

# Factors Associated with a Patient Centered Medical Home among Obese and Overweight Children

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## Abstract

**Objective:** This study aims to determine the frequency of overweight and obese children that have a Patient Centered Medical Home (PCMH), the factors associated, and the effect of having one on several common child outcomes.

**Methods:** 43,501 children from the 2011-2012 National Survey of Children's Health were analysed for this study. Descriptive, bivariate, and multivariate analyses were conducted.

**Results:** Parents report that 54% of overweight and obese children have a patient centered medical home. Results from the multivariate models suggest that just being overweight and obese was not associated with having a medical home. However, when comorbidities were accounted for overweight and obese children were less likely to have a medical home and had decreased outcomes as compared to their underweight/healthy weight peers. Obese and overweight children with comorbidities were more likely to have a personal doctor but less likely to have effective care coordination.

**Conclusions:** The PCMH is a model that could be used to improve health and health outcomes for the most vulnerable children. However, obesity should be taken as a chronic condition just as other conditions and addressed on a routine bases. The PCMH model offers a vehicle to develop and implement population-based processes to identify, assess, and manage care for these children.

**Keywords:** Obese; Overweight; Medical home; Child health outcomes, Comorbidities, Survey, Patient centred

## Introduction

Obesity is a public health concern for America's children and adolescents. Approximately 32% of children aged 2 to 19 years are overweight or obese with roughly 15% overweight and 17% obese [1]. Overweight is defined as having a body mass index (BMI) percentile between 85 and 95 and obese 95 percentile or greater. The body mass index (BMI) is a straightforward tool for monitoring childhood/adults obesity, which is influenced by both the genetic and non-genetic factors [2,3]. Obesity rates among children have increased since the late 1970s, with the rates tripling in adolescents (5.0% to 18.1%) and children (6.5% to 19.6%) since 1980 [4]. Body mass index (BMI) is a straightforward tool for monitoring childhood/adults obesity, which is influenced by both the genetic and non-genetic factors. Children that are overweight or obese have a higher risk of developing high blood pressure, high cholesterol, type 2 diabetes, breathing problems, joint issues, and psychological problems [5].

Primary care clinicians are on the front lines in the fight against obesity as they are typically the first to diagnosis and treat children. Because of this important role, guidelines have been developed to improve the prevention, diagnosis, and treatment of children who are overweight and obese. Bright Futures is a national health promotion and disease prevention initiative [6]. The Bright Future guidelines for childhood obesity are four pronged and include: prevention, screening, assessment, and treatment [7,8]. Although these guidelines are comprehensive, they are individually-focused. Children might also benefit from both practice level and population approaches to reduce obesity.

The patient centered medical home (PCMH) may be a model that could help in the fight against obesity. The PCMH focuses on care that is continuous, family-centered, coordinated, accessible, comprehensive, compassionate, and culturally effective [9]. Many healthcare organizations and government agencies advocated for the

PCMH model based on some early evidence that it improves outcomes. Although there have been PCMH studies for children with chronic conditions such as ADHD, asthma, autism, diabetes, cerebral palsy, and epilepsy, childhood obesity has not been explored [9-11].

Given this gap in knowledge, our study has two aims. Using parental responses from the 2011-2012 National Survey of Children's Health (NSCH) we 1) compare the factors associated with having a PCMH, and meeting the five sub-components of a PCMH, for children who are overweight or obese and 2) investigate the impact that having a PCMH on 5 health outcomes which include missed school days, number of preventative health care visits, unmet health care needs, number of preventative dental care visits, and receipt of needed mental health treatment. We hypothesize that children who are overweight or obese will be less likely to have a PCMH, not meet the sub-components of a PCMH, and have worse health outcomes.

## Methods

Survey data from the 2011-2012 National Survey of Children's Health were used in this study [12]. The NSCH is a random-digit dial survey that collects data from parents/caregivers of children ages 0-17. Overall, 95,677 respondents completed the survey representing approximately 1,800 households from each state and the District of Columbia. Our sample included 43,501 children between the ages of

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10 and 17 that did not have a missing value for BMI category or the outcomes.

A dichotomous PCMH indicator was generated by the survey developers based on the five medical home sub-components. The sub-components are: having a personal doctor; having a usual source of care, receiving family-centered care, having effective care coordination, and no problem getting referrals. Each of these sub-components is also dichotomous.

Survey items asked about the child's height (in either feet or inches) and weight (in either pounds or kilograms). The survey developers then converted that information into BMI classifications of underweight, healthy weight, overweight, and obese based on the 2000 Centres for Disease Control and Prevention growth charts [13]. We collapsed underweight and healthy weight together and overweight and obese together.

Logistic multivariate regressions were conducted to determine the association of several predictor variables with having a PCMH or meeting PCMH sub-components. Independent variables included weight category; child's gender, age, and race/ethnicity; insurance status; single or two-parent household; number of times moved; federal poverty status; and, mother's mental health. Using the same framework from other NSCSHCN studies, children were also stratified by comorbidity types: physical or mental health [14]. Children received a 1 in the physical condition dummy variable if they had any of the physical conditions that were asked in the survey including asthma; brain injury or concussion; bone, muscle or joint problems; hearing problems; vision problems; epilepsy; diabetes, Tourette syndrome; cerebral palsy and 0 otherwise. Children received a 1 in the mental health condition dummy variable if they had any of the mental health conditions that were asked in the survey including ADD or ADHD; depression; anxiety problems; and behavioural or conduct disorder; and 0 otherwise. Interaction variables were created which interact the physical and mental health dummy variables with the weight variable. Variables were selected based on previous studies in addition to the significance of the variables demonstrated in bivariate testing.

Multivariate analyses were then used to measure the effect of having a medical home and the weight categories on the five child outcomes. For two of the outcomes (unmet health care need and receipt of mental health treatment), dichotomous dependent variables were created and set equal to 1 if the outcome was met, and 0 otherwise.

Negative binomial models were used when the dependent variables were number of days missed from school and number of preventive care visits. Negative binomial regressions were used because the dependent variables exhibited over-dispersion. SAS 9.3 was used to conduct the analyses [15].

## Results

Table 1 summarizes the sample characteristics of the children. Most children were underweight or healthy weight (70.9%), White (69.7%), and male (52.2%). Most were from families with income >400% of the FPL (39.0%), two-parent homes (82.3%), and whose mother had excellent or good mental health. Mean age of the children in the sample was 13.66 years (Standard Deviation (SD) =2.32) and the average number of times moved was 2.11 (SD =2.28).

As seen in Table 2 children who were underweight/healthy weight had a higher percentage of having a PCMH (60.7%). Similar trends were seen across the five sub-components of PCMH.

Results from the multivariate logistic regressions are presented

in Table 3. Children who were overweight and obese and had mental and physical health comorbidities were 52% less likely than children of underweight/healthy weight to have a PCMH (Odds Ratio (OR)=0.48). Results for the sub-components indicated that obese and overweight children with mental and physical plus mental health comorbidities were significantly more likely to have a personal doctor (OR=1.68 and 2.22, respectively). Children who were overweight and obese with no comorbidities were more likely to have effective care coordination (OR=1.30) and the reverse was true when comorbidities were added.

Results from the logistic regression show that having a PCMH was associated with being less likely to have an unmet health care need and to have received needed mental health care in the past 12 months (OR=0.32 and 0.53, respectively) (Table 4).

Results from the negative binomial regressions yielded important findings as well. While having a PCMH was associated with 14% fewer school days missed, it was also associated with fewer preventive care visits and preventive dental visits (both were 11%). When accounting for weight and comorbidities, it was clear that adding on more comorbidities affected the results. Being obese and overweight as well as having both comorbidity types was associated with better outcomes with the exception of unmet health care needs. These same children were 2.76 times as likely to have an unmet health care need.

All the models were also performed using overweight and obesity without the interactions with mental and physical conditions. In these models there was no association between being overweight or obese and any of the outcome variables.

Variable	%	n
<i>Race/ethnicity</i>		
Hispanic	10.8%	4,633
White non-Hispanic	69.7%	29,785
Black non-Hispanic	9.6%	4,096
Other	9.9%	4,215
<i>Gender of Child</i>		
Male	52.2%	22,724
Female	47.8%	20,777
<i>Household Type</i>		
Single Parent	17.7%	7,033
Two Parent	82.3%	32,670
<i>Poverty status</i>		
0-99%	12.1%	4,802
100-199%	16.9%	6,691
200-399%	32.0%	12,671
≥400%	39.0%	15,449
<i>Mother's Mental Health</i>		
Excellent/Good	93.4%	37,212
Fair/Poor	6.6%	2,625
<i>Insurance coverage</i>		
Insured	95.5%	41,467
Uninsured	4.5%	1,962
<i>Weight Category</i>		
Underweight/Healthy weight	70.9%	30,839
Overweight/Obese	29.1%	12,662
	<b>Mean (Standard Deviation)</b>	
<i>Age of Child</i>	13.66 (2.32)	
<i>Number of Times Moved</i>	2.11 (2.28)	

Table 1: Sample characteristics (n=43501).

Category	% Has a Medical Home	Meets medical home sub-component				
		% Has a Personal Doctor	% Has a Usual Source of Care	% Has Family-Centered Care*	% Has No Problems Getting Referrals	% Has Effective Care Coordination*
Underweight/Healthy weight	60.7	92.4	94.5	73.4	85.4	69.8
Overweight/Obese	53.5	90.6	92.5	67.1	84.3	65.6

Table 2: Percent of children who have the medical home components by weight category.

Variable	Has a Medical Home		Medical Home Sub Components									
			Has a Personal Doctor		Has a Usual Source of Care		Has Family-Centered Care		Has No Problems Getting Referrals		Has Effective Care Coordination	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
<i>Weight and Condition Category</i>												
Overweight/Obese, No Comorbidities	1.00	0.88-1.14	0.82	0.66-1.02	1.02	0.79-1.30	0.90	0.78-1.04	1.05	0.70-1.58	1.30*	1.05-1.60
Overweight/Obese, Mental condition	0.73	0.53-0.99	0.96	0.51-1.81	1.00	0.56-1.78	0.85	0.62-1.17	0.95	0.54-1.66	0.67*	0.49-0.91
Overweight/Obese, Physical condition	0.95	0.75-1.20	1.68*	1.07-2.63	0.80	0.48-1.34	1.30	0.99-1.71	0.96	0.58-1.58	0.63**	0.47-0.86
Overweight/Obese, both Physical and Mental condition	0.48***	0.33-0.69	2.22*	1.13-4.37	0.83	0.45-1.52	1.09	0.75-1.58	1.47	0.85-2.55	0.42***	0.29-0.61
<i>Race/Ethnicity</i>												
Black, non-Hispanic	0.59***	0.51-0.69	0.58***	0.45-0.76	0.47***	0.36-0.61	0.49***	0.42-0.58	0.82	0.56-1.20	0.89	0.70-1.12
Hispanic	0.42***	0.36-0.50	0.58***	0.44-0.76	0.38***	0.29-0.48	0.40***	0.34-0.47	2.07***	1.39-3.08	0.59***	0.47-0.74
Other	0.53**	0.44-0.63	0.73	0.52-1.02	0.54**	0.38-0.76	0.50***	0.41-0.61	1.36	0.77-2.39	0.74*	0.59-0.94
<i>Gender of Child</i>												
Female	1.05	0.95-1.16	1.22*	1.00-1.48	0.88	0.72-1.08	1.02	0.91-1.14	0.93	0.69-1.25	1.05	0.91-1.22
<i>Household Type</i>												
Two parent	0.99	0.87-1.12	1.04	0.81-1.32	1.09	0.84-1.40	0.88	0.77-1.02	0.78	0.58-1.06	1.15	0.96-1.39
<i>Poverty Status</i>												
0-99%	0.60***	0.50-0.70	0.60**	0.44-0.81	0.41***	0.30-0.56	0.58***	0.49-0.70	1.28	0.86-1.90	1.24	0.96-1.59
100-199%	0.78**	0.67-0.91	0.68**	0.52-0.90	0.65**	0.49-0.86	0.71***	0.60-0.84	0.91	0.60-1.36	1.02	0.82-1.27
≥400%	1.31***	1.16-1.47	1.55**	1.17-2.04	1.71***	1.31-2.25	1.39***	1.22-1.60	0.68	0.45-1.03	1.22*	1.03-1.45
<i>Mother's Mental Health</i>												
Excellent/Good	1.85***	1.52-2.23	1.26	0.95-1.68	1.16	0.86-1.56	1.72***	1.42-2.07	0.96	0.59-1.56	2.18***	1.69-2.81
<i>Insurance coverage</i>												
Insured	2.21***	1.73-2.83	3.68***	2.77-4.89	3.87***	2.85-5.26	2.86***	2.24-3.64	0.46*	0.24-0.89	1.97**	1.29-3.08
Age of Child	0.98	0.96-1.00	0.96	0.92-1.01	0.94*	0.90-0.99	0.99	0.97-1.02	0.99	0.93-1.05	0.99	0.96-1.02
Number of time moved	0.94***	0.92-0.96	0.91***	0.88-0.95	0.95**	0.92-0.98	0.96**	0.93-0.98	1.07*	1.01-1.12	0.94***	0.91-0.97
Referent groups: Underweight/Healthy weight, White non-Hispanic, Male, Single Parent, 200-399% federal poverty level, air/poor mother mental health, and uninsured.												
*p<0.05, **p<0.01, ***p<0.001												

Table 3: Odds ratios of having a medical home and medical home components.

## Discussion

While the PCMH model may help improve health, it is increasingly important to understand how it serves children with varying health conditions. Results of this study contribute to the literature in several ways.

About 30% of the children in our study were overweight or obese. Of those children, 53.4% have a PCMH as compared with the national average of 49.8% of children with a special health care having a PCMH

[16]. This is encouraging; however, all children should have a PCMH. Given the current trend of more states, payers, and agencies that are facilitating, endorsing, and incentivizing the PCMH [17,18] these numbers should rise in time.

Results from our logistic regressions suggest that overweight and obese children with physical and mental comorbidities were the least likely to have a PCMH. These children were 52% less likely to have a PCMH versus their underweight and healthy peers. The fact that being overweight or obese was not associated with having a PCMH,

Variable	Has an Unmet Health Care Need		Received Needed Mental Health Care		Number of School Days Missed		Number of Preventive Care Visits		Number of Preventive Dental Care Visits	
	Odds Ratio <sup>1</sup>	95%CI	Odds Ratio <sup>1</sup>	95% CI	Coefficient <sup>2</sup>	95% CI	Coefficient <sup>2</sup>	95% CI	Coefficient <sup>2</sup>	95% CI
<i>Has a Medical Home</i>										
Yes	0.32***	0.25-0.40	0.53***	0.45-0.62	-0.14***	-0.16(-)-0.13	-0.11***	-0.13(-)-0.09	-0.11**	-0.13(-)-0.09
<i>Weight and Condition Category</i>										
Overweight/Obese, No Comorbidities	0.83	0.63-1.10	0.37***	0.29-0.49	-0.06***	-0.09(-)-0.04	0.03**	-0.05(-)-0.01	-0.11***	-0.13(-)-0.09
Overweight/Obese, Mental condition	1.58*	1.04-2.41	7.94***	5.81-10.85	0.35***	0.30-0.40	0.28***	0.23-0.32	0.19***	0.14-0.24
Overweight/Obese, Physical condition	2.30***	1.48-3.57	0.47***	0.32-0.69	0.49***	0.44-0.53	0.48***	0.40-0.55	0.26***	0.22-0.30
Overweight/Obese, both Physical and Mental condition	2.76***	1.68-4.53	7.94***	5.42-11.64	0.84***	0.78-0.91	0.59***	0.49-0.68	0.49***	0.44-0.54
<i>Race/ethnicity</i>										
Black non-Hispanic	1.02	0.78-1.34	0.44***	0.34-0.58	-0.58***	-0.62(-)-0.56	0.11***	0.08-0.14	0.11***	0.08-0.15
Hispanic	0.86	0.64-1.16	0.68**	0.51-0.90	-0.27***	-0.30(-)-0.24	0.06***	0.03-0.09	0.08***	0.05-0.11
Other	0.97	0.72-1.30	0.73*	0.57-0.93	-0.15***	-0.18(-)-0.12	0.06***	0.03-0.09	0.06***	0.03-0.09
<i>Gender of Child</i>										
Female	0.95	0.78-1.16	0.81**	0.6-0.95	0.07***	0.06-0.09	0.01	0.00-0.03	0.02*	0.00-0.04
<i>Household Type</i>										
Two Parent	0.78*	0.63-0.98	0.48***	0.40-0.59	-0.18***	-0.21(-)-0.15	-0.01	-0.04-0.01	0.00	-0.03-0.02
<i>Poverty status</i>										
0-99%	1.16	0.85-1.59	0.96	0.72-1.28	0.15***	0.12-0.19	0.25***	0.22-0.28	0.25***	0.22-0.29
100-199%	1.33*	1.02-1.74	0.75*	0.58-0.97	0.06***	0.04-0.09	0.08***	0.05-0.10	0.08***	0.05-0.11
≥400%	0.49***	0.37-0.65	1.07	0.89-1.30	-0.10***	-0.12(-)-0.08	-0.03**	-0.5(-)-0.01	-0.03**	-0.05(-)-0.01
<i>Mother's Mental Health</i>										
Excellent/Good	0.57***	0.43-0.75	0.44***	0.33-0.57	-0.28***	-0.32(-)-0.25	-0.13***	-0.17(-)-0.10	-0.14***	-0.17(-)-0.11
<i>Insurance coverage</i>										
Insured	0.25***	0.19-0.34	1.66	0.86-3.20	0.21***	0.16-0.25	0.21***	0.16-0.27	0.20***	0.15-0.26
<i>Age of Child</i>	1.07**	1.03-1.13	1.00	0.97-1.04	0.03***	0.03-0.03	0.00	0.00-0.01	0.00	0.00-0.01
<i>Number of Times Moved</i>	1.07***	1.04-1.11	1.06**	1.02-1.10	0.04***	0.03-0.04	0.01***	0.01-0.02	0.01***	0.01-0.01
<i>Pseudo R –squared<sup>2</sup></i>	0.14		0.15		0.03		0.02		0.00	

<sup>1</sup>Logistic model type; <sup>2</sup> Negative Binomial model type. \*p<0.05, \*\*p<0.01, \*\*\*p<0.001. Referent groups: Underweight/Healthy weight, does not have a medical home, White non-Hispanic, Male, Single Parent, 200-399% federal poverty level, fair/poor, mother mental health, uninsured.

<sup>2</sup>Pseudo R squared = 1 – loglikelihood (full model)/ loglikelihood (intercept). Unlike ordinary linear regression, the model cannot be judged based on Pseudo R-squared.

**Table 4:** Logistic and negative binomial regressions for five child health outcomes.

but became significant once comorbidities were added is interesting. Perhaps physical and mental conditions are more readily managed in the PCMH. Given the myriad of factors associated with obesity this makes it difficult to decrease or maintain. Providers might also be hesitant to discuss this with parents as it may be a sensitive topic.

When investigating the sub-components of the PCMH we found that overweight and obese children with comorbid conditions as compared to their healthy weight peers were more likely to have a personal doctor but less likely to have effective care coordination. Having a personal doctor is a critical element in the PCMH. A personal doctor assumes responsibility for a child and builds a partnership with the child and family. Overweight and obese children with comorbidities were associated with lesser frequency of having effective coordinated care. As the intensity and amount of coordinated increases, the task becomes challenging. Coordination specific for children who are overweight or obese might be with nutritionists or community resources. However, once comorbidities are present the care coordination becomes more complex. Barriers to care coordination include lack of access to specialists, difficulty obtaining prior authorizations, and lack of

resources in the primary care setting to pay for coordination [19,20]. As federal and state primary care reform occurs in the US, overcoming the barriers to effectively coordinating care should be monitored and studied [21].

Finally, our results suggest that the number of missed more school days was greater for overweight and obese children with comorbidities versus their underweight and healthy weight peers. These findings are in alignment with other studies of children with special health care needs [10,14]. Studies have found that obese children are more likely to have ADHD, dental caries, asthma, and metabolic risk factors (e.g. hypertension, hyperglycemia, low HDL cholesterol) [22-25]. Along with being sick, adding on these types of comorbid conditions increases the utilization of health care services which could be contributing to missed school days. Our findings that overweight and obese children with comorbidities have more preventive health and dental visits versus their underweight and healthy weight peers is somewhat encouraging. On the one hand, it is clear that more preventive visits are helpful as this provides more opportunities for the primary care provider to counsel the child and family about healthy behaviours. However,

if those additional preventive visits do not address obesity they have no marginal benefit for the obesity. Evidence suggests that it may be the later. Studies have found that about one-half or fewer paediatric primary care providers offer nutritional counselling to obese children [26] and that physicians would like proven strategies that are known to motivate patients to decrease weight [27].

Several study limitations merit attention. BMI reported by parents and not validated. If parents have a tendency to underreport their children's weight, as is typically the case [28], our findings could be negatively biased. BMI is the index used in this study to assign children to weight categories. While this continues to be a standard for weight assessment it could be argued that height and weight percentiles are a better way to assess weight [29]. The survey could have certainly asked about many other physical and mental conditions that would be considered comorbidities. The PCMH construct is parent-reported. Parents may not always be aware of changes that have occurred at the practice level.

## Conclusion

Our study is the first to comment on the frequency of overweight and obese children who have a PCMH and the factors associated with having a PCMH. Practices who are on the journey to becoming a PCMH, and those who have already become one, can use these findings in several ways. Practices can use patient registries to assist in population-based management [30] and should consider an overweight or obesity registry. Although our data did not include information on the presence of a registry, registries have been used in other chronic conditions to implement population based management. Patients placed on the registry would then be managed in proactive ways instead of reactive. Practices can also use the registries to ensure that tools are being used. The National Initiative for Children's Healthcare Quality offers toolkits on how to establish an obesity registry [31]. Registries could be cross referenced to identify children with multiple comorbidities as they are quite vulnerable. Finally, PCMH practices could establish linkages to community organizations that provide assistance on healthy behaviours.

Establishing a PCMH is important for children with multiple chronic conditions. Providers can use the PCMH model to help meet the needs of these patients in a systematic and more efficient manner. The PCMH can be one weapon in the arsenal in the fight against childhood obesity.

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