

# The Influence of Fathers on Children’s Physical Activity and Dietary Behaviors: Insights, Recommendations and Future Directions

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## Abstract

**Purpose of Review** Although fathers have an important influence on their children’s well-being, their unique influence on child lifestyle behaviors has been largely overlooked in the literature. To inform and encourage future research, this paper provides an overview of existing studies that have examined the influence of fathers on the physical activity and dietary behaviors of their children.

**Recent Findings** While the available data indicate that fathers’ behaviors and parenting practices likely play an important role in promoting healthy behaviors in children, the evidence base is limited by a reliance on observational designs and small, ungeneralizable samples.

**Summary** This paper also provides a summary of the methods, research findings, and experiential insights we have gained while conducting the “*Healthy Dads, Healthy Kids*” randomized controlled trials, which tested the efficacy and effectiveness of a socio-culturally targeted program that engages fathers to improve their own health and the health of their children. The paper concludes with a series of recommendations for recruiting and engaging fathers and a summary of directions for future research.

**Keywords** Fathers · Dads · Children · Physical activity · Diet · Obesity prevention · Parenting practices · Modeling · Co-physical activity

## Introduction

Childhood obesity is a global health concern. In developed countries, approximately 24% of boys and 23% of girls are overweight or obese [1]. Between 1980 and 2013, the prevalence of overweight and obesity also increased from 8 to 13% in both boys and girls from developing countries [1]. Compared to their healthy weight peers, these children are more likely to experience a range of negative biological, psychological, and social health consequences during childhood [2] and are at a greater risk of physical and psychological morbidity and premature mortality in adulthood [3]. Childhood obesity is also very difficult to treat and reverse. Compared to their healthy weight peers, overweight children are much more likely to become obese adolescents [4], and overweight or obese adolescents are at much greater risk of becoming overweight or obese adults [5, 6].

Parents play a key role in preventing childhood obesity by establishing healthy physical activity and dietary behaviors in their children from a very young age. In pursuit of effective strategies to reduce childhood obesity rates, the number of studies evaluating the impact of parent- or family-focused programs to improve children’s health has steadily increased in recent years, though progress has been modest [7]. As such, novel approaches are urgently required to improve the effectiveness of these interventions.

Recently, two reviews of observational [8••] and experimental [9••] parenting and childhood obesity studies identified that mothers represent an overwhelming majority of research participants. Unfortunately, this reflects a broader trend where

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fathers have been underrepresented across multiple domains of pediatric research including child and adolescent psychology treatment [10] and general parenting programs [11, 12]. As such, the unique contribution of fathers to fostering healthy lifestyle behaviors in their childhood has been largely overlooked. This is likely due to a combination of researchers specifically targeting mothers, who are assumed to be the primary caregiver and low response rates from fathers in research studies [13].

The lack of meaningful representation of fathers in childhood obesity research is a major evidence gap, which has likely reduced our understanding of the factors that influence childhood obesity and hindered the effectiveness of family-based interventions. Indeed, some research has shown that the weight status and parenting behaviors of fathers may be more important for predicting childhood obesity than mothers [14, 15]. For example, a recent study of 3285 Australian families reported that children with an obese father and a healthy weight mother were 15 times more likely to be obese than children with healthy weight parents, respectively [14]. In contrast, children with an overweight or obese mother and a healthy weight father were not at significantly increased risk of obesity. Similarly, a longitudinal study of nearly 5000 children identified that the parenting styles of fathers were reflected in the weight-related behaviors of their children. After controlling for multiple covariates including socioeconomic position, child sex, parent education level, and parent BMI status, children whose fathers were characterized as “permissive” or “disengaged” were at significantly increased risk of obesity compared to children whose fathers displayed high levels of warmth and control (i.e., authoritative parenting) [15]. In this study, mothers parenting styles were not associated with child weight outcomes.

This research suggests that fathers may have a particularly important influence on the weight status of their children [14, 15]. In addition, fathers are now spending more time with their children than ever before [13]. As such, much more high-quality research is warranted to identify the specific mechanisms of this effect and determine how fathers can best be targeted to improve their children’s health in future research and practice.

To inform and encourage future research in this area, this paper will provide an overview of existing studies that have examined the influence of fathers on the physical activity and dietary behaviors of their children. To begin, we will provide a summary of observational research findings, which represent the majority of evidence in the field to date. Following this, we will summarize the methods and results of our *Healthy Dads, Healthy Kids* randomized controlled trials [16, 17, 18], which were recently identified as the only published studies evaluating father-focused programs on children’s lifestyle behaviors [9]. Finally, we will

provide a series of experiential recommendations for researchers and practitioners who are looking to engage fathers, based on insights we have gained from our work in the field.

## Observational Research

### Overview

Recently, Davison and colleagues conducted a systematic review to identify the inclusion of fathers as research participants in observational studies on parenting and childhood obesity [8]. The study included all articles published from 2009 to 2015 that examined parental influences on childhood obesity or obesity-related behaviors, including physical activity and diet. Notably, fathers represented only 17% of parents across the 667 eligible studies, 48% of which included no fathers at all. In the 52% of studies that included at least one father, the unique insights of fathers were merged with mothers in the analysis 84% of the time [8]. Overall, only 10% of studies reported father-specific data and only 1% of studies included fathers only [8].

By clearly demonstrating that fathers are underrepresented in observational research into parenting and childhood obesity, Davison and colleagues concluded that this evidence gap has compromised the development of effective family-based obesity prevention interventions for children. The review also identified several notable biases in existing research; studies that included fathers were less likely to focus on children aged 0–5 years, more likely to focus on physical activity rather than diet, and less likely to represent fathers from underserved populations (e.g., ethnic minorities and fathers living in areas of low socio-economic position) [8].

In the following section, we will provide an overview of key findings from published observational studies exploring paternal associations with child physical activity and dietary behaviors. However, it is important to consider these findings as very preliminary insights given the overall dearth of research in this area [8]. While other behaviors such as sleep and sedentary behavior (e.g., screen time) have also been linked to childhood obesity, these will not be covered due to the lack of studies focusing on these outcomes.

### Physical Activity

Although parents are influential in promoting children’s physical activity behaviors, very little cross-sectional research has examined the unique influence of fathers [8, 19]. Of the limited research available, most has focused on “physical activity modeling” and “physical activity parenting” [19]. Other potentially important variables such as attitudes or

family cohesion have not yet been explored sufficiently to enable meaningful insights [20].

### *Physical Activity Modeling*

Although systematic reviews of parental correlates of physical activity have reported mixed evidence regarding the effect of parental physical activity modeling on child behavior [21, 22], most studies have combined data from both parents without considering the unique paternal and maternal impacts and inter-parental dynamics. However, in a review of environmental correlates of youth physical activity [23], Ferreira and colleagues noted that, while no associations in parent-child activity were identified in studies with merged parental data, paternal physical activity was significantly associated with child physical activity in 52% of cases, suggesting a modest, positive association. Neshteruk and colleagues supported this finding in their more recent review of the influence of fathers on child physical activity [19••], which similarly identified that 52% of published father-child physical activity correlations were significant and positive. In contrast, maternal physical activity levels have been found to be largely unrelated to child physical activity [23].

Although paternal physical activity levels have not predicted child physical activity in all studies, the apparent moderating effect of parent sex warrants further examination in future research. To advance the field, researchers should also consider the unique influence of fathers after controlling for maternal physical activity levels, which cannot be investigated when parental data are combined. For example, a recent longitudinal study with a nationally representative sample of 887 US children aged 10–18 years highlighted that fathers' vigorous physical activity levels were consistently and positively associated with children's vigorous physical activity, even after adjusting for possible confounders including maternal physical activity [24].

### *Physical Activity Parenting*

Another variable that is often identified as an important correlate of child physical activity is parental support [25], which can be conceptualized in a number of ways including logistic support (e.g., transport to sporting events), verbal encouragement, and co-participation. A growing body of research has shown that while mothers often take the lead in providing logistical support, fathers are much more likely to initiate and drive co-participation in physical activity and sport with their children [26, 27]. In a recent qualitative study, most mothers described fathers as the family's "physical activity leaders" who were generally responsible for engaging the children in sports and physical activities at home and in the community [26]. Similarly, in another study where children were asked to write, draw, and describe the factors that help them be more active, they were more likely to draw pictures where

they were engaged in co-physical activity with their fathers compared to their mothers, who were sitting and watching in some instances [28].

These qualitative insights have also been supported by quantitative evidence. In a large observational study with 10,694 kindergarten-aged children, Beets et al. determined that the amount of time fathers spent with their children on weekdays and weekends significantly predicted child physical activity levels, and this influence was mediated by time spent in family sporting activities [29]. A recent longitudinal analysis with accelerometer-measured physical activity also identified that a strong paternal influence may be particularly important to encourage sporting participation in young people living in areas of low socio-economic position [30].

Despite the limited research in this area, these studies provide a good indication that father-child co-physical activity is a key ingredient in establishing and maintaining positive physical activity habits in children. Although the mechanisms for this effect are still somewhat unclear [30], sociologists have noted that "play" is often more central to fathers' parenting styles than mothers' and this pattern emerges at a very early stage in child development [31]. Studies show that fathers typically play more often with their infants than mothers and with greater physicality [27], and in general, fathers are also better models for fundamental movement skill development (e.g., catching, kicking, throwing) due to their increased opportunity and encouragement to learn and practice these skills throughout life [32, 33]. Aside from the health benefits of increased activity, the typical "masculine interaction style" of fathers, characterized by unpredictable, stimulating, risky, vigorous, and fun play, is also thought to improve children's social-emotional well-being and help them develop the self-regulatory skills required to stay calm when needed and compete without aggression [31, 34, 35].

Father-child co-physical activity is also a key ingredient in nurturing the father-child relationship [27]. Indeed, scholars have conceptualized the father-child bond as an "activation relationship," which primarily develops through physical, rough-and-tumble play [34]. Father-child co-physical activity continues to play a key role as children grow older. For example, in a study with 43 men who were fathers and 43 adult women who were daughters (fathers and daughters not related), both groups described father-daughter participation in sporting activities during the daughter's childhood as the most common "turning point" in the quality of their relationship and emotional connection [36]. For this reason, sports and physical activity have been described as the dominant cultural contexts where fathers leave an enduring legacy with their children [37]. Finally, while some studies suggest that fathers spend more time being active with their sons than their daughters [21], a recent review identified inconclusive evidence on this topic [19••]. However, the authors acknowledged that this was likely due to the dearth of published research and called

for more studies to examine the potential moderating effect of child sex on fathers' physical activity parenting practices.

## Diet

To date, fathers have been largely overlooked in research relating to children's dietary behaviors [38]. However, the traditional gender roles of parents are changing over time and fathers now spend more time with their children than ever before [13, 39]. Recent estimates suggest that over 96% of fathers who live with their children and 30% of fathers who live apart from their children share a meal with their children every day or several times a week [40]. In addition, most fathers now agree that they have a responsibility to be involved in child feeding and ensuring that their children are receiving adequate nutrition at least half of the time [41]. In a recent qualitative study with a diverse range of fathers ( $n = 37$ ), 62% reported sharing child-feeding responsibilities with the child's mother and 16% reported sole responsibility [42]. For the parents who shared child-feeding duties, some completed all tasks together, some were responsible for unique tasks, and some were responsible for all child feeding tasks on alternating days. For these reasons, fathers may have a considerable influence on their children's eating behavior. As with physical activity, two hypothesized areas of paternal influence on children's dietary behaviors are fathers' modeling and parenting practices.

### *Dietary Modeling*

A growing body of research has investigated the role of parental modeling on child dietary intake. Most studies, however, have relied heavily on maternal data [43]. Despite this, the available evidence indicates that fathers' dietary habits have a unique and important influence on those of their children. Of the available data, independent studies have identified moderate correlations between father-child consumption of fruit for children aged 2–5 years [44], 5–12 years [45], and 12–18 years [46]. Independent of maternal intake, fathers' intake of sweet snacks during infancy has also predicted an increase in child intake of sweet snacks at 3.5 years [44]. In another recent study, McIntosh et al. identified that one of the strongest predictors for the amount of time children spent in fast-food restaurants was the fathers' use of such restaurants, but not the mothers' use [47]. The effect of paternal modeling on other dietary variables (e.g., vegetable intake, macronutrient diet composition) currently remains unclear, largely due to a lack of published research.

Similar to the studies examining the role of fathers' parenting practices on child dietary behaviors, it is important to note that the impact of paternal modeling is also likely to be moderated by a number of factors. To provide a recent example, Walsh and colleagues determined that the dietary intake of younger, overweight fathers from low socio-economic backgrounds may have a particularly strong influence on their children's intake [48]. For

this reason, much more research is required in this area before firm conclusions and insights can be drawn.

### *Dietary Parenting*

Recently, Khandpur and colleagues conducted a review of all research examining the role of fathers in child feeding, published up to February 2014 [49]. As expected, very little research was available. Of the 20 included studies, most recruited small, homogeneous samples of white, well-educated fathers with little representation of fathers from underserved groups. Most insights were based on cross-sectional data collected with survey instruments that were not validated for use with fathers. As such, all findings in this area should be treated as preliminary and interpreted with caution.

Acknowledging these limitations, the authors were able to identify some emerging patterns. Of the available evidence, fathers appeared to be more likely than mothers to focus on their child's overall food intake rather than the nutritional quality of the food [49]. In addition, fathers were often less likely than mothers to limit their child's access to food or monitor their food intake, but more likely to employ strategies to pressure their child to eat (e.g., food as a reward, physical prompts, praise) [50–52]. However, some research has demonstrated that paternal feeding practices are moderated by the child's weight status, with increased child BMI associated with greater paternal encouragement for healthy eating, lower pressure to eat, and greater restriction of child food intake [49]. The impact of child sex of paternal feeding practices was inconsistent.

In the time since the previous review was published, the field appears to have progressed with more studies considering fathers' perspectives and targeting fathers from a broader range of backgrounds (e.g., [53–57]). Consequently, it has become evident that paternal feeding practices vary between fathers from different cultural groups and socio-economic positions. For example, Lora et al. identified that child sugar-sweetened beverage intake was associated with instrumental feeding (i.e., use of food as a reward) and emotional feeding (i.e., use of food to calm) in Hispanic, but not African-American fathers [56]. In contrast, father reports of their child's "desire to drink" may be a stronger predictor of SSB consumption in African-American families. In another recent study, fathers who lived apart from their children and fathers without a college education were more likely than their counterparts to let their child dictate food preferences [57].

## Experimental Research

### Overview

To date, most studies exploring the influence of fathers on their children's physical activity and dietary behaviors have

used cross-sectional or longitudinal study designs [8••, 49••]. While these studies provide preliminary insights, observational data do not provide strong evidence for causality and should be supplemented with rigorous experimental data. However, progress in this area has been limited by a consistent lack of fathers in family-based programs targeting children's lifestyle behaviors [9••].

Recently, we conducted a systematic review of father involvement in randomized controlled trials, which tested obesity prevention or treatment programs for children aged 0–18 years [9••]. The review included 213 unique RCTs, all of which included a parental intervention component and were designed to improve children's physical activity, dietary habits, or sedentary behavior. As observed in Davison et al.'s review of observational research studies [8••], mothers also represented an overwhelming majority of parents in experimental research. Across the 213 RCTs, fathers represented less than 10% of parents. In trials where only one parent could participate, this proportion reduced to 6% ( $n = 12,604$  mothers;  $n = 871$  fathers). Notably, fathers were underrepresented regardless of study setting, delivery mode, or targeted child age group. Of interest, a greater proportion of fathers participated in studies targeting child physical activity (17%) rather than child diet (9%), though the difference was not significant.

Although the number of intervention studies increased steadily over time, the proportion of participating fathers remained small. Further, while 19 studies explicitly targeted mothers only, just two studies (1%) reported explicit attempts to increase father involvement. One of these was the only program (*Healthy Dads Healthy Kids* [HDHK]) that has specifically targeted fathers [16••, 17]. The second was a preschool nutrition program that included one session (out of 13) where fathers were invited to cook with their children [58]. Moreover, only four studies (2%) suggested that a lack of fathers was a possible limitation. Indeed, for those interventions that recruited some fathers, the nature of father involvement was not described in any study.

Given the complete absence of insights regarding fathers from published experimental research, the following section will feature the Healthy Dads, Healthy Kids program of work, which we have led from our research center. An overview of the program will be provided along with a summary of key components, study findings, and insights we have gained from conducting the only father-focused intervention internationally.

### *The Healthy Dads, Healthy Kids Program*

With colleagues at the University of Newcastle, Australia, we developed and tested the first childhood obesity prevention program specifically targeting fathers [16••, 17, 18, 67]. The HDHK program engages fathers as agents of change to

improve their own health and the health of their children with a range of strategies including increased co-physical activity, improved modeling of healthy eating behaviors, and enhanced knowledge of effective parenting practices to optimize child physical activity, dietary, and recreational screen time behaviors [18]. Importantly, the program also engages children to become healthy role models for their fathers. To date, HDHK has been tested in efficacy [17] and effectiveness [16••] RCTs and a translational trial [67].

Given the clear lack of fathers in previous studies [9••], the design and delivery elements of the HDHK program were socio-culturally targeted to appeal specifically to fathers [59]. Based on considerable quantitative (e.g., process evaluation) and qualitative (e.g., focus groups, interviews) formative work, the HDHK program has been continually refined to ensure that the unique preferences, attributes, values, and motivators of fathers are integrated into the program recruitment methods, content, format (i.e., setting and mode of delivery), facilitator selection, and pedagogy (i.e., teaching strategies) to ensure that the program was appealing and engaging. For example, the recruitment materials strongly targeted unique paternal motivators including the opportunity to spend quality time with their children having fun and engaging in rough-and-tumble and sporting activities [59]. We also highlighted the father-only nature of the program, as many fathers are reluctant to participate in “parenting” programs generally dominated by mothers [60] and the program was held after work hours to be more convenient for fathers [60].

Importantly, the core program messages were pitched as strategies to help fathers achieve outcomes they valued for their families. As many parents incorrectly believe that their children are meeting physical activity and dietary recommendations [61, 62] and fathers are generally less likely than mothers to consider excess weight as a problem for themselves [63] or their children [64], the program emphasized the importance of improving health behaviors for other purposes including optimizing children's social-emotional well-being, improving the quality of the father-child relationship, and increasing social interaction, bonding, and meaningful conversations [59]. The program also encouraged reciprocal reinforcement [16••], where the children were motivated to improve their health and role model healthy behaviors for the benefit of their father and vice versa. A recent systematic review and realist synthesis of family-based physical activity interventions [65], which included the HDHK studies, reported that targeting valued outcomes and encouraging children to become agents of change within their families were two of the most effective strategies to increase child physical activity levels.

The HDHK program was first tested in an efficacy RCT with 51 fathers and their 71 primary school-aged children (5–12 years) [17, 66]. In this trial, the program was conducted in a university environment and delivered by trained researchers

with physical education backgrounds. Over eight consecutive weeks, the participants attended five father-only education sessions and three joint education and physical activity sessions for fathers and their children. At the 3-month post-intervention assessment, medium-to-large group-by-time effects in favor of the intervention group were detected for fathers' weight, waist circumference, blood pressure, resting heart rate, and objectively measured physical activity (all  $p < 0.05$ ), but not dietary intake. Positive treatment effects were also detected for children's physical activity, dietary intake (daily kJ/kg), and resting heart rate. These effects were all maintained at 6 months post-baseline. Importantly, the feasibility of the program was confirmed through very high participant satisfaction, attendance, and retention rates.

After establishing the efficacy of the HDHK program, we then tested the program's effectiveness in a larger-scale RCT [16••], which included 93 fathers and 132 children living in rural areas with high rates of mining and shift-work employment. In this trial, the program was delivered in community settings by trained, local facilitators. At post-test, a number of small-to-medium effects were identified for a range of health outcomes for both fathers (e.g., weight, waist circumference, physical activity, energy intake) and children (e.g., BMI  $z$  score, physical activity) [16••].

Following this, the program was rolled out in a non-randomized community translation trial with 190 families across five local government areas in NSW, Australia [67]. At 12-month follow-up, an intention-to-treat analysis identified significant treatment effects for fathers' weight and children's BMI  $z$  score in addition to a range of health behaviors (e.g., physical activity, diet). Further, focus groups with fathers ( $n = 25$ ), mothers ( $n = 15$ ), and children ( $n = 41$ ) revealed improvements in "father-child bonding" and "family bonding" as key themes in all groups. Other themes included "positive family habits" (e.g., family walks, no TV during dinner) (fathers/mothers), "positive changes in dad" (e.g., reducing screen time, playing more fun/active games) (children), and "increases in dad's family involvement" (e.g., packing kids lunches, role in family) (mothers). Although the program effects in the effectiveness RCT and community translation trial were partially diluted compared to the efficacy trial, these studies provided additional support for our hypothesis that father-focused programs delivered in community settings were an effective and engaging strategy to improve family health outcomes and family functioning.

After establishing the program's efficacy and effectiveness, Lloyd et al. conducted a series of mediation analyses in an attempt to identify the mechanisms of the program's effect on children's core food intake and physical activity [16••]. With the HDHK effectiveness RCT data [16••], the mediation analyses indicated that approximately 73% of the intervention effect on child core food intake was attributed to improvements in the fathers' beliefs about the benefits of healthy

eating. While educating fathers about the holistic health benefits of healthy eating for their children may be an important consideration in future interventions, further research is needed to understand the possible mechanisms of influence. It is not known if any potential impact is a result of improved co-parenting or whether there is something unique about the interaction style of fathers in food purchase, preparation, and co-consumption that may be uniquely and independently influential.

Similarly, approximately 60% of the overall intervention effect on child steps/day could be attributed to increases in father-child co-physical activity [68•]. This finding is particularly interesting considering that the majority of parent-child co-physical activity interventions evaluated to date have been unsuccessful [20]. To advance the field, further work is required to identify the optimal intensity, duration, purpose, and nature of co-physical activity to elicit improvements in children's physical activity attitudes and behaviors. In HDHK, we provide fathers with the resources and motivation to provide one-on-one co-physical activity opportunities with their children that maximize enjoyment and, thus, opportunities for moving, laughing, talking, and learning. Whether these enhanced co-physical activities result in superior outcomes compared to more basic co-physical activities (e.g., passing a ball back and forth) requires further investigation. In particular, exploration of these associations accounting for possible child characteristics/attributes as moderators may be of interest, for example, personality, fundamental movement skill proficiency, and attitudinal disposition to physical activity.

Compared to the control group, HDHK fathers in the effectiveness trial reported significant improvements for some physical activity and diet-related parenting practices including limit setting and reinforcement [69]. Although other parenting practices were specifically targeted in the intervention (e.g., pressure to eat, monitoring, reinforcement), no changes were detected in these variables. As the program targeted children aged 5–12 years, this may highlight the difficulty in changing some entrenched parenting behaviors in fathers and the importance of involving fathers in early childhood programs. However, our recent review identified very low participation of fathers in obesity prevention RCTs targeting newborns/infants (0–1 years; 0%) and toddlers/preschoolers (2–4 years; 10%) [9••], with no studies specifically targeting fathers.

Although HDHK predominantly targeted fathers, the mothers received specific program resources, were invited to one session of the program, and participated in the family-based home tasks [17, 18]. This intervention dose in our community RCT was unfortunately not sufficient to generate changes in any maternal parenting practices at post-test [69]. The program has since evolved to engage mothers in a more meaningful way, and mothers have reported some positive changes in their parenting and home environment [67]. Of interest, a similar effect was also observed recently in the

**Table 1** Recommendations and research considerations for involving fathers in childhood obesity prevention and treatment studies

Recruiting dads	<ul style="list-style-type: none"> <li>• Research indicates that the most important and valuable program features for fathers are demonstrated effectiveness, personal relevance, and the use of trained facilitators [72]. Highlight these wherever possible.</li> <li>• Ensure that recruitment materials focus on salient motivators for fathers. For example, feature opportunities for father-child co-physical activity, which is particularly important to the paternal parenting style. Fathers also highly value opportunities to enhance the father-child relationship and increase their children’s self-esteem, confidence, and social skills.</li> <li>• Include targeted recruitment strategies with explicit reference to fathers. Fathers often assume that “parent” is interchangeable with “mother” in recruitment material.</li> <li>• Include children in the program wherever possible and maximize their involvement. The most common reason fathers signed up to our studies was to spend quality time with their children.</li> <li>• As fathers have expressed discomfort in participating in mother-dominated groups, target them specifically via father-only programs or father-specific sessions, where possible.</li> <li>• Ensure that face-to-face programs are held at convenient times and locations for fathers (e.g., after work hours or on the weekend).</li> <li>• Ensure that fathers are valued, recognized, and have an enjoyable experience during the program to increase the chances of positive word of mouth.</li> </ul>
Engaging dads	<ul style="list-style-type: none"> <li>• Promote a strength-based approach to fathering in all aspects of program delivery. Research shows that fathers want to be involved and care about their children’s physical activity and dietary habits.</li> <li>• Fathers view themselves as role models for their children but face considerable personal challenges to maintaining a healthy lifestyle. Provide fathers with sustainable and evidence-based strategies to improve their own behaviors.</li> <li>• To increase the likelihood of sustainable behavior change, facilitate reciprocal reinforcement between fathers and their children (i.e., motivate each group to role model healthy behaviors for the benefit of the other). Encourage children to become leaders within the family unit.</li> <li>• Use humor where appropriate to engage fathers and highlight key information.</li> <li>• As fathers may be less likely than mothers to view their child’s weight as a problem, consider focusing on other motivators when encouraging behavior change (e.g., co-physical activity leads to improved social-emotional well-being in children and improved father-child bonding).</li> <li>• Include practical, evidence-based parenting tips and provide opportunities for social connectedness by allowing fathers to share their unique experience with other fathers.</li> <li>• Make time to talk to fathers before and after sessions for candid and immediate feedback on the program.</li> <li>• Where possible, select facilitators who fathers would perceive as credible, relatable, and likeable sources of information.</li> <li>• It can be particularly effective to choose fathers as program facilitators, provided that they meet these desirable characteristics and have the required skills for effective program delivery.</li> <li>• Provide health information to fathers using a frank and realistic approach. Identify key messages and report them clearly.</li> <li>• Target co-parenting as a critical strategy for families to optimize their children’s health. Encourage dads to appropriately discuss new information with their partners. Engage mothers/partners in programs in some way (inviting to sessions/tailored resources).</li> </ul>
Future research considerations	<ul style="list-style-type: none"> <li>• Endeavor to collect data on parenting practices, modeling, and child health behaviors from both parent perspectives so the unique influence of fathers can be explored after controlling for maternal variables.</li> <li>• Additional insights into the unique and complementary roles of mothers and fathers on their children health could be gained through randomized controlled trials with interventions targeting fathers only, mothers only, or both mothers and fathers.</li> <li>• Consider the use of innovative technologies (e.g., wearable cameras, digital recorders) to gain novel insights into the unique contributions of fathers (e.g., to assess the quality of father-child co-physical activity, co-parenting variables, the quality of father-child interaction, dinner table parenting practices).</li> <li>• Conduct mediation and moderator analyses to further our understanding of <i>how</i> fathers influence their children’s physical activity and dietary. What are the specific mechanisms of this effect and are they “father-specific”? What is unique about how fathers support healthy home environments and/or interact and engage with children in relation to both diet and physical activity?</li> <li>• Identify the effectiveness of internet-based or e-health interventions targeting fathers, as these may be more appealing for some fathers due to increased accessibility and flexibility.</li> <li>• Implement strategies to increase the representation of fathers from ethnically diverse backgrounds, low socio-economic positions, and non-traditional family structures (e.g., fathers that live apart from their children) in both observational and experimental research.</li> <li>• Researchers and practitioners are strongly encouraged to develop and test childhood obesity prevention and treatment interventions that directly engage fathers. To date, less than 1% of published research trials have primarily targeted fathers as the agents of change within families.</li> </ul>

InFANT trial [70], where an early-childhood obesity prevention program targeting mothers did not generate any flow-on health benefits in the corresponding fathers. As fathers have reported a preference for father-only programs [60], an interesting challenge for researchers will be to identify how to increase the intervention effect through meaningful mother involvement, without compromising levels of father engagement.

## Recommendations

In addition to study outcome papers, scholars have recently called for researchers to report more experiential insights into effective recruitment strategies, engagement mechanisms, and intervention components that may be linked to intervention efficacy [71]. As relatively little is currently known about how best to engage fathers in obesity prevention research, we have included a summary of practical suggestions for researchers and practitioners (see Table 1). These suggestions are based on insights from our experience in the field in combination with other published recommendations (e.g., [60, 72, 73]). Combined with high-quality, methodologically rigorous observational and experimental data, we hope that these suggestions may help researchers achieve a more meaningful representation of fathers in future studies exploring the link between parenting and childhood obesity.

## Conclusion

A growing body of research has shown that fathers make a unique and valuable contribution to their children's development across social, cognitive, behavioral, emotional, and academic domains [39•]. Despite this, fathers have been notably absent in observational and experimental research exploring parental influences on child physical activity and nutrition [8••, 9••, 49••]. While the available data indicate that fathers play an important role in this area, a reliance on cross-sectional designs and small, ungeneralizable samples confirms that much more work remains to be done. To advance the field, high-quality longitudinal studies are required where the unique influences of fathers are considered independent of mothers. To improve the quality of childhood obesity prevention programs, a deliberate and sustained effort is also needed from researchers to greatly increase the meaningful engagement of fathers.

## Compliance with Ethical Standards

**Conflict of Interest** Philip J. Morgan and Myles D. Young declare they have no conflict of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

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