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A Formative Evaluation of Healthy Heroes: A Photo Comic Book-Social Cognitive Theory Based Obesity Prevention Program

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ABSTRACT

PURPOSE: *Low consumption of fruits and vegetables is often associated with poor diet quality, and childhood obesity. The purpose of this study was to assess the feasibility, and conduct a formative evaluation, of Healthy Heroes, an innovative, social cognitive theory-based program that uses child created photo-comic books to promote fruit and vegetable consumption.* ***METHODS:*** *Healthy Heroes was implemented with a small sample of children (9-11 years old; n=33) in a community after school setting. Parents (n=12) and afterschool employees (n=10) were also recruited to complete a one-on-one qualitative interview to discuss ways the program could be expanded for families and the community.* ***RESULTS:*** *Children reported enjoying the process of creating photo-comic books, and experienced a significant increase in expectations to consume fruits and vegetables ($p<0.05$). Parents and afterschool employees also reported favorable attitudes towards the program and provided insight into how the program could be enhanced, including using different outlets (such as the Facebook, email, and the afterschool program's website) to disseminate program information.* ***CONCLUSIONS:*** *This feasibility and*

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formative evaluation demonstrated that a theory-based intervention using photo-comic books could have a favorable impact on psychosocial variables related to fruit and vegetable consumption. ***RECOMMENDATION:*** *The Healthy Heroes program can be implemented as a stand-alone, health education intervention, at a low cost, and little effort by public health educators. However, to impact obesity related behaviors, and weight status, environmental and policy efforts should be implemented in tandem.*

KEYWORDS: *Childhood obesity; obesity prevention; health education; nutrition; comic book.*

INTRODUCTION

As children grow into adolescence and adulthood, individual dietary choices become critical as children gain more autonomy and control over what and how much they eat. Teaching children proper eating habits is vital, since poor dietary behaviors early in life are likely to persist into adulthood (Antoniou, et al., 2015; Mitchell, Farrow, Haycraft, & Meyer, 2013). Furthermore, dietary intake plays a role in the development of obesity and four of the top 10 leading causes of death in the United States (coronary heart disease, cancers, stroke, and diabetes) (Murphy, Kochanek, Xu, & Arias, 2015). Low consumption of fruits and vegetables is often noted as an important area for nutrition education and health promotion in community efforts. In the United States, dietary behaviors of our nation's youth are tracked using the Healthy Eating Index (HEI), which measures diet quality compared to the national dietary guidelines, and is expressed as a percentage that represents how many children are meeting a specified dietary component (Federal Interagency Forum on Child and Family Statistics, 2011). Among the twelve dietary components tracked by the HEI, four are related to fruit and vegetable intake: total fruit, whole fruit, total vegetables, and dark green and orange vegetables, and legumes. While recent data shows that young children (2-5 years) meet or exceed the standard for total fruit and whole fruit intake (≥100%), only 44% met the total vegetable recommendation and 19% met the dark green/orange vegetables, and legumes recommendation. Concurrently, HEI scores for older children (6-11 years) were either lower than the scores for young children, or stayed the same: 74% met the total fruit recommendation, 88% met the whole fruit recommendation, 44% met the total vegetable recommendation and only 12% met the dark green/orange vegetables, and legumes recommendation (Federal Inter-agency Forum on Child and Family Statistics, 2011).

Community interventions that can favourably impact health behaviours associated with obesity and chronic disease prevention, such as fruit and vegetable consumption, could help delay its future onset into adulthood and spare children from associated metabolic and psychological consequences. Such interventions should be based upon theoretical underpinnings, since theories help researchers identify and create program objectives and provide guidance for intervention methods and behaviour change techniques. Interventions should appeal to priority populations. Comic books (or comics) have not been well utilized in health promotion and health education but hold promise as a viable teaching tool, especially among children. Emerging research suggests that comics can serve educational purposes, such as helping children learn to read, while still maintaining an apparent *fun factor,* which can also attract the interest of reluctant readers (Grootens-Wiegers, de Vries, van Beusekom, van Dijck, & van den Broek, 2015; Upson, & Hall, 2013). Given the promise comics have as a means for community health promotion, and the lack of research in this area, more work is needed evaluating the feasibility of interventions using this approach.

PURPOSE

The purpose of this study was to conduct a feasibility and formative evaluation of the *Healthy Heroes* program, a new social-cognitive theory-based photo-comic-book program designed to encourage children to consume more fruits and vegetables. Feasibility and formative evaluations are commonplace in intervention development, as they are smaller scale, oftentimes includes qualitative and quantitative evaluation techniques, and provides rapid information about what aspects of the program work, and what other aspects should be replaced or refined. Three types of evaluations were employed in this study to complete this formative evaluation. First, children completed pre and post test on social

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cognitive theory constructs and fruit and vegetable consumption, to measure the short term efficacy of the intervention. Second, process evaluations were implemented to assure the program was feasible and children attended the program on a regular basis. Finally, semi-structured one-on-one qualitative interviews with parents of children enrolled in the program and community afterschool employees were completed to gain their perspective on the program, discuss ways that the program could be expanded to include families and the community, and consider other programs or services that could be offered in the future to enhance the intervention.

METHODS

Healthy Heroes

The Healthy Heroes program was delivered once every week, for four weeks, at an afterschool program for 60 minutes per lesson. The *Healthy Heroes* program has theoretical underpinnings in the social cognitive theory, which has been noted as the most commonly used and effective theory for obesity prevention interventions (Ickes, & Sharma, 2013; Knowlden, & Sharma, 2013). Constructs of SCT operationalized for this intervention included self-efficacy, expectations, and self-control. For this study, *self-efficacy* was operationalized as the children's perceived confidence to eat fruits and vegetables, even when faced with internal or external barriers. *Self-control* was operationalized as the children's perceived ability to set goals for eat more fruits and vegetables, and eventually meet the MyPlate recommendation. Finally, *expectations* combined outcome expectations (or belief that a certain outcome will occur as the result of eating fruits and vegetables) and outcome expectancies (or value a certain outcome will have as the result of eating fruits and vegetables).

Throughout the intervention behavior change techniques were utilized to mediate behavior change. For example, overall knowledge of fruits and vegetables, including the recommended amounts and what foods count as a fruit or vegetable, was enhanced through instructor led small group discussions. Children's communication skills were also enhanced through role-plays, which included the child taking the role of him/herself, and the instructor taking on the role of a parent or friend. The instructor and child would then act out a scenario in which the child had to convince the instructor that choosing a fruit or vegetable was a healthier choice than an unhealthy choice, such as a candy bar or chips. Each lesson also contained a taste-testing component, which allowed children to taste and eat familiar and unfamiliar fruits and vegetables. Finally, motivation was enhanced during the intervention by having children complete a decision balance activity, in which they were asked to problem solve in small groups and come up with as many pros of eating fruits and vegetables, and any cons of eating fruits and vegetables were discussed by the instructor.

Each lesson of the intervention also included a comic book component, teaching children how to create stories using comic books as a medium. Topics discussed throughout the program included: how to convey emotions in comic books, how to tell a story using pictures and words, and how to develop different character types, such as heroes and villains. The program culminated with children forming into small groups, and with the help of an instructor, they scripted and stared in a photo-comic book illustrating what they learned about fruits and vegetables throughout the program. See Figure 1 for an example of a student-created photo-comic book that was developed during this program.

Evaluation Plan

A valid and reliable survey was used to evaluate each construct of SCT (self-efficacy, self-control, and expectations) as it related to fruit and vegetable consumption (Sharma, Wagner, & Wilkerson, 2005-2006). All of the items on the survey used a 5-point Likert type scale: three items measured self-efficacy (ex. "How sure are you that you can eat 5 or more servings of fruits and vegetables everyday even if you do not like them?"), two items measured self-control, (ex. "How sure are you that you can set goals to eat 5 or more servings of fruits and vegetables?") and expectations were measured using the multiplicative score of 4 outcome expectations (ex. "If I eat 5 or more servings of fruits and vegetables I will feed better") and 4 outcome expectancies (ex. "How important is it to you that you feel better?"). Cronbach's α scores were used to confirm internal consistency reliability of each scale.

Fruit and vegetable intake was evaluated using a revised version of the "School Physical Activity and Nutrition questionnaire" (SPAN),

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using a total of 9 items (Thiagarajah, et al., 2008). Each item evaluated a subtype of fruit or vegetable as specified by MyPlate. Questions pertaining to fruits included *melons*, *berries*, *mixed fruit, and other fruits.* Questions pertaining to vegetables included *dark green vegetables, orange vegetables, dried beans or peas, starchy vegetables, and other vegetables.* To assist children in reporting the number of cups of each type of fruit and vegetable consumed, they were shown a three standard measuring cups (¼ cup, ½ cup, and 1 cup) along with balls, representing different amounts (golf ball for ¼ cup; tennis ball for ½ cup; baseball for 1 cup). All variables were measured before and after the intervention. A paired t-test was used to evaluate significant differences between pre and posttest scores, using an alpha of 0.05. All statistics were analyzed using SPSS (version 19.0).

A comprehensive process evaluation was also used to assure implementation fidelity and attendance was consistent for the program across the 3 afterschool programs. Implement-ation fidelity was evaluated using a structured tally sheet listing critical steps of each lesson, and an observer checked YES or NO contingent on if the steps were correctly implemented. Each lesson contained between 6 to 16 steps. Attendance was also tracked to assure children attended a majority of the intervention.

Parents of children enrolled in the program and community afterschool employees were invited to participate in semi-structured interviews. Each interview was done by the corresponding author of this study and lasted about 30 to 45 minutes. Each group had a separate interview guide. The guide for the parents focused on their satisfaction with the Healthy Heroes program, likelihood of them participating in a similar program with their children in the future, and other types of programs or services that could help them create a healthy food environment in their home. The guide for the afterschool employees focused on their satisfaction with the Healthy Heroes program, likelihood of them wanting to implement the program in the future on their own, and their perspective on what types of programs could help the families served by the afterschool program. Open-ended questions were followed with probes such as “Can you explain that a little more”. To assess the clarity of the questions on the interview guide, it was pilot tested a priori with a parent and afterschool employee. Field notes were taken immediately after each interview to capture key points. All of the interviews were audiotaped and transcribed verbatim. A coding dictionary with codes and definitions was generated to identify patterns. All statements by participants were open coded with NVivo qualitative software (QSR International Pty Ltd. V.9, 2012).

Participants and Afterschool Programs

Children from 3 Southwestern community afterschool programs, located in Norman, OK were recruited for participation in this study. To participate, all children were required to have a signed parental permission form and informed assent form. In addition, given the nature of the intervention in that pictures were being taken of the children, parents were required to sign a University-sponsored Talent Release Form, authorizing the authors of the study to reproduce, copyright, publish and use all photographs taken during the program. Parents and afterschool employees also signed a consent form, allowing researchers to record qualitative interviews. Before data collection approval from the institutional review board of the sponsoring university was obtained (IRB #2167).

RESULTS

Child and Program Evaluations

Across 3 afterschool programs, 33 children ranging from 9 to 11 years of age were recruited and included in the final data analysis [9.8 years (0.72)].There were more girls (n=18; 54%) than boys (n=15; 45%) enrolled in the program. Ethnicities of the children varied from mostly Caucasian (n=25; 76%), to African American (n=5; 15%), Asian (n=1; 3%), Hispanic (n=1; 3%), and Native American (n=1; 3%).

Results from the process evaluations showed that implementation was perfect (100%) at each site, for each lesson. As expected, given the nature of afterschool programming, not all children were able to attend the program in its entirety. On average, children attended 3 lessons, and a majority of children attended either 3 or 4 lesson (n=21; 64%). Children who did not participate in every lesson were tracked and given informal make-up lessons in an attempt to cover program activities they missed.

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Table 1 shows results from fruit consumption, vegetable consumption, and each of the SCT construct subscale score at pre and posttest. At the beginning of the study, children reported consuming 2.3 cups of fruit and 2.03 cups of vegetables and after the program, neither significantly changed [fruits (2.54 cups); vegetables (1.91 cups)]. Significant improvements over time were observed for fruit and vegetable expectations [pre=67.91 (19.3); post=72.10 (18.9); $p<0.05$], however self-efficacy [pre=10.88 (2.8); post=11.0 (2.8); $p<0.70$] and self-control [pre=8.30(1.7); post=7.82(2.0); $p<0.16$] did not change significantly.

Parent & Afterschool Employee Evaluations

Twelve parents and ten afterschool employees participated in the one-on-one interviews. Both groups reported having positive attitudes towards the *Healthy Heroes* program. Parents mentioned the program was a positive experience for his or her child, and many mentioned the program would be appropriate for other kids the same age of their children. Specific attributes of the program parents mentioned the most was that children had fun and had a chance to be creative. In addition, the program was not *authoritative,* and did not only focus on what children should or should not eat. One parents said:

> *"She loved it. She wanted extra copies (of the comic book) to give to everybody at home."*

Other comments included:

> *"To me I think she enjoyed it because it was fun."*
>
> *"…it was not just hey look its fruits and vegetable"*

Consistent with what parents said, staff members mentioned that the kids liked being creative and that the time frame for each session was a good length. The staff members also said that since the program involved personalized interaction with the kids, it was a unique experience for them. One staff member said:

> *"They have never had something that has featured them so prominently and in an awesome way. So I think it was really important for them."*

Parents and staff members also provided insight into their attitudes toward the afterschool program having a greater emphasis on health promotion. Most parents referenced this topic and all of the references were favorable towards this concept.

> *"I think anything to promote that [health] and continue will be really beneficial."*
>
> *"The more of the message kids get all over, not just in gym class, the better."*

Staff members responded in a similar way:

> *"That'd be awesome, I mean that's what we are working on…"*
>
> *"I like them (health programs) however I do think there can be more effective way of doing it…"*

Parents and staff members also commented on what health behaviors would be important and appropriate for children in the program. Table 2 shows which behaviors were mentioned most often. To summarize, 50% of both parents and staff members reported *eating fruits and vegetables* as the most important health behavior, followed by excessive snacking, sugary drinks, and physical activity. Health behaviors mentioned by one or two referents included: drinking more water, making healthy foods, dental health, and learning about the scientific background of health, fiber, learning about good fats, and planting a garden.

Interviews also revealed that parents and staff members thought involving families was important, however difficult to execute. While barriers exist when working with parents, such as time, overall the parents had positive attitudes towards being included. One staff member said:

> *"I think that is great idea. I think that is best just to include family because we [the afterschool program] are struggling on that right now."*

However, staff members also said that the parents are busy, and that it would be difficult to do any type of organized program with them.

> *"That's really hard because some of our parents are so busy and that's the reason they have their kids in [the afterschool program] because they can't be with their kids all the time and they don't have the spare time so I don't know how we could work with the parents on that."*

Some parents mentioned that if an intervention was implemented it would need to

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include their children and family in some capacity, and that they would not participate in programs just for parents. Additionally, a key towards having parents participate would be whether their children wanted to be in the program, and in turn, wanted them to be part of the program.

> *"Honestly think it's best working through the kids and giving them choices and knowledge and empower the kids so that they can do better. And maybe along the way, they can teach their parents."*

> *"If you can get the kids excited about something, and they won't stop talking about it, that's a huge carryover for most siblings and parents. So if they're really excited about something, they'll really carry that on."*

Many staff members mentioned that it would take time to achieve 'buy-in' from parents to participate in health promotion programs.

> *"I think that first step is definitely building that strong relationship, being on good terms with the parents and then working from there."*

To complement organized intervention strategies, parents and staff members were asked about additional or alternative communication strategies that would be feasible when communicating with parents about a health programs content. Table 3 shows which strategies were mentioned most often. To summarize, 100% of parents and 90% of staff members reported email as the best form of communication, followed by take-home newsletters, social media such as Facebook or twitter, and texting messages on cell phones.

DISCUSSION

This formative evaluation demonstrated that a theory-based intervention using photo-comic books could have a favorable impact on psychosocial variables related to fruit and vegetable consumption. To our knowledge this is the first published study reporting results from a photo-comic book intervention, in which children create and star in their own photo-comic book about nutrition. During the intervention, children reported enjoying creating the photo-comic books while learning about fruits and vegetables. Additionally, from the qualitative results, parents and afterschool employees corroborated children's attitudes towards the program.

It is envisioned that this program will expand to include a family and home component, along with an afterschool component such as enacting policies about time spent being physically active and what foods can or cannot be served during snack times and parties. In a recent review of literature on family and home-based obesity interventions, authors found only nine interventions were published from 2001 to 2011, showing that there is great need for further developing this approach (Knowlden, & Sharma, 2012). Furthermore, the authors from the review found four barriers, that future researchers and practitioners should confront: 1) a lack of theory in the design and evaluation of programs, 2) low use of process evaluations to evaluate implementation fidelity, 3) high attrition rates or dropouts, and 4) an overall lack of evidence for the efficacy of such programs (Knowlden, et al., 2012; Knowlden, Sharma, Cottrell, Wilson, & Johnson, 2015). *Healthy Heroes* would be an ideal program to include in a family or home based obesity intervention, as it has strong theoretical underpinnings in SCT, has process evaluations to evaluate program fidelity, and from this study, has demonstrated that children, parents and afterschool employees perceive the program as both fun and educational. To reduce attrition rates, results from this study suggest that children should be targeted first, and the program should largely appeal to the children so they can recruit and retain parents in the program.

To evaluate the *Healthy Heroes* intervention, SCT constructs were evaluated along with fruit and vegetable consumption, both using previously validated instruments. While significant improvements were found for expectations ($p<0.05$), significant changes in self-efficacy and self-control were not observed. In turn, fruit and vegetable consumption did not change. This likely occurred for a number of reasons. First, at baseline while expectations were closer to the mid-range on the scale, self-efficacy and self-control were higher indicating that children already had a higher degree of both constructs. As a result, a ceiling effect might have occurred, whereby it would have taken a larger, more intense, intervention to change constructs that were already high at baseline. The significant change in expectations is

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promising however, as it demonstrates a brief intervention can impact psychosocial constructs. This has been demonstrated in other studies as well. For example, significant improvements for self-efficacy and outcome expectancies were reported from the *Food Fit* program, a 6-week nutrition education program (Branscum, & Kaye, 2009), as well as the *LA Sprouts* program, a 12-week community garden–based program, which reported improvements for self-efficacy (Gatto, Ventura, Cook, Gyllenhammer, & Davis, 2012). When working with children it can be difficult to expect changes in dietary behaviors, since parents are the gatekeepers of what is provided at home, and schools and afterschool program are the gatekeepers of what is provided in those environments. For chronic disease prevention, especially as it relates to obesity prevention, a purely educational approach will likely not suffice for the long term.

Limitations

This study is not without limitations. First, this study contained a small sample size. However, it should be noted that other formative evaluations have contained similar sample sizes, such as the Family Education Diabetes Series, a diabetes education program implemented in a Native American community which followed 36 participants (Mendenhall, et al., 2010), and BOUNCE, a healthy lifestyle intervention implemented in summer camps to 37 mother-daughter dyads (Olvera, et al., 2010). Similarly, this study did not use a control group, making randomization of children into an experimental or control condition not possible. While large randomized controlled trials are considered the gold standard for implementing and evaluating health promotion interventions, Stevens and colleagues (2007) argue that more evidentiary or intermediate studies are needed to evaluate the ability of interventions to impact process variables related to obesity and chronic disease prevention, such as psychosocial variables (self-efficacy and expectations) and behaviors. In addition, the authors advocate for more research to evaluate the efficacy of single-component interventions to determine what components appear to be most promising for future multi-component interventions (Stevens, et al., 2007).

Further limitations of this study included the self-report nature of evaluating fruit and vegetable consumption, and that consumption was based on a 1-day recall, which may not be representative of a typical day. Furthermore, the reliability of the "Promoting Healthy Lifestyles" survey was found to be inadequate for the self-control scale making the interpretation of this result difficult. Cottrell and McKenzie (2011) notes that Cronbach α scores can be sensitive to scales with fewer items, and in this case the scale had only 2 items. Future researchers may consider lengthening this scale to 3 or 4 items, to follow suit with the self-efficacy and expectations constructs.

RECOMMENDATIONS

The findings from this study are important for community health educators for several reasons. First, this study was designed to be a formative study, in which we were able to attain trends regarding the impact of this approach on fruit and vegetable consumption and SCT constructs. Additionally, this study gives important preliminary findings regarding the feasibility and acceptability of this approach to inform future larger trials. To make an impact on obesity and the overall well-being of children, schools, and afterschool programs will play an essential role, but cannot be the only entity working towards progress. Interventions targeting families and the community at large will be essential in these endeavors.

It was also apparent that creating photo-comic books was fun for the children, and could be used as an incentive to encourage children and families to participate. We now live in an age that attracting children's attention and receiving *buy-in* is difficult, and for future trials, if children do not perceive the program as worth-while, they will choose not to participate. Children are generally drawn to comic books, since they are an entertaining escape from everyday tasks, contain exciting characters with powers and abilities, and are fun to read. Community health educators need to be cognizant that while it's important for programs to have key health message for which they are promoting, the approach should be entertaining as well.

Finally, a main advantage to this approach is it was relatively inexpensive, and easy to use, making it accessible to schools, afterschool programs and families. Besides needing a computer, all of the comic books in this program were created using the software *Comic Life*, which was purchased for $30.00. Pictures to

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develop the comic books can now be taken using a smart-phone, or an inexpensive digital camera, and free pictures can be obtained using websites such as Wikimedia Commons (https://commons.wikimedia.org/wiki/MainPage) for background pictures.

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Table 1: Fruit and vegetable consumption and social cognitive theory constructs before and after the program.

Variable	Cronbach's Alpha	Possible Range	Observed Range	Pretest Mean (SD)	Posttest Mean (SD)	p-value
Fruit Consumption (in cups)	**	0 – 8	0 – 7	2.30 (1.7)	2.54 (1.8)	0.47
Vegetable Consumption (in cups)	**	0 – 10	0 – 7	2.03 (1.7)	1.91 (1.7)	0.63
Self-Efficacy	0.72	3 – 15	3 – 15	10.88 (2.8)	11.0 (2.8)	0.70
Self-Control	0.56	2 – 10	3 – 10	8.30 (1.7)	7.82 (2.0)	0.16
Expectations	0.77	4 – 100	25 – 100	67.91 (19.3)	72.10 (18.9)	0.05

**Only social cognitive theory constructs computed

Table 2: Parent and staff references to important health behaviors after school programs should target towards childhood obesity.

Behavior	Parent References (n=12)	Staff References (n=10)
Eating Fruits & Veggies	6	5
Snacking	5	3
Sugary Drinks	3	3
Physical Activity	4	1

Table 3: Parent and staff references to communication channels best suited for childhood health programs.

Strategy	Parent References (n=12)	Staff References (n=10)
Email	12	9
Take Home Newsletter	4	9
Social Media (ex. Facebook/Twitter)	9	4
Texting on Personal Cell Phone	5	3

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Figure 1: Example of a student-created photo-comic book.

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