Mini Review

Summary of the Evidence for the Role of Incentives in Health-Related Behavior Change: Implications for Addressing Childhood Obesity

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Abstract

Childhood obesity is a growing global priority and strategies for health-related behavior change in children have received an increasing level of attention. There has been a recent focus of research on incentives based on behavioral economics literature but work remains to build the evidence base, and inform future translation of behavior change strategies into policy and implementation in community initiatives addressing childhood obesity. The review aims to summarize the literature on effectiveness of incentives for health-related behavior change in children, and discuss gaps in the evidence base and considerations for the design of future strategies for managing childhood obesity. The review found limited but encouraging evidence for a role of incentives in improving health-related behaviors in children, and the behavioral science literature identifies ways in which incentive schemes may be enhanced. Future research that draws on behavioral science will assist in the design and implementation of behavior change strategies for overweight and obese children. Combined with detailed process evaluation, to understand context, this research will support constructive change in tackling the growing global problem of childhood obesity.

ABBREVIATIONS

RCT: Randomized Controlled Trial; BMI: Body Mass Index, Incentives, Behavior Change

BACKGROUND

Childhood obesity is a global priority with the number of overweight children in 2013 under the age of five estimated at over 42 million [1]. Overweight and obesity in childhood is likely to continue into adulthood [2] and is a major risk factor for chronic diseases such as diabetes and cardiovascular diseases at a younger age [3]. The increasing prevalence also poses a growing burden on current and future health services [4] and improving management and preventative measures of childhood obesity is extremely important.

Facilitating health-related behavior change, especially sustained behavior change, is an ongoing challenge for child-focused obesity services as individuals find it difficult to make lasting behavior changes related to healthy eating and exercise [5]. This is in spite of the specific behaviors required for effective weight-loss, which includes increasing consumption of fruit and vegetables and increasing physical activity [6-11] and elements that are recognised as important to achieve long-term behavior changes [6-9] being well established. Furthermore, associated implementation challenges mean that behavior change interventions are often not up-scaled and translated into the community context [9-13].

The current burden coupled with the expanding need for prevention has led to a focus by researchers and policy makers on novel behavior change strategies that have potential to improve health-related behaviors and encourage habit formation. Recently, there has been increased interest from policy makers in strategies informed by principles of psychology and behavioral science [14,15], including the role of incentives for improving health-related behavior change in children. The aim of this review is to provide an overview of current evidence relating to the potential role of incentives in health-related behavior change and to discuss implications for future research and translation into policy.
THE POTENTIAL ROLE OF INCENTIVES IN HEALTH-RELATED BEHAVIOR CHANGE

The difficulties in facilitating behavior change and policy interest in behavioral science [15] has stimulated an increase in research investigating whether incentive schemes might facilitate behavior change. These schemes based on psychological and behavioral theory, and using small, tangible and non-food-based rewards, might therefore provide a solution to some of the challenges faced by public health interventions.

Incentives research targeting behavior change involving adults

There is promising research in adults that has demonstrated that incentives can encourage health-related behavior change in the short-term [16-18]. For example, several systematic reviews (of adult populations) have demonstrated effective outcomes in terms of managing overweight and obesity as a result of financial incentives for dietary behavior change [19-21]. A review of randomized controlled trials (RCTs) using body mass index (BMI) as an outcome measure reported that all four of the included studies demonstrated monetary incentives increased food purchases, food consumption and weight loss [21]. A meta-analysis of seven RCTs on behavioural obesity treatments considered the effects of incentives after removal [20] and found support for effects of small financial incentives on dietary behaviors during intervention phases, but no significant effects of incentives on weight loss or maintenance of behavior change at 12 months and 18 months. Recently a systematic review that included a broad range of study designs provided further evidence for associations between financial incentives and improved dietary behavior change [19]. All of the 12 studies included in the review called for more specific information on the type, timing and magnitude of incentives needed to motivate individuals to change their behavior, as well as disincentives, highlighting that further research is needed in this area.

Two systematic reviews, each including more than 10 RCTs, demonstrated that monetary incentives improved exercise behaviors, such as participation and adherence. Similar to studies on dietary behaviors, outcomes regarding sustained effects were variable [22,23]. Further, due to high heterogeneity in terms of design, incentive strategy and outcomes, along with a lack of long-term follow up, firm conclusions regarding the most effective incentive strategy could not be drawn. It was suggested however, that rewarding individuals after a behavior is performed multiple times within a set timeframe may be more effective for habit formation than rewarding each instance of behavior [22], and that having certainty of receiving a reward and behavior assessed objectively may moderate incentive effectiveness [23]. Both studies also emphasized the importance of drawing upon behavioral principles in the design of incentive strategies and highlighted those existing incentive strategies in the real world context lacking grounding in basic behavioral theories.

Incentives research targeting behavior change involving children

Despite the advancing evidence base for research in adults, robust research investigating the value of incentives focused on improving health-related behaviors in children remains limited. There is, however, encouraging emerging preliminary evidence (Table 1). For exercise behavior, one (non-randomized) study in children (n=1,589) has found that an incentive program, based on receipt of lottery-style tickets, increased the probability of children bike riding to school by 16% [24]. Two RCTs that aimed to increase physical activity have shown that combining feedback on physical activity via an accelerometer plus token-style rewards redeemable for a high preference activity (access to television viewing) could be an effective strategy for increasing physical activity in children [25, 26], and potentially lead to habit formation [25]. However, the small sample sizes in many of these studies must be noted. In relation to healthy eating, three randomized studies (across 40 primary schools) have reported that simple rewards (such as stickers or low value monetary rewards) doubled the number of children consuming a serving of fruit or vegetables with their school lunch [27-29], and two of these studies reported sustained effects at two months [28] and six months [29] after the intervention.

Several small RCTs have used combined reinforcement strategies by applying the psychological principle of peer modeling [30] coupled with low value extrinsic rewards (such as stickers and balls) in child-focused behavior change interventions relating to exercise [31,32], and healthy eating (fruit and vegetable consumption) [29,33] within primary schools. The studies highlighted that one incentive strategy that proves to effectively influence one target behavior may not work in the same way for another behavior. Peer modeling with rewards were effective in encouraging both physical activity [31,32] and healthy eating [29,33] during intervention phases, but inconsistencies between studies emerge with regards to the impact of rewards on exercise behavior in the longer term [31], and the different effects by gender and age.

Current evidence indicates that incentives may also work differently over different time periods, and for different children. Two studies [27,33] found the greatest increases by incentives on fruit and vegetable consumption in children from lower socioeconomic backgrounds, which has encouraging implications for these children who may benefit the most from eating more fruit and vegetables [34]. Emerging acknowledgement of wider influencing factors in research with children is encouraging and strongly supports the call for more research to investigate the context in which incentives provide the most effective solution to changing and sustaining health-related behaviors [35]. The nine studies discussed above are included on the basis of findings from a (nonsystematic) literature search using specific search terms such as “child incentives” and “child health behaviour change” in the PubMed library. Key word Internet searching and study reference lists were also utilized. The studies found are summarized in Table.

Whilst the literature above provides an optimistic foundation from which further research in children may build, the limitations of these studies should be acknowledged and addressed. Existing studies are small (Table for sample sizes), the duration of the intervention and follow-up is generally short and inconsistent between studies (e.g. intervention duration ranged from eight days to four months, and follow-up duration ranged from four...
Table 1: Overview of current evidence for the role of incentives in health-related behavior change in children.

<table>
<thead>
<tr>
<th>Design</th>
<th>Participants</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuffe et al. (2012)</td>
<td>Before-after, cohort N= 8 elementary schools, 1589 healthy children</td>
<td>Lottery-style tickets worth $10 in cash for walking or riding to school in a 5 day prize period</td>
<td>16% increased probability of riding to school</td>
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<tr>
<td>Just &amp; Price (2012)</td>
<td>Randomized field experiment, with 4 week follow-up after incentives removed N=15 elementary schools</td>
<td>5 different incentive schemes varying in size and timing</td>
<td>Increased number of children consuming a serving of fruit or vegetables by 80%. No sustained effect 4 weeks post intervention</td>
</tr>
<tr>
<td>Lowenstein et al. (2015)</td>
<td>Field experiment, with 2 month follow-up after incentives removed N=40 elementary schools, 800 healthy children</td>
<td>Small rewards during a 3-5 week intervention phase</td>
<td>Increased fruit and vegetable consumption. A sustained effect 2 months post intervention</td>
</tr>
<tr>
<td>Morill et al. (2015)</td>
<td>Randomized field experiment, with 6 month follow-up after incentives removed N= 6 primary schools, 2,292 healthy children</td>
<td>Small rewards for consuming fruit or vegetables at school, delivered within an existing program</td>
<td>Increased effectiveness of an existing program. A sustained effect 6 months post intervention</td>
</tr>
<tr>
<td>Roemmich et al. (2012)</td>
<td>RCT, with 1 year follow up N=31 healthy, sedentary children</td>
<td>Open loop feedback via an accelerometer combined with token-style rewards for television viewing, over 4 months</td>
<td>Feedback plus rewards increased physical activity and reduced television viewing, with a sustained effect 1 year post intervention</td>
</tr>
<tr>
<td>Goldfield et al. (2006)</td>
<td>RCT</td>
<td>N=30 overweight or obese children</td>
<td>Feedback plus rewards increased physical activity and reduced television viewing</td>
</tr>
<tr>
<td>Hardman (2011)</td>
<td>RCT</td>
<td>N= 3 primary schools, 386 healthy children</td>
<td>Largest effects on increased physical activity found during intervention in the peering modelling plus rewards group (80% above control), but the peer modelling only group produced longer term effects after 14 weeks (33% above control compared to 10% above control)</td>
</tr>
<tr>
<td>Horne et al. (2009)</td>
<td>RCT</td>
<td>N= 2 primary schools, 100 healthy children</td>
<td>Girls had significantly higher step counts during intervention and at follow up compared to control, whilst boys had higher step counts only during the intervention phase</td>
</tr>
<tr>
<td>Horne et al. (2004)</td>
<td>RCT</td>
<td>N=2 primary schools with higher than average social deprivation, 749 healthy children</td>
<td>Peer modelling plus small rewards for consuming fruit or vegetables at school, compared with control, over 16 days, with tapering of reinforcements up to 4 months</td>
</tr>
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Abbreviation: RCT: Randomized Controlled Trial

weeks to one year), they focus on a single health-related behavior (i.e. either exercise or diet) and there is no known qualitative research associated with the trials. There is also no systematic review of good quality trials in children or accompanied process evaluation and therefore, robustly designed research is needed to determine for whom and in what context incentive schemes might be most effective as they relate to health behaviors in children.

IMPLICATIONS FOR ADDRESSING CHILDHOOD OBESITY

Existing literature in both adults and children highlights a number of uncertainties relating to the psychology involved in how and why people are motivated to change their behavior. For example there is considerable debate within behavioral science about whether the use of extrinsic rewards discourages...
the development of intrinsic motivation amongst individuals which is needed to support long-term behavior change [36]. The disadvantages of using rewards to modify fruit and vegetable intake or physical activity could include unspoken messages to children about the lack of intrinsic value in increasing fruit and vegetables or physical activity, or that they are not capable of such health behavior without the reward. The reward may therefore produce desired behavior change in the short term, but undermine longer term habit formation as a result of the child being less eager to seek out that behavior once the reward is removed. The wider implications on a mass scale could mean a societal shift in attitudes towards the importance of taking responsibility for one’s own health, consequently impacting responses to public health promotional activity. Note further, that all of the studies mentioned in this review have used small, tangible and non-food-based rewards for desired behavior. The use of food as rewards or punishments has been recognized as being detrimental to children’s ability to regulate eating, encouraging eating without hunger, and can lead to eating disorders in adulthood due to the mixed messages it communicates to children [37]. There are also mixed findings as to whether incentives are more useful for simple one-off behaviors (e.g. attendance at a vaccination) rather than complex health behaviors such as dietary behavior change, and if specific groups may benefit more from incentive schemes [17]. This highlights the need to fully understand not only the psychological influences on behaviour change, but also social and environmental factors as well when designing behavior change interventions, indicating that an ecological approach would be most effective.

The behavioral literature relating to young people and incentives highlights important conditions that may influence the effectiveness of incentives. One such condition is incentivising clearly defined behaviors (e.g. exercise, healthier lunches, less snacking etc.) rather than outcomes (e.g. weight loss) for longer-term outcomes. In a series of RCTs across 203 elementary schools, it was reported that providing incentives for reading books was more effective than providing incentives for outcomes such as scores on a test [38]. The size, type and timing of incentives also need to be sufficient to motivate change. One study in children [27] found that a larger financial reward (a US quarter rather than a nickel) combined with receiving it on the same day as the behavior was performed produced the largest behavior change. Therefore, when designing incentive schemes, it is potentially important to consider the value and timing of the incentives in terms of effectiveness [36]. Setting is also an important consideration for its extrinsic influence on motivations with a recent systematic review finding that community-based settings were more effective than school settings for incentivizing healthy behaviors in children [39]. Overall, behavioral theory is important for informing the design and evaluation of incentive-based interventions for children, however caution must be observed with regard to potential unintentional messages as a consequence of using extrinsic rewards, and in-depth contextual evaluation should be carried out to inform widespread implementation and translation.

FUTURE RESEARCH AND TRANSLATION

At present there remains a need for robustly designed studies in children with longer term follow up, and for detailed exploratory research conducted alongside RCTs to provide information on for whom and why and in what context incentives are most effective. In response to the gaps in the current literature, and the emergence of behavioral science literature in policy design [5,40], a cluster RCT (n=40 sites and 570 participants) is currently being conducted within an existing community-based weight management program for children, investigating the effectiveness of incentives on health-related behavior change in overweight and obese children [41]. This trial will test a goal setting and rewards program that incentivizes nutrition and physical activity on the basis of its impact on anthropometric measures. The primary outcome measure will be BMI, with secondary anthropometric measures, and behavioral and self-esteem measures. The intervention will be evaluated qualitatively and quantitatively in order to inform future implementation and facilitate translation into policy.

CONCLUSION

This is an exciting time for a new area of research in weight management and prevention of childhood obesity. There is currently limited but encouraging preliminary evidence for a role of incentives in improving health-related behaviors in children and addressing the challenges of public health interventions. In this review we hope to bring to attention the need for further research to continue developing and evaluating incentives schemes for children based on behavioral literature. This research will assist researchers, community health practitioners and policy makers in implementing behavior change strategies for overweight and obese children, supporting advances in tackling the growing global problem of childhood obesity.

REFERENCES


37. Puhl RM, Schwartz MB. If you are good you can have a cookie: How motivations for health and weight control shape children’s food choices. Appetite. 2006.


