



# HHS Public Access

Author manuscript

*J Obes Weight Loss Ther.* Author manuscript; available in PMC 2017 January 12.

Published in final edited form as:

*J Obes Weight Loss Ther.* 2014 February ; 4(1): . doi:10.4172/2165-7904.1000207.

## Peers and Obesity during Childhood and Adolescence: A Review of the Empirical Research on Peers, Eating, and Physical Activity

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### Abstract

Obesity during childhood and adolescence is a growing problem in the United States, Canada, and around the world that leads to significant physical, psychological, and social impairment. In recent years, empirical research on factors that contribute to the development and maintenance of obesity has begun to consider peer experiences, such as peer rejection, peer victimization, and friendship. Peer experiences have been theoretically and empirically related to the “Big Two” contributors to the obesity epidemic, eating and physical activity, but there has not been a comprehensive review of the extant empirical literature. In this article, we review and synthesize the emerging theoretical and empirical literatures on peer experiences in relation to: (a) eating (food consumption and food selection); and (b) physical activity, during childhood and adolescence. A number of limitations and issues in the theoretical and empirical literatures are also discussed, along with future research directions. In conclusion, we argue that the involvement of children and adolescents’ peer networks in prevention and intervention efforts may be critical for promoting and maintaining positive behavioral health trajectories.

### Keywords

Peer influences; Childhood obesity; Food intake; Food selection; Leisure activities

### Introduction

The rates of pediatric obesity in the United States, Canada, and around the world have been steadily increasing. Today, approximately 31% of children and adolescents in the United States are considered overweight or obese, with similar rates reported in Canada and European countries [1-3]. The increased prevalence of child and adolescent obesity is worrisome for a number of different reasons, one being that children and adolescents are now experiencing medical conditions that were once diagnosed almost exclusively in adults, such as Type II diabetes [4, 5] cardiovascular disease [6], and hypertension [7,8]. It is also

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the case that childhood obesity is a robust predictor of obesity in adulthood [9,10] which is disconcerting given that the negative physical, social and psychological costs of obesity likely accumulate over time.

It is also alarming that being overweight appears to becoming a normative state, for children, adolescents, and adults. Social psychology research has consistently shown that norms, or what is considered typical, are likely to influence the initiation and maintenance of a variety of behaviors, including alcohol use [11,12] smoking [13-15] and sexual behavior and practices [16-18]. Recent evidence suggests that the same is true for obesogenic-related behaviors and overweight status [19-22]. Indeed, in the same way that the social milieu of an alcoholic serves to support the drinking of those in the network, it appears that the social networks of obese and overweight individuals often promote and maintain unhealthy lifestyles and diminish awareness of and motivation to change weight problems. In addition, it is consistently found that parents of overweight children, who also tend to be overweight, often fail to accurately identify the weight status of their children, misclassifying them as healthy or normal weight [23]. For instance [24], found that approximately one-third of mothers identified their obese child (95<sup>th</sup> BMI-for-age percentile) as “about the right weight.” The failure to recognize their children as overweight may explain, in part, why many parents fail to take active measures and intervene on their children’s weight problems. Similar problems in recognizing overweight risks also exist among professionals; children less than 5 years of age with Body Mass Index percentiles (BMI%) between 85% and 94% are unlikely to receive a diagnosis and intervention for being overweight [25]. Finally, it appears that the social norms of obesity also impact youth themselves. Children and adolescents whose social networks (parents and schoolmates) comprise overweight individuals are more likely to underestimate their own weight and develop inaccurate perceptions of what constitutes appropriate weight status [26]. As the prevalence of overweight status and obesity increases, one can only predict that this apparent normalization of obesity will continue to reinforce obesogenic behavior and overweight status.

Due to the considerable and rising costs of obesity during childhood and adolescence, there has been considerable interest in understanding the early causes and origins of obesity. Research consistently shows that several biological, social, environmental and psychological factors contribute to an increased risk for obesity during childhood and adolescence, including variability in genetic influences on eating, familial influence, physical inactivity and metabolic rate [2,27,28] as well as recent technological advances that reduce the energy costs of daily living and promote sedentary behaviors [22,29,30]. These recent discoveries have led to refinements of etiological theories such that a multitude of factors including personal, environmental, societal and healthcare-related, as well as physiological mechanisms and regulation [2], are now recognized as contributors to the obesity epidemic. Recent findings have also led to important changes in clinical intervention and prevention efforts. For instance, most programs for youth now focus on modifying energy intake and expenditure vis-à-vis decreased calorie intake and exercise programs that utilize behavior-modification principles to change the family environment [31].

In recent years, there has also been increased interest in such peer experiences as peer rejection, peer victimization, and friendships as contributing factors to the development and maintenance of obesity [32-34]. Given this new focus in research, there is a need for a comprehensive empirical review of the existing literature on peers and obesity. There is little doubt that peers do influence eating and physical activity during childhood and adolescence. However, the lack of a comprehensive review impedes our ability to clearly ascertain from the extant literature: (a) the degree to which peers and friends impact eating and physical activity, and obesity; (b) under what circumstances and why peers are strong contributors to childhood and adolescent obesity, and (c) how to most effectively translate knowledge to inform efficacious prevention and treatment approaches. Thus, the overarching aim of the present review is to review the extant literature on peer experiences and obesity during childhood and adolescence, focusing on peers in relation to the “Big Two” contributors to the obesity epidemic, eating and physical activity [1].

We have organized this review into six sections. We first define our search strategy and specify the basic terminology employed in this review. We then provide a brief overview of the peer experiences of obese and overweight youth. We do so to set the stage for understanding the characteristics of peer experiences that have the potential to impact the eating and physical activity of overweight and non-overweight youth. In the third section, we review the major theoretical frameworks that guide research on the social influences on eating in adult populations, and the evidence relevant to these frameworks. Few existing theories attempt to explain any type of social influence on physical activity (in adults and youth populations) and eating in children and adolescents. Therefore, in this review, we attempt to specify how the theoretical literature on eating in adults might be useful for understanding peers in relation to eating and physical activity during childhood and adolescence. In the two subsequent sections, we review the empirical literature on peers and youths’ eating (energy intake and food selection) and physical activity. Here, we also draw links between the specific mechanisms cited in the adult literature and findings in studies of children and adolescents. Finally, we synthesize findings and highlight significant gaps across the existing literatures and discuss future research directions and clinical implications.

## Review of Study Selection Criteria and Terminology

Our review of the literatures on peers, eating, and physical activity during childhood and adolescence was theoretically driven by earlier reviews of the general social influences on the eating and physical activity of overweight individuals [33] and by Herman and colleagues’ theoretical framework for the impact of social influences on eating [35]. In addition, to find relevant English-language empirical work for the food consumption/selection sections of this review, a literature search of PsychInfo, PubMed and GoogleScholar was conducted using the following key words: “modeling”; “impression management”; “social facilitation”; “peer influence”; “normative influence”; “food consumption”; “food selection”; “children” and “adolescents.” These key words were used in combinations of three to include one theoretical keyword (i.e., modeling, impression management, social facilitation), one eating (i.e., food selection, food consumption) and one age group identifier (i.e., children). The reference lists of relevant publications were also

reviewed to identify additional pertinent published and unpublished literature. The literature search for empirical work on peers and physical activity also utilized PsychInfo, PubMed and Google Scholar search engines to identify pertinent publications. Key words for this literature search were the same as for the food consumption/selection section, but we substituted “physical activity” for “food consumption” and “food selection.” Again, the reference lists of relevant publications were reviewed and additional empirical studies were identified. In general, we searched for experimental research on these topics; however, we expanded our review to also include survey research and non-experimental literature when few experimental studies were found (particularly for research on peers and physical activity).

## Terminology and Definitions

Before proceeding, we should define some constructs, delineate additional parameters of our review, and acknowledge the limitations of our study selection. First, in this review (as well as elsewhere), peers refer to same-sex and other-sex youth who are of a similar age [36]. Friendships refer to voluntary, reciprocated relationships that form between two individuals that are based on mutual affection; during childhood and adolescence, most friendships form between same-sex, same-age peers [37-39]. Friendships occur at the *dyadic*-level of social complexity and involve two youth, whereas peer relations constructs such as peer acceptance, popularity, peer rejection, peer victimization, and peer exclusion or ostracism occur at the *group*-level and reflect how the child or adolescent fares with the larger peer group [40]. Accordingly, in this review, we describe studies of both dyadic- and group-level peer relation experiences in relation to eating and physical activity.

It is important to note that no studies, to our knowledge, have examined the developmental trajectory of the effects of peer influences on children’s and adolescents’ eating and physical activity. For this reason, we selected studies of children and adolescents of all ages, from preschoolers to teens, even though there are almost certainly considerable developmental differences in the source(s) and nature of the peer influence. However, we acknowledge here that peers and friends are likely more influential on eating and physical activity as children get older. Indeed, it is during late childhood and early adolescence that youth spend the majority of their waking hours in the company of peers and when positive peer relations experiences become critical for healthy psychosocial development and adjustment [40]. We further acknowledge that the larger social context also includes parents and family members, and direct the interested reader to the following excellent recent reviews on the family and obesity: [41,42].

Finally, there exists a large body of research on eating disorders that focuses on the influence of peers and friends on children’s and adolescents’ dieting, body image concerns, and eating attitudes and behaviors [43-46]. Although we recognize that the findings of these studies are consistent with our guiding premises (i.e., to review the literature on peer influences on eating and activity during childhood and adolescence), in this review we opted to strictly focus on studies of non-psychiatric populations and problems.

## The Peer Social Context of Child and Adolescent Obesity

Studies have consistently shown that the peer social worlds of overweight and obese children and adolescents tend to be hostile, rejecting, and negative. For instance, it is well established that negative physical characteristics, such as being overweight, are common reasons for teasing among children and adolescents, and peer sociometric studies consistently show that overweight youth are perceived more negatively and less accepted by peers than are normal weight youth [47-50]. The increasing prevalence of obesity and the fact that being overweight is becoming a normative state may lead to the expectation that the degree of disapproval of obesity would have declined over the past decades. However, Latner and Stunkard [51] found that the bias against obese children was even stronger in 2001 than it had been 40 years ago. Although it is not clear why the negative bias has increased despite the increased prevalence of obesity and also increased knowledge about the difficulties in losing weight, we offer some possible reasons in the concluding section of this review.

Regardless of the reason for the maintenance of weight stigmatization, it is clear that these prejudices against overweight individuals begin to develop during early childhood. Studies have shown that three year-old children already hold negative attitudes about obesity and believe that overweight children have more negative personality and behavioral characteristics than normal-weight children [52,53]. Children also report that being overweight is less desirable than having a physical handicap [53], and overweight children themselves hold negative attitudes toward other overweight individuals [54,55]. Of note, the negative bias against overweight youth has been found not only in North America, but also European and Asian countries [56]. Studies further indicate that children are less inclined to seek the company of overweight than average weight youth and they do not enjoy interacting with them as much as they do with normal-weight youth [47,49,57]. The prejudiced attitudes also appear to feed discriminatory actions and translate into such group-level peer difficulties as peer rejection (which refers to active dislike by the larger peer group) and physical (i.e., hitting, kicking) and relational (e.g., rumors, negative gossip) peer victimization [58-60].

Beyond group-level peer difficulties, research has consistently shown that overweight children have fewer friendships and are less likely to have reciprocated or mutual friendships than normal-weight children [61,62], seminal study showed that overweight adolescents were less likely to receive friendship nominations (i.e., being identified by others as friends), less likely to receive “best” friendship nominations, and more likely to receive no friendship nominations than normal-weight adolescents [61]. Given that group-level peer difficulties, such as peer rejection, during middle childhood often set the stage for later friendlessness in early adolescence [63], it is likely that the group-level peer difficulties of overweight children and adolescents explain why they are often friendless.

Being rejected or victimized, and friendless is worrisome for any child or adolescent because such negative peer relations experiences are related uniquely to internalizing and externalizing difficulties [64]. However, recent evidence has emerged suggesting that negative peer experiences may also lead to unhealthy eating and physical activity, especially

for overweight children and adolescents. Findings from these recent studies are described in the sections below.

## Theoretical Frameworks

Research on the general social influences on eating has been proliferating over the past several decades. As described below, this work has allowed for the identification of the conditions in which social influences are most likely to be found, but the research conducted has been largely a theoretical. In the following section, we review the three primary explanatory mechanisms that have been used to account for the effects of general social influences on eating in adult populations: social facilitation, impression management, and modeling. We also describe the normative framework [35] which helps to explain the sometimes conflicting empirical findings on social influences and eating during adulthood. Extensions of these frameworks to research on peers, eating, and physical activity in children and adolescents are offered in this section and the two subsequent sections. The three mechanisms and the normative framework have been helpful in explaining findings (or lack thereof) linking social influences and eating in adult populations. However, the field would clearly benefit from more theory-driven research on physical activity in youth and adult populations as well as specific tests of one mechanism against the other and specific tests comparing the mechanisms by which different types of social influences (i.e., friends vs. acquaintances) impact eating and physical activity.

### Social facilitation

In its earliest conceptualization, social facilitation described an increase in performance as a result of the presence of others [65]. However, in his reanalysis of social facilitation theory, Zajonc specified that the presence of others serves as a source of arousal, and that although heightened arousal increases the likelihood of well-learned or habitual responses, it can impair performance on difficult tasks [66,67]. It was further argued that it is not simply the presence of others that increases arousal, but the evaluation that occurs when in the company of others [68-70], or the degree of distraction or cognitive overload [71].

In support of theory on social facilitation, a variety of behaviors have been shown to increase when in the company of others (from cycling during sport events to the levels of laughter among 7-8 year old children [65,72]. In addition, it is consistently found that individuals eat more in the presence of others than when they are alone, and that food intake increases as the number of co-eaters increases [73-75]. Of note, the effect of the presence of others on eating has been shown across a range of meal occasions (e.g., breakfast, lunch, dinners, snacks); when adults are eating on weekdays and weekends; regardless of alcohol consumption at the meal; and when eating at home or in a restaurant [73-78]. In addition, the effects have been found in studies of children and adolescents [79], in a number of different societies (i.e., United States, France, Netherlands [80-82], and across a variety of research methodologies, including the food diary approach, direct observation, and the “gold standard” experimental method [83-86].

Given the ubiquity of the effect, it should be noted that there are some instances in which the effects of social facilitation do not appear to be as straightforward as initially formulated.

For instance, although the finding that the amount of food consumed is a function of the number of others present is quite robust [75], there is some indication that social facilitation is attenuated or even absent when people eat with unfamiliar others in contrast to eating with familiar individuals, such as friends and family members [74,84,87]. This effect appears to be greater for overweight than normal-weight individuals [74,88-91] has argued that individuals may feel more comfortable with familiar than unfamiliar others, which in turn, allows for the release of inhibitions that control eating (and the dominant response to be displayed); this may be especially true for overweight individuals who often face negative treatment by unfamiliar individuals. However, it is worth noting that deCastro excluded dieters from the majority of his studies. Arguably, successful dieters might be more cautious to release their eating inhibitions in response to social influences [92]. Alternatively, it is plausible that restricting one's eating might be a dominant response for dieters, in which case, the presence of others could lead to less rather than more eating. Future research should test this possibility.

The application of social facilitation to physical activity is fairly straight forward considering that its original conceptualization was developed based on physical activity performance. In the earliest published research on social facilitation, Triplett observed that among bicycle racers, the presence of other cyclists tended to increase performance, leading to faster race times. Social facilitation processes are rarely referenced in recent studies of the effects of others on physical activity, which tend to be descriptive in nature [65]. Yet, as discussed in greater detail below, there is some indication that the presence of unfamiliar peers and friends during childhood and adolescence increases physical activity [93-98].

### **Impression management**

The second explanatory mechanism tested in studies of social influences on eating in adults is impression management. The general idea is that individuals consciously or unconsciously attempt to control the impressions that other people form by regulating information and their self-presentation [99]. The strongest evidence that impression management influences eating in the presence of others comes from studies that consistently show that adults eat less when they are motivated to convey a good impression [100-103]. Similar evidence has been found in studies of older children and young adolescents, who are also concerned with being perceived positively by age-mates and friends [87,91]. Conveying a good impression through eating at any age appears to involve eating less, likely because obesity is highly stigmatized and individuals tend to associate negative characteristics with people who consume large amounts of food [56,103-108]. Other research shows that overweight adults (who likely feel a strong need to overcome stereotypes about overweight individuals and overeating) are especially likely to suppress their eating in the presence of unfamiliar adults, particularly those adults who are not overweight and may be more likely to judge and be critical of overweight individuals who overeat [86-90].

Given that negative stigma is also associated with overweight individuals who are sedentary and physically inactive, one would expect that the impression management motives to increase physical activity would be especially strong for overweight individuals. In support of this idea, one study revealed that the presence of unfamiliar peers has a greater positive

impact on the physical activity of overweight youth than their leaner peers [96]. However, it is also consistently found that overweight youth are less likely to engage in physical activities than normal-weight youth [109,111], likely because they have learned that removing themselves from physical activity settings altogether is a “safer” option than participating in these activities and potentially being scrutinized and teased by peers. The apparent inconsistency between these results (i.e., studies indicating that others increase physical activity and other research showing that overweight youth are less likely to engage in physically active leisure activities) can possibly be accounted by the characteristics of peer experiences during physical activity (i.e., positive vs. negative experiences). This is discussed below in the section on the peers and youths’ physical activity.

## Modeling

In addition to social facilitation and impression management, investigators have argued that the social influences on eating can be accounted for by modeling. According to Bandura, most human behavior is learned observationally through modeling: by observing others’ behavior, attitudes, and the outcomes of those behaviors, one forms an idea of how new behaviors are performed, and on later occasions, this acquired information serves as a guide for behavior [112-114]. Bandura’s theory was developed to account for the behavior of individuals of all ages [112].

Studies on eating conformity (or modeling of eating), in which participants are paired with one or more individuals whose level of eating has been pre-determined (i.e., an experimental accomplice), have consistently shown that individuals eat very little or a lot depending on the behavior of the eating partners [115-117]. This conformity/modeling effect has been found to be quite robust and to over-ride strong physiological influences [118,119]. A modeling effect also appears when the eating model is not physically present but when participants are led to believe that previous participants have eaten a certain amount [120-123] even found that participants continue to adhere to the amount originally consumed by the model in the absence of the model and on a different day [123]. Importantly, these findings have been found in studies of not only adults, but also children and adolescents [87,91,124,125]. The studies with children and adolescents are reviewed below.

Theory on modeling has guided physical activity interventions with the basic premise that children and adolescents who are provided opportunities to watch models engage in physical activity should become more physical active. What is striking in this literature is not necessarily the use of modeling as an intervention tool, but the scarcity of the basic research (in comparison to similar studies on eating conformity) testing the circumstances under which conformity or modeling is optimized. The use (or overuse) of modeling in physical activity interventions is possibly due to the heavy reliance of this literature on the concept of self-efficacy, also developed [126]. In Bandura’s theory [126], self-efficacy, or beliefs about one’s personal (in)adequacies, is a cognitive mechanism thought to mediate exposure to behaviors and subsequent action, and physical activity self-efficacy refers to an individual’s belief that he/she can successfully overcome perceived barriers and perform required skills necessary to engage in physical activity (in terms of frequency, duration, and intensity). Although a number of studies have shown that physical activity self-efficacy is both an

important determinant as well as a consequence of physical activity and that exposure to physically active models can increase physical activity [22,127-133], the (over) simplistic application of the modeling methodology in these interventions has often resulted in very limited success as described in the later review of these studies.

Another weakness of the modeling literature (on eating and physical activity) is its inability to account for the reasons why people model others and conform. Possible explanations have been offered (e.g., vicarious reinforcement is motivating, particularly if an individual identifies with a model), but the only strong conclusions that can be drawn from these studies is that people eat more when others eat more, eat less when people eat less, are more physically active when others are more physically active, and engage in sedentary behaviors when others are also sedentary. As Herman and his colleagues [35] noted, “perhaps the very strength of modeling effects has had the unfortunate consequence of inhibiting curiosity as to how they operate; it is as if models exert such a strong influence that the explanation simply reduces to modeling” [35].

### Normative framework

The literatures reviewed above show that the effects of social influences on eating are complex and that the direction of the influence (increase vs. decrease) depends on situational (e.g., how much the “other” is eating) and individual (e.g., weight status) factors. Herman and his colleagues integrated these mechanisms into a normative framework accounting for the effects of others on eating [35]. This normative model posits that, in the presence of palatable food, and in the absence of other constraints, people are motivated to eat as much as they want but that the presence of others, and perceptions of social norms, determine when eating stops. In other words, individuals are motivated to eat as much as they can. However, social norms serve an inhibitory function, indicating at what point individuals must stop eating if they are to avoid excess and become socially inappropriate (i.e., social facilitation). What might appear to be a systematic matching or modeling of food intake in some cases would actually be a systematic effort to avoid incurring the stigma of excess, or to conform to the norms in place [122]. In this framework, individuals conform to others’ behaviors because they see the amount eaten by others as an indicator of how much one can/should eat or because they believe that by conforming they will ingratiate themselves to others, and thus positively manage their impression [134,135].

Herman and colleagues’ framework was designed to better understand how social influences operate on eating, but we believe that similar ideas can be used to understand social influences on physical activity. However, since this framework has not been empirically tested with physical activity, it is unclear how the presence of others impact on exercise. In other words, are people naturally unmotivated to exercise, but others impact how much they exercise?

Or, are people naturally inclined to exercise, and others influence how hard they work?

The influence of subjective norms, as originally formulated in the theory of planned behavior [136], has often emerged as a weak predictor of physical activity [137]. However, descriptive norms (as opposed to objective ones) or perceptions about the prevalence and

frequency of others' behavior [138,139] have been found to be strong predictors of behavior [140]. One factor, however, that seems to influence the relation between descriptive norms and behavior is the relevance of the normative group. For example, Campo [141] found a stronger association between the drinking of college students and the drinking norms of their friends than between the drinking of college students and the drinking norms of general others in the students' college. Campo [141] found that norms about a "typical student" were not related to behavior in students while norms about "friends" were [141]. In addition, it has been found that descriptive norms about friends' recycling predicted adults' intentions to recycle [138]. Furthermore, and most relevant to this review, it has been found that friends' physical activity was related more strongly with individual physical activity than was the physical activity behaviors of other groups [142], and that the descriptive norms associated with friends' physical activity are the strongest predictors of individual physical activity [140].

The notions of descriptive norms and the normative framework put forth by Herman and his colleagues are consistent with recent social network theory and research. As mentioned previously, behaviors that are normative are behaviors that are shared by the social milieu. The well publicized study [143] showed that adults were more likely to gain weight (or stay lean) over three decades if their same-sex friends were overweight or obese [143], and similar findings have been found in children [62]. Christakis and Fowler suggested that the psychosocial mechanisms accounting for the spread of obesity may rely less on behavioral imitation or modeling (and proximal influences) and more on changes in individuals' general perceptions and distal knowledge of the social norms regarding the acceptability of obesity [143], an argument that is similar to Herman's normative model [35]. The general idea is that when individuals become aware that their friends are gaining weight (or losing weight), the social norms about what is socially acceptable change. Thus, after witnessing (either in person, on the internet, or through pictures) or hearing about friends gaining weight, an individual might relax his or her exercise program or diet, in part because the standards and social norms for weight have been altered. Of course, the weight gain in friends might be determined by different behaviors (e.g., increased intake of unhealthy foods, decreased physical activity which are also normatively determined), but the norms about weight are still modified by each other. The observation that geographic distance does not attenuate the effect of friends' weight on individuals' own weight provides additional support that norms rather than modeling (which often requires direct observation) may best account for the findings of [143].

## **The Peer Social Context and Eating during Childhood and Adolescence**

### **Energy intake**

In contrast to the adult literature, there is little research testing or describing the underlying mechanisms accounting for the influence of peers on children's and adolescents' energy intake [33]. However, as suggested in the previous section, a review of the available evidence indicates that similar mechanisms as those operating in adults may be relevant for understanding the influences of peers on food intake during childhood and adolescence. We describe this evidence in greater detail below. First, there is some evidence that the food

intake of children and adolescents is impacted by peers vis-à-vis social facilitation processes. For instance, [124] examined the effect of group size on preschool-aged children's food consumption. Children's eating was observed during their regular snack time in two conditions: (1) eating in a small group (three classmates); or (2) eating in a large group (nine classmates). Each child was given one graham cracker on an individual plate and plates of additional crackers were placed on the table. A trained experimenter observed the snack sessions and recorded the snack duration, eating rate, and eating initiation, and it was found that children started eating more rapidly, ate faster and consumed more food in the larger group than in the smaller group. Also, when the duration of the snack lasted longer, children ate more in the larger group, but not in the smaller group. Interestingly, children in the larger group showed less social interaction compared to those in the smaller group, which the authors attributed to heightened arousal in the larger group, which in turn, led to greater food consumption [124]. However, similar to the adult literature, it is clear that the presence of peers does not always increase youths' food intake. For example, Péneau and colleagues compared the effects of peers and the availability of alternative activities on 15-16 year-old adolescents' food intake [125]. Participants were scheduled to eat four lunches under the following conditions: (1) alone; (2) with a group of three *unfamiliar* peers; (3) while watching TV alone; and (4) while listening to their own music alone, and were presented with the same food at each lunch: a main dish (ground beef and mashed potatoes), dessert (chocolate cake), water, orange juice, and soda. The amount of food and beverages was weighed before and after the meal. Results indicated that adolescents ate *less* food when paired with three unfamiliar peers than in any other condition, likely due to impression management concerns or social norms that are present when in the company of unfamiliar peers. Another important finding is that the effects of peers on eating also appear to depend on weight status, during childhood and early adolescence (10-14 years). In one study, it was found that overweight children (ages 6-9 years) ate *more* when alone than when in the presence of three unfamiliar peers [87]. Normal-weight children did not eat differently when in the presence of three unfamiliar peers or when alone, but they did spend less time eating when alone than when in the company of peers. These results were later replicated with olderyouth (10-12 years) who were tested in dyads (as opposed to groups of four children) and exposed to a greater variety of foods and alternative sedentary activities [91]. Thus, it appears that for certain children and adolescents, such as those who are overweight, impression management processes may supersede social facilitation. As noted previously, overweight youth face considerable stigma and prejudice, and often encounter rejecting and hostile peers. Such experiences may make them especially motivated to make a positive impression on new and unfamiliar peers. In general, this hypothesis is similar to Maykovich's contention that overweight adults suppress their food intake in the presence of others in an attempt to counteract the attribution that their excessive weight is due to excessive eating [90]. Of course, it is also plausible that being alone allows overweight individuals to eat in a "natural" manner (their dominant response) or how they would typically eat at home.

In this regard, it should be noted that overweight youths' intake after the experimental session (i.e., for the remaining of the day) was not assessed and that their energy intake prior to the study was merely estimated based on youth's (and parents) self report. Therefore, it is

unknown whether the amount of food consumed by overweight youth simply equates the amount of kilocalories necessary to maintain their body mass.

However, several studies also indicate that overweight youth consume more food when paired with *overweight* than non-overweight unfamiliar peers and friends [87,96] results which suggest that the impression management concerns of overweight youth may be eased when in the company of similarly-overweight peers. It is also plausible that social norms explain these findings such that similarly-overweight youth set norms for each other that allow for increased eating. Further understanding the mechanisms responsible for these findings is critical given that overweight youth tend to form friendships with similarly-overweight youth [144-147] and become more similar in weight over time. Thus, overweight youths' friendships may be contributing to- or helping to maintain their tendencies to overeat. These findings may, in part, explain [143] observations. More recent research has considered the effects of negative peer experiences, that often lead to aloneness, on children's and adolescents' eating. These studies have provided initial evidence that *ostracism*, or peer exclusion, leads to increased consumption of unhealthy food in youth [148,149], results which are similar to those found in studies of adults tested the impact of simulated ostracism on young adolescents' (12-14 years-old) motivation to eat unhealthy snack food relative to interacting with an unfamiliar, same-sex peer, and their actual consumption of unhealthy snack food was used to induce ostracism or inclusion in overweight/obese and non-overweight participants, and then participants completed an operant computer task to earn points exchangeable for portions of snack food or time socializing with a peer [150-152]. Finally, all participants were provided with equally large portions of snack food (to reduce the possibility of a ceiling effect) and the amount of food consumed was recorded. The findings indicated that ostracized overweight participants were more motivated for food and had a greater energy intake than non-ostracized or included overweight participants; differences were not found between ostracized and non-ostracized normal-weight participants [149]. Previous researchers have shown that ostracism impairs self-regulatory abilities, and thus it is likely that ostracism impairs the self-monitoring and self-regulatory processes required for controlled eating not only during adulthood, but also childhood and adolescence [153]. In addition, given their negative peer relations experiences, overweight youth may be especially sensitive to ostracism. Others have found similar associations between peer victimization and disordered eating highlighting the need for future work to determine the direction of influence between negative peer experiences and unhealthy eating, and suggesting that clinicians may do well to target the peer difficulties of overweight youth, an idea that is described in greater detail below [154].

## Conclusions

Although most of the work on social influences on children's food intake has focused on parental [155-159] accumulating evidence suggests that peers also impact energy intake during childhood and adolescence. The work reviewed above suggests that the presence of peers leads to increased eating, except for youth and situations in which the need for approval is high or there is an increased awareness of the amount of food consumed. In these latter situations (e.g., when overweight youth eat with non-overweight unfamiliar peers and friends), food consumption is decreased or suppressed. In addition, peer difficulties (e.g.,

being alone, ostracized by peers) seem to either increase eating or allow children and adolescents (particularly those who are overweight) to eat as much as they want without fear of incurring negative stigmas. However, additional research is clearly needed to test the specific mechanisms involved before strong conclusions about the specific mechanisms involved can be made.

## Food Selection

Although it is important to consider the amount of food that children and adolescents consume, it is equally important to consider the nutritional characteristics of the foods that they choose to consume. Childhood and adolescence are developmental periods of active physical growth during which adequate nutrition is vital for bone development and physical maturation [160]. Furthermore, nutritional habits acquired in childhood and adolescence are often maintained into adulthood [161,162]. If peers influence food intake, it is reasonable to assume that they also influence the types of foods that children and adolescents choose to eat. In fact, the idea that youth who are given the opportunity to watch peers eat fruit and vegetables should be more likely to consume these foods has guided the large majority of interventions aimed at increasing healthy eating in children and adolescents. In support of this idea and theory on modeling [113], many of these interventions have been shown to be effective in increasing healthy eating, with models such as cartoon characters [163,164] and unfamiliar peers and peer team leaders [165-175]. Mothers, unfamiliar adults have also been found to be effective models, likely because all individuals are most likely to imitate the behaviors of others whom they like and admire, and with whom they identify [166]. In one study, arranged lunch time seating so that target preschool-aged children who preferred vegetable A to vegetable B were seated with three or four peers with the opposite preference pattern [165]. The children were offered both vegetables at lunch for four consecutive days and allowed to choose, in the presence of the other children, which vegetable they wanted to eat. The target children showed a significant increase in the likelihood of choosing the initially non-preferred vegetable from Day 1 to Day 4. It was further found that changes in preferences were maintained post-experiment when children were tested in the absence of the original peers. In a conceptually similar experiment conducted many years earlier, compared preschool-aged children's food choices and consumption and the results were essentially identical to Birch's findings. In a related study examined the effectiveness of using trained peer models to encourage food acceptance in preschool children during meals. Children were trained by the models, and then retested one month later. Results indicated that the models were initially effective in accepting novel foods, but that the effect disappeared with time. It is worth noting that the studies reviewed above were limited by only presenting healthier foods and thus it was not clear whether the presence of peers who are eating healthy food could influence youths' healthy food selection when more palatable foods (albeit unhealthy) are available and in "competition" with the selection of healthier options.

However, findings from one study provide some evidence for the "power" of peer modeling of healthy food, even when in the presence of unhealthy food [91]. In this study of young adolescents (9-11 years), youths' consumption of healthy (grapes and baby carrots) and unhealthy (cookies and chips) snacks when alone and in the presence of an unfamiliar, same-

sex, same-age peer was recorded, and it was found that the best predictor of whether participants consumed *healthy* snack foods was whether their co-eater consumed these nutrient-dense snack foods. That is, participants who were in the presence of a peer who consumed more healthy snacks also consumed more healthy snacks. Consumption of unhealthy food, however, was predicted by the interaction of social condition (alone vs. social) by participants' weight status such that overweight participants consumed more unhealthy snacks when tested alone than when tested with an unfamiliar peer. No condition differences were found for non-overweight participants; the condition difference for overweight youth is likely explained by impression management strategies and overweight youths' aware of weight stigmatization, as discussed previously.

## Conclusions

Taken together, the aforementioned studies suggest that the presence of healthy eating peers can influence healthier food selection in both overweight and non-overweight children when healthier foods are available. However, the mechanisms responsible for these findings are not clear. Modeling and impression management processes may account for some of these findings. Findings from other studies suggest that eating norms may have an impact on food selection in children, suggesting that the normative framework might also help account for these findings. For instance [176], found those children's normative beliefs about the extent to which their peers and friends consumed fruits, juice, and vegetables (FJV) were strongly associated with their FJV consumption [176]. These findings potentially have implications for interventions focused on increasing consumption of nutrient-rich foods during childhood and adolescence. Also, in a rare longitudinal study of food selection from middle adolescence into young adulthood, it was found that perceived peer support for healthy eating was a negative longitudinal predictor of later fastfood [177]. However, these latter two studies focused on naturally occurring friendships and peer groups, and the question of whether the effects from interventions involving unfamiliar peers are long-lasting is equivocal as some studies have found that these effects last beyond the model meals while others did not [165,170]. It is also worth mentioning that the intervention studies reviewed involved fairly young children. Results may be even stronger if adolescents were tested given that young adolescents appear to be the most vulnerable to any type of peer influence, due to the importance of peer acceptance during this developmental period [178,179]. On the other hand, children may still be in the process of forming their preferences and, accordingly, may be more susceptible to social influence in matters of preference than older youth who have already formed clearer food preferences. If this is the case, we would expect to find evidence for influence declining from very early childhood through adolescence and early adulthood. Unfortunately, such data do not exist at the present. Another limitation of this research is that relatively little is known with regard to the impact of friends (as opposed to unfamiliar peers or strangers) on youths' food selection. The clinical relevance of using unfamiliar peers to modify children's food choices appears fairly limited as children are more likely to share their meals with their family and friends than with unfamiliar peers. Yet, there is some initial indication that friend influence is not always in favor of healthful eating. For instance, using food frequency questionnaires, Feunekes et al. found no significant correlations for fat intake among friends although it was found that friends were similar

(than non-friends) in the specific foods (i.e., snacks) they were consuming [180]. Studies from our laboratory further indicate that overweight adolescents “match” the unhealthy food consumption of overweight friends [96], but match the healthful eating of unfamiliar peers [91]. For instance, in the study, it was found that matching of healthy and unhealthy food intake was high and statistically significant in all conditions (i.e., dyads of: lean friends, lean strangers, overweight/lean friends and overweight/lean strangers), except in dyads of overweight friends for the consumption of nutrient-dense (i.e., healthy) foods, suggesting that overweight friends might not rely on their friends to determine their healthy foodchoices. These findings are important because as adolescents become more autonomous, they can consume on average 500 less healthy kilocalories per day at school and in other settings [181]. This work suggests that peers and friends may serve as role models for consumption of these snacks, albeit the direction of the influence may be different among acquaintances and in friends. These findings have important clinical implications, which are discussed further in the integrative discussion below.

## Peer Influences on Physical Activity during Childhood and Adolescence

Regular physical activity and active play during childhood and adolescence are associated with several physical and psychological benefits, such as increased musculoskeletal and cardiovascular fitness, decreased stress, greater self-confidence, and psychological well-being [182-186]. In recent years, studies have consistently found that overweight children are less physically active [187,188], perceive physical activity more negatively [189-193], and find sedentary activities more reinforcing than physical activities relative to normal-weight children [31,194]. These findings are worrisome because the lack of physical activity and engagement in sedentary behaviors in children and adolescents are concurrently and prospectively related to obesity and other health difficulties [195-198]. Despite the importance of peers and friends in the lives of youth [199] very few studies have examined their impact on youths’ physical activity and most of the available literature is characterized by a dearth of theory describing mechanisms that may account for the effects of peers on physical activity. When one considers the empirical evidence, however, it appears that the theoretical frameworks described in the previous sections can be used to understand the influence of peers on physical activity and overweight youths’ poor participation in physically active leisure activities during childhood and adolescence. We organize the next section by first describing the research on the presence (or absence) of peers and physical activity. We then review work on the characteristics of youths’ peer experiences in relation to physical activity [187,188].

### Presence of peers and physical activity

Peer relations theory and research indicate that same-age peers provide unique opportunities for companionship and recreation during childhood and adolescence [40]. And, many physical activities during these developmental periods typically involve some form of play, whether it be organized sports or spontaneous physically active play, that requires play partners [200,201]. Therefore, it should not be too surprising that a number of empirical studies have found that children and adolescents are more physically active when in the presence of peers than when alone that youth who report a greater presence of peers in their

lives also report engaging in greater physical activity (Beets et al. [93], and Duncan et al. [95], and that lonely children, who are often friendless and rejected by peers, report the least amount of physical activity [202-205]. Peers can also increase the variety of physically active alternatives, which in turn has been shown to increase the amount of physical activity youth participate in, as well as their enjoyment of that activity [206]. Overall, this existing work strongly suggests that peers are a necessary requirement for physical activity during childhood and adolescence. In addition, recent work on the presence of peers and physical activity reveal, in part, why overweight children and adolescents tend to be less physically active than their normal-weight peers. For instance, utilizing experience sampling procedures, two studies found that although overweight and non-overweight youth were equally physically active when in the presence of friends, overweight children and adolescents are alone more frequently than non-overweight youth [87]. In addition, in an experimental study of overweight/obese and normal-weight boys, Rittenhouse et al. [207] found that when alone, overweight boys were less physically active than normal-weight boys. However, when paired with a non-overweight or overweight peer, overweight/obese boys increased their physical activity to a level that was similar to the non-overweight boys, a finding that is consistent with early research on social facilitation and physical performance [207]. The utility of exposing children and adolescents to peer models who are physically active has also been explored. Although some work has found evidence that exposing youth to fictional cartoons [208] or videos of physically active youth is related to increased physical activity, results which are consistent with the “power” of modeling described in section on peer influences on eating, it is important to note that investigators have yet to test whether peer modeling of physical activity have lasting effects or which positive contingencies outside the laboratory (e.g., continued modeling or encouragement from friends) are needed to maintain improvement [208,209]. For instance, Horne et al. [208] found that exposing children to physically active cartoon characters increased both boys’ and girls’ physical activity to more than 30 minutes of moderate-to-vigorous physical activity per day. This intervention was found to be especially effective for girls, but it is not known whether the physical activity benefits were maintained over time. In addition, the processes accounting for the effects were not tested. Modeling processes might be at work; similar to the work on eating, the effects have been found when the physical active model is not physically present Horne et al. [208]. Yet, it is also plausible that observations of physically active youth begin to alter social norms and expectations.

### **Characteristics of peer experiences and physical activity**

Results from recent studies provide suggestive evidence that the presence of peers does not always unequivocally increase physical activity in children and adolescence. Instead, it appears that the qualitative nature of children’s and adolescents’ peer experiences (the degree to which they are negative or positive relationships) is an important determinant of whether peers encourage or discourage physical activity. Investigators have documented that perceptions of support from and positive relations with peers and friends are associated positively with children’s and adolescents’ participation in physical activity [210-212]. These findings have been found in both concurrent and longitudinal studies. For instance, in a cross-sectional study of 418 middle school-aged students, Davison and Jago [213] found that positive perceptions of friendship and peer acceptance in the physical domain predicted

positive physical self-worth and affect, which in turn, predicted preferences for challenging physical activities and adolescents' physical activity levels. In one longitudinal study of 174 girls from late childhood into adolescence (i.e., 9-15-years-old), it was found that girls who maintained their level of physical activity over time reported increasing levels of perceived peer support [213]. However, it should be noted that support from friends has been more strongly linked to youths' engagement in team sports than general moderate-to-vigorous physical activity, perhaps because unlike moderate-to-physical activity, team sports require the involvement of peers [214,215]. Subjective (e.g., beliefs about the extent to which important people would want the adolescent to engage in physical activity) and group (e.g., beliefs about the extent to which friends at school are physically active) norms about physical activity have both been found to be unique predictors of intentions to be physical active and self-reports of physical activity during adolescence, findings that suggest that adolescents rely on normative information from friends, and pressure from close family and friends, when making decisions about whether to be physical active [214-216], and support the Herman's normative framework described previously. However, Vilhjalmsson and Thorlindsson [217] found that beliefs about best friends' physical activity levels were associated significantly with self-reports of physical activity only for those adolescents with emotionally close best friendships, suggesting that only specific friends may have the "power" to influence youths' physical activity. In addition, it has been found that youth who participate in physical activities with a friend also report greater enjoyment of physical activity [93-966] and higher levels of physical activity [218]. Several other studies have found that friends tend to be similar to each other in their physical activity levels [219]; such shared and positive physical activity likely fosters further enjoyment of physical activity and closeness between close friends. A variety of negative peer experiences have also been related to decreased physical activity. For instance, several studies have linked weight criticism by peers and weight-related concerns, which are especially strong among overweight youth, to decreased physical activity [220-223]. In one study of 576 5th-8th grade students, Faith et al. [220] found that self-reports of weight criticism during physical activity (WCA), which were more common among girls and heavier participants, were associated negatively to sports enjoyment and mild-intensity leisure activity. In a related study, it was found that girls' (but not boys') self presentational motives (i.e., the way they want to appear to others) for exercising were significantly and positively related to their levels of public self-consciousness and anxieties about others' evaluations of their bodies Martin, et al. [222]. Girls who found to be more self conscious or more anxious about other's evaluations of their bodies were more likely to avoid exercise. In addition, girls' self-presentation concerns were related to excessive dieting, likely because many girls engage in dieting in order to convey a good impression to others. Another negative peer experience that has been associated with reduced physical activity is peer victimization, or repeated physical, verbal (e.g., teasing), and/or relational peer abuse [224-226]. In one study, Storch et al. [226], for instance, examined the linkages between peer victimization and child- and parent-reports of psychosocial adjustment and physical activity in a clinical sample of at-risk-for overweight and overweight children and adolescents. Peer victimization was found to be positively related to child-reported depression, social anxiety, and loneliness, and parent-reports of internalizing and externalizing symptoms. Peer victimization was also negatively related to physical activity, and both depressive symptoms and loneliness

mediated the relations between peer victimization and physical activity, suggesting that the negative internalizing consequences of peer victimization explain prevent some adolescents from being physically active. In another study, Hayden-Wade et al. [227] found that teasing during early adolescence (10-14 years) was associated with higher preferences for sedentary/isolative activities and lower preferences for active/social activities. Although many children and adolescents may avoid physical activities in an attempt to avoid further weight criticism, teasing, and victimization from peers in general, there is some evidence indicating that it may matter who is doing the victimizing and criticizing. In one study, Kunesh et al. [212] found that weight-related criticism and peer victimization had a negative impact on girls' overall physical activity. However, the effect of the victimization and criticism was context- and relationship-specific, such that victimization from friends in the neighborhood was not associated with physical activity in this context. Findings further indicated that the most detrimental effects of peer victimization on physical activity were found when victimization occurred at school and when boys were the victimizers, which the authors suggest might be explained by girls' attributions. Girls may be most likely to attribute victimization to a lack of physical activity ability and internalize victimization by their classmates and other-sex peers, perhaps due to the importance of these relationships during early adolescence. One recent study investigated the impact of another form of negative peer experience, ostracism, on physical activity (Barkley et al. [206]. Because it is well-established that the presence of peers increases youths' activity [91], the authors tested whether being ostracized or excluded by peers would decrease youths' activity. During two separate laboratory sessions, children played the Cyberball game (Williams and Jarvis [152], and then were given free-choice access to a variety of physical and sedentary activities in a gymnasium for 30 minutes. Physical activity was monitored via an accelerometer and a stopwatch was used to record the amount of time children allocated to physical and sedentary activities.

## Results

Indicated that after being ostracized, children accumulated 22% fewer accelerometer counts and allocated 27% more time to the sedentary activities compared to the non-ostracized/ included condition. These results offer preliminary support for the causal relationship between negative peer difficulties and decreased physical activity in children. However, our review revealed that this was the only experimental study of negative peer experiences and physical activity, which clearly highlights the need for additional experimental studies, although such studies will require

Careful thought and creativity given the obvious ethical dilemma of manipulating peer difficulties such as ostracism.

## Conclusion

Overall, the existing literature indicates that positive peer and friendship experiences foster engagement in physical activity but that negative peer experiences function as a deterrent to physical activity [220-226]. Given the social nature of physical activity during childhood and adolescence it is likely that positive experiences with peers makes physical activities more enjoyable, but that negative peer experiences lead many youth to want to avoid

physical activities [39]. Limitations of the existing literature include the relative lack of longitudinal and experimental research, and as a result, uncertainty about direction of effects and the specific mechanisms involved. For example, it is not known whether weight criticism and negative peer experiences might be the cause or consequence of poor/reduced physical activity. There is some indication that overweight youth may be less coordinated than leaner youth, and that motor skills are related to self-efficacy and confidence in physical activity [227-232]. Thus, although negative peer experiences may discourage youth from being physically active, and further developing their activity skills, it is also plausible that poorer physical activity skills increase the complexity and difficulty of physical activities, which in turn, leads to negative peer experiences and or evaluation apprehension (and therefore avoidance of these activities).

It is plausible that over time, children who experience negative peer experiences may begin to value sedentary activities over physical activities, as suggested by numerous studies that demonstrate that overweight children and adolescents find sedentary activities to be highly accessible and also more reinforcing than physical activity [231-236]. Two recent studies found that friends, particularly girls, were similar in their engagement in certain sedentary activities (e.g., playing video and computer games [237-238]). These findings are concerning because they suggest that once physically *in* active, children's and adolescents' friends may reinforce such inactivity. It is also plausible that children and adolescents become more physically inactive over time after they become friends with physically inactive youth. The direction of effects of friendship will need to be determined in future research, but the studies reviewed above suggest another possible trade-off of certain friendships during childhood and adolescence: Some friendships may be fun and enjoyable (and therefore good for youths' psychological well-being; Parker and Asher [239]; Rubin et al. [40]), but at the same time, reinforce physical inactivity. A promising line of research aiming at increasing physical activity in overweight and obese youth involves integrating new activities that are less dependent on weight status. For instance, there has been recent interest in the benefits of strength training for overweight and obese youths. Although strength training is not generally associated with a high caloric expenditure, these activities may provide obese youth with a positive activity that enables them to enjoy purposeful exercise, experience personal improvement, and train cooperatively with friends in a supportive setting and exciting atmosphere [240].

## **Concluding Remarks, Recommendations for Future Research, and Implications for Intervention**

This review provides, for the first time, a comprehensive overview of the research of peer influences on children's and adolescents' eating and physical activity. There is no question that peers impact eating and physical activity, but this review reveals some clear patterns of findings regarding when and how peers impact the "Big Two" contributors of obesity during childhood and adolescence. Review of the eating research indicates that, in general, the presence of peers increases children's and adolescents' energy intake, except (1) in situations in which social evaluative concerns are high, and (2) when peers exhibit healthy eating. In terms of physical activity, review of the available evidence indicates that having

peers/friends to play with, and having positive relationships with these youth, foster involvement in physical activity during childhood and adolescence, whereas being alone and/or experiencing negative peer difficulties appears to deter or prevent youth from being physically active. In reviewing the extant literature, we extended four theoretical mechanisms/frameworks (social facilitation, impression management, modeling, normative framework) from the literature on the general social influences on eating in adults to the research of peer influences on eating and physical activity in children and adolescents. Although these theoretical frameworks helped to interpret and integrate the reviewed studies, they were designed for research on eating in adults. Children's cognition and the ways in which they think about themselves and their social worlds change with increased age, suggesting that the nature and influence of processes involving impression management and social norms (and even modeling) may differ across developmental periods [40]. Other relevant developmental differences have been found, including evidence suggesting that the transitions from early to middle adolescence and middle to late adolescence (for boys) are particularly risky times for increases in fast food consumption [241]. Thus, there is a clear need for developmentally-informed research that specifically tests these frameworks in samples of children and adolescents, and that considers differences across developmental periods. Another limitation of this review, and a primary limiting factor in this area of research, is that it is not always clear which mechanism (i.e., social facilitation, normative framework) prevails and under what circumstances. The study of peers, eating, and physical activity can be significantly advanced by specifically testing the different possible mechanisms. But, it probably can be safely concluded that more than one mechanism is responsible for the effects of peers on eating and physical activity during childhood and adolescence. Future work will also need to go beyond past research that has been descriptive and correlational in nature in order to advance our understanding of the specific ways in which peers contribute to the development and maintenance of unhealthy eating and activity and how they can promote healthier trajectories. Longitudinal research will be important to test the direction of the effects reported in many of the studies reviewed herein, and the likely bidirectional associations. For instance, although overweight children and adolescents may become more sedentary over time, due to impoverished and negative peer networks, it is also possible that some children and adolescents are more sedentary (perhaps due to personal preferences for sedentary activities), which in turn causes them to experience peer isolation and related peer difficulties and to gain weight. Once these peer and weight difficulties are established, they may further reinforce preferences for sedentary behavior. As mentioned earlier, it is not clear why the negative bias toward obesity has worsened over the years considering despite the fact that the prevalence of obesity has increased steadily. One would think that people become more tolerant toward overweight and obese individuals when more than the majority of adults (i.e., 60%) and a third of children are classified as overweight. Future research is clearly needed to better understand this effect but it is possible that changing social norms (toward obesity) have led individuals to become less likely to recognize obesity in themselves and close family members and friends (as discussed previously), but that the strong and persistent socio-cultural standards of "thin is beautiful" continue to cause group- and society-level stigma and exclusion toward obese individuals Brown [242]. In addition, the recent increased media attention on active weight-loss programs may have solidified biases about the controllability of weight [243], which

individuals are most likely to attribute to out-group than in-group members [244]. Again, future research on this topic is needed, but there is strong evidence suggesting that individuals' perceptions of themselves, their close friends and/or family members often differ markedly from and are more positive than their perceptions (and judgments) of unfamiliar others and outgroup members, particularly when norm violations occur [244,245]. The advantages of targeting and modifying the family unit for the treatment of childhood obesity have been well-established [245-248]. The rationale underlying family interventions is that modification of the youths' family environment is necessary to ensure maintenance of treatment gains. Based on this literature review and the evidence regarding when and how impact eating peers and physical activity, we purport that it might also be necessary to modify the peer social environment to significantly impact the child and adolescent obesity epidemic. For instance, the evidence reviewed herein suggests that increasing the presence of friends (or decreasing the time that overweight youth spend alone) could increase many youths' involvement in physical activity (which in turn, could help youth lose weight). The involvement of friends in weightloss programs is appealing as involving friends may help reinforce healthy behavior change in the same way the family support change in family-based interventions. Some of the barriers or pitfalls related to such efforts should, however, be mentioned. First, friendships in children and adolescents are often short-lived or subject to change over relatively short periods of time [249]. As a result, friendships that initially support weight loss efforts may deteriorate and either have a negative impact on youths' efforts or negatively affect their social and psychological well-being. Furthermore, the work reviewed above suggests that overweight friends may inadvertently reinforce obesogenic-related behaviors. Therefore, modifications of the social networks may need to involve fostering new social connections, or improving negative features of overweight youths' existing peer networks to achieve meaningful results. Since the social context of obesity is still characterized by strong stigmatization, these attempts could prove very challenging. An alternative to these approaches is to form new social networks of youths sharing similar goals such as losing weight and being healthier, similar to peer-pair therapy designed for socially anxious youth. Decades of research in social psychology substantiate that sharing goals leads to greater cohesiveness and relatedness among individuals and similar processes would likely improve overweight youth physical and psychosocial wellbeing. Yet, it is unclear at this point which option (involving friends vs. involving unfamiliar peers sharing common goals) is the most acceptable from the youths' perspective, the most feasible, and the most effective in terms of durable behavior change. Indeed, it might prove challenging to foster new, authentic friendships and social networks for many youth. However, if impoverished peer networks are left unchanged, many overweight/obese youths who are motivated to change may be unable to do so because of a lack of positive social structure facilitating participation in physical activity. Finally, although peers and friends undoubtedly influence eating and physical activity during childhood and adolescence, it is important to acknowledge that these factors are most likely part of an intricate web of complex relations involving youths' individual characteristics (i.e., age, personality, gender, taste preferences [250], their larger social networks (i.e., romantic relationships, parents, teachers, and other systemic influences (e.g., the school system, the community at large, culture [251-253]. Future research needs to examine how the influence of peer/friends interacts with individual characteristics (such as gender and

ethnic/race differences) and other social systems, and it may be the case that the most efficacious interventions are those that are sensitive to individual characteristics and simultaneously target multiple systemic influences.

## Acknowledgments

This work was supported by the National Institute of Child Health and Human Development grant 1RO1HD057190-01A1 awarded to Dr. Sarah-Jeanne Salvy.

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