

# Unmet Social Needs and Adherence to Pediatric Weight Management Interventions: Massachusetts, 2017–2019

Micaela Atkins, MD, Ines Castro, BA, Mona Sharifi, MD, MPH, Meghan Perkins, MPH, Giselle O'Connor, MPH, Man Luo, MPH, Megan Sandel, MD, MPH, Elsie M. Taveras, MD, MPH, and Lauren Fiechtner, MD, MPH

**Objectives.** To examine effects of unmet social needs on adherence to pediatric weight management intervention (PWMI).

**Methods.** We examined individual associations of positive screens for parental stress, parental depression, food insecurity, and housing insecurity with intervention adherence, and associations of 0, 1 or 2, and 3 or 4 unmet social needs with adherence, among children enrolled in a 2017–2019 comparative effectiveness trial for 2 high-intensity PWMI in Massachusetts. Models were adjusted for child age, body mass index (BMI), parent BMI, and intervention arm.

**Results.** Families with versus without housing insecurity received a mean of 5.3 (SD = 8.0) versus 8.3 (SD = 10.9) contact hours ( $P < .01$ ). There were no statistically significant differences in adherence for families reporting other unmet social needs. Children with 3 to 4 unmet social needs versus without received a mean of 5.2 (SD = 8.1) versus 9.2 (SD = 11.8) contact hours ( $P < .01$ ). In fully adjusted models, those with housing insecurity attended a mean difference of  $-3.14$  (95% confidence interval [CI] =  $-5.41, -0.88$ ) hours versus those without. Those with 3 or 4 unmet social needs attended  $-3.74$  (95% CI =  $-6.64, -0.84$ ) hours less than those with none.

**Conclusions.** Adherence to PWMI was lower among children with housing insecurity and in families with 3 or 4 unmet social needs. Addressing social needs should be a priority of PWMI to improve intervention adherence and reduce disparities in childhood obesity.

**Trial Registration:** ClinicalTrials.gov identifier: NCT03012126. (*Am J Public Health*. 2020;110:S251–S257. doi:10.2105/AJPH.2020.305772)

 See also Dasgupta, p. S174.

While trends in childhood obesity show that prevalence is plateauing in some populations, childhood obesity continues to disproportionately affect low-income families and those of racial and ethnic minorities.<sup>1–3</sup> Despite ongoing efforts, the development of successful interventions for these groups has proven challenging.<sup>4</sup> To help address this public health crisis, the US Preventive Services Task Force (USPSTF) evaluated behavior-based pediatric weight management interventions (PWMI) and determined that larger benefits were seen with higher number of intervention or “contact” hours.<sup>5</sup> A total of 26 or more contact hours in a period of 2 to 12 months was found to be effective in reducing body mass index (BMI). However,

the report acknowledges that adherence to such time-intensive interventions is a major factor in determining the success of the interventions.<sup>6</sup>

Unmet social needs are those that may have immediate mitigation opportunities by

the health care system such as providing food from a food pantry for those struggling with food security, but do not actually modify the underlying social and economic conditions children are living in.<sup>7</sup> Those most affected by childhood obesity are affected by unmet social needs such as parental stress, parental depression, food insecurity, and housing insecurity.<sup>8</sup> Food security is defined by the US Department of Agriculture as “access by all people at all times to enough food for an active, healthy life.”<sup>9(p2)</sup> In 2017, 15.7% of US households with children were food insecure at some time during the year.<sup>9</sup> The US Department of Health and Human Services identifies 5 conditions that contribute to the definition of housing insecurity: high housing costs, poor housing quality, overcrowding, homelessness, and unstable neighborhoods (characterized by poverty, crime, and unemployment).<sup>10</sup>

With more research focusing on the psychosocial aspects of childhood obesity, evidence linking childhood obesity to specific unmet social needs such as parental stress, depression, and food and housing insecurity is growing. A recent meta-analysis demonstrated that maternal psychological stress was associated with greater risk of obesity in children,<sup>11</sup> and another study with exclusively Hispanic/Latino youths and their families showed that the number of

## ABOUT THE AUTHORS

Micaela Atkins, Ines Castro, Meghan Perkins, Giselle O'Connor, and Man Luo are with Department of Pediatrics, Division of General Academic Pediatrics, MassGeneral Hospital for Children, Boston, MA. Mona Sharifi is with Section of General Pediatrics, Department of Pediatrics, Yale University School of Medicine, New Haven, CT. Megan Sandel is with Division of General Academic Pediatrics, Boston Medical Center, Boston. Lauren Fiechtner is with Department of Pediatrics, Division of General Academic Pediatrics and Division of Gastroenterology and Nutrition, MassGeneral Hospital for Children. Elsie M. Taveras is with Department of Pediatrics, Division of General Academic Pediatrics, MassGeneral Hospital for Children, and Department of Nutrition, Harvard T.H. Chan School of Public Health, Boston.

Correspondence should be sent to Micaela Atkins, 125 Nashua St, Suite 860, Boston, MA 02114 (e-mail: matkins3@partners.org). Reprints can be ordered at <http://www.ajph.org> by clicking the “Reprints” link.

This article was accepted May 8, 2020.

doi: 10.2105/AJPH.2020.305772

caregivers' chronic stressors was positively correlated with obesity in their children.<sup>12</sup> The association with parental depression is less well studied, but previous studies have hypothesized that parental depression negatively affects parenting quality, which in turn increases sedentary behavior and decreases active leisure activity.<sup>13</sup> One study of parents and their 17-year-old children found that parental major depressive disorder was associated with their child's obesity risk.<sup>14</sup> Although it is clear that the household food environment, including the amount and type of food available, plays a major role in children's nutritional intake and weight status, studies to assess the relationship between food insecurity and obesity have shown inconsistent associations.<sup>15,16</sup> Housing insecurity and obesity is less well-studied, but 1 study from Los Angeles, California, showed that preschool children living in housing-cost-burdened households were more likely to have obesity.<sup>17</sup>

Research in both adult and pediatric patients suggests that unmet social needs are associated with poor engagement with treatment strategies, resulting in worse health outcomes.<sup>18,19</sup> One study examining the rate of participation in a caregiver-mediated intervention for young children with autism spectrum disorder showed that families with higher socioeconomic status were more likely to have higher rates of attendance.<sup>18</sup> Another study describing unmet needs for services, such as housing and psychiatric treatment, and their relationship with health care outcomes among individuals receiving HIV care in the southeastern United States showed that participants with 1 or more unmet needs were less likely to be taking any HIV medications.<sup>17</sup> However, the specific link between unmet social needs and adherence has not been studied in childhood obesity. An exploration of potential factors related to limited PWMI contact hours is critically important, as decreased adherence could prevent children at highest risk from experiencing the full benefits of PWMI, which in turn worsens health disparities.

This study seeks to explore the association between unmet social needs and adherence (both attendance of treatment sessions and adherence to 1 treatment recommendation—completing health coaching calls in the Healthy Weight Clinics [HWCs]), to PWMI

meeting the USPSTF recommendation of at least 26 contact hours. We hypothesized that families who screened positively for unmet social needs would have fewer completed contact hours over the 1-year intervention period. We chose to focus on parental stress, parental depression, food insecurity, and housing insecurity as we felt that these areas would affect our families' ability to attend the PWMI and these were areas our clinical partners could help address.

## METHODS

Study participants were children enrolled in the Clinic and Community Approaches to Healthy Weight study, a randomized controlled trial in 2 communities in Massachusetts with large populations of low-income families. Study design is described in detail elsewhere.<sup>19</sup> The 2-arm trial compares the effects of HWCs embedded in a federally qualified community health center versus the Modified Healthy Weight and Your Child (M-HWYC) programs delivered at local YMCAs. Participants included children aged 6 to 12 years with a body mass index (BMI) of greater than or equal to 85th percentile seen in primary care at the 2 federally qualified community health centers. The study used a simple a priori randomization by health center where each participant had a 50% chance to be in either intervention arm.

Each of the 2 intervention groups received an intensive 6-month intervention followed by a 6-month maintenance period that delivered 30 or more hours of contact time—30 hours for the HWC and 50 hours for the M-HWYC—over the 1-year intervention period, consistent with the current USPSTF guidelines.<sup>20</sup> The M-HWYC program delivered in this study is different than the current program that is being implemented nationally by the YMCA, which offers 25 sessions delivered over 4 months to children with obesity and severe obesity.

Parents of study participants were surveyed at baseline (enrollment in the program) and after 6 and 12 months from first program interaction through a phone-based interview conducted by trained research assistants who were blinded to the intervention assignment. The study preserved blinding of the research coordinators during the baseline assessment

and further assessments at 6 months and 1 year. All data were collected and stored on REDCap. Parents were given a set of incentives that included a \$25 gift card for completion of each phone-based survey and up to 3 \$25 gift cards for attending the visits. Parents were also offered transportation vouchers by the intervention staff to accommodate travel to and from the sites for all HWC or M-HWYC visits. These vouchers were not offered universally; we relied on the HWC and M-HWYC staff to identify those families who needed help with transportation. All participants who were enrolled in the study were included in these analyses.

Thirty-two participants were missing parent BMI and so were not included in fully adjusted models.

## Main Exposures

The main exposures for this analysis were individual positive screens at baseline to parental stress, parental depression, food insecurity, and housing insecurity. Stress was measured by the single-item question validated by Elo et al.<sup>21</sup> and recommended by the Institute of Medicine,<sup>22</sup> which asked, "Stress means a situation in which a person feels tense, restless, nervous, or anxious or is unable to sleep at night because his or her mind is troubled all the time. Do you feel this kind of stress these days?" A positive screen was identified if a parent answered "rather much" or "very much" to this question.

Depression was assessed with a single question asking parents if they had ever been diagnosed with depression: "Did you ever see a health care professional who said that you were depressed?" A positive screen was an affirmative answer to this question.

Housing insecurity was measured by 2 questions taken from the National Survey of America's Families asking parent participants (1) "During the last 12 months, was there a time when you and your family were not able to pay your mortgage, rent or utility bills?" and (2) "During the last 12 months, did you or your children move in with other people even for a little while because you could not afford to pay your mortgage, rent or utility bills?"<sup>23</sup> A positive screen was an affirmative answer to either of these questions.

Food insecurity was assessed by a pair of questions addressing food costs within the

context of the family budget: (1) “Within the past 12 months we worried whether our food would run out before we got money to buy more” and (2) “Within the past 12 months the food we bought just didn’t last and we didn’t have money to get more.”<sup>24</sup> A positive screen was determined if the parents answered “sometimes true” or “often true” to either question.

We also created a cumulative score to summarize the total number of unmet social needs reported by participants. We first counted the number of unmet social needs reported as a continuous score, which ranges from 0 to 4. Next, we categorized this score into 3 levels: 0, 1 or 2, and 3 or 4 unmet social needs. If participants did not answer 1 or more questions about the 4 unmet social needs listed previously, the cumulative score was set to missing.

## Outcome

Program adherence in hours was the main outcome. This was defined as the number of contact hours, which included attending in-person visits (HWC and the M-HWYC), in addition to completing health coaching phone calls (HWC only). Total contact hours were determined by intervention site attendance reports. Nobles et al. denote an engagement pathway, or “extent to which, and how, individuals participate in weight management services,” and define the key concepts of adherence and attendance to an intervention.<sup>25(p133)</sup> Attendance refers to “individual’s presence in a weight management session.”<sup>25(p136)</sup> Adherence is the “extent to which individuals follow treatment recommendations,” and can capture multiple dimensions of a service so that it encompasses both adherence to treatment sessions and adherence to treatment recommendations.<sup>25(p136)</sup> We felt that adherence encompassed both attendance of treatment sessions and adherence to 1 portion of treatment recommendations, which was the health coaching calls. On average, the HWC visits were 1.5 hours in duration and the M-HWYC visits were 2 hours in duration, resulting in an intended 30 hours total and 50 hours total, respectively. Study staff did quarterly observations of the programs at the HWC and the M-HWYC to confirm average visit length was as intended. Coaching calls

were approximately 10 minutes in duration, as reported by the dietitians and community health workers completing these calls.

## Barriers to Adherence

Parents and guardians were asked on the 12-month survey about the barriers to attending the PWMI. The question was asked, “Were any of the following a problem in attending the program?” Participants could endorse more than 1 option. Answer choices were

1. getting to or from the program,
2. day or time program was scheduled,
3. how many times the program met over the past 12 months,
4. how long each visit or class was,
5. didn’t like the program,
6. my family or friends didn’t think the program was important for my child,
7. family changes (such as illness, moving, pregnancy),
8. didn’t have child care for other children, and
9. an optional “other” box.

## Statistical Analysis

We performed descriptive analysis of the exposures, outcomes, and covariates. We conducted the  $\chi^2$  test and 2-sample *t* test to compare baseline demographics between HWC and M-HWYC programs. We then examined associations of individual positive screens for unmet social needs (i.e., parental stress, parental depression, food insecurity, and housing insecurity) at baseline with adherence using the 2-sample *t* test. We stratified the sample by the HWC and M-HWYC programs and again analyzed them with the 2-sample *t* test. In addition, we examined the associations of 0, 1 or 2, and 3 or 4 unmet social needs with contact hours using unadjusted linear regression. Finally, we conducted multivariate linear regression adjusting for child age, child BMI category at baseline, parent BMI category, and intervention arm examining the associations between the individual unmet social needs and contact hours as well as the cumulative social needs and contact hours. We also examined number of visits as the outcome and engagement as attending at least 1 visit (Tables C to F, available as supplements to the online version of this

article at <http://www.ajph.org>). We conducted statistical analyses with SAS version 9.3 (SAS Institute Inc, Cary, NC).

## RESULTS

At baseline, the mean child age was 9.6 years (SD = 1.8), 27% of children had overweight, 43% had obesity, and 30% had severe obesity (defined as greater than or equal to 120th percent of the 95th percentile; Table 1). Of the participants, 93% were Hispanic and 69% lived in families with an annual income of \$20 000 or less. Overall, 64.9% of kids (264 out of 407) attended at least 1 visit, 67.7% (136/201) at HWC and 62.1% (128/206) at M-HWYC. The contact hours received ranged from 0 to 46 among all participants, with mean contact hours of 7.4 (SD = 10.2). In the HWC, contact hours received ranged from 0 to 23.3, with a mean of 4.8 (SD = 5.7). In the M-HWYC, contact hours received ranged from 0 to 46 hours with mean contact hours of 9.9 (12.7) hours. At baseline, 30% of parents reported experiencing stress “rather much” or “very much,” 36% reported a health care professional said they were depressed, 30% reported housing insecurity, and 49% reported food insecurity.

Families with housing insecurity received a mean of 5.3 (SD = 8.0) contact hours versus 8.3 (SD = 10.9) contact hours for families without housing insecurity ( $P < .01$ ; Table 2). There were no statistically significant differences in adherence for children whose parent had a diagnosis of depression or had high levels of stress at baseline or for those with food insecurity, although there was a trend for fewer contact hours for those unmet social needs as well. These trends were similar when the programs were stratified (Table A, available as a supplement to the online version of this article at <http://www.ajph.org>). In fully adjusted models, those families suffering from housing insecurity attended  $-3.18$  (95% confidence interval [CI] =  $-5.36, -1.00$ ) hours compared with those without housing insecurity. Again, the other unmet social needs were not statistically significantly associated with adherence but trended toward fewer contact hours for the other unmet social needs.

When we examined the number of unmet social needs per family, we found that those

**TABLE 1—Baseline Demographics of Participants in the Clinic and Community Approaches to Healthy Weight Study: Massachusetts, 2017–2019**

	Total (n = 407)	HWC (n = 201)	M-HWYC (n = 206)	<i>P</i> <sup>a</sup>
Age, years, mean (SD)	9.6 (1.8)	9.6 (1.9)	9.6 (1.8)	.88
Sex: female, no. (%)	184 (45.2)	89 (44.3)	95 (46.1)	.71
BMI z score, mean (SD)	1.9 (0.5)	1.9 (0.5)	2.0 (0.5)	.96
BMI kg/m <sup>2</sup> median (IQR)	24.2 (21.6–27.6)	24.2 (21.7–27.64)	24.3 (21.6–27.5)	
% of the 95th percentile, median (IQR)	109.5 (99.0–122.4)	109.6 (98.5–122.9)	109.3 (99.5–121.9)	
BMI category, no. (%)				
Overweight	109 (26.8)	54 (26.9)	55 (26.7)	.98
Obesity	176 (43.2)	86 (42.8)	90 (43.7)	
Severe obesity	112 (30.0)	61 (30.3)	61 (29.6)	
Race/ethnicity: Hispanic, no. (%)	377 (92.9)	186 (92.5)	191 (92.7)	.67
Parents born outside of United States (n = 406), no. (%)	145 (35.7)	74 (36.8)	71 (34.6)	.65
Parent education (n = 403), no. (%)				.55
< High school	177 (43.9)	84 (42.4)	93 (45.4)	
High-school graduate	132 (32.8)	70 (35.4)	62 (30.2)	
≥ Some college	94 (23.3)	44 (22.2)	50 (24.4)	
Marital status: married or living together, no. (%)	152 (37.3)	73 (36.3)	79 (38.3)	.67
Parent BMI (n = 375), no. (%)				.05
Underweight (BMI < 18.5)	4 (1.1)	2 (1.1)	2 (1.0)	
Normal weight (BMI = 18.5–24.9)	60 (16.0)	29 (15.9)	31 (16.1)	
Overweight (BMI = 25.0–29.9)	99 (26.4)	61 (33.5)	38 (19.7)	
Obesity class 1 (BMI = 30–34.9)	91 (24.3)	42 (23.1)	49 (25.4)	
Obesity class 2 (BMI = 35–39.9)	71 (18.9)	27 (14.8)	44 (22.8)	
Obesity class 3 (BMI ≥ 40)	50 (13.3)	21 (11.5)	29 (15.0)	
Family assistance, no. (%)				
WIC	104 (25.6)	54 (26.9)	50 (24.3)	.63
Food stamps/SNAP/EBT	280 (68.8)	137 (68.2)	143 (69.4)	.87
Free/reduced price meals at school	360 (88.5)	182 (90.5)	178 (86.4)	.25
Household income, \$ per year, no. (%)				
≤ 20 000	218 (68.6)	101 (63.9)	117 (73.1)	.1
> 20 000	100 (31.4)	57 (36.1)	43 (26.9)	
Social needs, no. (%)				
Housing insecurity	121 (29.7)	59 (29.4)	62 (30.1)	.87
Food Insecurity	200 (49.1)	93 (46.3)	107 (51.9)	.25
Parental stress—rather or very much	124 (30.5)	60 (29.9)	64 (31.1)	.79
Parental depression	147 (36.1)	84 (41.8)	63 (30.6)	.02
Mean contact hours received (SD)	7.4 (10.2)	4.8 (5.7)	9.9 (12.7)	< .01
Contact hours, median (IQR)	3.0 (0.0–10.0)	3.0 (0.0–7.7)	5.0 (0.0–16.0)	
Engaged in at least 1 visit, no. (%)	264 (64.9)	136 (67.7)	128 (62.1)	.24
Completed at least 26 contact hours, no. (%)	30 (7.4)	0 (0)	30 (14.6)	< .01

Note. BMI = body mass index; EBT = Electronic Benefits Transfer; HWC = Healthy Weight Clinic; IQR = interquartile range; M-HWYC = Modified Healthy Weight and Your Child; SNAP = Supplemental Nutrition Assistance Program; WIC = Special Supplemental Nutrition Program for Women, Infants, and Children. <sup>a</sup>*P* value calculated by 2-sample *t* test.

with several unmet social needs had significantly lower adherence than families without (Table 3). Families with no unmet social needs received a mean of 9.2 (SD = 11.8) contact hours, while families with 3 or 4 unmet social needs received a mean of 5.2 (SD = 8.1) contact hours (*P* < .01). In fully adjusted models, those with 3 or 4 unmet social needs attended –3.74 (95% CI = –6.64, –0.84) hours less than those with no unmet social needs. The most common barriers to adherence endorsed on the 12-month survey (Table 4) included “day or time the program was scheduled” (23%) and “getting to or from the program” (19%).

## DISCUSSION

In this randomized trial of children with overweight and obesity enrolled in 2 high-intensity PWMIs, we found that unmet social needs were highly prevalent and associated with lower program adherence. Families with housing insecurity at baseline attended fewer contact hours than those in stable housing. Children whose parents reported any of the other unmet social needs assessed (parental stress, parental depression, or food insecurity) received fewer contact hours, but this was not statistically significant. We did find that regardless of the unmet social need reported, the total number of unmet social needs was significantly associated with program adherence. Families with 3 or 4 unmet social needs had significantly fewer contact hours than families without unmet social needs, suggesting a cumulative effect of unmet social needs.

Previous studies have demonstrated that people who screen positively for unmet social needs have an increased risk for obesity and its comorbidities.<sup>16,17</sup> While other studies have demonstrated the significance of unmet social needs on health outcomes, this study provides evidence that unmet social needs have an impact on the number of contact hours a participant receives, which is a marker of the most effective PWMIs. In line with effective weight management, there exists a robust body of literature to support whole-family integration into ongoing PWMIs instead of focusing on a patient.<sup>19</sup> It is critical, then, to screen and include an entire family’s needs at the onset of a program. If a parent or guardian is expressing a barrier, then the family

TABLE 2—Mean Contact Hours by Individual Unmet Social Need at Baseline: Massachusetts, 2017–2019

Unmet Social Need	No.	Contact Hours, Median (IQR)	Contact Hours, Mean (SD)	Unadjusted Mean Difference (95% CI)	Fully Adjusted Model, Mean Difference (95% CI) <sup>a,b</sup>
<b>Parent stress</b>					
Yes	124	3.3 (0.0–7.9)	6.1 (9.0)	-1.92 (-3.94, 0.10)	-1.68 (-3.85, 0.50)
No	283	3.0 (0.0–12.2)	8.0 (10.6)	0 (Ref)	0 (Ref)
<b>Parent depression</b>					
Yes	147	2.0 (0.0–8.0)	6.3 (9.3)	-1.75 (-3.81, 0.31)	-0.88 (-3.01, 1.24)
No	260	4.0 (0.0–11.6)	8.0 (10.6)	0 (Ref)	0 (Ref)
<b>Housing insecurity</b>					
Yes	121	2.0 (0.0–7.7)	5.3 (8.0)	-2.95 (-4.86, -1.04)	-3.18 (-5.36, -1.00)
No	286	4.0 (0.0–12.0)	8.3 (10.9)	0 (Ref)	0 (Ref)
<b>Food insecurity</b>					
Yes	200	3.0 (0.0–11.0)	7.2 (9.9)	-0.34 (-2.33, 1.65)	-0.65 (-2.68, 1.38)
No	207	3.2 (0.0–10.0)	7.6 (10.5)	0 (Ref)	0 (Ref)

Note. CI = confidence interval; IQR = interquartile range.

<sup>a</sup>N = 32 missing parent body mass index.

<sup>b</sup>Fully adjusted model adjusted for child age, body mass index category, parental body mass index category, and intervention arm.

approach is undermined and impedes the success of the patient.

While it is presumed that unmet social needs are associated with increased risk of obesity, this study explores 1 potential mechanism behind this association, specifically the adherence to the PWMI. A lower program adherence may occur because families with unmet social needs, and particularly several of them, may have competing priorities and prioritize nonurgent appointments lower than other needs. The immediate need for stable housing may take precedence over attending an appointment to mitigate the longer-term consequence of their child's obesity. For example, there is evidence that suggests that a family's stress of competing demands such as home heating and cooling costs may have an adverse impact on the health and nutritional status of children and other vulnerable populations, particularly for low-income families in states with severe

seasons such as Massachusetts.<sup>26</sup> Findings from the report by Frank et al. on the Low Income Home Energy Assistance Program raise the concern that a confluence of home energy costs may exacerbate possible risks to the health and growth of young children.<sup>26</sup> Furthermore, studies that look at how unmet social needs affect individuals' health decisions highlight the trade-offs that exist between household and individual needs. Focus groups in 1 study described a prioritization of household needs such as food, rent, and utilities over paying for nonurgent medical care.<sup>27</sup> Families also relayed a reluctance to discuss financial strain in clinical settings, citing a perceived "lack of openness, embarrassment and stigma."<sup>27(p406)</sup> Although weight management intervention participants may value and prioritize adherence to physician-recommended therapies when possible, there is evidence to suggest

that adherence may be affected when resources are lacking.

Although research on housing and obesity is scarce, a few studies have shown that obesity is highly prevalent in the adult homeless population.<sup>28</sup> Our result, that families with housing insecurity had lower adherence, is in line with existing research on housing insecurity and treatment adherence in other fields of medicine. For example, in a study of diabetes treatment, participants described housing as a "foundational need" that, when not met, inhibited diabetes self-management.<sup>29</sup> In 1 case-control study looking to examine a link between home foreclosure and health care utilization, patients were more likely to have a no-show appointment and less likely to have a primary care physician visit in the 6 months immediately before the receipt of a foreclosure notice. These results suggest changes in health care utilization in the time period around foreclosure.<sup>30</sup>

TABLE 3—Mean Contact Hours by Number of Unmet Social Needs: Massachusetts, 2017–2019

Categories	No.	Contact Hours, Median (IQR)	Contact Hours, Mean (SD)	Unadjusted Mean Difference (95% CI)	Fully Adjusted Model, Mean Difference (95% CI) <sup>a,b</sup>
No unmet social needs	111	4.5 (0.0–15.2)	9.2 (11.8)	0 (Ref)	0 (Ref)
1 or 2 unmet social needs	211	3.5 (0.0–10.0)	7.3 (9.9)	-1.89 (-4.22, 0.44)	-1.59 (-3.99, 0.82)
3 or 4 unmet social needs	85	2.0 (0.0–6.0)	5.2 (8.1)	-3.99 (-6.86, -1.12)	-3.74 (-6.64, -0.84)

Note. CI = confidence interval; IQR = interquartile range. The sample size was n = 407.

<sup>a</sup>N = 32 missing parent body mass index.

<sup>b</sup>Fully adjusted model adjusted for child age, body mass index category, parental body mass index category, intervention arm.

**TABLE 4—Reported Reasons Families Were Not Able to Attend Intervention Sessions: Massachusetts, 2017–2019**

Reason	Frequency, No. (%)
Day or time program was scheduled	95 (23.3)
Getting to or from the program	79 (19.4)
Family changes, such as illness, moving, and pregnancy	60 (14.7)
How many times the program met over the past 12 mo	38 (9.3)
Didn't have child care for other children	37 (9.1)
How long each visit or class was	27 (6.6)
Didn't like the program	15 (3.7)
My family or friends didn't think the program was important for my child	11 (2.7)

Note. The sample size was  $n = 407$ .

Our results did not show a significant association between other individual unmet social needs (reported food insecurity, parental stress, and parental diagnosis of depression) with adherence to the PWMI. This may be because housing has a greater impact on ability to attend appointments while food insecurity, parental stress, and a diagnosis of depression may have greater impact on families' ability to make healthy lifestyle change. With regard to food insecurity, both PWMI offered healthy snacks at the group visits and supermarket gift cards for attendance, so families reporting food insecurity may have had a stronger impetus to attend the PWMI. We did, however, see a trend between each unmet social need and fewer contact hours, so it is possible that the questions to screen for these needs were not sensitive or that we were not powered to see these effects.

Intervention attrition (if individuals “permanently do not re-engage” in a service)<sup>25</sup> and poor adherence has been an ongoing challenge in this field; recent reviews reported mean attrition rates of 30% to 40%.<sup>31</sup> In the USPSTF report,<sup>5</sup> there are 9 studies that look at change in BMI in behavior-based weight loss intervention trials with an estimated contact of 26 to 51 hours.<sup>32</sup> Of these studies, 3 report “number of intervention sessions” attended by a participant, with attendance ranging from 63% to 86% of total sessions offered.<sup>33–35</sup> In our study, only 7% of participants met the threshold attendance of at least 26 hours even with incentives for adherence. However, our study population had a higher prevalence of Hispanic ethnicity and low-income participants. Race and ethnicity,

low family income, age of children, and public health insurance have all been described in the literature as significantly associated with attrition or poor adherence.<sup>31</sup> In our primarily Hispanic, low-income study population, 72.4% of families reported at least 1 unmet social need, and this high prevalence may explain the low treatment adherence. We did not adjust for income or race/ethnicity as our study population was homogeneous and income value was frequently missing when less than \$20 000 per year.

### Limitations

As in any study, this study has its limitations. First, this study was cross-sectional in design, so no causal conclusions can be made. Second, when screening for depression, a single question was used to determine whether a parent had a previous diagnosis of depression. We are aware that a positive or absent diagnosis of depression does not reliably indicate the presence of signs or symptoms of depression, nor does it indicate the presence of behavioral health support. We also used a single-item screener of stress instead of longer measures to reduce participant burden. And last, the generalizability of these results is limited based on the predominantly Hispanic, low-income sociodemographic profile of the participants who received incentives for attendance and adherence such as snacks at the group visits and supermarket gift cards.

### Public Health Implications

As PWMI strive to meet the USPSTF guidelines of offering at least 26 contact hours,

it will be increasingly important to identify potential reasons for low adherence and design PWMI to address those reasons. Among all participants in this study, independent of prevalence of unmet social needs, the mean program attendance was low at a mean of 7.4 (SD = 10.2) hours (out of 30 hours for the HWC and 50 hours for M-HWYC) despite research and clinical staff efforts to keep the participants engaged, with incentives for attendance. Given the challenge of attrition in these high-intensity PWMI, future work should investigate the threshold of contact hours necessary for clinically important BMI improvements.

Finally, given our results, we strongly suggest that PWMI and health care providers for children with overweight and obesity work concurrently on mitigating unmet social needs and healthy lifestyle changes to help reduce the disparities experienced in this disease. Possible avenues for patient retention include hosting the PWMI in local schools, public housing developments, or community venues, such as a church or playground, where patients and families already attend regularly. **AJPH**

### CONTRIBUTORS

M. Atkins and I. Castro wrote the initial draft of the article. L. Fiechtner supervised the writing of the initial draft. All authors assisted with the conceptualization and design of the study as well as the interpretation of the data analysis, revised the article, and approved the final version of the study. M. Luo completed the statistical analyses. E. Taveras obtained funding and originated and supervised as principal investigator of the larger study.

### ACKNOWLEDGMENTS

This study was supported by the Centers for Disease Control and Prevention National Center for Chronic Disease Prevention and Health Promotion (award U18DP006259). L. Fiechtner was supported by grant K23HD090222 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development. M. Sharifi was supported by grant K08HS024332 from the Agency for Healthcare Research and Quality. E. Taveras was supported by grant K24 DK10589 from the National Institute of Diabetes and Digestive and Kidney Diseases.

**Note.** The content is solely the responsibility of the authors and does not necessarily represent the official views of the Centers for Disease Control and Prevention, the National Institutes of Health, or the Agency for Healthcare Research and Quality.

### CONFLICTS OF INTEREST

The authors report no conflicts of interest.

### HUMAN PARTICIPANT PROTECTION

All study procedures were approved by the Massachusetts Department of Public Health institutional review board. All participants provided informed consent.

## REFERENCES

1. Hales CM, Fryar CD, Carroll MD, Freedman DS, Ogden CL. Trends in obesity and severe obesity prevalence in US youth and adults by sex and age, 2007–2008 to 2015–2016. *JAMA*. 2018;319(16):1723–1725.
2. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA*. 2014;311(8):806–814.
3. Skinner AC, Skelton JA. Prevalence and trends in obesity and severe obesity among children in the United States, 1999–2012. *JAMA Pediatr*. 2014;168(6):561–566.
4. Stice E, Shaw H, Marti CN. A meta-analytic review of obesity prevention programs for children and adolescents: the skinny on interventions that work. *Psychol Bull*. 2006;132(5):667–691.
5. O'Connor EA, Evans CV, Burda BU, Walsh ES, Eder M, Lozano P. Screening for obesity and intervention for weight management in children and adolescents: evidence report and systematic review for the US Preventive Services Task Force. *JAMA*. 2017;317(23):2427–2444.
6. Fleegler EW, Lieu TA, Wise PH, Muret-Wagstaff S. Families' health-related social problems and missed referral opportunities. *Pediatrics*. 2007;119(6):e1332–e1341.
7. Green K, Zook M. When talking about social determinants, precision matters. *Health Affairs Blog*. October 29, 2019. Available at: <https://www.healthaffairs.org/doi/10.1377/hblog20191025.776011/full>. Accessed May 26, 2020.
8. Tate EB, Wood W, Liao Y, Dunton GF. Do stressed mothers have heavier children? A meta-analysis on the relationship between maternal stress and child body mass index. *Obes Rev*. 2015;16(5):351–361.
9. Coleman-Jensen A, Rabbitt MP, Gregory CA, Singh A. Household food security in the United States in 2017. Economic Research Report No. 256. Washington, DC: US Department of Agriculture, Economic Research Service; 2018:2–10.
10. Johnson A, Meckstroth A. Ancillary services to support welfare-to-work. US Department of Health and Human Services. 1998. Available at: <https://aspe.hhs.gov/report/ancillary-services-support-welfare-work>. Accessed April 3, 2020.
11. Isasi CR, Hua S, Jung M, et al. The association of parental/caregiver chronic stress with youth obesity: findings from the Study of Latino Youth and the Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study. *Child Obes*. 2017;13(4):251–258.
12. McConley RL, Mrug S, Gilliland MJ, et al. Mediators of maternal depression and family structure on child BMI: parenting quality and risk factors for child overweight. *Obesity (Silver Spring)*. 2011;19(2):345–352.
13. Marmorstein NR, Iacono WG. Associations between depression and obesity in parents and their late-adolescent offspring: a community-based study. *Psychosom Med*. 2016;78(7):861–866.
14. Kohn MJ, Bell JF, Grow HMG, Chan G. Food insecurity, food assistance and weight status in US youth: new evidence from NHANES 2007–08. *Pediatr Obes*. 2014;9(2):155–166.
15. Morales ME, Berkowitz SA. The relationship between food insecurity, dietary patterns, and obesity. *Curr Nutr Rep*. 2016;5(1):54–60.
16. Nobari TZ, Whaley SE, Blumenberg E, Prellip ML, Wang MC. Severe housing-cost burden and obesity among preschool-aged low-income children in Los Angeles County. *Prev Med Rep*. 2018;13:139–145.
17. Reif S, Whetten K, Lowe K, Ostermann J. Association of unmet needs for support services with medication use and adherence among HIV-infected individuals in the southeastern United States. *AIDS Care*. 2006;18(4):277–283.
18. Carr T, Shih W, Lawton K, Lord C, King B, Kasari C. The relationship between treatment attendance, adherence, and outcome in a caregiver-mediated intervention for low-resourced families of young children with autism spectrum disorder. *Autism*. 2016;20(6):643–652.
19. Fiechtner L, Perkins M, Biggs V, et al. Rationale and design of the Clinic and Community Approaches to Healthy Weight Randomized Trial. *Contemp Clin Trials*. 2018;67:16–22.
20. Grossman DC, Bibbins-Domingo K, Curry SJ, et al. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *JAMA*. 2017;317(23):2417–2426.
21. Elo A-L, Leppänen A, Jahkola A. Validity of a single-item measure of stress symptoms. *Scand J Work Environ Health*. 2003;29(6):444–451.
22. Giuse NB, Koonce TY, Kusnoor SV, et al. Institute of Medicine measures of social and behavioral determinants of health: a feasibility study. *Am J Prev Med*. 2017;52(2):199–206.
23. Wen M. Racial and ethnic differences in general health status and limiting health conditions among American children: parental reports in the 1999 national survey of America's families. *Ethn Health*. 2007;12(5):401–422.
24. Hager ER, Quigg AM, Black MM, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. *Pediatrics*. 2010;126(1):e26–e32.
25. Nobles JD, Perez A, Skelton JA, Spence ND, Ball GD. The engagement pathway: a conceptual framework of engagement-related terms in weight management. *Obes Res Clin Pract*. 2018;12(2):133–138.
26. Frank DA, Neault NB, Skalicky A, et al. Heat or eat: the Low Income Home Energy Assistance Program and nutritional and health risks among children less than 3 years of age. *Pediatrics*. 2006;118(5):e1293–e1302.
27. Nguyen OK, Higashi RT, Makam AN, Mijares JC, Lee SC. The influence of financial strain on health decision-making. *J Gen Intern Med*. 2018;33(4):406–408.
28. Koh KA, Hoy JS, O'Connell JJ, Montgomery P. The hunger-obesity paradox: obesity in the homeless. *J Urban Health*. 2012;89(6):952–964.
29. Keene DE, Guo M, Murillo S. "That wasn't really a place to worry about diabetes": housing access and diabetes self-management among low-income adults. *Soc Sci Med*. 2018;197:71–77.
30. Pollack CE, Kurd SK, Livshits A, Weiner M, Lynch J. A case-control study of home foreclosure, health conditions, and health care utilization. *J Urban Health*. 2011;88(3):469–478.
31. Dhaliwal J, Nosworthy NMI, Holt NL, et al. Attrition and the management of pediatric obesity: an integrative review. *Child Obes*. 2014;10(6):461–473.
32. O'Connor EA, Evans CV, Burda BU, Walsh ES, Eder M, Paula L. Screening for obesity and intervention for weight management in children and adolescents: a systematic evidence review for the US Preventive Services Task Force. Evidence Synthesis No. 150. AHRQ publication no. 15-05219-EF-1. Agency for Healthcare Research and Quality. 2016. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK476325>. Accessed March 1, 2020.
33. DeBar LL, Stevens VJ, Perrin N, et al. A primary care-based, multicomponent lifestyle intervention for overweight adolescent females. *Pediatrics*. 2012;129(3):e611–e620.
34. Sacher PM, Kolotourou M, Chadwick PM, et al. Randomized controlled trial of the MEND program: a family-based community intervention for childhood obesity. *Obesity (Silver Spring)*. 2010;18(suppl 1):S62–S68.
35. Kalarchian MA, Levine MD, Arslanian SA, et al. Family-based treatment of severe pediatric obesity: randomized, controlled trial. *Pediatrics*. 2009;124(4):1060–1068.