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Risk Factors for Attrition from a Pediatric Weight Management Program

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Risk Factors for Attrition from a Pediatric Weight Management Program

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Introduction

Childhood obesity has increasingly been recognized as a serious health problem and crisis in public health in recent years. Not only does obesity negatively impact the health of the children it affects, it also negatively contributes to future health as these children transition into adulthood. Therefore, obesity is a condition that has the potential to cause lifelong harm. There are many risk factors for childhood obesity, including poor nutrition and a lack of physical activity, as well as many demographic and biologic factors and social determinants of health. As a result, there are many approaches that interventions can take.

The purpose of this study is to assess reasons for attrition at a pediatric medical weight management program and the risk factors for the patients who drop out of treatment. The weight management program under study is located at the Pediatric Obesity Center for Treatment, Research, and Education at Connecticut Children's Medical Center which receives referrals from community pediatricians throughout Connecticut, although primarily in the Greater Hartford area. The results of this study will provide important information about barriers to patient success in medical weight management programs and inform outreach efforts that may need to be implemented for increased effectiveness in treating childhood obesity.

Specific Aims

The objective of this study is to investigate attrition rates in the nonsurgical weight management program at the Pediatric Obesity Center for Treatment, Research, and Education at Connecticut Children's Medical Center, in Hartford, Connecticut. The research question this study will explore is: What are the risk factors for attrition at this pediatric weight management program?

It is hypothesized that identified demographic risk factors for attrition at this clinic will be similar to those found in previous studies, such as ethnicity and minority status, Medicaid insurance, and lower socioeconomic status. It is also hypothesized that food insecurity, which has not specifically been addressed in other studies, will also impact attrition since individuals who identify as food insecure will be less able to adhere to healthy food behaviors and changes recommended in diet. It is hypothesized that parental and child perceptions of importance to make change and confidence to enact change will also impact attrition. Individuals with higher importance to change and confidence in being able to change will be more likely to engage in programming and less likely to drop out. The goal is to use these findings to inform new outreach approaches and retention strategies as treatment success is dependent on program engagement.

Background

Childhood obesity is a significant health problem and a growing epidemic in public health, both in the United States and globally. The prevalence of childhood obesity has tripled in the past four decades in the United States (Fryar, Carroll, & Ogden, 2012). Recent research has shown that 17.4% of children ages 2-19 are obese and a further 33.4% are overweight in the US

(Skinner, Perrin, & Skelton, 2016). This correlates to an obesity rate of just over one in six children. Globally, the World Health Organization (WHO) estimates that 41 million children under the age of 5 and over 340 million children and adolescents ages 5-19 were overweight or obese in 2016 (WHO, 2018). The most recent overweight and obesity research for the state of Connecticut shows approximately 29% of children ages 5-17 are overweight or obese (Poulin & Peng, 2018). When looking at children ages 2-4 in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), 15.3% have been found to be overweight and 14.8% are obese (Poulin & Peng, 2018).

A child is considered overweight when their body mass index (BMI) is at the 85^{th} percentile or above and is formally defined as obese when their BMI is greater than the 95^{th} percentile. BMI is calculated using height and weight measurements and is weight divided by $height^2$ (kg/m^2). Children with overweight and obesity are very likely to become overweight and obese adults, which significantly increases their risk for chronic conditions as well as a decreased quality of life (Field, Cook, & Gillman, 2005). Childhood obesity not only contributes to acute health problems, including both physical and mental health concerns, but also has a myriad of negative consequences as children develop and transition into adulthood.

Many disease conditions previously thought to be limited to adult populations are now beginning to be seen in children. These include conditions such as cardiovascular disease, Type 2 diabetes, nonalcoholic fatty liver disease, obstructive sleep apnea, polycystic ovarian syndrome, and many orthopedic problems (Kelsey, Zaepfel, Bjornstad, & Nadeau, 2014). Mental health concerns include poor self-esteem, negative self-image, eating disorders, higher levels of anxiety and depression, and lower health-related quality of life (Pizzi & Vroman, 2013). There are many reasons why psychological health is affected and it is important to recognize this

impact of childhood obesity. Obesity negatively contributes to a child's ability to interact and engage with his peers, in both home and school settings, fostering less social participation and increased feelings of social isolation (Pizzi & Vroman, 2013). Overall, the cumulative cost of obesity and all its comorbidities is immense with estimates approaching $1 trillion per year by 2030, which would account for 16-18% of all US health-care costs (Wang, Beydoun, Liang, Caballero, & Kumanyia, 2008).

There has been much research into the risk factors that lead to childhood obesity. Probably the most well-known of these are behavioral risk factors such as poor nutrition and diet in addition to the lack of physical activity and exercise. Diet patterns that contribute to the problem include the intake of unhealthy foods, such as fast food, processed foods, and foods and beverages high in sugars and high fructose corn syrup (Brown, Halvorson, Cohen, Lazorick, & Skelton, 2015). These foods are also being consumed in larger portions by American children, both inside and outside of the home (Piernas & Popkin, 2011). The portions of marketplace foods, which have significantly increased since the 1970s, surpass federal dietary guidance and food label standards (Young & Nestle, 2002). According to data from the 2014-2016 Youth Risk Behavior Surveillance System (YRBSS), an estimated 25.4% of Connecticut children drink at least one 12 ounce soda or sugar sweetened beverage per day, and almost one-third eat fast food or pizza two or more times per week (Poulin & Peng, 2018). While portions of high energy density foods have been increasing, fruit and vegetable portions have decreased and are below recommended amounts (van der Bend et al., 2017). It is important to recognize the habits underlying and likely worsening the consumption of such foods. These include the fact that more people are eating meals away from home, eating in the absence of hunger, and the increase of snacking behaviors (Brown et al., 2015).

When addressing physical activity, there is an inverse relationship between the amount of exercise a child engages in and their obesity risk. A large number of children do not meet the recommendations set forth by the Centers for Disease Control and Prevention (CDC), which state that children and adolescents should be engaging in at least 60 minutes of exercise daily (CDC, 2016). This is particularly evident in Connecticut – only 22.3% of high school students reported engaging in physical activity that increased their heart rate or made them breath heavier for at least 60 minutes every day in 2017 (Poulin & Peng, 2018). A low level of physical activity is compounded with higher rates of physical inactivity, specifically an increase in sedentary behaviors such as use of electronic devices and time spent in front of computer monitors (Eisenmann, Bartee, Smith, Welk, & Fu, 2008). The 2017 YRBSS showed that 42.3% of high school students had three or more hours of daily screen time (Poulin & Peng 2018).

There are many other determinants of health contributing to the problem that are just as impactful but less amenable to change. These include biological, environmental, social, and economic factors. Specific examples include race and ethnicity, socioeconomic status, poverty, the built environment, access to food and food security, community engagement, and cultural values. Race and ethnicity in particular are significant risk factors, with minority populations such as Hispanics and Non-Hispanic blacks often having higher rates of obesity (Flegal, Carroll, Ogden, & Curtin, 2010). This is evident in primarily minority populations in Hartford. A survey of kindergarten and third-grade students found that Hispanic children were the most likely to be overweight or obese (a combined rate of 43.3%, including 25% obese and 18.3% overweight), followed by non-Hispanic blacks (a combined rate of 40.8%, with 22.5% obese and 18.3% overweight), as compared to non-Hispanic white children (a combined rate of 26.8%, with 12.4% obese and 14.4% overweight) (Department of Public Health, 2015).

These ethnic differences may be impacted by lack of access to adequate nutrition and engagement in physical activities that help control weight since a disproportionate amount of minorities live in poverty (Sobal & Stunkard, 1989). However, there are also cultural differences in the perception of weight and body image. White women prescribe to an ultra-thin body as a cultural ideal while black women report having heavier body image ideals and higher body satisfaction (Fitzgibbon, Blackman, & Avellone, 2000). It is interesting to note that black women are more likely to think of themselves as normal weight when overweight when compared to white women. One study showed that 29% of black women who were overweight by at least 20 pounds did not consider this to be a problem (Fitzgibbon et al., 2000). Even when dissatisfied with weight, there is broader definition of attractiveness within the black community, with 44% of these women still identifying as attractive (Kumanyika, Wilson, & Guilford-Davenport, 1993). While research of body perception in Hispanic women is more mixed, there is still evidence that there is a larger body ideal that is considered healthier and more attractive (Fitzgibbon et al., 2000). In line with these perceptions, white women experience body image discrepancy at lower BMIs than black and Hispanic women and before they are in the overweight category (Fitzgibbon et al., 2000).

As mentioned previously, poverty and socioeconomic status are risk factors that have an overarching impact (Sobal & Stunkard, 1989). They influence where individuals live, what they are exposed to, and what they have access to. In regards to the built environment surrounding an individual's residence, areas that are more walkable and with lower crime rates tend to have lower BMIs than areas that do not (Doyle, Kelly-Schwartz, Schlossberg, & Stockard, 2006). Lower walkability and higher crime in turn are associated with higher reports of weight-related chronic illness and poor ratings of health (Doyle et al., 2006). Access to green space, including

safe green space, is also an important consideration. The likelihood of being physically activity is three times as high in residential communities with high levels of greenery, which corresponds to 40% less chance of being overweight or obese (Ellaway, Macintyre, & Bonnefoy, 2005). Physical activity is also influenced by access to recreational facilities with lower socioeconomic status and high-minority groups having a lower number of facilities (Gordon-Larsen, Nelson, Page, & Popkin, 2006). Increasing number of facilities has been shown to be associated with decreased overweight status and increased likelihood of participating in moderate to vigorous activity at least five times per week (Gordon-Larsen et al., 2006). In regards to access to food, there is an association between presence of supermarkets and lower prevalence of obesity and overweight. The opposite is also true with the presence of convenience stores being associated with a higher prevalence of obesity and overweight (Morlad, Roux, & Wing, 2006).

As is evident, childhood obesity is a serious problem and poses substantial and potentially devastating risks to children as they progress through adolescence into adulthood. Fortunately, many interventions have been implemented to learn how best to address this problem. These interventions have been developed to address the many different factors involved and differ in the settings in which they are implemented, with broad categories including school-based, clinic-based, and community-based. Studies have shown success in changing lifestyle and health behaviors in school-based and clinic-based interventions (Kelishadi & Azizi-Soleiman, 2014). School systems are an important area in which primary obesity prevention and health promotion interventions can be targeted because they have the ability to impact a large number of youth and are a place where children spend a majority of their time. However, it is also very important to have successful treatment options, which is where clinic-based interventions may be more appropriate.

The Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity established guidelines for the treatment of childhood obesity in 2007 (Demeule-Hayes et al., 2016). These guidelines proposed a four-stage approach and were endorsed by 16 medical organizations, including the American Academy of Pediatrics and the US Preventive Services Task Force (Barlow, 2007). Initially, treatment for obesity for a patient should focus on Stage 1 and 2 interventions, including goal-setting, education, and monitoring, delivered at the primary care office (Demeule-Hayes et al., 2016). Stage 1 interventions, known as the Prevention-Plus Protocol, involve dietary and physical activity recommendations with monthly follow-up. Examples of the lifestyle changes that are encouraged include eating greater than five servings of fruits and vegetables per day, getting more than one hour of physical activity per day, and having less than two hours of screen time per day (Barlow, 2007). If improvement in BMI is not seen within 3-6 months, then Stage 2 is considered. In Stage 2, known as the Structured Weight Management, there are increased restrictions including structured meals and adherence to a balanced diet, supervised physical activity of at least 60 minutes daily, and limits to screen time of one hour or less daily (Barlow, 2007). Again, if improvements in BMI are not seen within 3-6 months, then progression to the next stage of treatment is recommended.

Stage 3 interventions utilize a multidisciplinary approach, which can be delivered through a primary care office coordinating the multidisciplinary care or through weight management programs at pediatric tertiary care centers. These weight management programs provide diet and physical activity goal setting, behavior modification, food monitoring, and contingency management through appointments with a medical doctor, registered dietitian, behavior counselor, and exercise specialists among others (Demeule-Hayes et al., 2016). Finally, Stage 4

interventions are pursued only if adequate weight loss is not achieved at Stage 3 and include the additional use of medications, very low calorie diets, and the possibility of bariatric surgery (Demeule-Hayes et al., 2016).

Many weight management programs have been established following the best practice guidelines of the Expert Committee. Surveys have also shown that a majority of physicians report being aware of these recommendations and adhering to them as well (Harkins, Lundgren, Spresser, & Hampl, 2012). However, there is not much consensus yet about which programs are best or what stage of management is most effective. One pilot study done at a large, semi-urban pediatric primary care clinic in Minneapolis with children ages 4-9 with BMIs greater than or equal to the 85th percentile showed that a Stage 1 prevention-plus intervention is feasible and beneficial for implementing lifestyle changes (Stovitz et al., 2014). The behavioral changes in the intervention group that were seen included less screen time and less consumption of sugar-sweetened beverages. A decrease in BMI z-scores over three months was also seen in both the control and intervention group but was greater overall in the intervention group, 55% and 70% respectively (Stovitz et al., 2014).

Success has also been seen with Stage 2 interventions, which incorporate more structured programming than Stage 1. FitKids360, a Stage 2 weight management program for children ages 5-16 with BMIs greater than the 85th percentile, serves as an evidence-based model for how to focus on behavior modification with a family-centered approach (Tucker et al., 2014). The program itself involved a 2-hour orientation and assessment period followed by six 2-hour weekly sessions that provided dietary and physical activity education in addition to behavior counseling. Outcomes for those individuals who completed the program showed reduced BMIs, improvements in dietary behaviors, an increase in moderate to vigorous physical activity by 14

minutes, and a decrease in daily screen time by 44 minutes (Tucker et al., 2014). Participants were also assessed using a Family Nutrition and Physical Activity (FNPA) survey addressing risk factors for obesity, with lower scores being representative of obesogenic family environment. There was an overall increase in FNPA scores by 9% and of further note, 69% of participants who had baseline "high risk" FNPA scores fell out of the "high risk" category by follow-up (Tucker et al., 2014).

Stage 3 multidisciplinary pediatric weight management programs have also had positive outcomes in addressing weight-status (Skelton, DeMattia, & Flores, 2008; Demeule-Hayes et al., 2016). The NEW Kids Program at the Children's Hospital of Wisconsin is staffed by a pediatrician, nurse practitioner, dietitian, psychologist, and physical therapist and provides treatment for children ages 2-18 who are categorized as either overweight or obese (BMI greater than or equal to the 85^{th} percentile) with one or more obesity-related comorbidities (Skelton et al., 2008). The comorbidities included insulin resistance, dyslipidemia, hypertension, fatty liver, sleep apnea, orthopedic problems, and pseudotumor cerebri. After the initial visit with the team, individualized treatment plans were created with a focus on cognitive behavioral modification through awareness of daily lifestyle habits and transformation of maladaptive thoughts and behaviors. The outcomes in this study were promising because they showed improvement in weight status and cardiovascular risk factors was just as effective for both white children and children of ethnic minorities (Skelton et al., 2008). This is particularly important because ethnicity is a significant risk factor for obesity with higher rates of obesity being seen in minority children (Kimm et al., 2002).

Another Stage 3 weight management program for overweight and obese youth ages 2-18 in a metropolitan Mid-Atlantic region has shown promising outcomes in populations considered

high-risk, such as ethnic minorities, Medicaid recipients, and parents who are overweight or obese themselves (Demeule-Hayes et al., 2016). These high-risk populations have historically had low treatment success. Statistically significant improvement was seen at the 12-month follow-up in both anthropometric measurements and laboratory values, in particular in the HbA1C and HOMA-IR, which are values denoting insulin sensitivity and resistance (Demeule-Hayes et al., 2016).

If sufficient improvements are not seen with intensive lifestyle modifications at Stage 3, then pharmacologic and surgical interventions are implemented in Stage 4 treatment. Guidelines support considering the use of these interventions for adolescents with severe obesity, which is defined as BMI greater than or equal to the 99th percentile (Kelly et al., 2013). The American Heart Association Scientific Statement has also defined it as BMI greater than 120% of the 95th percentile according to sex and age for children older than 2 years or an absolute BMI greater than 35 kg/m^2, whichever is lower, due to statistical concerns using BMI percentile at greater than the 99th percentile (Wickham & DeBoer, 2015). In regards to medication, orlistat, a lipase inhibitor, is the only Food and Drug Administration (FDA) weight loss medication currently approved for adolescents 12 years and older, and has been associated with mean BMI reductions of 0.7–0.85 kg/m^2 compared to placebo (Wickham & DeBoer, 2015). Recommendations for weight loss surgery in adolescents include BMI ≥35 kg/m^2 with at least one severe comorbidity such as Type 2 diabetes, moderate to severe obstructive sleep apnea, severe nonalcoholic fatty liver disease, or pseudotumor cerebri, or BMI ≥40 kg/m^2 with other weight-related comorbidities (Wickham & DeBoer, 2015). Surgical approaches include the Roux-en-Y gastric bypass (RYGB), adjustable gastric band (AGB), and vertical sleeve gastrectomy (VSG). Studies of these surgical interventions in conjunction with continued lifestyle modifications have shown

success with mean reduction in BMI at 12 months after surgery of 17.2 kg/m^2, 10.4 kg/m^2, and 14.52 kg/m^2 respectively, in addition to improvements in comorbidities (Black, White, Viner, & Simmons, 2013).

It is important to note, however, that a significant limitation of all these studies and a barrier to obesity treatment in general is attrition. Reported attrition rates range from 27% to 73% in clinical programs, with the majority of hospital-based clinics having attrition rates of greater than 50% (Skelton, Irby, & Geiger, 2014). Demeule-Hayes et al. (2016) saw an attrition rate as high as 81% over 12 months. Factors that have been associated with higher rates of attrition in previous studies include ethnicity and minority status, health insurance coverage (specifically Medicaid recipients), higher parent and child baseline BMI, higher self-reported depressive symptoms, lower self-concept, location and timing of program visits, and overall quality of care (Hampl, Paves, Laubscher, & Eneli, 2011). The need to better understand and address these risk factors for attrition is critical to not only individual patient success but to overall improved health outcomes for vulnerable populations that are disproportionally affected by obesity. Other studies have shown that older age, as children transition to adolescence and assert more independence, and poor school performance are also risk factors for attrition (Skelton, Goff, Ip, & Beech, 2011). Better outreach and resources addressing these risk factors are also vital for continuing quality improvement for weight management programs.

This study looks at the weight management program at the Pediatric Obesity Center for Treatment, Research, and Education at Connecticut Children's Medical Center (CCMC), which provides Stage 3 multidisciplinary care for overweight and obese children, ages 3 and older. The focus of this study is on the nonsurgical weight management program, including the Group and Individual Fit 5 program. Participants in the program are mainly referred by their pediatricians,

with a smaller percentage being referred by pediatric subspecialties at CCMC, including pediatric endocrinology and pediatric gastroenterology. The patient population is ethnically diverse and represents a diverse range of demographic characteristics. Referrals come from throughout Connecticut, although most are from the Greater Hartford area, including the City of Hartford and its more affluent suburbs. Hartford is one of the cities most impacted by obesity in Connecticut. Thus, there is great need to assess the effectiveness of ongoing efforts at childhood obesity treatment to guide future programming in Hartford and elsewhere throughout the state.

Participants and/or their guardians complete referral forms that include demographic information, birth history, medical history, family history, and social history in addition to lab work. When they come to the screening visit, families complete an intake packet that assesses the patient's health behaviors including eating, exercising, and screen time, as well as parental and child perceptions of the importance to make healthy changes and their confidence in making these changes. At the screening visit, patients are evaluated for their appropriateness for the weight management program by a medical provider certified in treating obesity by the American Board of Obesity Medicine as well as by a pediatric psychologist. Inclusion criteria for participants include a classification of obesity by a BMI $\geq$ 95th percentile for age and sex. Recommendations for improving diet and increasing exercise, in addition to group or individual programming for behavior modification, are made after the screening visit is completed.

Participants make appointments with a dietician and physical therapist after being screened and join either the Group or Individual Fit 5 behavior programming. In the Group Fit 5 program, patients meet with other participants on a weekly basis for a total of ten visits with follow-ups with the medical provider and psychologist at six months and 12 months of program participation. During these group visits, families receive nutrition education and counseling in

addition to behavior modification education. If a family decides on the Individual Fit 5 program, they alternate back and forth with visits between the dietician and psychologist on a monthly basis with six-month and 12-month follow-up with the medical provider and psychologist to assess progress. If a patient misses three visits in the Fit 5 program, they are discontinued from the program and asked to be re-referred at a better time for the family. The duration of the program is 12 months after which patients return to the care of their pediatrician for ongoing weight management.

Methods

Research Design

This study analyzed cross-sectional and longitudinal data obtained through a retrospective chart review of the medical records for a single cohort of patients screened and admitted to the Fit 5 program in 2018. These patients were those that consented to having their data studied. The study examined the experience of program participants to assess their program engagement, including if they scheduled and attended visits after the initial screening visit, and how long they continued to attend programming. This was used to investigate at what point attrition was most likely to occur, such as at the outset or further along in programming. The relationship between attrition and the independent risk factors was also studied. Institutional Review Board approval was attained from Connecticut Children's Medical Center to conduct a prospective database.

Variables

Attrition was the dependent variable in this study. It was studied as early attrition and drop-out after engagement at the 3-month mark of the program. Early attrition was defined as loss to follow-up for any appointment after the initial screening visit, either due to lack of scheduling an appointment or not showing up for it. Early attrition was coded as a categorical variable as either follow-up after screening or no follow-up after screening. Drop-out after engagement was coded as a categorical variable as either active participation at three months or dropped out at three months.

Variables that were studied as possible risk factors for attrition included demographic variables such as patient age, gender, race/ethnicity, single parent household status, size of household, and patient town of residence to determine socioeconomic status of the patient's community. Age, which is a continuous variable, was recoded into three categories; young child (ages 2-5), child (ages 6-11), and adolescent (ages 12-18). Patient's gender was categorized as male or female. Race and ethnicity was categorized as non-Hispanic White, non-Hispanic Black, Hispanic/Latino, Other, or Unknown. Single parent household status was categorized as either "yes" or "no," with status defined as only one parent being involved in the care of the patient. This was determined through review of the social history if only one parent was the primary guardian and there was no other parent or step-parent in the house. Therefore, if a step-parent or other parent also provided care for the patient, this was not categorized as a single parent household. Size of household was a continuous variable, which counted all members in the household including parents, siblings, grandparents, and other extended family. Town of residence was used to determine Connecticut District Reference Group (DRG), which was used as a surrogate to assess for socioeconomic status. Connecticut provides socioeconomic data for

its DRGs, with the most recently updated analysis from 2016. DRGs correspond to average median household incomes with socioeconomic status getting poorer as the letter of the DRG gets higher in the alphabet.

Other variables that were studied included family history of obesity, parental report of food insecurity, and perceived parental and child importance and confidence for making healthy changes. Family history of obesity was categorized as "yes" or "no." Food insecurity was based on a two-question screening tool that comes from the USDA 18-item Household Food Security Scale. This 2-item tool has 97% sensitivity and 83% specificity as compared to the full scale (O'Keefe 2015). The two questions on the screening tool are: 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. An answer of "yes" to either of these questions indicated that a family was dealing with food insecurity and was categorized as "yes" to food insecurity. Parental and child importance and confidence for making healthy changes was assessed through the use of a readiness ruler of 0-10 for both parameters. The questions of parents and patients for both these variables were: 1) On a scale of 0-10, how IMPORTANT is it to you to make healthy changes in your eating and exercise habits?; and 2) On a scale of 0-10, how CONFIDENT are you that you can make healthy changes in your eating and exercise habits? Answers to these interval questions were transformed into categorical variables with scores of 0-3 categorized as "not important," scores of 4-7 categorized as "somewhat important," and scores of 8-10 being categorized as "very important."

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) v 25. Means and frequency distributions were used to describe each of the variables. Cross tab and chi square analyses were done to assess for the relationships between each of the independent risk factor variables and attrition.

Results

During 2018, 104 patients of those screened and recommended for treatment in the nonsurgical Fit 5 program at Connecticut Children's Medical Center allowed for their data to be analyzed. Of these patients, the majority (55.8%) were female (Table 1). The average age of participants was 12.12 years with an age range of three years to 17 years. The majority (62.7%) of participants were adolescents ages 12-18 followed by children ages 6-11 (33.5%). With regard to race and ethnicity, the largest group of participants were Hispanic (34.6%), followed by non-Hispanic Whites (28.8%), and non-Hispanic Blacks (25%).

Two-thirds of participants were from Hartford County. The largest percentage went to school and lived in DRG I (36.5%), which represents mostly Hartford. The majority (71.2%) of participants had public insurance, specifically Husky coverage. Slightly less than half (48.1%) of participants came from single parent households, and the average household size was 4.18 persons. Three-fourths of patients had a family history of obesity.

Data on food insecurity was available for only half of the patients (n=53). Among those patients, only 11.3% reported having food insecurity. Parental and child perceptions of the importance and their confidence in making healthy changes is shown in Table 2. A large majority of parents and children saw the need for healthy changes being very important (94.7%

and 85.5%, respectively). However, both were less confident in their ability to successfully make healthy changes (63% and 60.2%, respectively).

Table 1: Characteristics of the Patient Population for the Fit 5 Program, 2018

Characteristics of Participants		Percent (%) (n=104)
Sex	Male	44.2
	Female	55.8
Age	Mean age	12.12 years
	Ages 2-5	3.8
	Ages 6-11	33.5
	Ages 12-18	62.7
Race/Ethnicity	White, non-Hispanic	28.8
	Black, non-Hispanic	25
	Hispanic/Latino	34.6
	Other	8.7
	Unknown	2.9
Insurance	Public	71.2
	Private	28.8
Single Parent Household	No	51.9
	Yes	48.1
County of Residence	Hartford	68.3
	Other	31.7
DRG*	B-H	63.5
	I	36.5
Family History of Obesity	No	25
	Yes	75

*DRG is District Reference Group

Table 2: Parent and Child Perception about Participation in Fit 5 Program, 2018

Perception of Participants		Percent (n)
Food Insecurity	No	88.7 (n=47)
	Yes	11.3 (n=6)
Parental Importance of Change	Not important	0 (n=0)
	Somewhat important	5.3 (n=5)
	Very important	94.7 (n=95)
Parental Confidence of Change	Not confident	1.1 (n=1)
	Somewhat confident	35.9 (n=33)
	Very confident	63 (n=58)
Child Importance of Change	Not important	0 (n=0)
	Somewhat important	14.5 (n=12)
	Very important	85.5 (n=71)
Child Confidence of Change	Not confident	2.4 (n=2)
	Somewhat confident	37.3 (n=31)
	Very confident	60.2 (n=50)

When looking at attrition (Table 3), approximately one-in-ten (11.5%) participants had no follow-up appointments after the initial screening visit. Of those that did have follow-up visits (88.5%), 35.9% had dropped out by three months into the 1-year program. Overall, when combining loss to follow-up after initial screening and drop-out thereafter, the attrition rate was 43.3% by three months.

Table 3: Attrition Status from Fit 5 Program, 2018

Attrition Status		Percent (n)
Early Attrition	No follow-up after screening	11.5% (n=12)
	Follow-up after screening	88.5% (n=92)
Drop-out after Engagement	Dropped by 3 months	35.9% (n=33)
	Active at 3 months	64.1% (n=59)

The analysis then focused on the predictors of the two attrition groups: early attrition and drop-out after engagement. When chi-square analysis was done to assess whether each independent variable was associated with early attrition – no follow-up appointments after screening versus follow-up after screening – none was found to be statistically significant at the 0.05 level (Table 4). Trend differences, however, were observed for ethnicity, insurance status, and single parent head of household. It is interesting to note that 22.2% of Hispanics were in the no follow-up group compared to 3.8% of non-Hispanic Blacks and 6.7% of non-Hispanic Whites. Similarly, 14.9% of those with public health insurance were in the no-follow up group compared to only 3.3% of those with private coverage. Lastly, more participants who did not belong to single parent households failed to return for follow-up (16.7%) compared to 6% of those from single parent households.

Analysis was also done for predictors of drop-out after engagement. Chi-square analysis again did not show any statistically significant differences in predicting patients that had dropped out by three months and those that were still active at three months. Results of these analyses are provided in Table 5.

Table 4: Relationship between Risk Factors and Early Attrition for the Fit 5 Program, 2018

		No follow-up after screening (n=12)	Follow-up after screening (n=92)	p-value
Sex	Male	8.7%	91.3%	0.419
	Female	13.8%	86.2%	
Age	Ages 2-11	12.8%	87.2%	0.751
	Ages 12-18	10.8%	89.2%	
Race/Ethnicity	White, non-Hispanic	6.7%	93.3%	0.066
	Black, non-Hispanic	3.8%	96.2%	
	Hispanic/Latino	22.2%	77.8%	
Insurance	Public	14.9%	85.1%	0.095
	Private	3.3%	96.7%	
Single Parent Household	No	16.7%	83.3%	0.089
	Yes	6%	94%	
County of Residence	Hartford	9.9%	90.1%	0.432
	Other	15.2%	94.8%	
DRG*	B-H	9.1%	90.9%	0.303
	I	15.8%	84.2%	
Family History of Obesity	No	11.5%	88.5%	1.0
	Yes	11.5%	88.5%	
Food Insecurity	No	10.6%	89.4%	0.661
	Yes	16.7%	83.3%	
Parental Importance of Change	Not/somewhat important	20%	80%	0.478
	Very important	10%	90%	
Parental Confidence of Change	Not/somewhat confident	14.7%	85.3%	0.365
	Very confident	8.6%	91.4%	
Child Importance of Change	Not/somewhat important	16.7%	83.3%	0.483
	Very important	9.9%	90.1%	
Child Confidence of Change	Not/somewhat confident	9.1%	90.9%	0.677
	Very confident	12%	88%	

*DRG is District Reference Group

Table 5: Relationship between Risk Factors and Drop-out after Engagement for the Fit 5 Program, 2018

		Dropped by 3 months (n=33)	Active at 3 months (n=59)	p-value
Sex	Male	42.9%	57.1%	0.200
	Female	30%	70%	
Age	Ages 2-11	41.2%	58.8%	0.416
	Ages 12-18	32.8%	67.2%	
Race/Ethnicity	White, non-Hispanic	21.4%	78.2%	0.163
	Black, non-Hispanic	36%	64%	
	Hispanic/Latino	46.4%	53.6%	
Insurance	Public	38.1%	61.9%	0.512
	Private	31%	69%	
Single Parent Household	No	33.3%	66.7%	0.620
	Yes	38.3%	61.7%	
County of Residence	Hartford	35.9%	64.1%	0.984
	Other	35.7%	64.3%	
DRG*	B-H	35%	65%	0.812
	I	37.5%	62.5%	
Family History of Obesity	No	26.1%	73.9%	0.259
	Yes	39.1%	60.9%	
Food Insecurity	No	35.7%	64.3%	0.850
	Yes	40%	60%	
Parental Importance of Change	Not/somewhat important	40%	60%	1.0
	Very important	40%	60%	
Parental Confidence of Change	Not/somewhat confident	44.1%	55.9%	0.559
	Very confident	37.9%	62.1%	
Child Importance of Change	Not/somewhat important	41.7%	58.3%	0.811
	Very important	38%	62%	
Child Confidence of Change	Not/somewhat confident	39.4%	60.6%	0.898
	Very confident	38%	62%	

*DRG is District Reference Group

Discussion

This analysis provides important information about the use of the nonsurgical program in a subset of patients at Connecticut Children's Medical Center, which serves as a resource to community pediatricians for Stage 3 childhood obesity treatment when prior interventions have been unsuccessful. The average age of participants was 12.12 years, which is promising because studies have shown that there is greater success in lessening the impact of obesity on children if interventions begin at younger ages (Lobstein, Baur, & Uauy, 2004). This is also an age of great change and transition as children enter puberty and may be a beneficial stage in which to implement healthful life-long lifestyle changes.

With regards to race and ethnicity, approximately one out of three participants were Hispanic, and one in four were non-Hispanic black. Minority populations tend to be at greater risk for childhood obesity and this is true in Connecticut as well according to data from the Department of Public Health (2015). Most patients were residents of Hartford County and more than a third were from DRG I, which is the DRG of the City of Hartford. Patient proximity to clinic and distance needed to travel likely plays a large role in this.

This study was designed to assess attrition in a Stage 3 program and identify risk factors that may be predictive of attrition. Analysis showed that 11.5% of participants had no follow-up appointments after the initial screening visit. Of the 88.5% that did have follow-up, 35.9% had dropped out by three months into the program, which corresponds to an overall attrition rate of 43.3% when initial and three-month drop-out are combined. This attrition rate is consistent with the attrition rates of 27% to 73% that have been seen in other clinical programs, and is actually on the lower side of this range (Skelton et al., 2014). A caveat is that studies define their attrition

in different ways and in this study, it is only accounting for three months of follow-up. Therefore, when having a longer follow-up period, it is likely that attrition may be higher.

When comparing initial attrition and continued program engagement in participants with follow-up beyond screening, more participants started programming and were lost to follow-up by three months. This is suggestive that a majority of patients are motivated to participate in the program initially but may be experiencing barriers or reasons to stop participating as they progress through the program. The analyses, however, did not identify any barriers to program participation or predictors for dropping out of the program. One possibility may be that some participants and their families felt that they had received what they needed by three months and had enough education and resources to continue making a difference on their own.

Other studies have shown ethnicity, specifically minority status, and health insurance coverage, specifically Medicaid coverage, to be associated with higher rates of attrition (Hampl et al., 2011). Even though race and ethnicity were not statistically significant, it was noteworthy that 22.2% of Hispanics were more likely to be in the no follow-up group as compared to 3.8% of non-Hispanic blacks and 6.7% of non-Hispanic whites. This may be indicative of barriers that are disproportionately affecting Hispanic participants, such as communication and language barriers. These need to be further explored to determine if the program is adequately culturally sensitive and to incorporate any changes that may be needed. However, other aspects that may negatively affect program adherence and engagement and are important to address include body image ideals and the role of food in Hispanic culture. Hispanic women are more likely to have larger body shape ideals for both themselves and their children as overweight tends to be associated with good health and less vulnerability to illness (Rich et al., 2005). It is also necessary to understand the significance of "American" food in the acculturation process for

immigrant families. Latino immigrants transition from their usually healthful traditional dietary behaviors to more processed foods not just because of lack of access to healthy fruits and vegetables, but also due to novel access to foods previously considered unaffordable (Lindberg, Stevens, & Halperin, 2013). These foods often are high-density foods such as meats and desserts.

Although again not statistically significant, trend differences were observed with health insurance coverage and single parent head of household. 14.9% of those with public health insurance were more likely to be in the no-follow up group compared to only 3.3% with private coverage. Additionally, 16.7% of participants who did not belong to single parent households were more likely to not follow-up compared to 6% from single parent households.

The effect of food insecurity has not been specifically studied in the context of attrition from weight management programs before. Food insecurity is defined as limited access to adequately nutritious foods and disruption of food intake or eating patterns due to lack of financial resources (Coleman-Jensen, Gregory, & Singh, 2014). It greatly impacts a family's ability to make healthy food choices and is definitely an issue in Hartford and elsewhere in Connecticut. The 2016 Map the Meal Gap study by Feeding America, the largest domestic hunger-relief organization in the United States, and the Connecticut Food Bank, found that 12.2% of Connecticut residents are food insecure, approximately 437,530 people (Connecticut Food Bank, 2016). Within Hartford County itself, the child food insecurity rate is 15.7% (Connecticut Food Bank, 2016). The question of food insecurity has recently been asked in the Fit 5 program through utilization of a new 2-item screening tool, which was incorporated into the screening questionnaire as of 2018. There is interest into this measure due to research into food insecurity in Hartford and the designation of Hartford as a food desert (Zhang, 2017). Food

deserts are defined as socio-economically disadvantaged neighborhoods and communities that have limited access to healthy and affordable foods (Apparicio, Cloutier, & Shearmur, 2007). Food insecurity may promote the consumption of high-energy dense and nutrient poor foods due to their accessibility and affordability for low-income families (Papas, Trabulsi, Dahl, & Dominick, 2016).

The analysis of food insecurity in this study was limited by the number of respondents who provided this information (53 out of 104 participants). Only 11.3% met criteria for food insecurity. There were no ethnic or racial differences in patients who reported food insecurity. Although not statistically significant, 16.7% who identified as food insecure were likely to be in the no follow-up group compared to 10.6% who did not have food insecurity.

Parental and child perception of the importance and their confidence to make healthy changes were used to assess how motivation and readiness for change may impact attrition. Previous research has suggested that confidence, or self-efficacy, is associated with adherence and success in adult weight loss interventions (Walpole, Dettmer, Morrongiello, McCrindle, & Hamilton, 2011). This association is less clear in children but some studies have shown that confidence is positively related to higher youth motivation to eat healthy foods (Roach et al., 2003) and participate in physical activity (Boudreaux et al., 2003). While the majority of parents and children realized the need for healthy change and felt confident in their ability to enact change, this was not a protective factor with regard to attrition.

There were several limitations to this study. First, the size of the study group was small. Of the 104 participants who were screened and consented to having their data analyzed in 2018, not all participants provided answers for all the variables that were studied. In particular, food insecurity data were available for only 53 patients. When specifically looking at the no follow-

up group, only six out of 12 participants in this group provided this answer. These numbers are too small to assess the overall impact of food insecurity on early attrition. The small sample size also impacted the analyses of other risk factors. Observed trend differences in ethnicity, health insurance coverage, and single parent head of household may prove to be statistically significant at a larger sample size. Another limitation is the short follow-up for this study. There was only a 3-month follow-up data available for patients screened in 2018. A longer follow-up period may give more answers about predictive factors for attrition.

Future analysis can assess these variables in the context of greater follow-up, specifically 12-months, which is the expected duration of the program. To better evaluate attrition in the Fit 5 program, analysis can be done for more calendar years to see how attrition rates are changing. 2018 was picked for this study primarily due to the incorporation of the food insecurity screening tool. There was insufficient time for chart review of participants screened during other years. Another area that should be explored in the future is qualitative research directly asking patients and their families about what barriers they experienced to completing the program and why they stopped participating.

Conclusion

As is apparent in communities across the United States and across the world, childhood obesity continues to be a major health problem. This public health crisis is particularly devastating due to the negative impact it has on children throughout their lifetime. It has been reported that almost 70% of obese adolescents go on to become obese adults, which in turn leads to a lifetime of chronic obesity-related conditions in addition to poor health in childhood (Verotti, Penta, Zenzeri, Agostinelli, & De Feo, 2014). Due to the nature of the problem, there needs to be increased progress in both prevention and treatment of obesity.

This current study has many important implications for the childhood obesity problem and future public health practice. While weight management programs are being established according to best practice guidelines, these programs are still not having maximal impact due to high attrition rates. It is essential to determine what risk factors are leading to high rates of attrition and program failure as well as ways to engage patients in the programs. With knowledge of these risk factors and barriers, it will be possible to develop and increase specific outreach strategies. Unfortunately, none of the risk factors in this study were found to predict attrition. Future research should focus on qualitative data, including focus groups and semi-structured interviews to directly hear what barriers families are experiencing. Other variables that warrant further study include more information about the built environment such as transportation to clinic, access to healthy foods, and access to safe green spaces to understand why the City of Hartford is so disproportionately affected by obesity.

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