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Economic Evaluation of the Preventing Childhood Obesity through Mindfulness-Based Parent Stress Intervention

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Abstract

This study analyzed the intervention cost of a novel early childhood obesity prevention program -- Preventing Childhood Obesity Through a Mindfulness-Based Parent Stress Intervention (PMH+N) conducted by Yale Stress Center. The randomized clinical trial started from 11/01/2018 and will enroll 240 participants in total. Parents were included in the trial if they had: a child in the 2- to 5-year age group, a body mass index (BMI) over 28 kg/m², high levels of perceived stress as assessed by the Perceived Stress Scale (PSS) (score >25) and were able to read and write in English. For 12 weeks, about 13 parents in the PMH+N group meet weekly in a group setting for 2 hours with approximately 1.5 hours spent on stress reduction and mindfulness (PMH) and 30 minutes on nutrition and physical activity counselling(N). The control group (C+N) also includes approximately 13 parents in each group and meets weekly for 12 weeks. To approximately match the contact time of the PMH+N group, the C+N sessions include about 1.5-hour of watching a relaxing video, and 30-minute on nutrition and physical activity counselling which is same as the PMH+N group. The cost analysis included the cost of all materials, services, and other resources that would be needed to implement or replicate the intervention. The total intervention cost was approximately \$238,153 (95% UI, \$190,204-\$300,552) for the PMH+N group and \$215,767 (95% UI, \$174,243-\$273,143) for the C+N group. The cost per person is \$1,985 (95 UI, \$1,585-\$2,505) for the PMH+N intervention and \$1,798 (95%UI, \$1,452-\$2,276) for the C+N intervention. The incremental cost of PMH+N compared with C+N is \$22,386 (95% UI, -\$14-\$55,047) in total and \$187 (95% UI, \$0-\$459) per person.

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Introduction

Childhood obesity is a serious problem in the United States and worldwide (Lobstein, Baur, Uauy, & TaskForce, 2004). In the United States, obesity prevalence in 2019 was 13.9% among 2- to 5-year-olds, 18.4% among 6- to 11-year-olds, and 20.6% among 12- to 19-year-olds (CDC, 2019). Obesity in childhood is strongly associated with obesity in adulthood, which significantly increases utilization and expenditure for all healthcare services (Arterburn, Maciejewski, & Tsevat, 2005; Freedman et al., 2005). Excess weight is associated with greater medical expenditure even among children and adolescents (Biener, Cawley, & Meyerhoefer, 2020; Finkelstein & Trogon, 2008).

A number of studies show that parental overweight was an independent risk factor for the development of childhood overweight and obesity (Agras & Mascola, 2005; Danielzik, Czerwinski-Mast, Langnase, Dilba, & Muller, 2004; Whitaker, 2004). Weight stigma contributes to stress and obesogenic processes, ultimately developing a vicious cycle of stress to obesity to stress (Incollingo Rodriguez, Dunkel Schetter, Brewis, & Tomiyama, 2019). High levels of parental stress also has an adverse effect on parenting self-efficacy which reduces parents' capacity for warm, sensitive, and responsive caregiving with their children (Deater-Deckard & Panneton, 2017). Parental stress also affects children's eating, structured and unstructured physical activity, and screening-time usage (Baskind et al., 2019; Parks, Kazak, Kumanyika, Lewis, & Barg, 2016).

Evidence suggests that the intervention targeting parents as agents of change may be more effective than interventions solely focused on children (Agras & Mascola, 2005). However, evidence about effectiveness and costs of these parent-focused interventions is limited (Doring, Mayer, Rasmussen, & Sonntag, 2016). Information on the costs associated with implementing these interventions and on their cost-effectiveness can provide policymakers with essential information for optimal resource allocation.

Investigators at the Yale Stress Center previously conducted a novel early childhood obesity prevention intervention -- Preventing Childhood Obesity Through a Mindfulness-Based Parent Stress Intervention (PMH+N). After the 8-week randomized pilot study, the PMH+N group showed better group attendance, greater improvement in parental involvement, and decreased

parental emotional eating rating (Jastreboff et al., 2018). Furthermore, PMH+N was associated with less increases in child body mass index percentile during treatment compared with the contact control group.

In this study, we conducted a cost analysis based on the 12-week PMH+N intervention as implemented in a randomized clinical trial currently underway. These results will inform a cost-effectiveness analysis upon completion of the trial.

Methods

Summary of the Preventing Childhood Obesity Through a Mindfulness-Based Parent Stress (PMH+N) Intervention

The following provides a summary of the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention. The 12-week intervention was developed using well-established behavioral and mindfulness strategies adapted from mindfulness-based stress reduction (MBSR) to reduce caregivers' stress, to improve parenting and lifestyle choices, and to prevent obesity in their at-risk 2- to 5-year-old children.

Parents were included in the trial if they had: a child in the 2- to 5-year age group, a body mass index (BMI) over 28 kg/m², high levels of perceived stress as assessed by the Perceived Stress Scale (PSS) (score >25), and were able to read and write in English (Cohen, Kamarck, & Mermelstein, 1983).

For 12 weeks, about 13 parents in the PMH+N group meet weekly in a group setting for 2 hours with approximately 1.5 hours spent on stress reduction and mindfulness (PMH) and 30 minutes on nutrition and physical activity counselling (N). The PMH sessions are led by 2 PMH facilitators.

The control group (C+N) also includes approximately 13 parents in each cycle and meets weekly for 12 weeks. To approximately match the contact time of the PMH+N group, the C+N sessions include about 1.5-hour of watching a relaxing video, such as nature-related videos and decluttering video, and 30-minute on nutrition and physical activity counselling which is same as

the PMH+N group. Each group was led by a research staff member and a registered dietitian.

A registered dietitian developed the nutrition and physical activity counselling content delivered to both the PMH+N and the C+N groups. The group session includes discussion about family food and physical activity records, goal setting, healthy eating, and physical activity for parent and child.

In addition to the 12-week group sessions, parent-child dyads were assessed at pre-, mid-, and post-intervention, and at 6-, 12-, 18-, and 24- month follow-ups. Assessments included clinical interview, health assessments, biological measures of parent stress (reported stress, heart rate, cortisol), parenting and child behaviors to the Toy Wait Task (TWT) challenge, parent and child food intake, physical activity obtained in part from a Fitbit fitness tracker (parent) and an accelerometer (child), and child BMI percentile scores.

Sessions from each cycle were recorded, with the camera focused on the group leader, and a research assistant reviewed a random number of sessions (minimum of 30%) to ensure fidelity. The 1-3 cycles were conducted before the COVID-19 pandemic when the groups met in person. Groups met remotely via the internet due to the quarantine order during the COVID-19 pandemic.

Study Design

The retrospective cost evaluation was undertaken in the middle of the program in 2020 from the perspective of the health care funder. We used standard economic methods and a micro-costing approach to determine the components of an intervention, their unit costs, and mean total costs per participant to deliver PMH+ N and C+N intervention (Drummond, 2015). We assume that the project is conducted in-person and there is no need to hire any additional staff to implement the intervention in the setting as the baseline analysis. We also assume there will be 400-450 eligible and 240 participants enrolled in the study in total based on the RCT protocol and full adherence for all 240 participants.

Data collection

To identify the intervention components, we had meetings with the research team members and

used a Task Item Survey to learn the details of the project. The components of the project can be separated into four categories: Design and Development, Training, Recruitment, and Implementation. Research-based cost such as labor and materials associated with grant administration, analyzing assessments which are not directly related with the effect estimate, and data management are not included in the cost analysis. Figure 1 shows the components of the cost involved in the cost analysis. Design and Development cost are the labor of designing the 12-week PMH curriculum for the PMH+N group and the nutrition and physical activity counseling for both groups. Training cost includes the labor of training for recruitment and delivering the sessions. Recruitment cost includes material and labor cost in promotional materials and the labor of screening protentional eligible participants. Implementation cost include labor of preparing, delivering the sessions, communication with participants and some necessary assessments which may have an effect on the outcome of the intervention. We also include all monetary incentives, supply, and printing. Intervention components of the two groups are shown in Table 1.

Figure 1. Components of the PMH + N intervention

Design & Development	Training	Recruitment	Implementation
<ul style="list-style-type: none"> • Designing curriculum materials for PMH • Designing curriculum materials for N 	<ul style="list-style-type: none"> • Training for phone screening • Training to deliver intake sessions (pre-treatment assessment) • Training to deliver PMH • Training to deliver N 	<ul style="list-style-type: none"> • Preparing and distributing promotional materials • Phone screening for potential participants • Delivering intake sessions 	<ul style="list-style-type: none"> • Preparing binders of handout • Preparing for the following sessions • Participate in a session <ul style="list-style-type: none"> • Group leader • Providing childcare • Communication with participants • Assessment • Weekly meeting for new agenda items

Table 1. Components of the PMH + N and C + N interventions, base case analysis

Intervention Components	PMH+N Group	C+N Group
Design and Development		
Developing the entire Parenting Mindfully for Health (PMH) curriculum	✓	
Developing the entire Nutrition and Physical Activity Counselling (N) curriculum	✓	✓
Training		
Training to conduct phone screening	✓	✓
Training to do intake session	✓	✓
Training to deliver the PMH session	✓	
Training to deliver the N session	✓	✓
Screening and Recruitment		
Preparing and distributing promotional materials	✓	✓
Conducting screening phone calls, per participant	✓	✓
Conducting intake sessions for eligibility, per participant	✓	✓
Advertising Costs	✓	✓
Implementation		
Collecting height and weight, session evaluations, physical activity, and screen time surveys, per participant per week	✓	✓
Collecting food record, per participant per project	✓	✓
Communication with participants (session reminding, addressing other logistic or technical issues)	✓	✓
Preparing the binder of handouts, per project	✓	✓
Reviewing materials to prepare for the following session, weekly	✓	✓
Deliver PMH sessions, weekly	✓	
Delivering C sessions, weekly		✓
Delivering N sessions, weekly	✓	✓
Providing childcare during the session	✓	✓
Staff Meeting, weekly	✓	✓
Quality Assurance	✓	✓
Materials and Monetary incentive for participants		
Up to 901 for completing the entire program, per participant	✓	✓
Copier rental	✓	✓
Snacks and beverages	✓	✓
Fitbit fitness monitor, per participant	✓	✓
ActiGraph accelerometer, per participant	✓	✓

To determine the labor resources used, we evaluated job descriptions of different staff members and designed an Individual Cost Capture Survey with appropriate tasks for each type of staff. To capture the labor time as accurately as possible, we asked the staff members to give a reasonable range or average amount of the time estimate. Figure 2 shows a cost capture survey for a research assistant. In addition to the labor components, we also asked the admin for the documented expenses of printing and other project equipment.

Figure 2. Cost capture survey for research assistant

Yale Qualtrics Survey Tool

Please select your name from the dropdown list .

Please estimate the time you spend on the following activities.

PMH: parenting mindfully for health intervention
 C: contact control intervention
 N: nutrition ad physical activity counseling

Training:

Training for phone screening	0 min
Training to deliver intake sessions	0 min
Training to deliver PMH	0 min
Training to deliver N	0 min
Training to deliver C	0 min
Total	0 min

Communication with participants (not related to any assessment):

Session reminders by calls or email (minutes per week)	0
Addressing other logistic or technical issues (minutes per week)	0
Total	0

Preparing Handouts or other Materials for the following sessions per week:

The PMH+N group	0 min
The C+N group	0 min
Total	0 min

Making Session Plans for the following sessions per week:

The PMH+N group	0 min
The C+N group	0 min
Total	0 min

Participating in the following sessions per week:

The PMH session	0 min
The N for PMH+N group	0 min
The C session	0 min
The N for C+N group	0 min
Providing childcare	0 min
Total	0 min

Please tell us about any other time spent on activities related to PMH+N or C that are not included above:

To enhance the generalizability of the estimates, we used the Bureau of Labor Statistics (BLS) May 2019 Occupational Employment and Wage Estimates to value staff time with 45.7% fringe added per June 2019 US BLS report of Employer Costs for Employee Compensation.

The timeframe of our cost analysis includes the duration of the 12-week trial. Thus, no discounting of costs was needed.

Data analysis

The primary outcome was the total intervention cost of PMH+N and C+N intervention and the cost per participant. For cost data of one single estimate, we assume the actual cost follows a Gamma distribution with a standard deviation of 10% of the estimated value. For cost data of a range estimate, we assume the actual cost follows a uniform distribution between the upper and lower bond. To capture the uncertainty around our cost estimates, we conducted 2000 Monte Carlo simulations by taking random draws from the distribution of the cost components. All analyses were completed using Microsoft Office Excel version 16.47.

Sensitivity Analysis

To evaluate the sensitivity of our results to different contexts, we conducted scenario analysis of eliminating development cost which don't have to be conducted in replicate the intervention. We

also performed the cost analysis in remote model where group sessions are conducted remotely via the internet. In the remote model, the groups won't meet in-person, therefore, the cost of child-care and snacks won't be included, and stadiometers and scales will be distributed to participants to weight themselves (Table 2).

Table 2. Difference of Intervention Components between In-person Model and Remote Model

Intervention Components	In-person Model	Remote Model
Implementation		
Providing childcare during the session	✓	
Materials and Monetary incentive for participants		
Snacks and beverages	✓	
Stadiometer and body weight scale		✓

Results

We surveyed and/or interviewed a total of 10 staff conducting the study. Detailed labor and material costs are shown in the supplementary appendix. Table 3 displays the results of the simulation estimating the costs of the PMH+N intervention. The total intervention cost was approximately \$238,153 (95% UI, \$190,204-\$300,552) for the PMH+N group and \$215,767 (95% UI, \$174,243-\$273,143) for the C+N group. The cost per person is \$1,985 (95 UI, \$1,585-\$2,505) for the PMH+N intervention and \$1,798 (95%UI, \$1,452-\$2,276) for the C+N intervention. The incremental cost of PMH+N compared with C+N is \$22,386 (95% UI, -\$14-\$55,047) in total and \$187 (95% UI, \$0-\$459) per person.

For the PMH+N intervention, the cost of Materials and Monetary incentives makes up most of the intervention cost (51.16%). The cost of Implementation, Design, Training, and Recruitment makes up 40.37%, 3.25%, 2.37%, and 2.84%, respectively. For the C+N intervention, the cost of Materials and Monetary incentive also makes up most of the intervention cost (56.47%), and the cost of Implementation, Design, Training, and Recruitment makes up 37.60%, 1.81%, 0.99%, and 3.14%, respectively.

Table 3. Costs of the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention and the Control (C+N), base case simulation

PMH+N Components	Average Cost	95% UI ^a (Lower)	95% UI ^a (Upper)	Percentage of total cost
Design and Development	\$7,749.11	\$4,348.44	\$12,419.90	3.25%
Training	\$5,654.32	\$2,691.71	\$9,953.98	2.37%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	2.84%
Implementation	\$96,146.88	\$54,368.92	\$150,706.06	40.37%
Materials and Monetary incentive	\$121,833.12	\$120,136.10	\$123,709.22	51.16%
Total PMH+N Cost	\$238,153.18	\$190,203.56	\$300,552.40	
Total PMH+N Cost per Participant	\$1,984.61	\$1,585.03	\$2,504.60	
C+N Component				
Design and Development	\$3,912.33	\$1,864.59	\$6,699.42	1.81%
Training	\$2,126.16	\$1,029.19	\$3,780.63	0.99%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	3.14%
Implementation	\$81,125.56	\$42,898.79	\$134,450.96	37.60%
Materials and Monetary incentive	\$121,833.12	\$120,136.10	\$123,709.22	56.47%
Total C+N Cost	\$215,766.92	\$174,242.86	\$273,143.17	
Total C+N Cost per Participant	\$1,798.06	\$1,452.02	\$2,276.19	
Incremental Cost of PMH+N	\$22,386.26	-\$14.26	\$55,047.11	
Incremental Cost of PMH+N per Participant	\$186.55	-\$0.12	\$458.73	

^a 95% Uncertainty Intervals reflect the 5th and 95th percentile for 2000 Monte Carlo simulations

Table 4. Costs of the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention and the Control (C+N), without Development Cost

PMH+N Components	Average Cost	95% UI ^a (Lower)	95% UI ^a (Upper)	Percentage of total cost
Training	\$5,654.32	\$2,691.71	\$9,953.98	2.52%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	3.02%
Implementation	\$96,146.88	\$54,368.92	\$150,706.06	42.93%

Materials and Monetary incentive	\$121,833.12	\$120,136.10	\$123,709.22	54.40%
Total PMH+N Cost	\$223,974.28	\$218,339.36	\$230,908.05	
Total PMH+N Cost per Participant	\$1,866.45	\$1,819.49	\$1,924.23	
C+N Component				
Training	\$2,126.16	\$1,029.19	\$3,780.63	1.00%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	3.20%
Implementation	\$81,125.56	\$42,898.79	\$134,450.96	38.29%
Materials and Monetary incentive	\$121,833.12	\$120,136.10	\$123,709.22	57.51%
Total C+N Cost	\$211,854.59	\$170,927.41	\$269,882.02	
Total C+N Cost per Participant	\$1,765.45	\$1,424.40	\$2,249.02	
Incremental Cost of PMH+N	\$12,119.69	-\$40,700.22	\$49,384.98	
Incremental Cost of PMH+N per Participant	\$101.00	-\$339.17	\$411.54	

^a 95% Uncertainty Intervals reflect the 5th and 95th percentile for 2000 Monte Carlo simulations

Table 5. Costs of the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention and the Control (C+N), remote model

PMH+N Components	Average Cost	95% UI^a (Lower)	95% UI^a (Upper)	Percentage of total cost
Design and Development	\$7,749.11	\$4,348.44	\$12,419.90	3.30%
Training	\$5,654.32	\$2,691.71	\$9,953.98	2.41%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	2.88%
Implementation	\$88,488.13	\$50,517.19	\$138,625.25	37.66%
Materials and Monetary incentive	\$126,286.05	\$124,379.57	\$128,404.10	53.75%
Total PMH+N Cost	\$234,947.36	\$190,249.72	\$294,576.48	
Total PMH+N Cost per Participant	\$1,957.89	\$1,585.41	\$2,454.80	
C+N Component				

Design and Development	\$3,912.33	\$1,864.59	\$6,699.42	1.84%
Training	\$2,126.16	\$1,029.19	\$3,780.63	1.00%
Recruitment	\$6,769.75	\$3,160.70	\$12,114.84	3.18%
Implementation	\$73,466.80	\$39,689.81	\$119,260.54	34.56%
Materials and Monetary incentive	\$126,286.05	\$124,379.57	\$128,404.10	59.41%
Total C+N Cost	\$212,561.10	\$175,264.87	\$263,183.65	
Total C+N Cost per Participant	\$1,771.34	\$1,460.54	\$2,193.20	
Incremental Cost of PMH+N	\$22,386.26	-\$14.26	\$55,047.11	
Incremental Cost of PMH+N per Participant	\$186.55	-\$0.12	\$458.73	

^a 95% Uncertainty Intervals reflect the 5th and 95th percentile for 2000 Monte Carlo simulations

In the scenario analysis excluding the costs of development, the total interventional cost was \$223,974 (95% UI, \$218,339-\$230,908) for the PMH+N group and \$211,855 (95% UI, \$170,927-\$269,882) for the C+N group. The cost per person was \$1,866 (95 UI, \$1,819-\$1,924) for the PMH+N intervention and \$1,765 (95% UI, \$1,424-\$2,249) for the C+N intervention (Table 4). And in the remote model, the total cost of the intervention was 234,947 (95% UI, \$190,250 -\$294,576) for the PMH+N group and \$212,561 (95% UI, \$175,265-\$263,184) for the C+N group. The cost per person is \$ 1,958 (95 UI, \$1,585-\$2,455) for the PMH+N intervention and \$1771 (95%UI, \$1,461-\$2,193) for the C+N intervention (Table 5).

Discussion

Based on results from the pilot study, both the PMH+N intervention and C+N control appeared to improve parental involvement and decrease parental rating of emotional eating. The PMH+N was associated with less increases in child body mass index percentile during treatment compared with the contact control group. However, the cost of the two intervention has not been evaluated.

Our study demonstrated that the intervention cost of PMH+N intervention was higher than the intervention cost of C+N intervention. The cost of Material and Monetary Incentive was major

determinant of the total cost in the RCT. In addition, we found that, although a small part of the total cost, Design and Development cost makes up more in the PMH+N intervention (3.25%) than in the C+N intervention (1.81%). This difference come from the development cost of the mindfulness-based stress reduction (MBSR) curriculum. Another main part of the intervention cost was the implementation piece which is due to the large amount of time of group facilitators spending on the group sessions and childcare during the session time. The small scale of the intervention group was to increase the involvement of participants in the RCT setting. However, we could expect a lower cost per participant with the increase of group scale.

In our scenario analysis excluding development costs, we estimate that the intervention cost per participant of replicating the intervention in more general settings was decreased by around 3% and 2% for PMH+N and C+N, respectively, compared with the cost per participant in the RCT setting. The remote model would save some cost on the equipment and labor such as the cost of childcare during the session and snacks. However, there would be some extra equipment needed such as the scales for participants to weight themselves. Overall, the intervention cost of delivering the intervention in remote model marginally higher per participant for both PMH+N and C+N.

The labor cost in our study is not estimated based on the actual wage of the RCT investigators but is based on the 2019 US BLS report which estimates the wage for the nation as a whole. This improves the generalizability of our cost estimate. Volger et al. conducted a scoping review of studies about the early childhood obesity prevention programs from January 2001 to February 2018 and found that the cost data was available in only a few studies (Volger, Rigassio Radler, & Rothpletz-Puglia, 2018).

Compared with other interventions to present childhood obesity, the PMH+N intervention is targeting parents with obesity. Both the parents and the children will get benefits from the intervention, therefore could be expected to be cost-effective compared with intervention solely targeting the children (Agras & Mascola, 2005). There is another study targeting the parent stress as a consideration in childhood obesity prevention. However, there is not an explicit cost analysis (Hruska, Darlington, Haines, & Ma, 2020).

Our study has several limitations. This cost analysis is limited to healthcare sector perspective

and does not include other costs to society, such as participants' loss of productivity, transportation cost, etc. In addition, the study is limited to the costs incurred during the intervention and follow-up costs within the scope of the 12-week RCT. As the trial is still underway and effect estimates are pending, we did not predict the Health Care Expenditure of the two groups over a long-term time horizon.

The study is also limited by the quality of the data we were able to obtain and the risk of recall bias among staff. When we measured the labor, we attempted to use weekly cost capture survey and asked the investigators to record the precise amount of time they spent. However, we noticed that this was difficult to implement, and investigators mainly reported the time by multiplying the time estimate and the number of participants. For example, it was difficult for the research assistants to record their actual call duration for each phone screen for potential eligible participants. Therefore, we used retrospective cost data and let the investigators provide the most accurate labor estimate and allowed a range for uncertainty.

Conclusion

In this economic evaluation of the PMH+N trial, we estimate that the intervention cost approximately \$2000 for each parent with obesity and high perceived stress enrolled in the PMH+N intervention compared with \$1800 for the C+N intervention. In future work, we will examine the cost-effectiveness of the intervention compared with control.

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Supplementary appendix

Cost narrative for the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention and the contact control (C+N)

Summary

The following provides a summary of the Parenting Mindfully for Health plus nutrition and physical activity counseling (PMH+N) intervention. The 12-week intervention developed by using well-established behavioral and mindfulness strategies adapted from mindfulness-based stress reduction (MBSR) to reduce caregivers' stress, to improve parenting and lifestyle choices, and to prevent obesity in their at-risk 2- to 5-year-old children.

Parents were included in the trial if they had: a child in the 2- to 5-year age group, a body mass index (BMI) over 28 kg/m², high levels of perceived stress as assessed by the Perceived Stress Scale (PSS) (score >25), and were able to read and write in English.

For 12 weeks, about 13 parents in the PMH+N group meets weekly in a group setting for 2 hours with approximately 1.5 hours spent on stress reduction and mindfulness (PMH) and 30 minutes on nutrition and physical activity counselling(N). The PMH sessions are led by 1-2 PMH facilitators.

The control group (C+N) also includes approximately 13 parents in each cycle and meets weekly for 12 weeks. To approximately match the contact time of the PMH+N group, the C+N sessions include about 1.5-hour of watching a relaxing video, such as nature-related video and decluttering video, and 30-minute on nutrition and physical activity counselling which is same as the PMH+N group. Each group was led by a research staff member and a registered dietitian.

A registered dietitian developed the nutrition and physical activity counselling content delivered to both the PMH+N and the C+N groups. The group session includes discussion about family food and physical activity records, goal setting, healthy eating, and physical activity for parent and child.

In addition to the 12-week group sessions, parent-child dyads were assessed at pre-, mid-, and post-intervention, and at 6-, 12-, 18-, and 24- month follow-ups. Assessments included clinical interview, health assessments, biological measures of parent stress (reported stress, heart rate, cortisol), parenting and child behaviors to the Toy Wait Task (TWT) challenge, parent and child food intake, physical activity obtained in part from a Fitbit fitness tracker (parent) and an accelerometer (child), and child BMI percentile scores.

Sessions from each cycle were recorded, with the camera focused on the group leader, and a research assistant reviewed a random number of sessions (minimum of 30%) to ensure fidelity.

Study HIC#:2000023271

Effect

The primary outcome of the intervention is the children's BMI percentiles change at 12-week post-treatment assessment. Given that the trial is pending, we hold off the effect estimate until the results available.

Cost

Perspective of the cost analyses

This cost analysis is conducted from a health payer perspective. Intervention costs were defined as the value of all materials, services, and other resources that would be needed to implement or replicate the intervention (Ritzwoller et al., 2009, p. 222). The cost components are estimated according to data from the randomized control trial.

Key Assumptions

- We assume that there is no need to hire any additional staff to implement the intervention in the setting.
- We assume there will be 400-450 eligible, and 240 participants enrolled in the study in total based on the RCT protocol.
- We assume full adherences for all 240 participants.
- Group \approx 13 participant with 2 leaders. There will be 9 cycles in total.
- Program staff with links to Bureau of Labor Statistics Job Codes:

Staff Type	Number involved in RCT (the actual staff in the RCT)	BLS Code/Descriptor	Mean Annual Salary, May 2019, US\$	Mean Hourly Wage, May 2019, US\$
PMH Facilitator	2 (Rajita Sinha, Tara Bautista, Aly Jordan – clinical psych intern)	BLS Code 21-1091 Health Education Specialists	60,500	29.09
Registered Dietitian	1 (Mary Savoye)	BLS Code 29-1031, Dietitians and Nutritionists	62,330	29.97
Research Assistant	5 (Max Golden, Julie Schwartz, Maria Isabel Barros Guinle, Luke Harrison, Val)	BLS Code 19-4061 Social Science Research Assistants	51,340	24.68
Admin	1 (Cindy Tappe)	BLS Code 43-6014 Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	39,180	18.84

Intervention Components:

- **Design & Development**

- Labor: The time to design the entire PMH, C, and N curriculum.
 - For PMH: Lead PMH facilitator spent about 90 hours in total.
 - For N: For a topic, RD spent 4.5 hours to design the curriculum workbook and 3 hours to develop the instructor's manual. $7.5 \times 12 = 90$ hours in total.

- **Training**

- Labor:
 - 4 RAs spend 3-9.5 hours training to conduct phone screening (including sessions observing phone screening, mock screening, one real screening session).
 - 4 RAs spend 3.5-6 hours training to conduct intake session (including observing 2 or 3 zoom sessions, a couple mock surveys, one session with the assistance of another RA, one alone while being observed)
 - PMH facilitator spends 10 hours in training on delivering PMH session (reading protocols, publications, and other materials), already trained in delivering mindfulness-based interventions.
 - Lead PMH facilitator spent $0.75 \text{ hour} \times 12 \text{ weeks/cycle} \times 9 \text{ cycles} = 81$ hours training and supervise other facilitators on PMH intervention as a whole
 - PMH Facilitator spends 5 hours total in training on delivering N session (meeting with RD and reviewing manual)
 - RD spends 30 minutes weekly for 6 months in training on delivering N session. $0.5 \times 26 = 13$ hours

- **Recruitment:**

- Labor:
 - Admin spends 5 hours per cycle working on the Facebook flyer posting and monitoring it.
 - RA spends 20-25 minutes conducting screening phone calls per potential parent-preschooler dyads
 - RA spends 5 minutes per participant on intake sessions for eligibility (only count for time spent assessing Perceived Stress Scale, SES, parent BMI, exclusion criteria)
- Advertising Costs: The total advertising cost is \$506-\$3620 per cycle. Advertising media involve:
 - YRISPS pushing
 - Facebook advertising
 - Stamps to mail out letters
 - Patch media
 - Vector Media
 - Barrett outdoor communications
 - Craigslist

- **Implementation**

- Labor

- Assessment:
 - RA spends 8-10 minutes per participant per week collecting session evaluations, physical activity and screen time surveys, and collecting height and weight
 - RA spends 3.5-4.5 hours per participant per project collecting food records (checking, and processing the diaries using a food processor software), 7 diaries at baseline, 6 weeks, 12 weeks, 6 months, 12 months, 18 months, and 24 months
- Communication with participants:
 - PMH facilitator spend 30 minutes per week (sending emails or calls with reminders, checking in, reviews, or helping them with using the app)
 - 4 RAs spends 30 minutes per week.
- Preparing the binders of handout
 - RA spends 3 hours per cycle x 9 cycles = 27 hours
- Preparing for the following sessions:
 - For the C+N group:
 - RD spends 10 minutes for each group per week
 - RA spends 1-5 minutes preparing the video for each group per week
 - For the PMH+N group
 - Lead PMH Facilitator spends 45 minutes in total per week
 - PMH Facilitator spends 30-60 minutes in total per week
- Participating in the following sessions:
 - The PMH+N group:
 - PMH facilitator spends 2 hours/group/week
 - Lead PMH facilitator spends 2 hours/group/week
 - The C+N group:
 - RD spends 45 minutes/group/week
 - RA spends 1.5 hours /group/week
 - Providing childcare during the session:
 - 2 RAs spend 2 hours/group/week 2 x 120 = 240 hours
- Weekly meetings:
 - All staff member spends 1 hour in the weekly meeting in total per week
- Quality Assurance:
 - RA spends 20 hours per cycle reviewing the recorded sessions of each round to conduct quality assurance observation. 20 x 9 = 180 hours
- Monetary incentive for participants

Item	\$
First Intake	20
Pre-tx and post-tx assessment sessions x 2	100

TWT: \$50 x 2	100
Completion of week 6 assessments	50
12- week intervention: \$20 x 12	240
Metabolic measures blood draws: \$50 x 4	200
Follow up appointments (4): \$50 x 4	200
Total	901

○ Materials

- Copier rental: The rental of the copier is \$307 per month and shared by 6 projects.
- Snacks & beverages: food/snacks provided at each cycle is \$274.4-\$752.
- Stadiometer and body weight scale: stadiometer and body weight scale will cost \$3.99 and \$43.99 per participant in remote model.
- Fitbit fitness monitor: Fitbit fitness monitor is \$64.94 per patient.
- ActiGraph accelerometer: ActiGraph accelerometer \$7300 in total.

References

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