Social Status and Adolescent Physical Activity: Expanding the Insurance Hypothesis to Incorporate Energy Expenditure

Abstract: *Low social status (SS) is a determinant of poor health status and is associated with increased disease burden. Obesity affects 20.6% of American adolescents, most of whom are from low-SS families. Contributors to the development of obesity among adolescents include sedentary behavior and low levels of physical activity. Environmental determinants—infrastructure, policy, and social relationships— influence engagement in physical activity and are affected by SS. Significant declines in physical activity have been documented during adolescence, and adolescents of low SS engage in significantly less physical activity per week than those with high SS. This article briefly reviews the literature on the relationship between SS and physical activity in adolescents and introduces a proposed biological mechanism that may explain that relationship. Characterizing the effects that SS can have on physical activity may help tailor clinical interventions and public health campaigns seeking to improve*

adolescent physical activity and weight management, thus increasing their effectiveness. This may be particularly beneficial for underserved populations.

Keywords: environment; food insecurity; Insurance Hypothesis; obesity determinants

development of obesity because youth from low-SS families are more likely to have obesity as compared with youth in high-SS families.² Obesity in adolescence increases the risk of developing type II diabetes and having adverse cardiometabolic, pulmonary, and mental health outcomes.³ Longitudinal research shows the gap in obesity prevalence

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Introduction

In the United States, low social status (SS) is a determinant of poor health, and children in families with the lowest income and least education experience worse health than children in families with the highest income and most education.¹ This pertains to the

between low and high-SS adolescents is becoming wider, which could partially be explained by differences in dietary intake and physical activity.⁴

The development of obesity is multifactorial, but one of the primary physiological causes is positive energy balance sustained over time. By increasing energy expenditure, physical

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activity could protect against unhealthy weight gain. However, the research exploring the effects of physical activity on obesity prevention is mixed. From the most recent systematic review and meta-analysis on the association between physical activity and obesity prevention, prospective observational and intervention studies across age groups concluded that physical activity may not be a key determinant of unhealthy gains in adiposity, which corroborates previous reviews on the subject.^{5,6} Conversely, in more recent longitudinal research that objectively tracked physical activity from childhood to the beginning of adulthood, children whose activity declined from ages 5 to 19 were 2.77 times more likely to develop obesity than children who remained consistently active.⁷ Additionally, a 4-year intervention to increase physical activity and decrease sedentary behavior in adolescents showed significant increases in physical activity and lower weight gain in the intervention group at 4 years and 2.5 years after intervention cessation (6.5 years from baseline) when compared with the control group.⁸ What complicates this relationship is that many intervention studies fail to significantly increase physical activity among youth,⁶ and many children and adolescents engaged in interventions continue to fail to meet recommended levels of physical activity in the United States. Thus, there is a possibility that some studies miss capturing the true effect of physical activity on the development of obesity.

Physical activity levels significantly decrease through adolescence,^{9,10} particularly among girls, and evidence points to a disparity in physical activity behavior according to SS. Physical activity behavior can be moderated by environmental determinants such as infrastructure, policy, and social relationships, each of which is influenced by SS. For example, parent support of physical activity is associated with adolescent physical activity behavior.¹¹ If parents with low SS have financial concerns that manifest as long work hours, it may prevent them from providing transportation to or paying for

programs that permit their teen to be active.¹² Even when trying to account for environmental determinants that affect low-SS persons, interventions to improve physical activity do not always show significant effect sizes.¹³ This may be partly a result of a single intervention being unable to account for the multitude of factors that could affect physical activity behavior, but it could also mean that there are factors affecting physical behavior that have yet to be identified.

An existing hypothesis—the Insurance Hypothesis—explores the relationship of perceived deprivation, scarcity, and low SS to energy balance. It has led to interesting insights into underlying biological decision-making mechanisms that affect energy intake; however, implications of this hypothesis for energy expenditure have yet to be explored. The aim of this article is to briefly review the literature related to SS and physical activity and then delve into environmental determinants of physical activity to extrapolate how SS interacts with those determinants to influence physical activity behavior and energy expenditure in adolescents. Finally, the Insurance Hypothesis will be explored as well as the possibility of a biological effect of SS on physical activity behavior.

Social Status and Physical Activity

In the United States, national surveys of adolescent health report a positive relationship between SS and physical activity. Both the National Health and Nutrition Examination Survey and the National Survey of Child Health showed that, since 2005, adolescent activity has differed significantly by how much education parents have,⁴ with the proportion of adolescents engaging in regular activity being significantly smaller for parents with less education (high school education or less).⁴ Interestingly, a systematic review of the association between socioeconomic status (SES) and adolescent physical activity noted that how SES and physical activity are measured can weaken or strengthen the

relationship.¹⁴ Specifically, SES variables that represented finances were more positively correlated with physical activity, whereas neighborhood or environmental SES measures were not associated with an increase in physical activity. Additionally, when physical activity was measured by duration per session, a positive correlation with SES resulted.¹⁴ As SES increased, the duration of activity per bout of activity also increased.

Given that the relationship differs by types of measures, when discussing the relationship between SS and physical activity, it is important to be clear about whether a variable pertains to persons or the environment and the measures that are used. For example, in adults across 4 Asian countries, measures of subjective SS have been positively associated with odds of weekly or daily physical activity.¹⁵ One study of Finnish adolescents showed that school-related subjective SS was positively associated with moderate to vigorous physical activity (MVPA); however, societal subjective SS was not.¹⁶ This could mean that, for adolescents, their perception of their SS relative to other adolescents may have a greater impact on their health behavior than the perceived social standing of their family. However, additional studies are needed to replicate these findings because there is a paucity of research exploring subjective SS and physical activity in adolescents.

Environmental Factors and Physical Activity Behavior

The environment of adolescents can consist of their social environment, such as their family and peers, as well as their physical environment, such as their neighborhood or school. Physical environmental factors have been associated with level of adolescent physical activity: they include neighborhood safety; residential density; secure paths to school; access to parks, recreational facilities, or school/community programs; and policies on school recess, physical education, and

sports.¹⁷⁻²⁰ Specifically, a low level of physical activity is associated with neighborhood crime level,²¹⁻²³ poor quality recreational facilities,¹⁹ limited physical education time or elimination of recess for middle and high schools,²¹ and sparse offerings of school or community activity programs,¹⁹ all of which have been reported as barriers to participation in physical activity. Conversely, a higher level of adolescent physical activity is associated with safe walking or biking paths to school,²⁴ community programs,²⁵ residential density,²⁰ and access to recreational facilities and parks.^{20,25} Given that low-SS neighborhoods tend to have a higher rate of crime, poorer quality public facilities, and less school funding for diverse activity programs, the environment in which low-income adolescents reside appears to dissuade physical activity, making for an obesogenic environment. Furthermore, even if adequate recreational facilities or community programs are available, families with a low income report that they might not be able to participate because of cost and transportation concerns.^{19,21}

Social Support and Physical Activity Behavior

Support for physical activity plays an important role in physical activity patterns. During childhood, parental support facilitates physical activity, and a lack of family support for childhood activity is associated with a decline in physical activity in adolescence.²⁶ Parental support that shows small effect sizes with adolescent physical activity can include praising activity, watching activity, engaging in co-activity, transporting the adolescent to his/her activities, and providing equipment for activity.¹¹ Low-SS adults may work multiple jobs to support their family, limiting the time they can spend watching, transporting, or engaging in co-activity with their adolescent. As a child matures into adolescence, the importance of social environment to physical activity can shift to peer support for some adolescents.^{19,27} Adolescents

with friends who co-participate in physical activity accumulate more MVPA each week than those who do not have friends co-participating.²⁸ Interestingly, among adolescents who identify as Latino or Asian, parental support for physical activity can remain as important as peer support,²⁹ which suggests that support for physical activity varies by ethnicity.

Insurance Hypothesis and Physical Activity Behavior

Most of the determinants of physical activity behavior reported in the literature that can be related to SS are within the physical or social environment, and few studies have explored the possible effects of biological mechanisms.³⁰ Recent research on eating behavior has proposed that, during food deprivation, an underlying biological decision-making mechanism may increase energy intake to preserve survival.^{31,32} This hypothesis, known as the Insurance Hypothesis or the Resource Scarcity Hypothesis, posits that persons who experience food insecurity, which is more prevalent in families of low SS, will consume calories in excess of energy needs to store up energy in case food becomes unavailable.³³⁻³⁵ Randomized studies by our group and others demonstrate that the experience of being placed in a low-SS position can drive excess calorie consumption^{31,32,36} and alter satiety hormone signaling.³⁷ Applying these findings to physical activity behavior begs the question: Could this same mechanism influence energy expenditure? We hypothesize that food insecurity and other environmental insecurities that often arise in low-SS conditions, such as housing insecurity, may not only increase energy intake, but also decrease energy expenditure for the same reason: to preserve energy. A causal relationship has yet to be delineated, but a few studies of adolescents have looked at the correlation between physical activity and food insecurity.^{38,39} In a sample of students in their first year of college, those experiencing food insecurity were

less likely to engage in healthy physical activity habits on campus.³⁸ Additionally, a representative survey of adolescents in Trinidad and the West Indies found that food-insecure adolescents were more likely to intentionally gain weight and refrain from physical activity than food secure adolescents.³⁹ Both these observational studies show an inverse association between food insecurity and physical activity; however, randomized controlled studies are needed to further test the Insurance Hypothesis as it relates to energy expenditure.⁴⁰

Implications

Physical activity behavior is linked to SS in the form of environmental and possibly biological factors. These factors may contribute to a decline in physical activity in adolescents and further complicate guidance for lifestyle modification. Factors such as neighborhood safety and school policy reflect larger systemic issues that require policy change, which should be incorporated into multilevel ecological interventions addressing correlates of low-SS adolescent physical activity.³⁰ Other factors, however, such as peer support or use of recreational facilities might be improved through public health campaigns that focus on changing perceptions about physical activity.⁴¹ A geospatial analysis in Australia, combined with resident surveys, showed that when walkability and access to facilities was equal between low- and high-SES neighborhoods, residents of low SES neighborhoods still reported lower levels of activity.⁴¹ Survey responses showed that persons of low SES perceived their neighborhood as less attractive for and less supportive of walking, which reflects a possible sociocultural perspective toward physical activity.⁴¹ Thus, community and school interventions that focus on improving perceptions toward physical activity and that highlight positive aspects of the infrastructure may help increase physical activity in low-SS adolescents. Community interventions to improve and promote spaces for physical activity as

well as social support interventions have been effective in adults of low SS and merit further testing in adolescent populations.¹³

Although only a few studies have tested the associations between physical activity and food insecurity^{38,39} and randomized controlled trials testing the effects of the Insurance Hypothesis on physical activity are lacking, the implications of the Insurance Hypothesis for low-SS adolescents makes food insecurity and frequent deprivation relevant to meeting physical activity guidelines. Improving consistent access to food should be a priority in community interventions as well as for individual patients. The extent of the Insurance Hypothesis and its relation to energy expenditure and physical activity needs to be further explored and, ideally, should control for social and environmental factors that also affect physical activity behavior.

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Trial Registration

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