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Pilot survey of a novel incentive to promote healthy behavior among school children and their parents

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ABSTRACT

Reversing the obesity epidemic has been a persistent global public health challenge, particularly among low socioeconomic status populations and racial/ethnic minorities. We developed a novel concept of community-based incentives to approach this problem in such communities. Applying this concept, we proposed a school intervention to promote obesity prevention in the U.S. We conducted a pilot survey to explore attitudes towards this future intervention. The survey was collected as a nonprobability sample (N = 137 school-aged children (5–12 years)) in northern California in July 2013. We implemented multivariable logistic regression analyses where the dependent variable indicated the intention to participate in the future intervention. The covariates included the body mass index (BMI) based weight categories, demographics, and others. We found that the future intervention is expected to motivate generally-high-risk populations (such as children and parents who have never joined a past health-improvement program compared to those who have completed a past health-improvement program (the odds-ratio (OR) = 5.84, $p < 0.05$) and children with an obese/overweight parent (OR = 2.72, $p < 0.05$ compared to those without one)) to participate in future obesity-prevention activities. Our analyses also showed that some subgroups of high-risk populations, such as Hispanic children (OR = 0.27, $p < 0.05$) and children eligible for a free or reduced price meal program (OR = 0.37, $p < 0.06$), remain difficult to reach and need an intensive outreach activity for the future intervention. The survey indicated high interest in the future school intervention among high-risk parents who have never joined a past health-improvement program or are obese/overweight. These findings will help design and implement a future intervention.

1. Introduction

1.1. Traditional financial incentive in obesity prevention

Obesity prevention has been a serious public health challenge in the past decades in both developing and developed countries (Ng et al., 2014). Although the increase in adult obesity in developed nations has slowed down since 2006, the obesity prevalence in the United States (US) has been relatively higher than other developed nations (Ng et al., 2014). The obesity prevalence among adults is currently about 38% (Centers for Disease Control and Prevention (CDC), 2016; Committee on Accelerating Progress in Obesity Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012) and has increased from 5% to 18% among children in the past 30 years in the US (Centers for Disease Control and Prevention (CDC), 2016). These rates tend to be higher among ethnic minorities and low socioeconomic status (SES) populations (Committee on Accelerating Progress in Obesity Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012; Centers for Disease Control and Prevention (CDC), 2012; Centers for Disease Control and Prevention (CDC), 2015).

The obesity-related medical costs estimated to increase by $48–66 billion per year in the US during 2010–2030 (Wang et al., 2011). Although childhood obesity alone accounts for $14 billion in direct medical costs (Finkelstein et al., 2014), obese children are likely to become obese adults (Gordon-Larsen et al., 2004; Wang et al., 2008; Freedman et al., 2009; Freedman et al., 2005), significantly raising future obesity-related medical costs (Committee on Accelerating Progress in Obesity

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Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012; Ma & Frick, 2011). Obesity also imposes social costs through disability and lost productivity (Committee on Accelerating Progress in Obesity Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012; MacEwan et al., 2014).

Prior studies have evaluated various interventions to improve behaviors for obesity prevention such as school-based child obesity interventions (Wang et al., 2013; Waters et al., 2011; Oude Luttikhuis et al., 2009; Martin et al., 2014; Wyatt et al., 2013), family support (Epstein et al., 1990; Epstein et al., 1994; Kitzmann & Beech, 2006; Wrotniak et al., 2004; Drury et al., 2013; Epstein et al., 2014; Wilfley et al., 2007), peer support (McLean et al., 2003; Cohen et al., 1987; Jeffery et al., 1983; Osilla et al., 2012; Paul-Ebhohimhen & Avenell, 2009), competition/performance-based financial incentives (Martin et al., 2014; Wyatt et al., 2013; Drury et al., 2013; Jeffery et al., 1983; Volpp et al., 2008; Paul-Ebhohimhen & Avenell, 2008; You et al., 2012; Hersey et al., 2008; Hubbert et al., 2003; Sykes-Muskett et al., 2015; Mantzari et al., 2015; Purnell et al., 2014; Mayor, 2013; Mitchell et al., 2013; Burns et al., 2012; Kullgren et al., 2013; Crane et al., 2012; Finkelstein et al., 2013; Hunter et al., 2016; Ngo et al., 2014; Patel et al., 2016; Simpson et al., 2015; Finkelstein et al., 2016; Finkelstein et al., 2015; Hunter et al., 2015), donation to charity (Finkelstein et al., 2016; Finkelstein et al., 2015; Hunter et al., 2015), and a regulatory obesity policy in child care facilities (Wright et al., 2015). For instance, one study asked adults about their preferences for a hypothetical set of obesity prevention intervention incentives (You et al., 2012) which varied in the reward form, amount, and timing. For form and timing, consistent preferences were reported (Table 1). However, like other empirical studies, this study revealed the difficulty of interpreting preference for financial reward amount with a standard individual behavior theory in economics (You et al., 2012). The theory assumes that a higher financial incentive amount will proportionally increase respondents' intention to attend a behavioral change program, a perspective widely shared by other social science fields (Jeffery, 2012; Thorgeirsson & Kawachi, 2013; Bettinger, 2012). However, the mixed results of the literature in Table 1 indicate the need for a new theory explaining outwardly inconsistent behaviors.

To address this need, we developed a novel concept of a community-based incentive. This approach assumes that a proportion of people have a stronger incentive to maintain healthy behaviors when their efforts contribute to their own community rather than to individual-based rewards. This concept is expected to fill gaps in the knowledge on motivating individuals to change health behaviors and could be applicable to broad areas of behavior change outside of obesity prevention, like smoking cessation.

Table 1
Gaps in literature on the financial incentive effectiveness to motivate behavioral changes for obesity prevention (Martin et al., 2014; Wyatt et al., 2013; Drury et al., 2013; Jeffery et al., 1983; Volpp et al., 2008; Paul-Ebhohimhen & Avenell, 2008; You et al., 2012; Hersey et al., 2008; Hubbert et al., 2003; Sykes-Muskett et al., 2015; Mantzari et al., 2015; Purnell et al., 2014; Mayor, 2013; Mitchell et al., 2013; Burns et al., 2012; Kullgren et al., 2013; Crane et al., 2012; Finkelstein et al., 2013; Hunter et al., 2016; Ngo et al., 2014; Patel et al., 2016; Simpson et al., 2015; Finkelstein et al., 2016; Finkelstein et al., 2015; Hunter et al., 2015).

Incentive features	What was reported	Gaps: What should be explored
Overall effectiveness	Mixed: Some incentive is better than no incentive	Underlying motivation to respond to incentive
Effectiveness magnitude	Mixed: Not proportional to incentive amount	Optimal incentive amount to maximize motivation
Effectiveness period	Mixed: at best, short-period (during a payment period only or less than 1 year)	How to maintain long-term motivation
Reward form	Cash or cash-equivalent (gift card) is preferred	Optimal incentive form
Reward timing	"Pay at each weigh-in" is preferred to "Pay at the final weigh-in"	Optimal timing

To test this concept's validity, we proposed a school intervention to offer educational classes encouraging healthy diet and physical activity among elementary school students and their parents in low SES areas in northern California. The intervention would create a "virtuous circle" between individual healthy behavior and community environments. Each time participating students and/or their parents achieve an intervention goal (like attending an educational class or achieving a 2% weight loss), they will donate a monetary gift from the intervention funds to their school. These gifts will further improve physical activity among students – leading to additional gifts for their school.

1.2. Concept of novel community-based incentive

1.2.1. How our incentive challenges the current paradigm on behavioral change

Obesity prevention through behavioral change is especially important in low-income populations due to their high obesity prevalence (Committee on Accelerating Progress in Obesity Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012) and limited access to clinical treatments, which are often expensive (Newacheck et al., 1996) and uncertain in effectiveness (Neovius & Narbro, 2008; Padwal et al., 2011; Picot et al., 2009). These individuals also tend to live in unfavorable community environments with limited access to healthy food and space for exercise (Committee on Accelerating Progress in Obesity Prevention, Food and Nutrition Board (FNB) & Institute of Medicine (IOM), 2012).

To overcome such adverse environments, our innovative incentive scheme enables community members to make financial contributions to their community by improving their health behaviors. Our incentive scheme uniquely assumes the behavior change motivation to be reinforced by a seemingly different motivation for community contribution (i.e., altruism) among low-income populations. This idea was derived from two empirical studies. One study, analyzing the US nationally-representative Consumer Expenditure Survey, indicates potentially stronger altruism within a low-income population, compared to a middle-income population and even a high-income population (James & Sharpe, 2007). Specifically, the lowest-level income (<$10,000) households spent 4.8% of their household income on charity. Lower-level income (<$30,000) households spent a 1.3–3.4 times higher percentage of their income on charity than middle-level income ($30,000–$100,000) households (*Appendix Fig. 1, available only for peer-reviewers*). This pattern is consistent for both religious and non-religious gifts.

The other study implies that altruism (contributing to a community) could be stronger than self-interest (individual reward) with robust empirical results (Gneezy & Rustichini, 2000). This research involved 180 students, doing volunteer work to collect donations, who were randomly assigned into three groups. The students in group (a) did not receive any payment. The students in group (b) were promised to be paid 1% of the total donation amount collected. The students in group (c) were promised to be paid 10% of the total amount collected. It was made clear that the payment was financed by a research team, not by the collected donations. Unexpectedly, the highest collected donation was achieved by group (a). The average amounts of donation collected by group (a) and group (c) were higher than group (b) by 60% and 40%, respectively.

These findings could help explain the mixed and seemingly paradoxical results reported in the literature. For instance, the outcome (participation in a weight reduction program) did not necessarily improve in proportion to the increased financial incentive amount (You et al., 2012; Mantzari et al., 2015). When focusing on only one aspect of the motivation mechanism (groups (b) and (c)), a larger financial incentive appears to lead to greater motivation to collect donations. The current research paradigm on behavior change (Table 1) tends to focus only on a comparison between groups (b) and (c) with individual reward, paying little attention to another important motivating factor,

altruism, (represented by group (a)) - which could be a potentially stronger motivator than any individual reward.

Considering these studies, we hypothesized that a proportion of low-income populations have higher motivation to contribute to their own community than to seek a relatively small individual reward. Our proposed intervention utilizes this motivation for behavior change.

1.2.2. How our novel "community-incentive" differs from the traditional incentive for behavior change

Table 2 illustrates the innovation of our community-incentive, compared with self-oriented incentives that have been traditionally seen in the literature. The fundamental difference is the assumption about the financial incentive for behavior change. We will motivate participants by enabling them to contribute to their own community. On the other hand, a traditional incentive (such as cash or a voucher) is assumed to help maximize a participant's own disposable monetary income. This difference is reflected in the recipient of the financial reward. Although the traditional intervention gives the reward directly to participants (Volpp et al., 2008; Paul-Ebhohimhen & Avenell, 2008), the reward is donated to a participant's community under the proposed intervention. Under this incentive, a community member can enjoy the reward without participating. Traditional programs require each community member to participate to be rewarded (Cohen et al., 1987; Jeffery et al., 1983).

A recent randomized controlled trial (RCT) found that a cash incentive was more effective in increasing physical activity among working adults, compared to another incentive of donating to charity (Finkelstein et al., 2016). Their RCT study's charity incentive was different from our community-incentive in two ways. First, an intervention participant will donate to a local community that she/he is affiliated with (and hence can receive a benefit) under our community-incentive scheme. Alternatively, under a conventional charity donation scheme, the RCT's participants will donate to a local group that these participants are not affiliated with (Finkelstein et al., 2016). Second, our community-incentive aims to promote mutual support among a low SES population. In contrast, >90% of participants had college or higher educational attainment (a high SES population) in the RCT study (Finkelstein et al., 2016).

Our proposed incentive does not include direct competition. Under the traditional incentive, a group is rewarded only if the "average" (or "sum") weight reduction of all members meets the reward criterion (Jeffery et al., 1983). Thus, some successful members might impose uncomfortable peer pressure on others (who fail to lose weight) (Jochelson, 2007; Burton-Chellew et al., 2010). The exclusion of competition from the proposed intervention is expected to prevent negative peer pressure (Burton-Chellew et al., 2010) and promote positive peer support from group members (McLean et al., 2003; Cohen et al., 1987; Jochelson, 2007; Burton-Chellew et al., 2010). Another difference is the use of the financial reward. Financial rewards in our intervention will be used only for improving "own" school environments to further promote physical activity (like purchasing sports equipment) and healthier diets (such as expanding a salad bar in the school cafeteria).

One feasibility study was implemented to encourage children to walk to school, rewarding a school based on inter-school competition (Hunter et al., 2015). Since this study combines various reward forms (such as donation to a charity outside school, voucher for a specific family, and a cash prize for the school), this study did not examine the unique impact of the cash prize for the school that is similar to our community-incentive. One distinction is our community-incentive intentionally excludes any type of competition, while the feasibility study encouraged competition that determines the reward (Hunter et al., 2015).

2. Methods

2.1. Data collection

In July 2013, we conducted a pilot survey among parents in elementary schools within the Sacramento City Unified School District (SCUSD) in northern California to explore attitudes towards a future intervention with the community-incentive. The Sacramento area includes a large proportion of ethnic minority (White 65.3%) and low SES populations (16.5% under 100% federal poverty level (FPL)), compared to California (White 73.7%; 15.3% < 100% FPL) (U.S. Census Bureau, 2014).

Because this was an exploratory project, the survey was anonymous and collected as a nonprobability sample. Respondents of the survey were parents of children enrolled in two summer schools within the SCUSD, the proposed location of our future intervention. Our researchers asked parents if they were interested in completing a questionnaire when they picked up their child(ren) at school. After these parents completed a survey, they received a $5 coffee shop gift card. A part of the survey, explaining the details of the proposed intervention, is attached in the Appendix. This study's protocol was approved by the IRB at the University of California, Davis.

The number of responses to the survey was 89. Because some parents had more than one school-aged (5 to 12 years old) child, we collected information for 137 children (about a 40% response rate). Due to missing values in some questionnaires and outliers (parent aged older than 60 (N = 5)), a subsample of 114 children was included in the multivariable regression analysis.

The primary survey question focused on intention to participate in the school intervention. Intention was categorized as (a) both parent and child, (b) child only and (c) no participation. Based on self-reported height and weight, we calculated the body mass index (BMI) and categorized each parent and child into overweight, obese or other. These category threshold levels were 25 and 30 BMI for adults and 85th and 95th percentile for children (Centers for Disease Control and Prevention (CDC), 2001).

2.2. Statistical analyses

Descriptive analyses were conducted to examine the association between intention to participate in the proposed school intervention and (i) the BMI-based weight categories or (ii) past enrollment in a

Table 2
Differences between our novel community-incentive and traditional incentives for behavior change (Martin et al., 2014; Wyatt et al., 2013; Drury et al., 2013; Jeffery et al., 1983; Volpp et al., 2008; Paul-Ebhohimhen & Avenell, 2008; You et al., 2012; Hersey et al., 2008; Hubbert et al., 2003; Sykes-Muskett et al., 2015; Mantzari et al., 2015; Purnell et al., 2014; Mayor, 2013; Mitchell et al., 2013; Burns et al., 2012; Kullgren et al., 2013; Crane et al., 2012; Finkelstein et al., 2013; Hunter et al., 2016; Ngo et al., 2014; Patel et al., 2016; Simpson et al., 2015; Finkelstein et al., 2016; Finkelstein et al., 2015; Hunter et al., 2015).

		Novel community-incentive	Traditional incentives
1	Assumption about financial incentive	Altruism (contribution to community)	Maximize self-interest/income
2	Recipient of a financial reward	Entire community of a participant	Participant that changed behavior
3	Individual participation requirement (to be rewarded)	No	Yes
4	Competition among participants		
	(a) Individuals	(a) No	(a) Yes
	(b) Community	(b) No	(b) Yes
5	Potential negative pressure from a community (group)	No/Less likely	Yes
6	Use of financial rewards	Community environment to promote physical activity and diet	Up to each individual recipient

health promotion program among both children (N = 137) and parents (N = 89).

We also implemented multivariable logistic regression analyses where the dichotomous dependent variable indicated the intention to participate by the child and their parent together. The key covariates were the BMI-based weight categories (both child and parent) and past enrollment in a health promotion program. Other covariates included age, sex, race/ethnicity, parent's education, current enrollment in another health promotion program, and eligibility for a free or reduced-price meal program. Sensitivity analyses were conducted where the dependent variable indicated the child's intention to participate (regardless of their parent participation), excluding covariates with a high correlation (>0.3) and including outliers (parent aged older than 60).

3. Results

The survey sample reasonably represented the area population in terms of the child obesity prevalence and parent characteristics in the Sacramento area. The proportion of overweight and obese children (BMI > 85th percentile) was 45.3% in the sample, which was not statistically different from 39.9% in the Sacramento area (Babey et al., 2012) ($p > 0.2$). The proportion of surveyed parents with at least a college education was 60.7%, which was not statistically different from 64.7% (U.S. Census Bureau, 2013) in the SCUSD ($p > 0.4$).

The survey sample overrepresented ethnical/racial minorities. The proportion of Hispanic children was 47.4% among the surveyed children, higher than 24.6% in the SCUSD (U.S. Census Bureau, 2013). Similarly, the proportion of White children was only 21.2% in the survey sample, lower than the 56.6% in the SCUSD (U.S. Census Bureau, 2013). This lower proportion of White children could be partly because some White children were reported as "Other/decline to state" (29.2%) or "Mix" (2.2%).

The results showed high interest among parents. Specifically, in 137 school-aged children, 56.2% would join with their parent and 85.4% would join the intervention regardless of parent participation.

Descriptive analyses indicated that there was no statistically significant association between the intention to participate in the intervention and the BMI-based weight categories among children ($p > 0.4$) or parents ($p > 0.6$). Another descriptive analysis examined participation intention by three categories of past health program enrollment: "no enrollment," "enrolled and completed," and "enrolled but dropped out." This analysis implied a higher participation intention among those who were not successful in past conventional programs, i.e., the high-risk populations. For instance, the intention of participation with a parent was the highest among the category "enrolled but dropped out" (100% of 3 children) and relatively higher among the category "no enrollment" (57.8% of 116 children), compared to the lowest-risk category "enrolled and completed" (38.9% of 18 children). The differences across these categories were marginally statistically significant ($p < 0.1$).

Table 3 summarizes the characteristics of the subsample (N = 114) included in the multivariable logistic regression analyses. These analyses also revealed that the future intervention will likely cover the high-risk populations (Table 4). One of these high-risk populations was families who have never joined any past health promotion program. Such high-risk families are 484% more likely to participate in the future intervention than those with the experience of participating in and completing a health promotion program (reference group; the odds-ratio (OR) = 5.84 ($p < 0.05$)). Namely, the proposed intervention seems to motivate high-risk families who were not motivated by other programs. The higher intention of participation among this high-risk population is consistent with the descriptive analysis illustrated earlier. As another example of high-risk populations, a child with an obese or overweight parent is 262% more likely to participate in the future intervention with their parent (OR = 2.72 ($p < 0.05$)), compared to a child without an obese or overweight parent.

Two types of high-risk populations, however, were found to be less likely to participate. These populations are Hispanic children (OR = 0.27 ($p < 0.05$)) and a child from a free or reduced-price meal program eligible family (OR = 0.37 ($p < 0.05$)). A sensitivity analysis, where the dependent variable was child only participation, yielded similar results except that "never enrolled in past health program" and "free meal"

Table 3
Pilot survey[a] results in Sacramento City (conducted in July 2013): Definitions and mean values.

Variable	Definition	Mean values (std. dev.)
Dependent variable		
Child and parent participation	1 if both child and parent intend to join the future intervention, 0 otherwise	0.544
Child participation (used in a sensitivity analysis)	1 if child (either with or without parent) intends to join the future intervention, 0 otherwise	0.868
Covariates		
Overweight/obese parent	1 if parent is overweight or obese, 0 otherwise	0.579
Overweight/obese child	1 if child is overweight or obese, 0 otherwise	0.447
Past never	1 if never enrolled in past health program, 0 otherwise	0.868
Current program	1 if current enrollment in another health promotion program	0.149
College	1 if parent went to at least college, 0 otherwise	0.623
Age of child	age of child (in years)	8.14 (1.93)
Age of parent	age of parent (in years)	39.4 (7.43)
Female child	1 if child is female, 0 otherwise	0.526
Female parent	1 if parent is female, 0 otherwise	0.772
Hispanic child	1 if child is Hispanic or Latino, 0 otherwise	0.474
Other than white child	1 if child is other than white, 0 otherwise	0.754
Free meal	1 if eligible for free or reduced-price meal program, 0 otherwise	0.482

[a] N = 114 school-age children.

Table 4
Multivariable logistic regression analyses[a]: Dependent variable was "child and parent participation".

Covariates[b]	OR	95% CI of OR	p > |t|
Overweight/obese parent	2.72	(1.01, 7.31)	**0.047***
Overweight/obese child	0.76	(0.30, 1.92)	0.567
Never enrolled in past health program[c]	5.84	(1.06, 32.07)	**0.042***
Current enrollment in another health promotion program	1.33	(0.30, 5.79)	0.707
College	0.90	(0.34, 2.41)	0.831
Age of child	1.02	(0.81, 1.28)	0.872
Age of parent	0.96	(0.90, 1.03)	0.262
Female child	2.45	(1.03, 5.85)	**0.043***
Female parent	3.67	(1.29, 10.47)	**0.015***
Hispanic child	0.27	(0.10, 0.78)	**0.015***
Other than white child	0.78	(0.29, 2.11)	0.623
Free meal	0.37	(0.14, 1.01)	**0.053†**
Constant	0.60	(0.01, 32.43)	0.802

Summary model statistics: Log likelihood (−70.21), Pseudo R-squared (0.15); LR chi-squared (12; 23.87), Prob > chi-squared (0.02).

[a] N = 114 school-aged children.

[b] The definitions and mean values of covariates are summarized in Table 3 (Pilot survey conducted in Sacramento City in July 2013).

[c] Reference group is "a child and parent who have completed a past health promotion program".

† $p < 0.1$.

* $p < 0.05$.

were statistically insignificant. Other sensitivity analyses also showed robust results, regardless of the exclusion of covariates with a high correlation (>0.3) and/or the inclusion of outliers (parent aged older than 60).

4. Discussion

The analysis results appeared very promising in terms of high interest in the proposed school intervention. They also suggested that the intervention would motivate high-risk populations to participate, particularly those who have never enrolled in a health program or enrolled but dropped out of the program.

Our analyses indicated a high participation intention among female children, and those with an overweight/obese parent. Our analyses showed, however, that some subgroups of high-risk populations, such as Hispanic children and children eligible for a free or reduced price meal program, remain difficult to reach and need an intensive outreach activity for the future intervention.

We plan to start an actual school intervention in elementary schools located in low SES areas within the SCUSD. To avoid the stigma about obesity, the intervention will recruit both obese and non-obese students who do not meet their Fitnessgram® target test score. Fitnessgram® is a tool used to assess five components of health-related fitness: aerobic capacity, muscular strength, muscular endurance, flexibility, and body composition (measured by BMI or percent body fat) using various tests such as the one-mile run, push-ups, and trunk lift (The Cooper Institute, 2013). Children are compared to criterion-based Healthy Fitness Zone® standards, established for each age and gender, that indicate good health. Namely, since children are not compared to each other, our future intervention can recruit any child who des do not meet their Fitnessgram® target test score. Fitnessgram is used nationwide including statewide implementation in California and district implementations in New York City (The Cooper Institute, 2013) as well as in recent studies (Bai et al., 2017; Schwartz et al., 2016). The survey results were encouraging in terms of this recruitment plan since participation intention was equally high among children regardless of child's weight categories.

The specific reasons for the intention to participate were not directly asked in the questionnaires. However, since these respondent parents had been invited, but had not participated in past similar interventions without a community-incentive, these respondents were likely motivated to participate in the proposed intervention due to our community-incentive. To test this, we plan to conduct another survey to identify specific reasons for participation when we implement an actual intervention.

Our intervention will require participation with a parent, even though the pilot study showed that some parents were interested in their child participating without them. This is because a family-based intervention is reported to have a high effectiveness based on a meta-analysis (Wilfley et al., 2007), long-term positive outcomes (Epstein et al., 1990; Epstein et al., 1994; Kitzmann & Beech, 2006; Wrotniak et al., 2004), and a cost-effective impact (Epstein et al., 2014). Since the rewards for a participant's efforts will be shared with other children and parents in the same school, peer support can be expected (McLean et al., 2003; Cohen et al., 1987; Jeffery et al., 1983; Osilla et al., 2012; Paul-Ebhohimhen & Avenell, 2009).

Our future intervention plans to randomly assign participants across three groups: a higher-value reward group, a lower-value reward group, and a control group (educational classes offered without any community-incentive). These educational classes will include physical exercise time, since participants tend to prefer organized activities rather than self-directed one (Drury et al., 2013). We hypothesize a clear dose-response association among these groups, i.e., the most favorable outcomes among the higher-value reward group, followed by the lower-value reward group. If such obvious monotonic relationship is observed, a future subsequent study can explore the optimal monetary value of an incentive. As described previously, the conventional financial schemes found it difficult to find an optimal value, mainly due to the lack of a monotonic relationship between the reward value and its effectiveness (You et al., 2012; Mantzari et al., 2015). The maximum donation amount in our future intervention will be $500 per participant, which is lower than a $550 reward in an RCT study that failed to promote workplace weight loss (Patel et al., 2016). Due to different motivation mechanisms, our intervention may work with a lower amount reward. Since the Affordable Care Act allows employers to use up to 30% of premiums or $1800 (assuming the average price of an individual premium in 2014) (Patel et al., 2016), a greater incentive amount could be justifiable given our community-incentive has a positive impact on a parent participant.

Regarding the period of the intervention and its follow-up, meta-analyses on similar interventions (promoting healthier eating and physical activities) found that a financial incentive had a positive effect only up to twelve months (Mantzari et al., 2015), but no statistically significant long-term positive effect ($p > 0.05$) either beyond twelve months or beyond two months after incentive removal (Mantzari et al., 2015). A future intervention period would ideally be at least twelve months. However, since our school collaborators suggested that it would be difficult to implement a school intervention over the summer, our intervention will provide an incentive up to the end of the nine-month intervention period (i.e., up to the start of summer) and then follow-up six months after incentive removal. These planned periods still allow us to test unique hypotheses such as a potentially stronger effect during the nine-month intervention period compared to a conventional incentive (summary odds ratio 1.39) (Mantzari et al., 2015) and a potentially statistically significant and positive effect after incentive removal.

The survey analysis has a number of limitations. First, the small sample size reduces the statistical power of our analyses. Second, the generalizability of this population was potentially limited by the nonprobability sampling. Because the intervention will be performed in low SES areas, the oversampling of racial/ethnic minorities is acceptable for our exploratory goal. The sample was comparable to the corresponding population in the SCUSD in terms of child obesity prevalence and parent educational attainment. Finally, since the survey questionnaires asked about a hypothetical future intervention, survey responses could have been different from a survey that is followed by an actual intervention.

5. Conclusion

We developed an original concept of community-based incentives to fill the gaps in the literature on health promotion. Applying this concept, we proposed a school intervention to promote healthy diet and physical activity among elementary school children and their parents in low SES areas in northern California. The exploratory survey found high interest among parents in the proposed intervention. These findings will help implement a future intervention currently under preparation. Moreover, the proposed concept of community-incentive is expected to be applicable to settings other than obesity prevention and outside the US.

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Conflict of interest statement

The authors declared no potential conflicts of interest with respect to the financial sources, research authorship, and/or publication of this article.

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Appendix A. Appendix

The first page text of the pilot survey conducted in July 2013 is below:

Dear Parent or Guardian,

This anonymous survey is about a new school program that promotes healthier life styles in children and their parents/guardians. This program is FREE for you and/or your child (student) and gives you the chance to earn gifts for your child's school. This program is a new partnership between the Sacramento Chinese Community Service Center, the Sacramento City Unified School District and researchers from University of California (UC) Davis.

If you and/or your child join this program, you will have a list of opportunities and goals. For each opportunity you join and each goal you reach, **the program will donate a gift to your child's school**. This one-year program is absolutely free and you will not be asked to donate or pay for anything from your own pocket.

Gifts can be used for:

- Sports equipment
- Additional books for the library
- Any school events (e.g., field trip)

The program will donate a gift to your child's school each time you:

- Sign-up for the program ($3 for the one-year program)
- Attend a class on healthy diet and on physical activity ($4 per class; $36 for 9 classes)
- Report your weight online ($1 per report every 2 weeks; $25 for 25 reports)
- Weigh-in at school ($4 per weigh-in every 3 months; $16 for 4 weigh-ins)
- Reduce your weight by at least 2%, and keep the weight off ($40 for a 3-month period; $120 for 9 months)

If both you and your child participate, your gift value will be doubled.

If you have questions about this program, please ask a staff at school. (We will finalize some details of this program after this survey.)

We want to know your thoughts about this new program, past related experiences and family.

2. Which "gift" amount would be enough to motivate you or your child just to sign-up for the program?

If both you and your child sign-up for the program, you can use the money from the program to double your gift amount. Please choose one of the amounts below.

(5 choices ranged from 50 cents to $25)

3. Which "gift" amount would be enough to motivate you and/or your child to attend one educational class on healthy diet or physical activity? Every time you attend a class, you will use the money from the program to donate a "gift". For instance, if you attend two classes, you can take twice as much money from the program for your gift. Please choose one of the amounts below

A. "Gift" amount needed to attend one educational class on healthy diet.

(5 choices ranged from 50 cents to $25)

B. "Gift" amount needed to attend one educational class on physical activity.

(5 choices ranged from 50 cents to $25)

4. Once you join the program, we ask that you confidentially report your weight on the school website every two weeks. Nobody other than the research team will be able to see what you report. You can use the money from the program to donate a "gift", every time you report your weight. You can give this "gift" even if you do not reach other goals

Which "gift" amount would be enough to motivate you and/or your child to report your weight online every two weeks (on the school website)? Please choose one of the amounts below.

(5 choices ranged from 50 cents to $25)

5. Once you join the program, we ask that you measure your weight at your child's school every three months. You can do this when picking up or dropping off your child. The weight assessment is conducted by a trained professional in a private place where no one else can see the results. The results are confidential and stored in a secured location

You can use the money from the program to donate a "gift" every time you weigh in at your school, even if you do not achieve other goals.

Which "gift" amount would be enough to motivate you and/or your child to measure your weight at school every three months? Please choose one of the amounts below.

(5 choices ranged from 50 cents to $10)

6. When you join the program, you will be able to use the money from the program to donate a "gift" if you can reduce your weight by 2% and keep the weight off for 3 months. If you reduce your weight by 4% for 3 months, your "gift" will be doubled. Also, if you reduce your weight by 2% for 6 months, your "gift" will be doubled

Which "gift" amount would be enough to motivate you and/or your child to reduce weight by 2% and keep the weight off for three months? For instance, if you weigh 200 lb, you lose 4 lb and keep it off for 3 months. Please choose one of the amounts below.

(5 choices ranged from $10 cents to $70)

7. When you use the money from the program to donate a "gift" to your school, which of these gifts would you like most? (you can circle more than one)

a. Sports equipment (e.g., soccer balls and basket balls)
b. Salad bar in school cafeteria
c. School events (e.g., school excursion)
d. Library books
e. No preference, supporting any school activity is fine
f. Other (please specify:)

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.pmedr.2017.03.020.

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