

ORIGINAL ARTICLE

Weight gain prevention content delivered to mothers: Lessons from an intervention embedded in a community organization

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Summary

Background: Transparent reporting of the intervention content study participants receive is particularly important for dissemination and implementation of evidence-based interventions to address obesity. This study explores intervention delivery and perceptions of content when an intervention is embedded within an organization's usual practice and associations with weight outcomes.

Methods: This is a secondary analysis from the Healthy Eating and Active Living Taught at Home (HEALTH) randomized trial. HEALTH is a weight gain prevention intervention embedded within a national home visiting programme (Parents as Teachers, PAT). To be consistent with PAT practice, HEALTH has a suggested but also flexible home visit structure. Therefore, the number and frequency of home visits are determined by the family's needs and preferences based on the parent educator's professional judgement. The proportion of participants who received each curriculum core lesson was explored among the 105 families randomized to the HEALTH intervention group, as were mean parent educator perception ratings of the visits (5-point Likert-type scale). A chi-square test was used to examine the association between utilization (ie, low: 1-6, middle: 7-12, or high: 13-18 visits) category and weight maintenance.

Results: Mothers received on average 13.3 (standard deviation 6.2) core visits. Mean parent educator perception of the mothers' response (out of 5) ranged from 3.99 to 4.27; educators' perception of their own experience with the lesson ranged from 4.13 to 4.34. Among mothers who maintained their weight, 13% were low, 22% were middle, and 65% were high utilizers, while among mothers who gained weight, 3%, 31%, and 67% were low, middle, and high utilizers, respectively; this difference was not statistically significant.

Conclusions: This study identified wide variation in the visits families received from the curriculum but minimal variation in visit perceptions. Future studies could explore

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whether there are optimal patterns for visit content, associated with successful outcomes.

KEYWORDS

home environment, intervention delivery, weight gain prevention

1 | BACKGROUND

In the United States, the prevalence of obesity among women 20 to 39 years of age is 28.7%, higher than the prevalence among men (24.5%).¹ On average, young women gain as much as 0.96 kg per year, for a total of 11.9 kg over 10 years.² Development of obesity during childbearing years may also lead to its intergenerational transfer, heightening the need for interventions to prevent weight gain.³ Addressing this excessive weight gain among young adult women is necessary to reverse the epidemic of obesity.⁴

Evidence-based lifestyle interventions are available, which can help modify behaviours related to weight gain, and there have been efforts to translate these interventions to practice. A review of studies translating the Diabetes Prevention Program (DPP) to real-world settings by Aziz et al⁵ found the percentage of participants achieving a 5% weight loss ranged from 20% to 64% across interventions. However, evidence-based interventions, such as the DPP,⁶ often fail to reach young women due to time and priority constraints such as childcare and financial constraints/concerns.⁷ Further, there is limited literature describing details about intervention delivery, which hampers efforts to understand what participants actually receive, and therefore how interventions might be tailored and optimized.

Healthy Eating and Active Living Taught at Home (HEALTH) was designed to work within Parents as Teachers (PAT), an existing system which already reaches young women across the country. PAT is a national home visiting organization, which supports and engages parents and caregivers of young children to promote school readiness through optimal early development, learning, and health from the prenatal period until kindergarten, and is offered free of charge to families. PAT National Center is responsible for training all parent educators to deliver PAT curricula (all parent educators are trained in the foundational curriculum, with 75 additional specialty training options).⁸ The programme trains parent educators to provide social support for parents and families, reach families where they are, and engage families who may not otherwise have access to such resources. PAT improves family strength outcomes, reduces child neglect, and increases school readiness.⁹ In 2016, parent educators conducted more than 1.7 million home visits with nearly 170 000 families.¹⁰ HEALTH embedded content within PAT's existing visit structure, allowing a sustainable channel to reach young women with lifestyle modification content. In an effectiveness study, HEALTH led to a 4.7 kg difference in weight at 24-month follow-up, which was driven by an average weight gain in the usual care group of 3.2 kg

(standard deviation = 7.6) and an average 1.5 kg (standard deviation = 8.3) weight loss in the intervention group.¹¹

Conducting pragmatic research which can inform real-world practice is critical to translating research into sustainable interventions with broad reach.^{12,13} As described in the PRagmatic-Explanatory Continuum Indicator Summary (PRECIS-2) tool,¹⁴⁻¹⁶ a tool for describing how pragmatic a study is, one of the nine domains on which to categorize a study is Flexibility: delivery. This encourages investigators to conduct pragmatic trials that allow delivery of the intervention under study to be similar to delivery in usual practice. To be consistent with PAT's usual practice, HEALTH has a suggested but flexible visit structure, so the frequency and number of visits are determined by the family's needs and preferences based on the parent educator's professional judgement. This type of flexibility likely has benefits in terms of study pragmatism, family experience with the programme, and impact.¹⁷⁻¹⁹ However, this can also make it difficult to report what was actually delivered in an effectiveness study, further complicating translation potential.²⁰ In addition, little is known about what the parent educators delivering the intervention think of the content. Dissemination and implementation of HEALTH have significant potential to address the secular trends in obesity seen in young women,⁴ so transparent reporting of what participants in intervention studies actually receive and how these are perceived by providers is needed. To address a common gap in intervention reporting, the secondary analysis presented in the current paper describes the intervention content delivered to families in the HEALTH study and explores associations between dose and weight outcomes.

2 | METHODS

2.1 | Study design

These data are from intervention group participants from a pragmatic, randomized trial, which was conducted within PAT affiliated programmes located across eight St. Louis, Missouri regions.^{8,11} The aim of the lifestyle change programme was to prevent weight gain in women.²¹ This is a secondary analysis to facilitate transparent reporting of this descriptive information as the original study was not designed to explore specific content delivered to mothers participating in the study. The trial is pragmatic in that it was designed to evaluate the intervention's effectiveness in routine practice.²¹⁻²³ PAT participants were selected within each region by stratified random sampling, such that the number of participants selected per region was proportional to the size of the region.

Mothers' data collection occurred at baseline, 12-month, and 24-month follow-up, and participants received a \$50 gift card for completing the measures at each time point. Visit records were completed by the parent educator after each visit.

2.2 | Participants and recruitment

Details about the study are included elsewhere,¹¹ but a brief description is provided here. Due to the pragmatic nature of the study, inclusion criteria were selected to mirror real-world PAT practice: female participants, 18 to 45 years of age, with a BMI 25 to 45 kg/m², with at least one preschool child at risk for overweight (BMI percentile \geq 60%) living in the home, who planned to continue in the PAT programme for 2 years, and who were able to give informed consent. Women were excluded if they were currently pregnant or planned to become pregnant in the next 24 months, unable to speak English, currently enrolled in a weight loss programme, undergoing treatment for diabetes or eating disorders, or unable to engage in a walking programme. As the current study explores components of the HEALTH intervention, only participants randomized to the HEALTH group are discussed in the remainder of the manuscript. This study was approved by the Washington University in St. Louis Human Research Protection Office. All participants provided written informed consent (Trial Registration: This study is registered at www.clinicaltrials.gov NCT01567033 (First Posted: March 30, 2012); <https://clinicaltrials.gov/ct2/show/NCT01567033>).

2.3 | HEALTH intervention

Mothers randomized to HEALTH received the standard PAT with content adapted from the DPP lifestyle intervention²⁴ embedded within the standard PAT curriculum. As reported in detail elsewhere,¹¹ social cognitive theory guided incorporation of healthy weight content into the curriculum. The content focused on core behaviour change constructs addressing intrapersonal influences (eg, constructs of self-assessment and reinforcement), interpersonal influences (eg, observational learning/parental modelling), and home environment influences (eg, food access and TV with meals).²⁵ Intervention development was guided by formative work, and the content was simplified to address factors such as behavioural and environmental strategies such as limiting intake of sugar sweetened beverages, which influence caloric intake of mothers of young children with significant time constraints. Consistent with PAT practice, the frequency and number of visits, as well as the focus and time spent on each intervention component in HEALTH, are determined by the family's needs and preferences.

The intervention was delivered by parent educators trained in PAT's standard curriculum (usual care curriculum). HEALTH educators ($N = 9$; mean age 44 years [range 29 to 67]; 67% with a college degree) received additional training on the intervention (eg, importance of parental lifestyle and modelling on child weight and development). In-person training took place over one day (8 h), which is

consistent with PAT training protocols. Consistent with PAT practice, parent educators were trained to use their professional judgement in deciding which lessons to deliver and the frequency and number of visits, by gauging the family's responses and interest. Intervention lessons could be delivered over the full 24 months in which the mother participated in the study. Lesson plan checklists on which parent educators documented content delivery and audio recordings of home visits were used to monitor fidelity. These were reviewed by expert study staff. For each parent educator, two home visits were randomly observed.¹¹

2.4 | Data collection and measurement

Measures for the current study were drawn from lesson plan checklists used to document content delivery. Parent educators completed these checklists following each study visit. The checklists collected general data about the visit such as the date, beginning and end time, and amount of preparation time required. The topic of the visit was selected from a list of the 18 core intervention visits (Table 1 provides a description of each lesson); parent educators could select "other" and provide a description of the content covered. Educators also reported on their perception of their ability to deliver the visit (six items, eg, "I have enough support and resources to deliver the HEALTH lesson.") and of the mother's response to the visit (five items, eg, "HEALTH content was helpful to family's current situation."), with higher scores indicating more positive perceptions (1 = strongly disagree, 3 = neutral, 5 = strongly agree).

Research staff measured participants' height and weight in accordance with National Health and Nutrition Examination Survey procedures.²⁶ Sociodemographic measures (such as age, marital status, number of children, and monthly income) were assessed by survey.

2.5 | Data analysis

All analyses were carried out using SAS version 9.1 and Excel 2016. Initial analyses explored the number and percent of participants receiving each core lesson from the curriculum. Families were categorized based on utilization (in three sets of six lessons based on evenly dividing the intended 18), with those with low utilization receiving one to six of the core lessons at least once, those with middle utilization receiving seven to 12 of the core lessons at least once, and those with high utilization receiving 13 to 18 of the core lessons at least once; mothers were also categorized in terms of weight maintenance (ie, whether they maintained their weight or gained weight). A chi-square test of independence was used to examine the association between weight maintenance and utilization category. The correlation between the number of lessons received and percent weight change was explored using Pearson correlation. A P value of .05 was used as a cut-off for statistical significance for the two comparisons with significance testing. To describe parent educator perceptions of the visit, means were calculated for each lesson.

TABLE 1 Healthy Eating and Active Living Taught at Home (HEALTH) intervention content

HEALTH Topic	Lesson Overview
Introduction to HEALTH	<ul style="list-style-type: none"> •Basic review of programme and expected outcomes
Goals for HEALTH	<ul style="list-style-type: none"> •Review goal setting and self-monitoring
Healthy beverages	<ul style="list-style-type: none"> •Show sugar in beverages and benefits of drinking water
Portion size	<ul style="list-style-type: none"> •Show appropriate portion sizes for common foods and identify ways to reduce portion
Four ways to eat less calories	<ul style="list-style-type: none"> •Review calories requirement and high-calorie foods the family consumes •Identify ways to reduce calories
Food cues	<ul style="list-style-type: none"> •In different environments, especially the home, identify problem food cues and ways to make changes
Being active: a way of life	<ul style="list-style-type: none"> •Identify barriers to being active •Learn two different ways to find the time to be active •Develop an activity plan
Take charge of your environment	<ul style="list-style-type: none"> •Identify positive cues to be active at home •Learn recommendations for screen time for children •Set goal to reduce inactive time
Problem solving	<ul style="list-style-type: none"> •Assess barriers to meeting goals •Learn the five steps to problem solving •Practice the steps to problem solving
Eating out	<ul style="list-style-type: none"> •Identify ways to plan ahead to avoid eating out •Learn 4 basic principles for healthy eating out: planning ahead, assertion, stimulus control, and healthy food choices •Identify specific examples of how to apply these principles at the type of restaurant the participant frequents
Talk back to negative thoughts	<ul style="list-style-type: none"> •Recognize that everyone has negative thoughts and identify examples of them •Learn how to stop negative thoughts and talk back with positive cues •Discuss what to do after a slip to get back on your feet again
Meal planning	<ul style="list-style-type: none"> •Chart and plan regular meals and snack •Identify healthy meals and snacks •Identify strategies for healthy shopping
Cook more	<ul style="list-style-type: none"> •Identify basic cooking skills to cook more at home •Identify low calories options to favourite menus •Prepare a healthy recipe
Social cues	<ul style="list-style-type: none"> •Review examples of problem social cues and helpful social cues •Discuss ways to change problem social cues and add helpful ones •Review strategies and make an action plan for coping with social events—parties, vacations, holidays, etc
Routines	<ul style="list-style-type: none"> •Discuss why routines help maintain healthy behaviours (set mealtimes and sleep) •Identify benefits of healthy sleep •Plan sleep time and routines
Family meals	<ul style="list-style-type: none"> •Learn benefits of eating family meals •Identify strategies to eat family meals •Plan times when you can eat family meals without distractions (TV)
Healthy breakfast	<ul style="list-style-type: none"> •Learn the benefits of eating a healthy breakfast •Identify strategies to eat a healthy breakfast •Plan times when you can eat a healthy breakfast
Maintain motivation	<ul style="list-style-type: none"> •Review the participant's progress (<i>weigh</i> participant), and if not at goal, develop a plan to improve progress •Discuss the importance of motivation and ways to stay motivated •Develop action plan for common barriers

3 | RESULTS

One-hundred five mothers were part of the intervention group. These mothers received on average 13.3 (± 6.2) core intervention visits and 17.6 (± 9.9) total visits, with a range from 1 to 45 visits.

The frequency with which families received each lesson is described in Table 2. Most families received the "Introduction to HEALTH" lesson at least once, with 100 families (95.2%) receiving this lesson at least one time, while only 47 families (44.8%) received the

"Maintaining motivation" lesson at least once, making it the most frequently missed lesson. Some lessons were frequently received multiple times; 16 (15.2%) families received the "Goals for HEALTH" lesson two or three times, and 11 (10.5%) of families receive the "Four ways to eat less calories" and "Maintaining motivation" lessons two or three times.

Eighty two mothers had weight data from baseline and follow-up (12 mothers (15%) had only 12-month follow-up, two mothers (2%) had only 24-month follow-up, and 68 mothers (83%) had 12- and

TABLE 2 Number of times families received each visit (n = 105)

Lesson	0		1		2 or More ^a	
	n	%	n	%	n	%
1. Introduction to HEALTH ^{***}	5	4.8	94	89.5	6	5.7
2. Goals for HEALTH	17	16.2	72	68.6	16	15.2
3. Healthy beverages	23	21.9	76	72.4	6	5.7
4. Portion size	25	23.8	67	63.8	13	12.4
5. Four ways to eat less calories	29	27.6	65	61.9	11	10.5
6. Food cues	38	36.2	62	59.0	5	4.8
7. Being active: a way of life	28	26.7	71	67.6	6	5.7
8. Take charge of your environment	37	35.2	60	57.1	8	7.6
9. Problem solving	37	35.2	61	58.1	7	6.7
10. Eating out	44	41.9	56	53.3	5	4.8
11. Talk back to negative thoughts	35	33.3	60	57.1	10	9.5
12. Meal planning	36	34.3	60	57.1	9	8.6
13. Cook more	45	42.9	56	53.3	4	3.8
14. Social cues	45	42.9	54	51.4	6	5.7
15. Routines	48	45.7	51	48.6	6	5.7
16. Family meals	53	50.5	47	44.8	5	4.8
17. Healthy breakfast	45	42.9	53	50.5	7	6.7
18. Maintaining motivation	58	55.2	36	34.3	11	10.5
19. Other	37	35.2	13	12.4	55	52.4

^aFor all lessons except "Other," max number was 2 or 3.

Abbreviation: HEALTH, Healthy Eating and Active Living Taught at Home.

24-month follow-up). Among mothers who maintained their weight, 13% were low utilizers, 22% were middle utilizers, and 65% were high utilizers (Table 3). Although this pattern appears different among mothers who gained weight, where only 3% were low utilizers, 31% were middle utilizers, and 67% were high utilizers, this difference was not statistically significant ($\chi^2 = 3.11$; $P = .211$). The correlation between percent weight change and number of lessons received was low ($r = .12$) and not statistically significant ($P = .30$).

Parent educator perception of the mothers' response was highest (4.27 out of 5, with 5 as strongly agree) for both the Goals for HEALTH visit and for the Family meals visit and lowest (3.99 out of 5) for the Food cues visit. For the parent educator's perception of her

own experience with the lesson, ratings were highest (4.34 out of 5) for Family Meals and Routines visits and lowest (4.13 out of 5) for the Being Active: a Way of Life visit.

4 | DISCUSSION

This study identified wide variation in the visits families received from the suggested curriculum, which allows for flexibility in dose, intensity, and content based on family need. That the lesson most often received at least once was the first lesson, and the lesson missed the most was the final lesson in the suggested curricular order may be expected, as parent educators may have preferentially offered the visits in the suggested order, and families may not have completed the entire intervention. However, a visit from near the end of the curriculum (Family Meals) was only received at least once by 52 (49%) families. Many of the most frequently delivered lessons presented very specific, objective, and concrete content (eg, identifying calorie content in food, portion size, healthy beverages, and being active), while lessons with broader topics (eg, routines, cooking more vs eating in restaurants) were missed more frequently. Interestingly, lessons more frequently delivered (ie, Four Ways to Eat Less Calories and Portion Size), were rated lower according to parent educator perceptions of their own lesson delivery, and were also rated lower based on the parent educator's perception of the mother's experience with the lesson. Educators appear to have focused on building the cognitive- and skill-based parent knowledge needed to promote weight gain prevention prior to teaching more complex topics to further support behaviour change. This approach is consistent with learning theory approaches supported by the PAT programme,²⁷ and that of other evidence-based interventions such as the DPP, which generally include the same presentation of topics across the curriculum.²⁸

This investigation found limited variation in parent educator rating of her own delivery of the visit (4.13-4.34) and of the mother's perception of the visit (3.99-4.27). While the mother's satisfaction was not collected separately for each lesson, results from a post survey of participants rating the home visits overall published elsewhere,¹¹ found 90% and 84% of mothers randomized to HEALTH and usual care, respectively, rated visits as very good or excellent. As mentioned, visits most frequently delivered were not necessarily those that parent educators rated highly. This suggests parent educators offered lessons they determined were most useful to the family,

TABLE 3 Category of weight maintenance based on core visit utilization (n = 82)

	Utilization						Total n
	Low		Middle		High		
	n	%	n	%	n	%	
Did not gain	6	13.0	10	21.7	30	65.2	46
Gained (gain any weight)	1	2.8	11	30.6	24	66.7	36
Total	7		21		54		82

Note. Low = 1 to 6 core lessons at least once; middle = 7 to 12 core lessons at least once; and high = 13 to 18 core lessons at least once.

regardless of their comfort with or preference for the lesson. Given that HEALTH demonstrated a reduction in availability and accessibility of soda in the home,²⁹ it is notable Food Cues, a lesson focused on changing the cues in the home to reduce consumption of highly caloric items such as soda had low ratings based on parent educator report of her own delivery and her perception of the mother's experience. This highlights the opportunity to develop additional training and support for lessons rated less favourably.

Previous studies have found that higher doses of content and/or contact lead to better weight loss outcomes,³⁰ which was not consistent with the results of this study. In this observational, secondary analysis, only one mother who gained weight was a low utilizer (one to six core study visits), while six mothers who did not gain weight were low utilizers. Further, there was no linear correlation between weight change and number of visits received. Other studies have found that when participants are randomized to either a standard weight loss programme or a stepped approach to intervention intensity, those randomized to the stepped approach did not require all steps, suggesting full intervention may not be required for all.³¹ Similarly in this study, rather than the larger number of sessions leading to greater weight change, the findings may indicate that mothers at higher risk for weight gain or with more barriers to weight gain prevention needed more intervention sessions, although the causal direction could not be determined given the observational design. The current study was also not designed to evaluate dose response.

The team is not aware of other, detailed reports in the literature of which lessons individual participants received. This type of reporting has significant potential to inform replication of efficacious interventions and dissemination and implementation of evidence to practice. Although some studies have described the quantity of intervention content received,^{32,33} transparency regarding which intervention content is delivered and to what extent is not reported, making it difficult to determine which content families engage with. Reviews of efforts to translate the DPP into real-world settings have found that data on attendance (ie, number of sessions attended in general) are reported.^{34,35} However, even at the programme level, description of specific sessions removed or retained from the standard curriculum are rarely reported, making it difficult to determine what individual participants receive.³⁵ Movements in the field have aimed to enhance reporting of behaviour change strategies,³⁶⁻⁴² and the extent to which these are delivered with fidelity,⁴³⁻⁴⁵ but detail about actual intervention content and what portion of this content is actually received is lacking. Future studies, with sample sizes large enough to and study designs appropriate for analysis of the patterns of lessons, and whether these differed between those maintaining, compared with those gaining weight are needed.

While a strength of this study is that it fills a gap in transparency in reporting what intervention content is actually delivered to participants, it is limited in that the study was not designed to explore specific lessons. The randomized trial was set-up to evaluate intervention impact on mothers' weight, relative to usual care PAT; therefore, causality cannot be determined. Further, since this includes only participants from the intervention group, with a follow-up measure

(12 and/or 24 months), the sample size is limited, especially when considering the trial was not powered for this type of analysis. Finally, all data about the lessons, in particular the visit ratings, were collected by parent educator self-report on scales without reliability or validity evidence; therefore, these are subject to reporting error and bias.

5 | CONCLUSIONS

This study provides a detailed description of the visits and content actually delivered to mothers participating in an intervention which was developed with a suggested core curriculum but also with flexibility to be tailored based on the family's needs. While data demonstrating HEALTH's effectiveness have been presented,¹¹ as with most lifestyle modification programmes, it is difficult to determine what an intervention which allows for flexibility in dose, intensity, and content means. Such reporting can help facilitate incorporation of elements from evidence-based intervention to speed dissemination and implementation of such interventions to practice. Future work should also aim to understand what drives the curriculum delivered in flexible interventions. This is likely influenced by both the provider delivering the intervention and the recipient, and efforts to assess preferences and characteristics of providers and participants may help build an understanding of who needs what intervention components, how much intervention dose is needed, and why.

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CONFLICT OF INTEREST STATEMENT

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AUTHOR CONTRIBUTIONS

R.T. analysed the data. D.H.-J. and C.S. designed and managed the study. All authors (R.T., A.M., C.S., and D.H.-J.) contributed to the interpretation of the results and prepared the manuscript.

DECLARATIONS

Ethics approval and consent to participate The Washington University in St. Louis Human Research Protection Office approved the study protocol, and all participants provided written informed consent.

AVAILABILITY OF DATA AND MATERIAL

The datasets for this manuscript are not publicly available because of confidentiality requirements. Requests to access the datasets should be directed to Debra Haire-Joshu (djoshu@wustl.edu).

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