., 2013), while at least 40 % of adults are reported to be physically inactive in Japan and Taiwan (Annear et al., 2021; Bauman et al., 2009). These studies suggest that despite the diversity of political climates, environments, and cultures in the region, physical inactivity is highly prevalent across Asian countries. Importantly, while physical activity of the general population are insufficient to confer health benefits, participation is disproportionately lower in individuals from underrepresented and disadvantaged groups, as indicated by negative associations between physical activity participation and socio-structural variables representing disparities such as socioeconomic status, education, and health literacy (Barsell et al., 2018; Juneau et al., 2015; Kari et al., 2020).

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Identifying socio-structural factors that are indicative of disparities in physical activity participation is of particular importance in countries where high levels of income and education inequality are observed. During the 1990s and 2000s, income inequality rose across Asia and the Pacific, particularly in China and India (Yang, 2020). While there has been a dramatic reduction in extreme poverty in recent decades, this reduction has been accompanied by rising income inequality in large areas of Asia (Zhuang, 2023). The increased inequality may manifest in greater health disparities between lower and higher income communities in this region, including disparities in participation in health behaviors such as physical activity. This highlights the need identify the socio-structural variables associated with health behavior participation that characterizes such disparities and, importantly, to identify possible mediators of these associations which may point to possible solutions through behavioral intervention.

One set of proposed mediators are the psychological constructs that represent individuals' processing of social information and are purported to affect their subsequent decision making with respect to health behaviors. Specifically, recent theory and research has proposed and tested the hypothesis that belief-based constructs derived from social cognition theories applied in health behavior contexts may serve to mediate associations between socio-structural variables and health behavior (e.g., Godin et al., 2010; Hagger & Hamilton, 2021; McAnally & Hagger, 2023; Orbell et al., 2017; Schüz, 2017). The proposal of such a mechanism is purported to represent how individuals' economic and social environment, that is, their available resources (e.g., income), access to services (e.g., healthcare, education), support networks (e.g., family support), and socio-environmental conditions and circumstances (e.g., place of living, employment) relates to their health behavior participation through their influence on the sets of beliefs (e.g., attitudes, norms, perceived capacity) involved in decision making and serve to motivate their uptake and maintenance of those health behaviors. In the next sections, we introduce a process model that links socio-structural variables that represent individuals' economic and social environment to physical activity participation through the mediation of social cognition constructs that represent the motivational processes that lead to decisions to participate in physical activity. The model aims to provide an empirically testable set of hypotheses to guide future research to verify this mechanism. In doing so we provide several illustrative examples of how specific socio-structural variables (e.g., education, income, health literacy) relate to physical activity through their influence on the sets of beliefs that underpin behavioral decision making according to social cognition theories. The proposed model also provides guidance on how the development of foundational evidence in support of its predictions may serve to inform potential strategies to be used in behavioral interventions to promote physical activity.

A proposed process model linking socio-structural variables with physical activity participation

Although disparities in physical activity participation associated with socio-structural variables have been observed in social epidemiological research (Barsell et al., 2018; Juneau et al., 2015; Kari et al., 2020), theoretical means to explain these associations, and the associated empirical evidence to support them, are relatively sparse. One possible mechanism offered to assist in explaining these disparities is through effects of the socio-structural variables that serve to indicate disparity on the sets of beliefs involved in individuals' decisions to engage in physical activity. Numerous theorists have proposed a model in which relations between socio-structural variables and health behavior are mediated by beliefs, as represented by constructs from multiple existing social cognition theories such as protection motivation theory (Rogers, 1975), theory of planned behavior (Ajzen, 1985), and the health belief model (Janz & Becker, 1984). A central premise of social cognition theories is that individuals' social and economic environment serves as a source of information from which individuals draw when making decisions to perform behaviors and, as such, effects of variables representing such information on behavioral engagement should be mediated by these beliefs (see Ajzen, 1991; Godin et al., 2010; Hagger, 2019). Such models have also been tested in a number of contexts, with generalized support for the indirect effect of socio-structural variables on behavior mediated by social cognition constructs in multiple contexts and behaviors (Godin et al., 2010; Hagger & Hamilton, 2021). The model has value in that it provides a possible mechanism to explain associations between socio-structural variables and health behavior participation, particularly, why there may be disparities in engagement in these behaviors from underserved groups (e.g., lower participation in health behaviors among lower income individuals and those with poorer education). That is, that the observed disparities may be due to compromising effects of individuals social environment on the beliefs likely to line up decisions to participate in the health behavior. For example, individuals with lower education may not have sufficient knowledge to comprehend health information or recognize the link between the behavior and health risks, which affects their perceptions of risk regarding performance of health promoting or health protective behaviors.

Based on this prior research, we propose a process model in which effects of socio-structural variables such as socioeconomic status, education, and health literacy on physical activity and health outcomes are mediated by the belief-based variables derived from social cognition theories. In this model, socio-structural variables effectively serve as sources of information on which their beliefs about physical activity are based represented by core constructs from key social cognition theories (e.g., Fishbein et al., 2001; Hagger & Orbell, 2022; Hamilton et al., 2020; McMillan & Conner, 2007; Protogerou & Hagger, 2017). These include beliefs about the value of behavior (e.g., attitudes), beliefs about risk (e.g., perceived susceptibility, perceived vulnerability), perceptions relating to capacity (e.g., self-efficacy, perceived behavior control) and perceived social influences (e.g., subjective norms) [1]. Consistent with these theories, these beliefs serve as proximal determinants of intentions toward, and actual participation in, physical activity in future. Therefore, socio-structural factors, which are indicative of social context and environment, permeate beliefs about physical activity which, in turn, affect decisions to participate in physical activity. Given that regular participation in physical activity is proposed to ultimately lead to health outcomes (e.g., reduced risk of non-communicable disease, better psychological health), such a model may provide important information on the processes by which individuals' social context and environment relate to their health behavior and outcomes.

The proposed model is presented in Fig. 1. In the model, socio-structural variables (e.g., socioeconomic status, education, health literacy) are depicted as determinants of social cognition beliefs (e.g., attitudes, subjective norms, self-efficacy, etc.). Effects of these belief-based social cognition constructs on subsequent physical activity participation are proposed to be mediated by intentions, which reflect individuals' motivation to perform the behavior in further and serve as the most proximal determinant of physical activity. Importantly, the model

[1] Social cognition theories such as the protection motivation theory (Rogers, 1975), the theory of planned behavior (Ajzen, 1985, 1991; see also, Hagger, 2019; Hagger and Hamilton, 2023a), and the health belief model (Janz & Becker, 1984) report multiple constructs as behavioral determinants. There is broad recognition that there is substantive redundancy across these constructs such that constructs with similar content are referred to by different labels, a 'jangle' fallacy (Block, 1995; Hagger et al., 2017). To manage this problem in the current research we concerned ourselves with a core set belief-based constructs with unified labels and definitions for each derived from commonalities in construct content across multiple theories. These constructs are proposed to adequately capture the essential sets of beliefs implicated in individuals' decision making. We based our decisions on prior integrative and expert consensus research that has identified these core constructs through reviews of social cognition theories (Fishbein et al., 2001; McMillan & Conner, 2007).

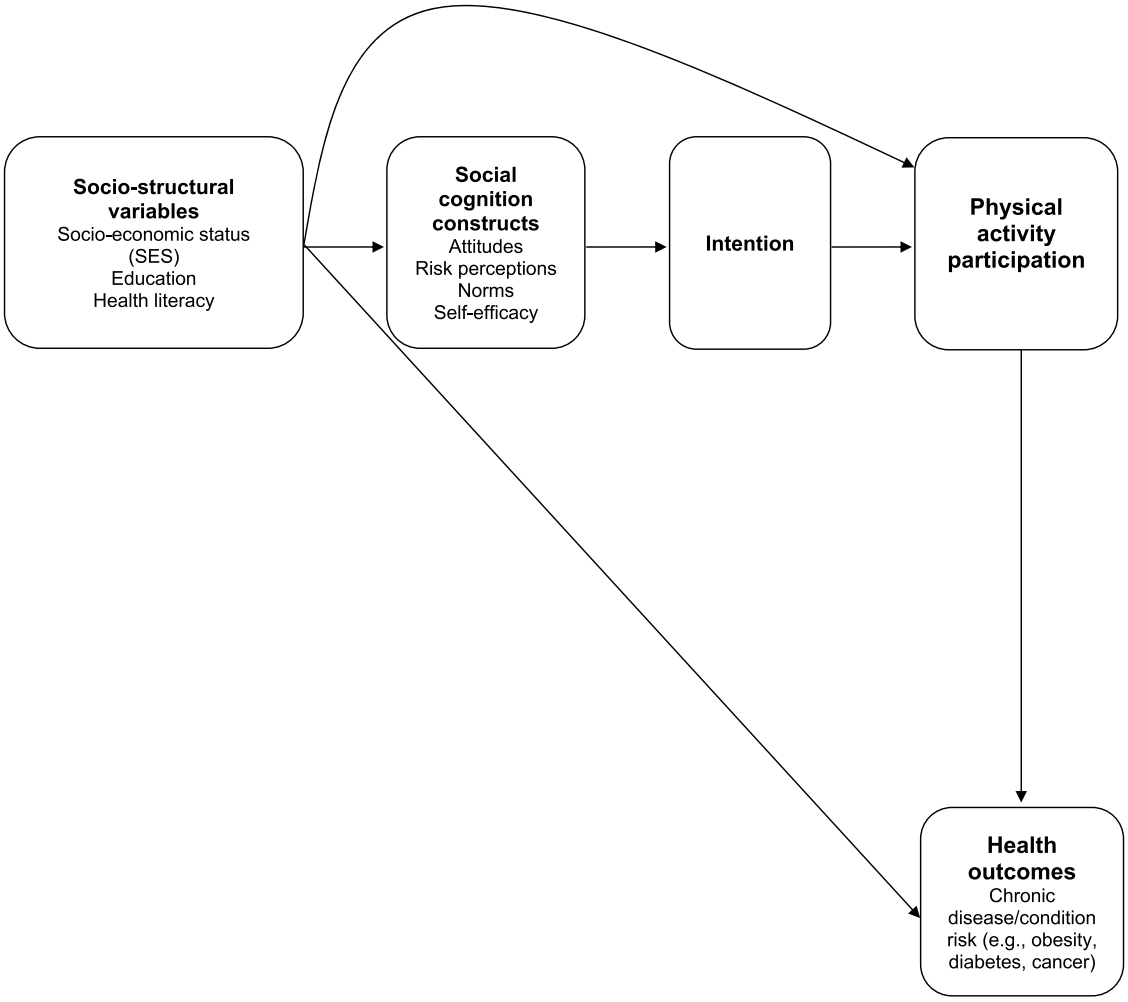

Fig. 1. Proposed model outlining the processes by which socio-structural variables relate to behavioral intertions, health behaviors, and health outcomes mediated by theory-based social cognition constructsl.

proposes indirect effects of socio-structural variables on physical activity and health outcomes through the social cognition constructs, the key process which represents the mechanistic explanation of how social contexts in environment may related to health behavior. Ultimately, participation in physical activity over time is expected to have effects on health, as represented by the association between physical activity and health outcomes. Ultimately, the social cognition constructs and intentions serve to explain, at least in part, the observed relations between socio-structural variables and behavior and health, indicated by the direct effects of these variables on physical activity and health outcomes.

Other than elucidating a potential mechanism by which social-structural variables relate to physical activity participation and health related outcomes, the process model may assist in informing intervention efforts to promote physical activity participation through the identification of potential modifiable constructs that could be targeted by the content of these interventions. The associations between socio-structural variables and physical activity participation may imply that resolution of disparities in physical activity participation in underserved groups indicated by those associations may lie in targeting change the social structures involved. However, changes in socio-structural variables are often unfeasible or prohibitively expensive (e.g., changing structural healthcare access, or changing education systems) and are therefore not viable targets for individual-level interventions (c.f., Chater & Loewenstein, 2022). However, if social cognition constructs are shown to mediate effects of socio-structural variables on physical activity participation, as proposed in our model, they may serve as more viable targets for intervention. Social cognition constructs are considered more malleable than the social structural variables whose effects on behavior they are purported to mediate. Specifically, there is research suggesting that techniques and strategies included in behavioral interventions, such as messages that highlight risk or promoting successful practice, could lead to changed in relevant beliefs regarding future participation in the behavior, such as the link between behavior and health risk or beliefs in personal capacity to successfully perform the behavior, and can therefore be targeted by behavioral interventions to produce individual-level change (Hagger et al., 2020a, 2020b; Sheeran et al., 2017). This is based on research examining the proposed theory-based mechanisms by which interventions are purported to operate in changing behavior, that is, through changing the psychological constructs that represent the change or activation of mental processes that line up future participation in the behavior (Sheeran et al., 2023). Therefore, interventions that systematically target the mediating social cognition beliefs of the effect of socio-structural variables on physical activity participation may be efficacious in affecting change in subsequent physical activity participation and, particularly, resolving observed disparities in physical activity behavior.

In summary, our process model suggests that belief-based social cognition constructs may partially explain the link between socio-structural constructs and physical activity participation and health outcomes. The value of identifying these belief-based mediators is that they may signal the potentially modifiable constructs that could be

targeted for change in behavioral interventions aimed at promoting physical activity change and, ultimately, promoting adaptive health outcomes. In the following sections, we provide illustrative examples of how this process model can be applied to provide a mechanistic explanation for the relationship between key socio-structural and physical activity – relations which are indicative of disparities in health behavior participation.

Socioeconomic status

Socioeconomic status is one of many socio-structural variables associated with physical activity participation and health outcomes, and can be indicative of the disparities observed in this health behavior due to economic and social circumstances (Adler et al., 1994). Socioeconomic status refers to individuals' economic and social standing and reflects their available resources such as economic resources (e.g., income, benefits, savings), which can determine, for example, their level of access to health care services and their capacity to pursue health behaviors such as physical activity. Individuals with lower socioeconomic status report engaging in lower levels of physical activity, and this relationship is found across the lifespan from adolescence to older age (Juneau et al., 2015; Stalling et al., 2022). In addition, the relationship between low socioeconomic status and physical inactivity has been found in populations from countries in the Asia region including South Korea (Lee et al., 2019), Taiwan (Lin et al., 2017), and China (Chen et al., 2015).

With respect to the proposed process model, socioeconomic status reflects individuals' resource availability that may serve as a source of information for them when they estimate their beliefs with respect to their perceived capacity to perform health behaviors in future. For example, individuals on low incomes cannot afford access to facilities, equipment, or safe spaces for physical activity, which may be reflected in their perceived barriers toward participating in physical activity in future. Given that high barriers and low perceived capacity are likely to lead to lower intentions to perform physical activity in future, such beliefs may partially explain the links between socioeconomic status and lower physical activity participation. This is supported in prior research, for example, studies have found higher socioeconomic status is associated with fewer perceived barriers and participation in more physical activity among Taiwanese women (Chen et al., 2015). Lower socioeconomic status may affect physical activity by affecting individuals' capacity beliefs or *self-efficacy* to perform physical activity in future. Self-efficacy is a subjective assessment of the level of control an individual expects to have within a situation and can affect the amount of effort an individual is willing to invest in a behavior (Bandura, 1997). It is also a strong correlate of physical activity in many populations, including Asian populations (Hu et al., 2021; McAuley & Blissmer, 2000). Individuals who have not had the opportunity to participate in physical activity and gain experiences of success because of their socioeconomic status, are more likely to report lower self-efficacy to perform physical activity in future. Therefore, individuals with lower socioeconomic status may feel they are less capable of being physically active, may be less likely to form intentions toward to be physically active, and may be less likely to participate in physical activity, in future. Consistent with this approach, prior research has confirmed this mediation effect. For example, a study demonstrated that the relationship between socioeconomic status and recreational walking was partially mediated by self-efficacy (Cerin & Leslie, 2008).

Similarly, prior experiences of normative behaviors within a social group may also be reflected in individuals' normative beliefs and affect their decisions to participate in physical activity in future. For example, escalating costs of physical activity (e.g., high prices of gym memberships or transport to reach facilities) may lead individuals on low incomes to generally forego purchasing memberships or opt not to travel to the facilities because they are perceived to be unaffordable in the long run. Observation of such trends within one's social group may foster perceptions that physical activity is not attainable for those on similar lower incomes or with the same financial resources and that such trends are normative. This is likely to be reflected in individuals' descriptive norms with respect to physical activity, which reflect beliefs in the extent to which individuals within one's close social group are likely to perform a behavior. Thus the effect of socioeconomic status, reflecting lack of resources to access physical activity, on physical activity intentions and behavior, may be mediated by individuals' normative beliefs.

The proposed process model is relevant to an Asian population due to the higher rates of income inequality within Asian countries such as China and India (Cerin & Leslie, 2008). In the face of income inequality, a large percentage of the population might perceive more barriers to physical activity, have lower self-efficacy for physical activity, and report descriptive norms that reflect lack of access to physical activity for their social group. While the full process model examining this proposed pattern of effects for physical activity has not been applied in Asia, the extant literature supports an association of self-efficacy and physical activity in Chinese university employees (Hu et al., 2021), and in Korean (Kang & Kim, 2015) and Chinese (Hu et al., 2016) students. Future research should, therefore, seek to apply the proposed process model to test the proposed mediation effects in this context. Application of the model may assist in elucidating a potential mechanism by which socioeconomic status relates to physical activity intention and participation.

Education

Education level is a further key socio-structural variable that has been consistently linked with physical activity participation across different socioeconomic groups (Shaw & Spokane, 2008). Specifically, studies have indicated that educational attainment is positively related to physical activity participation and adaptive health outcomes (Kari et al., 2020; Scholes & Bann, 2018). These associations could be attributed to individuals with higher education attainment being more knowledgeable about the health benefits of physical activity, being more informed on physical activity guidelines and having better understanding of means to uptake physical activity, and having greater access to health information (Mirowsky & Ross, 2017).

Consistent with research in other national contexts, similar patterns of associations between physical activity participation and education attainment have been observed in studies conducted in Asian countries. For example, individuals with higher levels of education have been shown to be more likely to exercise regularly (Park & Kang, 2008) and education has been identified as a positive correlate of physical activity (Bauman et al., 2012). As with other research, this may be attributable to knowledge about health benefits. For example, South Asian females with lower levels of education exhibit inadequate knowledge regarding the health benefits of exercise and the amount of physical activity required for achieving optimal health (Ranasinghe et al., 2013). The association between education levels and physical activity participation in Asian populations indicate health behavior disparities provide further imperative for efforts aimed at promoting physical activity among groups with lower levels of education in these populations.

In keeping with the proposals of our mechanistic model, one possible mechanism by which lower levels of education may be linked to lower levels of physical activity is through the sets of beliefs implicated in the decision-making context. For example, individuals with lower levels of knowledge about the health benefits of physical activity, and the risks associated with inactivity, may have difficulty creating a link between positive health outcomes and physical activity. This is likely to manifest in their beliefs about the utility of the behavior, that is, they will not see their future physical activity participation as having salient benefits, and may, as a consequence, report lower attitudes toward physical activity when prompted. Similarly, individuals with lower levels of education may lack knowledge of the methods and means to engage in appropriate

physical activity for health, and may have limited access to information and resources needed to develop the skills and knowledge necessary to do so. As a consequence, they may perceive performing physical activity as difficult and challenging. This is expected to be reflected in their beliefs regarding their capacity to perform the behavior insofar as they report lower self-efficacy to perform physical activity in future. That both attitudes and self-efficacy are key correlates of physical activity intention and behavior implies a mediating role for these belief-based constructs on the relationship between education level and participation physical activity participation. This highlights how individuals' beliefs in their capacity to engage in physical activity serve as salient mediators of the relationship between education and physical activity. In Asian contexts, where a significant proportion of the population has low education levels (Friel et al., 2011), the inability to perform a certain behavior due to a lack of knowledge could account for the lower levels of physical activity engagement observed among this population.

Taken together, the proposed process model indicates that lack of knowledge specific to physical activity may be reflected in lower attitudes and lower self-efficacy in performing the desired behavior and may, therefore, be related to lower intentions toward, and actual participation in, physical activity. This implies that efforts to intervene to change physical activity may focus on targeting these modifiable determinants (e.g., attitudes, subjective norms, and perceived behavioral control) to promote adaptive beliefs and intentions toward, and subsequent participation in physical activity, among individuals with lower education levels.

Health literacy

A socio-structural variable closely related to education that has also been associated with health behavior participation and outcomes is health literacy. Health literacy is defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information (Baker, 2006). Although health literacy is highly correlated with other indices of disparity like socioeconomic status or education level, it has been shown to have unique effects on health behaviors when statistically controlling for the effects of other socio-structural variables (Chang, 2011; Wolf et al., 2005). Higher levels of health literacy may promote health behavior participation because it affords individuals' increased capacity to act on their personal health information. A number of studies have shown that adequate health literacy is positively associated with participation in health behaviors. These findings are consistent across behaviors, with adequate health literacy positively associated with physical activity participation and healthy eating, and negatively associated with smoking and alcohol consumption. Health literacy has also been positively correlated with general preventive health behaviors like wearing sunscreen and cancer screening attendance (Gunawan et al., 2018; McAnally & Hagger, 2023). Moreover, individuals with adequate health literacy were more likely to meet physical activity recommendations more than those with inadequate health literacy (Aaby et al., 2020). Although these associations has been widely demonstrated, the research has mostly been conducted in Western or European samples, with relatively limited research studying these relations in Asian populations (Tang et al., 2017).

With respect to our proposed model health literacy serves as another socio-structural variable whose association with physical activity may be mediated by the sets of beliefs proposed to line up health behaviors as expressed in social cognition theories. Specifically, individuals with adequate health literacy are more likely to have the capacity to understand and utilize health information or have increased capability of engaging in the behavior. This is summarized in the beliefs individuals likely hold regarding their performance of physical activity in future, including their perceived utility of physical activity, expressed as attitudes, perceived risks associated with engaging or abstaining from performing physical activity, captured in risk perceptions, or their confidence in successfully engaging in physical activity in future, represented by self-efficacy. Given that attitudes, risk perceptions, and self-efficacy have been shown to be related to health behavior intentions and behavior, including in physical activity contexts, the mechanistic explanation for health literacy-physical activity relationship is implied. Specifically, adequate health literacy is likely to be positively related to attitudes and self-efficacy (Barsell et al., 2018), and negatively related to risk perceptions, with respect to future physical activity participation, and more likely report intentions to perform, and participate in, subsequent physical activity. This is because individuals who have the capacity to obtain and interpret health information and use it are more likely to see high value, lower risks, and perceive greater personal capacity to perform preventive health behaviors such as physical activity. This is because individuals who have the capacity to obtain and interpret health information and use it are more likely to see high value and lower risks to performing the behavior, and perceive greater personal capacity to perform it. For example, individuals may view physical activity as having value in maintaining fitness, expected to be expressed in their attitudes, perceive that physical activity is likely to reduce risk of health threats such as chronic disease, reflected in their risk perceptions, and report confidence in their ability to perform a given physical activity in future, likely represented in their self-efficacy beliefs.

Primary and meta-analytic research has provided evidence for a process model in which the association between health literacy and health behavior participation is mediated by social cognition constructs (Adams et al., 2013; McAnally & Hagger, 2023). Despite this evidence there remains a relatively dearth of research testing this model in physical activity in Asian populations. While the component associations may have been verified, demonstrating, for example, associations between health literacy and physical activity participation, and between social cognition constructs and physical activity intentions and behavior, tests of the mechanism implied in the process model are absent, as is high quality longitudinal and experimental research in this context. As high variability in health literacy levels (Li et al., 2021), and high prevalence of inadequate health literacy (Rajah et al., 2019), pervade in many Asian countries, testing this model in these contests should be considered high priority.

Implications for intervention

In the previous sections, we provided illustrative examples of how our proposed process model can be applied to provide a mechanistic explanation of relations between socio-structural variables and physical activity participation, and as a consequence, how the model may at least, in part, outline one reason for observed disparities in physical activity participation. The process model may also provide potential guidance for practice by catalyzing research on the socio-structural and social cognition correlates of physical activity which, may, ultimately indicate possible approaches for interventions aimed at promoting physical activity, particularly to redress disparities in participation. Associations between socio-structural factors and physical activity may indicate that change in such factors may ultimately impact physical activity participation. However, affecting change in many of the socio-structural factors identified here such as socioeconomic status and education and health literacy levels is likely to be unfeasible and prohibitively costly. Such structural changes likely necessitate broad systemic changes (e.g., introducing employment schemes to redress imbalances in income in low-income populations; broadening access to education among those with inadequate access; changing school curricula to include health literacy instruction) which are complex, expensive, and require large-scale policy change with associated political and financial capital to implement for a wider discussion of this issue see Hagger and Hamilton (2023b).

By contrast, the current model provides an alternative avenue for intervention that can help address disparities in physical activity participation through individual- and group-level interventions that

target change in behavior through change in the mediating constructs. Such interventions are more proximal to the target population, and may be feasible and cost-effective as they do not require the large-scale systemic change of interventions aimed at changing social structures. Specifically, such interventions assume that interventions can deliver behavior change strategies and techniques (e.g., Marques et al., 2023), or prompt self-enactable behavior change techniques (e.g., Knittle et al., 2020), that target change in modifiable theory-based constructs that are purported correlates of behavior, and tap in to the processes by which such techniques are purported to change behavior according to theory, that is, their mechanisms of action (Hagger et al., 2020b; Sheeran et al., 2017). Such interventions could, therefore, focus on targeting salient beliefs that have been shown to be related to physical activity participation and mediate socio-structural variable effects on physical activity participation. This would necessitate additional research to isolate the salient beliefs of the target population that may be deficient or incomplete and, therefore, implicated in the indirect effects. We have provided some examples of such beliefs in the previous sections: they include, but are not limited to, promoting physical activity utility by highlighting benefits, pointing our potential risks, and allaying concerns (targeting change in attitudes and risk perceptions), and providing information about means to be physically activity and prompt successful behavioral practice (targeting self-efficacy change). Such beliefs could then be incorporated in messaging campaigns delivered by multiple means such as media (e.g., social media, web-based, advertising) and practitioner-based (e.g., content such as physical education curricula, training for exercise instructors) interventions (Hagger et al., 2020a). Such interventions would also need to be culturally sensitive and developed through co-design with the members of the community that comprise the target population, and important consideration for the Asian context which is both culturally and ethnically diverse.

Conclusion

Research has reported consistent associations between socio-structural variables such as socioeconomic status, education level, and health literacy that correlate with physical activity and associated health benefits. Such associations are suggestive of substantive disparities in physical activity participation – individuals from lower socioeconomic and educational backgrounds, and those with inadequate health literacy, are less likely to participate in physical activity. Further, research has suggested that disparities in participation in health behaviors such as physical activity account for, at least partially, overall disparities in health outcomes such as chronic disease risk. However, socio-structural variable-physical activity participation relations do not provide information on the potential mechanisms responsible. In the current study, we introduce a process model based on prior theory and research that outlines how belief-based constructs from established social cognition theories serve to mediate the relationships between socio-structural variables and physical activity participation. The model has value because it outlines one potential means to explain these associations and may guide research examining whether this holds in different contexts, populations, and behaviors, particularly physical activity in Asian populations. Importantly, it also provides potential avenues for individual-level interventions which eschew potentially costly and unfeasible systemic interventions that target structural change, and instead focus on changing the potentially modifiable beliefs that are associated with physical activity participation and are implicated in the mechanism of action by which techniques used in intervention content are purported to change behavior (Hagger et al., 2020a).

We have provided illustrative examples of how the proposed model can be applied to partially explain the relationship between a set of key socio-structural variables (socioeconomic status, education, health literacy) and physical activity. However, tests of this model in Asian populations are limited and many of proposed associations outlined are speculative based on the model itself and extant research that is often correlational and focusing only on one of the component associations implied by the model (for a further discussion see Hagger et al., 2023; McAnally & Hagger, 2023). Future researchers should apply this model to verify our predictions and test the indirect effects suggested. Such research should seek to employ fit-for-purpose designs to test such effects, including experimental and intervention work which provides a better foundation for causal inferences. Furthermore, intervention research is needed to verify whether inducing change in targeted social cognition constructs identified in the model leads to change in physical activity participation through change in the belief-based constructs implicated in the model.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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