

Is childhood overweight a special health care need?

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## **ABSTRACT**

Asheley Cockrell Skinner, BS: Is childhood overweight a special health care need?

(Under the direction of Morris Weinberger, PhD)

Background: Children with special health care needs (CSHCN) are those who: (1) have or are at increased risk for a chronic medical condition and (2) require more health care than children generally. Because the CSHCN designation is intended to improve access to care, including securing a medical home and public programs that address the health needs of CSHCN, an important policy issue is whether childhood overweight meets both criteria that define CSHCN.

Methods: This is a cross-sectional analysis of two nationally representative data sources, the 2001-2002 National Health and Nutrition Examination Survey (NHANES) and the 2002 Medical Expenditure Panel Survey (MEPS). Both surveys are used to examine the relationship between overweight and health status.

NHANES is used to examine the relationship between overweight and three chronic conditions: dyslipidemia, dysglycemia, and hypertension. MEPS is used to examine the relationship between overweight, health care use and expenditures, and a medical home.

Results: Overweight children, compared to healthy-weight children, have significantly increased risk for high total cholesterol, high or borderline LDL cholesterol, low HDL cholesterol, high triglycerides, high fasting glucose, high glycohemoglobin, and high systolic blood pressure. Overweight children report

worse health status than healthy-weight children. Compared to healthy weight children, overweight children are less likely to have any health care expenditure; this difference does not remain after adjusting for socioeconomic status. Having a medical home tends to be associated with greater health care use and expenditures, though not consistently.

Conclusions: These findings suggest that overweight children may meet the definition of CSHCN. They are clearly at increased risk for chronic health conditions that require more health care than that needed by healthy-weight children. Including overweight children under the umbrella of CSHCN is one potential strategy for improving access to care and enhancing health care resources available to overweight children. Such strategies to address overweight during childhood are critical to prevent chronic conditions, improve health status, and reduce health care expenditures, both during childhood and into adulthood.

For AbFab and Sambo.

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## CHAPTER 1

### INTRODUCTION

#### ***Children with special health care needs***

The Maternal and Child Health Bureau established a work group which defined children with special health care needs (CSHCN) as “(1) those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and (2) who also require health and related services of a type or amount beyond that required by children generally”.<sup>1</sup> As indicated by the definition, CSHCN use more care generally.<sup>2, 3</sup> However, they also have more unmet needs for care,<sup>4, 5</sup> and have families that carry a heavier financial burden due to the child’s health.<sup>2, 6</sup>

The CSHCN designation is intended to help meet the specific health care needs of these children by providing them access to a medical home. The American Academy of Pediatrics (AAP) recommends that all CSHCN have a medical home with a primary care physician who helps coordinate care so that CSHCN can access a full spectrum of services related to their special needs.<sup>7, 8</sup> In addition, the designation assists clinicians by alerting them to patients whose visits may need more time for conversation with parents and additional examination or screening.

From a societal perspective, the CSHCN designation attempts to address costly health care problems by guiding appropriations of grants to states through

Title V of the Social Security Act. These grants enable the states “to provide and promote family-centered, community-based, coordinated care (including care coordination services defined in the legislation) for children with special health care needs and to facilitate the development of community-based systems of services for such children and their families”.<sup>9</sup> Each state develops its own program designed to meet these goals. In addition to Title V funds, many states have Medicaid or state-funded programs targeted to improving care for children with special health care needs.

### ***Overweight as a special health care need***

The prevalence of overweight in children has increased dramatically over the last 30 years,<sup>10</sup> with 16% of children overweight and an additional 15% at risk of becoming overweight in 1999-2002.<sup>11</sup> Prevalence of overweight is greater among children who are boys, older, African-American, and Mexican-American.<sup>11</sup> One of the primary concerns with overweight in childhood is that it increases the likelihood of being overweight or obese as an adult.<sup>12-19</sup> Overweight children are also more likely as adults to have risk factors for cardiovascular disease<sup>13, 15</sup> and poorer socioeconomic outcomes.<sup>18</sup>

Overweight in children is associated with elevated systolic blood pressure,<sup>19-33</sup> high triglycerides,<sup>27, 28, 31-33</sup> high LDL cholesterol,<sup>31, 34, 35</sup> low HDL cholesterol,<sup>27, 28, 31-34</sup> high insulin levels,<sup>27, 28, 31, 34-36</sup> impaired glucose tolerance,<sup>27, 37</sup> type 2 diabetes,<sup>38, 39</sup> hepatic steatosis (non alcoholic fatty liver disease),<sup>40-43</sup> cholelithiasis (gallstones),<sup>44-46</sup> pseudotumor cerebri,<sup>47, 48</sup> sleep apnea,<sup>49, 50</sup> orthopedic conditions (slipped capital femoral epiphysis and Blount’s disease),<sup>51-53</sup> and polycystic ovarian

syndrome.<sup>54</sup> Findings on the relationship between overweight and asthma or asthma symptoms in children have been inconsistent, though the relationship, if any, is likely weak.<sup>55-60</sup> Unfortunately, the studies that examine immediate health effects of childhood overweight do not provide an adequate picture of the prevalence of these conditions among children in the United States. The studies are typically comprised of small samples,<sup>24, 28, 34-37, 39-44, 47-51, 53, 56</sup> limited populations,<sup>20, 22, 27, 29-31, 38, 54, 57</sup> or are conducted outside of the United States.<sup>19, 21, 23, 25, 26, 28, 35, 41-45, 49-51, 55, 58, 59</sup> The studies that do permit national estimates of the effects of overweight on medical conditions are few and use data ending in 1994<sup>32, 60</sup> and 2000.<sup>33</sup>

Many conditions commonly known to be related to weight (e.g., hypertension) are often asymptomatic; however, these conditions can have significant impacts on long-term health and should be treated as early as possible. Therefore, the presence of a chronic condition, regardless of whether or not it is recognized and diagnosed by a physician, is important when considering whether overweight is a special health care need

Typically, CSHCN designation has been reserved for children diagnosed with clinical conditions with overt symptoms, such as attention deficit and hyperactivity disorder, diabetes, asthma, and depression. Considering the health risks and need for more services, it is possible that childhood overweight might meet the qualifications of a special health care need. Because the CSHCN designation is intended to improve access to care, including securing a medical home and public programs that address the health needs of CSHCN, an important policy issue is whether childhood overweight meets both criteria that define CSHCN. Specifically,

is childhood overweight a chronic condition (or does it increase the risk for having a chronic condition) and require increased care use?

The first part of the definition considers whether overweight is a chronic condition or increases the risk for a chronic condition. Although overweight in children is persistent,<sup>61</sup> there is disagreement as to whether it should be treated as a medical condition. Despite convincing data that overweight children are at risk for chronic illness in adulthood, there is no national, population-based evidence of its being a risk factor for chronic conditions prior to adulthood or whether medical care can improve health outcomes of overweight children. Determining whether overweight children require increased care is more difficult. It is possible to examine the differences in health care use between overweight and healthy-weight children. However, it is necessary to consider whether overweight children are at increased risk for a chronic condition that requires increased health care, regardless of whether or not they actually receive it.

There are two main difficulties in determining whether overweight children should receive CSHCN designation—underdiagnosis and underutilization. Currently, the most common method of identifying CSHCN is the CSHCN Screener. With this instrument, CSHCN are identified by positive responses for  $\geq 1$  of the following: increased need for medical care or mental health care, need for prescription drugs, functional limitations, need for special therapy, or need for treatment or counseling for conditions that have or are expected to last more than one year.<sup>62</sup> Although many chronic conditions, such as asthma and diabetes, have objective symptoms or laboratory results that facilitate diagnosis, overweight per se

is less readily recognized by a clinician as a medical condition. Overweight children are more likely to be poor and/or minority,<sup>63-65</sup> both of which contribute to limited access to care.<sup>66-69</sup> Thus, even if physicians consistently diagnose and treat the overweight children they care for, overweight children may not see a physician because their socioeconomic status may limit their access to care. Thus the current methods of identifying CSHCN may systematically miss children who are overweight.

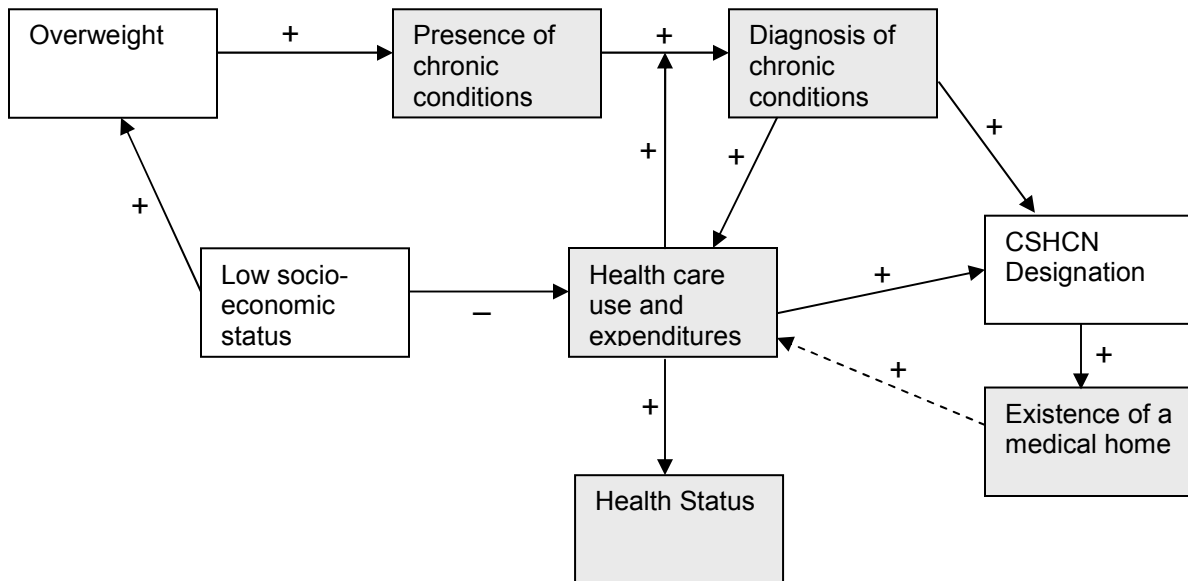
Overweight children with chronic conditions will only demonstrate increased use of medical care if their conditions are widely diagnosed and treated. Although objective measures of chronic conditions may show that overweight children “require” more medical care, overweight children may actually demonstrate less use of medical care due to inadequate diagnosis and socioeconomic barriers to medical care.

### ***Conceptual model***

Figure 1.1 depicts the conceptual model related to the definition of CSHCN for overweight children. Both being at increased risk for chronic conditions (typically a diagnosis) and increased utilization are necessary for a child to be considered a CSHCN. Socioeconomic factors both increase the likelihood that of a child being overweight and reduce utilization of health care. Inadequate utilization may decrease the likelihood of making a diagnosis and, ultimately, being designated as a CSHCN even among children who have diagnosable weight-related conditions. Overweight children need to be treated for their weight and weight-related conditions in order achieve the health benefits that health care can afford them. A CSHCN

designation and increased likelihood of having a medical home should affect the characteristics of the health care they use, which should translate into improved health outcomes.

**Figure 1.1. Conceptual Model**



In order to examine whether childhood overweight is a special health care need, it is necessary to consider three questions related to the definition of CSHCN:

- Do overweight children have more chronic conditions than healthy-weight children (Question 1a, below)?
- Do overweight children demonstrate poorer health than healthy-weight children (Question 1b, below)?
- Do overweight children use more health care than healthy-weight children (Question 2, below)?

In addition, as a secondary aim of this study, it is important to examine whether the existence of a medical home—one of the primary clinical goals for CSHCN—improves outcomes for overweight children (Question 3, below).

By examining these questions, it will be possible to consider the overall goal of this study:

*Considering the increased likelihood of overweight children being diagnosed with weight-related chronic conditions, experiencing poor health outcomes and having greater health care use, do they meet criteria for CSHCN designation?*

### ***Chronic conditions in overweight children***

Question 1a: *Are children who are overweight more likely to have a chronic condition than healthy-weight children?*

Hypothesis 1a: *Overweight children have more chronic conditions compared to healthy-weight children.*

Overweight and obesity are persistent throughout childhood,<sup>61</sup> but it is less clear the extent to which they should be considered “medical conditions”. From a practical point of view, parents do a poor job recognizing that their child is overweight,<sup>70-72</sup> and even when they do, they are often not worried about their child’s weight.<sup>73, 74</sup> As such, parents may be reluctant to view childhood overweight as a medical condition.

Physicians and other health care providers also under-diagnose overweight/obesity,<sup>75-77</sup> although they do report believing that overweight needs

treatment and affects risk of developing chronic diseases.<sup>78</sup> Most health care providers also report using a variety of methods to assess overweight, ranging from clinical impression to body mass index (BMI).<sup>79</sup> Interestingly, providers who are given height and weight percentiles are less likely to show concern about short and long term health outcomes than providers given BMI percentiles.<sup>80</sup> Despite the apparent concern about overweight in children, many extremely overweight children are never referred for medical care due to their weight.<sup>74</sup> Various factors may explain why physicians may not screen for, or diagnose, overweight. Pediatricians overwhelmingly report low perceived ability to treat obesity, citing environmental barriers (e.g., availability of soft drinks and fast food) and practice-based barriers (e.g., lack of a dietitian on-site).<sup>81</sup> Pediatricians, nurse practitioners, and registered dietitians report significant barriers in the treatment of overweight children, including lack of patient and parent involvement, lack of reimbursement, and feeling that treatment is futile.<sup>78</sup> Providers may also be discouraged by the lack of evidence that screening and treatment of overweight in children actually improves health outcomes.<sup>82</sup>

Few data are currently available to describe the extent to which physicians screen and diagnose overweight children for conditions related to their weight. Because many of these conditions are asymptomatic, parents and children are dependent on a physician for screening in order to recognize the condition. Several studies indicate that while physicians and other providers do screen overweight children more frequently than healthy-weight children, the overall prevalence of screening is quite low. One study finds a large but not statistically significant

difference in occurrence of blood pressure screenings among children with and without an obesity diagnosis, although prevalence even among the overweight group was just over 60%.<sup>75</sup> While some studies suggest that blood pressure screening is routine, far fewer providers frequently screen overweight children for dyslipidemia,<sup>83</sup> orthopedic problems, insulin resistance, and type 2 diabetes,<sup>79</sup> as well as general conditions that require laboratory studies.<sup>77</sup>

Assessing the extent of chronic illness in overweight children is impeded by both the possibility of less use of care by overweight children and lack of diagnoses of chronic conditions. These subjective measures will likely underestimate the presence of chronic conditions since overweight children disproportionately belong to socioeconomic groups with limited access to care and physicians may not screen for and diagnose these conditions. Therefore, an objective measure is needed that does not rely on the child seeking care or a physician making a specific diagnosis.

### ***Health outcomes of overweight children***

*Question 1b: Do overweight children demonstrate poorer health than healthy-weight children?*

*Hypothesis 1b: Overweight children will demonstrate poorer health than healthy-weight children.*

Not surprisingly, CSHCN report poorer health status than healthy children.<sup>62, 84, 85</sup> Overweight adults report poorer health,<sup>86, 87</sup> and there is limited evidence that overweight children report poorer health status than healthy-weight children. An Australian study shows that parents of overweight children are more likely to report poorer general health for their children than for healthy-weight children, for both boys

and girls, and poorer physical functioning for boys.<sup>88</sup> A Canadian study found that obese adolescents were less likely to report their health as very good or excellent.<sup>89</sup> One U.S. study using data from 1994-1995 shows that obese adolescents are more likely to report poor general health.<sup>90</sup> Because chronic conditions can interfere with children's social, psychological, and physical functioning, CSHCN have more days of restricted activity<sup>85</sup> and more missed school days.<sup>85, 91</sup> Some studies suggest that similar differences in outcomes exist between overweight children and their healthy weight peers. One study shows that obese children are more likely than their healthy weight peers to report functional limitations and more likely to report poor school functioning, including more missed school days.<sup>90</sup> Two other studies show that overweight children were more likely to report poor physical functioning.<sup>92, 93</sup> In addition, children with type 2 diabetes, which in children is almost universally associated with overweight, and their parents report poorer quality of life, social functioning, and school functioning.<sup>94</sup>

These studies do not give us a clear picture of the current effects of overweight on health status and health-related outcomes among U.S. children. The growing obesity problem in the U.S. necessitates a thorough examination of how weight affects the health status of U.S. children, as this serves as an indicator of the negative health effects of overweight. Even without a formal diagnosis of overweight or weight-related condition, poor health in overweight children may be demonstrated by their perceived health status and other health-related outcomes.

## ***Use and costs of medical care by overweight children***

*Question 2: Do overweight children use more medical care than healthy-weight children?*

*Hypothesis 2: Overweight children will use more medical care than healthy-weight children.*

One of the biggest difficulties in considering whether overweight should be considered a special health care need is that these children may not be receiving care for overweight, including appropriate diet and activity counseling, and management plans for any associated medical problems. Given these needs, the health care usage of overweight children would be expected to be greater than that of healthy-weight children, though patterns of health care usage have been infrequently examined previously. In addition, given an increased risk of chronic conditions among overweight children, we would expect children who are overweight to use more medical care to screen for these conditions.

The current literature provides little evidence regarding the actual frequency of health care use among overweight children. However, several studies report variations in health care use among adults. Compared to healthy-weight individuals, adults who are obese have more hospitalizations,<sup>95</sup> more outpatient visits,<sup>87, 95-99</sup> more emergency visits,<sup>87</sup> more prescription medications,<sup>87, 95, 97, 98</sup> and more overall medical services.<sup>95, 97</sup> Although obese adults use significantly more health care services than healthy-weight adults, it is not clear if the same will hold true for children. The relationship between current illness and weight is much better established in the adult population, so adults may be more frequently screened,

treated, and monitored for these conditions. This poses the question of whether or not overweight children make greater use of health care services than healthy-weight children.

In addition to the frequency of health care use, overweight children may have greater health care expenditures than healthy weight children. Several studies show that adults with higher BMIs have greater outpatient expenses,<sup>96, 98, 101, 102</sup> inpatient expenses,<sup>95, 96, 98, 102</sup> pharmacy expenses,<sup>95, 98, 101, 102</sup> emergency care expenses,<sup>96</sup> and total expenses.<sup>95, 96, 98, 99, 101, 102</sup> Another study predicting the costs of obesity-related diseases demonstrates that rising levels of obesity are related to greater costs associated with these diseases.<sup>103</sup> Similar studies among overweight children have not yet been published.

If overweight children are being screened and treated for their weight as well as for weight-related conditions, we would expect them to have greater medical expenses, even in the absence of actual diagnoses of any weight-related conditions. Even if there are few or no differences in the number of health care visits between overweight and healthy-weight children, it is possible that overweight children still have greater medical expenses due to more in-depth care or additional laboratory screenings.

### ***Effect of a medical home on overweight children***

*Question 3: Do overweight children with medical homes have improved outcomes compared to overweight children without medical homes?*

*Hypothesis 3: Having a medical home will*  
*improve health outcomes for overweight children.*

One important reason for the CSHCN designation is to increase children's access to a medical home that can provide a full spectrum of services that can improve health.<sup>104</sup> A medical home is the primary place for health care that a child uses to coordinate all aspects of pediatric care, and that involves a provider that is known to and trusted by the family.<sup>104</sup> More specifically, the AAP uses a detailed definition of medical that focuses on seven primary domains of what is desired in a medical home: accessible, family-centered, continuous, comprehensive, coordinated, compassionate, and culturally effective.<sup>8</sup>

Despite the recommendations, there is little evidence regarding how the medical home conceived by the AAP affects CSHCN. Children who have a usual source of care are more likely to see a physician,<sup>105</sup> receive preventive and problem-focused medical care,<sup>106</sup> and less likely to delay immunizations.<sup>107</sup> There is evidence that CSHCN with medical homes have lower health care costs<sup>108</sup> and fewer unmet health needs.<sup>109</sup> It is not known if a medical home provides specific benefits for overweight children. Adults who have a usual source of care demonstrate better use of preventive care, including blood pressure and cholesterol screening.<sup>110-112</sup> In addition, adults with a usual source of care received more follow up care and medication for hypertension,<sup>113</sup> and demonstrate better glycemic control for type 2 diabetes.<sup>114</sup> More information about how a medical home affects overweight children is needed, both to understand its effects on these children and to consider the utility of a CSHCN designation for this population.

## ***Significance***

Childhood overweight and weight-related conditions are an increasing concern in the U.S, but there is little information on the care these children receive. If overweight children have more medical conditions, but do not have greater use of care, it may indicate unmet needs. A higher prevalence of chronic health problems among overweight children also suggests that these children should be considered to have a special health care need, in terms of “having or being at risk for” weight-related conditions.

Better understanding of the prevalence of weight-related conditions and effects of childhood overweight on health may reframe the perception of childhood overweight as a chronic condition. Additional emphasis on the health effects and health needs of overweight children demonstrates to parents and health care providers the increased need for care among the population and encourages efforts to ensure receipt of needed health care.

A CSHCN designation could allow clinicians to assure they are providing appropriate care for these children. Policy-makers would have additional incentive to develop programs that aim to reduce the prevalence of overweight and to specifically address the health needs of overweight children. Demonstration of a positive effect of a medical home for overweight children would be of particular interest when clinicians and policy-makers consider where to begin addressing the health problems of this population.

## **CHAPTER 2**

### **METHODS**

#### ***Study design***

This study will be a cross-sectional analysis of existing data from two sources, the 2001-2002 National Health and Nutrition Examination Survey (NHANES) and the 2002 Medical Expenditure Panel Survey (MEPS). These two surveys provide complementary data that, when used together, can address the study questions outlined above. The primary purpose of using both data sets is the differences in operationalizing “medical condition” available with each. NHANES uses objective measures based on actual measurement of laboratory and medical examination values. MEPS uses subjective measures of medical conditions, based on actual diagnoses by a health care provider. The two data sets also differ in the availability of selected variables necessary to address the study questions. In many cases, similar variables will be used from each survey. In other cases, variables address a similar construct, but are operationalized differently. When possible, parallel analyses will be conducted with both data sources.

#### ***Data***

NHANES is a stratified, multistage probability sample of the civilian, non-institutionalized population of the United States.<sup>115</sup> It is composed of two major

components, both of which will be used in this study. The first is a household interview. For individuals under the age of 16, the interview is with a proxy, typically a parent. For minors age 16 and older, the parent or guardian consents and the child is permitted to respond for themselves. The second component is a health examination performed in a mobile examination center (MEC). This includes a physical examination and laboratory tests from urine and blood specimens. The NHANES data used in this survey is solely from the public release data files. These files contain no identifiable information, including administrative or other confidential information.

MEPS is also a nationally representative sample of the civilian, non-institutionalized population in the United States.<sup>116</sup> MEPS uses an overlapping panel design, so the 2002 data includes information from individuals in Rounds 3, 4, and 5 of Panel 6 and Rounds 1, 2, and 3 of Panel 7. Data are collected simultaneously for the two panels. For example, many of the access to care questions are asked during round 4/2—that is, round 4 for Panel 6 and Round 2 for Panel 7. This study will be restricted to the Household Component, which includes information on demographics, use of medical care, access to medical care, health status, income, and employment. The MEPS data used in this study is exclusively from the publicly available data files, from which all potentially identifying information has been removed.

### ***Relevant population***

The sample studied will be children aged six to seventeen years, as these are the ages at which overweight is most prevalent. When outcomes are either not

relevant to or not available for younger children, analyses will be limited to children 2-17 years old. Severely underweight children (< 5<sup>th</sup> percentile for BMI) will be excluded as they are likely to have health conditions that will prevent developing a clear picture of the differences between healthy-weight and overweight children. Because these children represent a small fraction of the population, their exclusion will have limited impact on our generalizability.

## ***Measures***

### ***Body Mass Index (BMI)***

The definition of overweight in children is based on BMI, calculated as body weight in kilograms divided by height in meters squared ( $\text{k/m}^2$ ). Because this value fluctuates throughout childhood, no specific value of BMI can be used as a cutoff for overweight in childhood. Current recommendations define children as overweight when their BMI is at or above the 95<sup>th</sup> percentile for age, at risk for overweight when their BMI falls between the 85<sup>th</sup> and 95<sup>th</sup> percentiles, and underweight when their BMI is under the 5<sup>th</sup> percentile using the current growth charts.<sup>63, 117</sup> These percentiles appear to correlate with established cutoff values of BMI for adults.<sup>118</sup>

The most recent growth charts used to measure BMI percentiles are the 2000 National Center for Health Statistics. The percentiles were developed using data from the National Health Examination Survey and NHANES and include data from the years 1963-1994.<sup>119</sup> Therefore, the percentiles do not necessarily reflect the actual distribution of the current population but are historical measures applied to the current population.

In NHANES, BMI is calculated using measured height and weight and converted to percentiles for age in months and sex using the CDC's SAS programming code developed for that purpose.<sup>120</sup> In MEPS, BMI is based on parents' reports of the child's height and weight. The BMI values are converted to percentiles for age and sex, using the same CDC algorithm.<sup>120</sup> Within MEPS, 14% of the sample has missing values for weight. Because these missing values do not appear to be randomly distributed, we include a dummy variable representing missing weight values in all MEPS analyses involving weight.

While there are generally agreed-upon measures of overweight and at risk for overweight, it is not clear that these are the most appropriate cutoffs for use of BMI in predicting morbidity. In order to examine the effect of BMI across the weight spectrum, a sensitivity analysis was performed looking at differences in various health outcomes along the entire BMI curve.

#### *NHANES Control Variables*

Table 2.1 shows the control variables used from NHANES. Age at examination (when height and weight are measured) is used throughout the analyses, rather than age at household screening, to ensure accurate BMI calculations. Children are defined as poor if their family's income is below 100% of the poverty level. Race is categorized as Hispanic, which includes Mexican-American and other Hispanic, non-Hispanic Black, non-Hispanic white, and other race.

**Table 2.1. Description of NHANES variables relevant to all study questions**

| Variable       | Description                                                               | Type        | Source               | Notes |
|----------------|---------------------------------------------------------------------------|-------------|----------------------|-------|
| Age            | Age in years at time of examination                                       | Continuous  | NHANES Demographics  |       |
| Income         | Poverty as classified using poverty income ratio                          | Binary      | NHANES Demographics  |       |
| Race/Ethnicity | White non-Hispanic, Black, Hispanic, Other                                | Categorical | NHANES Demographics  |       |
| Insurance      | Private insurance, public insurance, ever uninsured in previous 12 months | Categorical | NHANES Questionnaire |       |
| Sex            | Male, Female                                                              | Binary      | NHANES Demographics  |       |

### *MEPS Control Variables*

Table 2.2 shows the control variables used from MEPS. Because questions about height and weight are asked during the second round of the 2002 survey, age in months at the end of the second round (estimated from reported date of birth) is used throughout the analyses. Income is a categorical variable of the family's income as a percentage of poverty level. Insurance is categorized for 2002 as any private insurance, only public insurance, or uninsured for the full year.

**Table 2.2. Description of MEPS variables relevant to all study questions.**

| Variable       | Description                                    | Type        | Source                                | Notes |
|----------------|------------------------------------------------|-------------|---------------------------------------|-------|
| Age            | Age in years at end of the second round        | Continuous  | MEPS Full-Year Consolidated Data File |       |
| Income         | Poverty as defined by percent of poverty level | Categorical | MEPS Full-Year Consolidated Data File |       |
| Race/ethnicity | White non-Hispanic, Black, Hispanic, Other     | Categorical | MEPS Full-Year Consolidated Data File |       |
| Insurance      | Any private, only public, uninsured all year   | Categorical | MEPS Full-Year Consolidated Data File |       |
| Sex            | Male, Female                                   | Binary      | MEPS Full-Year Consolidated Data File |       |

### *Chronic Conditions*

All analyses related to this question focus on three chronic conditions: dyslipidemia, dysglycemia, and hypertension. These three are chosen because of their relatively high prevalence and well-known association with overweight in adults.

Table 2.3 describes the operational definition of these chronic conditions

**Table 2.3. Variables used for study question 1a.**

| <b>Variable</b>        | <b>Description</b>                                                                                   | <b>Type</b> | <b>Source</b>                             | <b>Notes</b>                                                                                |
|------------------------|------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------|---------------------------------------------------------------------------------------------|
| Overweight diagnosis   | Obesity diagnosis                                                                                    | Binary      | MEPS Office-based Medical Provider Visits | ICD-9-CM condition code 278                                                                 |
| Blood pressure         | Average blood pressure measure                                                                       | Categorical | NHANES Blood Pressure Examination         | Will categorize as normal, borderline, high using age, sex, and height specific percentiles |
| Glycohemoglobin        | High (>5.7%)<br>Normal (<5.7%)                                                                       | Binary      | NHANES Laboratory Data                    |                                                                                             |
| Fasting plasma glucose | Undiagnosed diabetes (>126 mg/dL)<br>Impaired fasting glucose (126-110 mg/dL)<br>Normal (<110 mg/dL) | Categorical | NHANES Laboratory Data                    |                                                                                             |
| Total cholesterol      | Acceptable (< 170 mg/dL)<br>Borderline (170-200 mg/dL)<br>High (>200 mg/dL)                          | Categorical | NHANES Laboratory Data                    |                                                                                             |
| HDL Cholesterol        | Acceptable (>35 mg/dL)<br>Low (<35 mg/dL)                                                            | Binary      | NHANES Laboratory Data                    |                                                                                             |
| LDL Cholesterol        | Acceptable (<110 mg/dL)<br>Borderline (110-129 mg/dL)<br>High (>129 mg/dL)                           | Categorical | NHANES Laboratory Data                    |                                                                                             |
| Triglycerides          | Acceptable (<200mg/dL)<br>High, >200 mg/dL)                                                          | Binary      | NHANES Laboratory Data                    |                                                                                             |

For NHANES, the outcome variables are based on laboratory and examination indicators of dyslipidemia, dysglycemia, and hypertension. Definitions of normal, borderline, and abnormal lipid measurements come from AAP<sup>121</sup> and the American Heart Association.<sup>122</sup> The primary diabetes-related measure is plasma glucose and uses the definition from the American Diabetes Association.<sup>123</sup> Because fasting plasma glucose (FPG) levels are only available for a subsample of the population, glycohemoglobin (A1c) will also be used.<sup>124</sup> Although A1c can not be used to diagnose diabetes, it provides a measure of glycemic control during the preceding 2-3 months. Hypertension is defined using percentiles of systolic and diastolic values, based on height, age, and sex. Values above the 95<sup>th</sup> percentile

are regarded as hypertensive and values between the 90<sup>th</sup> and 95<sup>th</sup> percentile are considered borderline.<sup>125</sup> All measures will be analyzed both as continuous and categorical outcomes.

### *Health Status*

We have 3 indicators of health status (Table 2.4). Both NHANES and MEPS ask parents to rate their children's health as excellent, very good, good, fair, or poor. For NHANES, parents are asked about the child's "health in general" during the questionnaire. Although MEPS asks about health status at all three rounds, we only use data from the second round (the same time that BMI, health status, and medical home questions were asked).

**Table 2.4. Variables used for study question 1b.**

| Variable               | Description                                                                | Type        | Source                                | Notes |
|------------------------|----------------------------------------------------------------------------|-------------|---------------------------------------|-------|
| Health status          | Parent-reported health status: excellent, very good, good, fair, poor      | Categorical | MEPS Full-Year Consolidated Data File |       |
| Health status          | Parent-reported health status: excellent, very good, good, fair, poor      | Categorical | NHANES Questionnaire                  |       |
| Missed days            | Number of days of school missed due to illness or injury in 2002           | Continuous  | MEPS Full-Year Consolidated Data File |       |
| Missed days            | Number of days of school missed due to illness or injury in past 12 months | Continuous  | NHANES Questionnaire                  |       |
| Functional limitations | Any limitation in physical functioning reported in 2002                    | Binary      | MEPS Full-Year Consolidated Data File |       |
| Functional limitations | Crawl, walk, run, or play limitations                                      | Binary      | NHANES Questionnaire                  |       |

Number of school days missed due to illness or injury is asked in both surveys. NHANES asks parents to report days missed in the previous 12 months. MEPS asks parents to report days missed during each 4-month round. The responses from the three rounds of MEPS are summed to estimate days missed during the full 12 months. School days missed are examined in three ways: having

missed any days, having missed  $\geq 2$  days, and having missed more than the mean number of days.

Functional limitations are defined in NHANES using a single question that asks if the child has any impairment or health problem that limits the ability to crawl, walk, run, or play. In MEPS, functional limitations are defined as any limitation in physical functioning reported during 2002 in any round.

#### *Health care use and expenditures*

Health care use is measured with several variables, all from MEPS (Table 2.5). Total outpatient use equals the total number of office-based visits to physicians, nurse practitioners, physician assistants, and physical/occupational therapists and the total number of visits to hospital outpatient departments that occurred in the previous 12 months. Office-based visits to other providers, such as chiropractors and optometrists, are not included. Inpatient visits are the total number of hospital discharges for the year. Emergency room use is the total number of visits to a hospital emergency room.

For all expenditure variables, expenditures are defined as “the sum of direct payments for care provided during the year”.<sup>116</sup> Total health care expenditures reflect all types of health care, not just those that are examined separately. Outpatient expenditures include those related to office-based physician, nurse practitioner, physician assistant, and occupational/physical therapist visits and outpatient department visits. Inpatient expenditures are all expenditures associated with a hospital admission, including associated emergency room charges.

**Table 2.5. Variables used for study question 2.**

| <b>Variable</b>                | <b>Description</b>                                            | <b>Type</b> | <b>Source</b>                         | <b>Notes</b> |
|--------------------------------|---------------------------------------------------------------|-------------|---------------------------------------|--------------|
| Outpatient visits              | Number of visits to outpatient medical care providers         | Continuous  | MEPS Full-Year Consolidated Data File | Sum of below |
|                                | Number of visits to physician                                 | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Number of visits to nurse practitioners                       | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Number of visits to physician assistants                      | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Number of visits to physical/occupational therapist           | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Number of visits to hospital outpatient departments           | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Inpatient visits               | Number of inpatient stays                                     | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Emergency room visits          | Number of emergency room visits                               | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Total health care expenditures | Total health care expenditures                                | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Outpatient expenditures        | Expenditures for outpatient visits to medical care providers  | Continuous  | MEPS Full-Year Consolidated Data File | Sum of below |
|                                | Expenditures for office-based physicians                      | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Expenditures for office-based nurse practitioners             | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Expenditures for office-based physician assistants            | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Expenditures for office-based physical/occupational therapist | Continuous  | MEPS Full-Year Consolidated Data File |              |
|                                | Expenditures for hospital outpatient department               | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Inpatient expenditures         | Total inpatient expenditures                                  | Continuous  | MEPS Full-Year Consolidated Data File |              |
| Emergency room expenditures    | Total emergency room expenditures                             | Continuous  | MEPS Full-Year Consolidated Data File |              |

Emergency room expenditures are payments for emergency room visits. In cases where the emergency room visit results in a hospital admission, MEPS considers the emergency room expenditures as zero and considers those as part of the inpatient expenditures.

### *Medical Home*

The AAP definition of “medical home” encompasses seven domains and 37 distinct concepts.<sup>8</sup> There is no validated survey measure that operationalizes the full construct of medical home. Bethell and colleagues<sup>126</sup> have examined the use of existing population-based surveys, including MEPS, to approximate the AAP construct of the medical home. Based on this work, MEPS can be used to create a measure of medical home that captures most aspects of the AAP definition. Specifically, we use 15 items from MEPS that represent the general medical home concept of usual source of care along with the domains of accessible, family-centered, comprehensive, coordinated, compassionate, and culturally effective (Table 2.6). This is similar to the methods used by Bethell and colleagues, but uses slightly different measures than those available in the MEPS year used in their analysis. Any child without a usual source of care is assumed to not have a medical home. In addition, responses of “don’t know” for each item are considered responses of “no” or “never”, since it is unlikely that individuals unable to respond to a question are actually experiencing that construct.

**Table 2.6. Medical Home Items.**

| <b>Domain</b>                      | <b>Item description</b>                                                                                                                        |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b><i>Usual source of care</i></b> | Has a usual source of care other than ER                                                                                                       |
| <b><i>Accessible</i></b>           | How long it takes to get to USC<br>How difficult it is to get to USC<br>USC has night/weekend hours                                            |
| <b><i>Family-centered</i></b>      | Sees a particular provider<br>Provider asks person to help decide<br>Provider gives person control of treatment<br>Provider explains options   |
| <b><i>Continuous</i></b>           | None available                                                                                                                                 |
| <b><i>Comprehensive</i></b>        | Goes to USC for new health problems<br>Goes to USC for preventive care<br>Goes to USC for referrals<br>Goes to USC for ongoing health problems |
| <b><i>Coordinated</i></b>          | Provider asks about other treatments                                                                                                           |
| <b><i>Compassionate</i></b>        | Provider shows respect for other treatments                                                                                                    |
| <b><i>Culturally effective</i></b> | Provider speaks person's language                                                                                                              |

As with Bethell and colleagues, two methods will be used to construct a medical home variable. The first method uses a scoring system to measure “homeness” on a continuous scale. Each question is scored depending on whether it is categorical or binary. For example, for a binary outcome a “yes” answer would score 100 points and a “no” answer would score zero. For a 4-point categorical outcome “always” would score 100, “usually” would score 75, “sometimes” would score 25, and “never” would score 0. This gives a continuous variable representing the amount of time a child experiences medical care consistent with the concept of a medical home. A child scoring  $\geq 75$  would, on average, “usually” or “always” experience such medical care.<sup>126</sup> The second method will use the same scoring method to construct a binary medical home variable. A child will be classified as having a medical home if their score is  $\geq 75$  for each domain.<sup>126</sup>

For NHANES, a single-item measure—child has a single usual source of care at a doctor’s office or clinic—will be used to measure medical home. We recognize that this is a crude measure of medical home. To allow for comparison, a similar one-item measure will also be used with MEPS data. Table 2.7 describes the medical home variables used for study question 3.

**Table 2.7. Variables used for study question 3.**

| <b>Variable</b>      | <b>Description</b>                                                      | <b>Type</b> | <b>Source</b>                         | <b>Notes</b>                                          |
|----------------------|-------------------------------------------------------------------------|-------------|---------------------------------------|-------------------------------------------------------|
| Medical home         | Multiple-item construct representing the AAP definition of medical home | Binary      | MEPS Full-Year Consolidated Data File | Outcomes are previously described dependent variables |
| Medical home         | Multiple-item construct that measures the level of medical “homeness”   | Continuous  | MEPS Full-Year Consolidated Data File | Outcomes are previously described dependent variables |
| Usual source of care | Has a routine place for health care other than emergency room           | Binary      | MEPS Full-Year Consolidated Data File |                                                       |
| Usual source of care | Has a routine place for health care other than emergency room           | Binary      | NHANES Questionnaire                  | Outcomes are previously described dependent variables |

## ***Analyses***

### ***Weights and sampling units***

Correction for the complex survey design is done using the information on sampling methods and the weights included with each data set. For NHANES, we use the stratum and primary sampling unit (PSU) variables provided. The probability weights differ based on the section or sections of the survey being analyzed, the household interview component, the medical examination component, or the sub-sample fasting laboratory component. In cases where a single analysis involves more than one component, the most restrictive weight is used (i.e. the component with the smallest sample).

MEPS is designed with few PSUs within each stratum, which, in the analyses, often results in a single PSU per stratum. In order to permit analyses that account for the complete survey design, a new PSU variable was created that differs across the entire population, not just within strata. This PSU alone was used to control for the sampling design. We used the probability weights provided.

### *Demographics*

For both NHANES and MEPS, demographics will be examined for the entire relevant population. Wald F-tests, adjusted for survey design, will then be used to determine if there are any significant differences in prevalence of overweight and at risk for overweight by the demographic variables included.

### *Specifications*

*BMI sensitivity.* BMI percentiles were divided into 5-point increments (e.g., 5-9, 10-14, etc.), excluding underweight children. The only exception is children above the 99<sup>th</sup> percentile are assigned a single category (the 100<sup>th</sup> percentile). The first step in examining the effect of BMI on health outcomes uses an ordinary least squares regression, including correction for survey design. A dummy variable for each five-point increment in BMI percentile is regressed on a continuous variable for each health measure. The lowest BMI (5<sup>th</sup>-9<sup>th</sup> percentiles) is the base case. Each point is compared using an adjusted Wald test, to determine whether coefficients for each 5-percentile increment are significantly different from each other.

The second step uses a similar process to determine the effect of BMI percentile on the likelihood of having a condition. Logistic regression is used to regress a dummy variable for each 5-point BMI increment on a dummy variable

representing presence of each of the health outcomes. Again, adjusted Wald tests are used to determine whether coefficients for each 5-point increment are significantly different from each other. These analyses do not control for any other factors.

*Logged expenditures.* Because expenditure data are highly skewed, we used log transformations for our analyses. Simple graphical analysis of the distribution of expenditures was used to determine whether expenditures are normally distributed (see Appendix A).

*Hypothesis 1a: Overweight children have more chronic conditions compared to healthy-weight children.*

Data from NHANES will be used to compare the prevalence of dyslipidemia, hypertension, and dysglycemia among children who are overweight, at risk for overweight, and healthy weight. The next step will use logistic regression (for binary outcomes), ordered logit (for categorical outcomes), or ordinary least squares regression models (for continuous outcomes) to estimate the effect of overweight on the likelihood of having each of the conditions, controlling for demographic factors.

*Hypothesis 1b: Overweight children will demonstrate poorer health than healthy-weight children.*

First, NHANES data will be used to examine differences in perceived health status among children who are overweight, at risk for overweight, and healthy weight. Ordered logit regression analysis will also be used to estimate the effect of overweight on reported health status. Second, MEPS data will be used to perform

similar analyses. Although statistical comparisons cannot be made, comments can be made on the magnitude of differences seen, if any.

Bivariate analyses will be used to examine differences in the number of school days missed among children who are overweight, at risk for overweight, and healthy weight. The distribution of the number of missed school days will be examined. If there is little clustering of observations at zero, ordinary least squares regression will be used to estimate the effect of overweight on number of days of school missed. If there is clustering of observations at zero, a two-stage model will be used to estimate the effect of weight, first, on the likelihood of missing any school days, and second, on the number of days missed, controlling for other factors. These analyses will be performed with both MEPS and NHANES data. Although statistical comparisons cannot be made, comments can be made on the differences in effect magnitude, if any.

Bivariate comparisons will be used to examine differences in the prevalence of any functional limitation among children who are overweight, at risk for overweight, and healthy weight. Logistic regression analyses will be used to estimate the effect of overweight on the likelihood of any functional limitation, controlling for other factors. These analyses will be performed with both MEPS and NHANES data. Although statistical comparisons cannot be made, comments can be made on the differences in effect magnitude, if any.

*Hypothesis 2: Overweight children will use more medical care than healthy-weight children.*

Using MEPS data, initial analyses will examine bivariate comparisons of the total number of health care visits and the number of visits to each type of provider, among children who are overweight, at risk for overweight, and healthy weight. Next, a two-stage model will be used to estimate the effect of overweight on number of health care visits, controlling for other factors. The first stage will estimate the effect of overweight on the likelihood of having any health care visit. The second stage will estimate the effect of weight on number of health care visits among children with any visit.

Similar analyses will be performed for health care expenditures. Initial analyses will examine bivariate comparisons of total health care expenditures and the expenditures for each type of provider, among children who are overweight, at risk for overweight, and healthy weight. Next, a two-stage model will be used to estimate the effect of overweight on health care expenditures, controlling for other factors. The first stage will estimate the effect of overweight on the likelihood of having any health care expenditure. The second stage will estimate the effect of weight on total expenditures among children with any expenditure.

*Hypothesis 3: Having a medical home will improve health outcomes for overweight children.*

After the multiple-item medical home variable is constructed, bivariate comparisons will be used to examine the differences in prevalence of health conditions and health status among overweight children with and without medical homes. Logistic regression will be used to examine the independent effect of a

medical home on the likelihood of having a weight-related condition and poorer health status among overweight children. An interaction of overweight and having a medical home is used to consider the differential effect of a medical home specifically for overweight children.

## CHAPTER 3

### RESULTS

#### *Demographics*

##### *NHANES*

Using the measured values of height and weight in NHANES, 17.1% of children are overweight, 16.0% are at risk for overweight, and 67.0% are healthy weight (Table 3.1). The average age is 11.6 years, and girls and boys are nearly equal. The race distribution is: 59.5% white, 15.1% black, 19.6% Hispanic, and 5.8% other race. Most children live above poverty (78.4%), though 21.6% live below poverty, as defined by the poverty-income ratio. Most children are insured, either through private insurance (59.3%) or public coverage (21.6%), though 19.2% are uninsured.

There are no significant differences in age or gender by weight category, nor are there any significant differences in the prevalence of overweight by insurance status. Overweight is more prevalent among black and Hispanic children, and among children living below poverty.

**Table 3.1. NHANES Demographics (N=2959).**

|                       | Total | Overweight | At Risk | Healthy weight |        |
|-----------------------|-------|------------|---------|----------------|--------|
| <b>Age</b>            |       |            |         |                |        |
| Years                 | 11.6  | 11.7       | 11.5    | 11.7           | ns     |
| <b>Sex</b>            |       |            |         |                |        |
| Male                  | 50.1  | 18.7       | 15.5    | 65.8           | ns     |
| Female                | 49.9  | 15.5       | 16.4    | 68.1           |        |
| <b>Race/Ethnicity</b> |       |            |         |                |        |
| White                 | 59.5  | 15.2       | 14.7    | 70.1           | p<0.05 |
| Black                 | 15.1  | 21.0       | 14.6    | 64.3           |        |
| Hispanic              | 19.6  | 20.6       | 18.9    | 60.5           |        |
| Other                 | 5.8   | 15.0       | 21.9    | 63.1           |        |
| <b>Income</b>         |       |            |         |                |        |
| Below poverty         | 21.6  | 20.4       | 17.6    | 62.0           | p<0.05 |
| Above poverty         | 78.4  | 16.3       | 15.2    | 68.6           |        |
| <b>Insurance</b>      |       |            |         |                |        |
| Private               | 59.3  | 15.4       | 15.8    | 68.9           | ns     |
| Public                | 21.6  | 19.3       | 14.0    | 66.7           |        |
| Uninsured             | 19.2  | 19.9       | 18.3    | 61.8           |        |
| <b>Weight</b>         |       |            |         |                |        |
| BMI percentile        | 64.7  |            |         |                |        |
| Overweight            | 17.1  | -          | -       | -              |        |
| At risk               | 16.0  | -          | -       | -              |        |
| Healthy weight        | 67.0  | -          | -       | -              |        |

Significance tests compare overweight, at risk, and healthy weight children, using adjusted Wald tests.

### MEPS

The distribution of weight in MEPS is similar to NHANES, with classification of overweight based on parental report of the child's height and weight: 20.1% are overweight, 17.4% are at risk for overweight, and 62.5% are healthy weight (Table 3.2). The demographic characteristics are also similar to those seen in NHANES. The average age is 11.6 years. Children are primarily white (60.6%), with 14.9% black, 18.0% Hispanic, and 6.5% other race. Based on the federal poverty level, most children are above poverty (84.2%), with 15.8% living below poverty. Most children have either private insurance coverage (61.6%) or public coverage (19.0%), though 19.3% of children are uninsured.

The average age is somewhat younger for overweight children (10.6 years), compared the healthy weight children (12.3 years). Overweight is more prevalent

among boys (23.5%) than girls (51.1%), and more prevalent among blacks (30.2%) and Hispanics (25.8%) than whites (16.1%). Children living below poverty have greater prevalence of overweight (28.4%) than those living above poverty (18.7%). Finally, overweight is less prevalent among children with private insurance (16.6%) than those with either public coverage (28.8%) or no insurance (23.7%).

**Table 3.2. MEPS Demographics (N=7363).**

|                             | Total | Overweight | At Risk | Healthy weight |        |
|-----------------------------|-------|------------|---------|----------------|--------|
| <b>Age</b>                  |       |            |         |                |        |
| Years                       | 11.6  | 10.6       | 11.7    | 12.3           | p<.001 |
| <b>Sex</b>                  |       |            |         |                |        |
| Male                        | 48.9  | 23.5       | 17.2    | 59.3           | p<.001 |
| Female                      | 51.1  | 16.4       | 17.7    | 65.9           |        |
| <b>Race/Ethnicity</b>       |       |            |         |                |        |
| White                       | 60.6  | 16.1       | 16.4    | 67.4           | p<.001 |
| Black                       | 14.9  | 30.2       | 17.2    | 52.6           |        |
| Hispanic                    | 18.0  | 25.8       | 22.4    | 51.8           |        |
| Other                       | 6.5   | 21.3       | 16.0    | 62.6           |        |
| <b>Income</b>               |       |            |         |                |        |
| Below poverty               | 15.8  | 28.4       | 18.8    | 52.8           | p<.001 |
| Above poverty               | 84.2  | 18.7       | 17.2    | 64.1           |        |
| <b>Insurance</b>            |       |            |         |                |        |
| Private                     | 61.6  | 16.6       | 16.8    | 66.5           | p<.001 |
| Public                      | 19.0  | 28.8       | 17.9    | 53.3           |        |
| Uninsured                   | 19.3  | 23.7       | 19.9    | 57.1           |        |
| <b>Weight</b>               |       |            |         |                |        |
| BMI percentile              | 67.2  | -          | -       | -              |        |
| Overweight <sup>a</sup>     | 20.1  | -          | -       | -              |        |
| At risk <sup>a</sup>        | 17.4  | -          | -       | -              |        |
| Healthy weight <sup>a</sup> | 62.5  | -          | -       | -              |        |
| Missing weight              | 13.8  | -          | -       | -              |        |

<sup>a</sup> Among those with non-missing weight values. Significance tests compare overweight, at risk, and healthy weight children, using adjusted Wald tests.

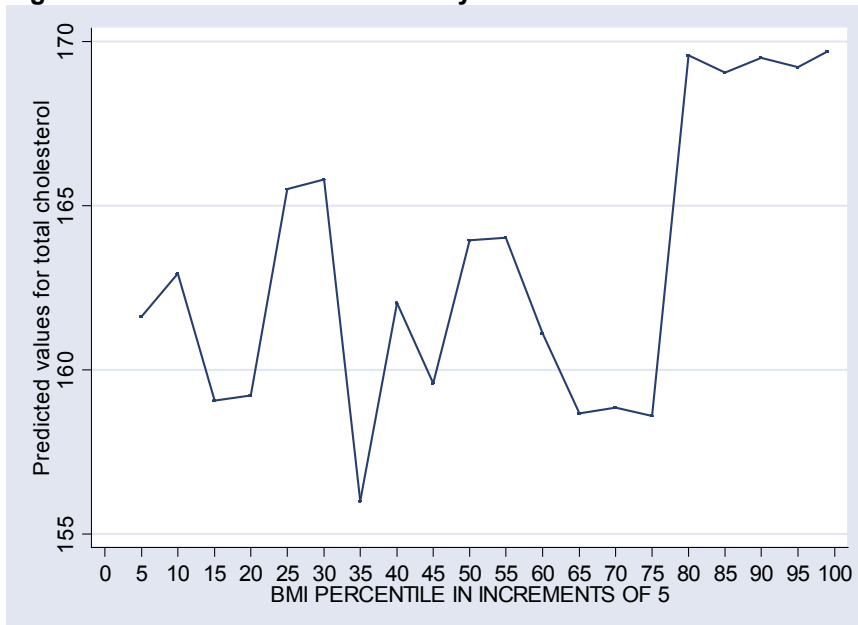
## Specifications

### BMI Sensitivity/Measurement

*Total cholesterol.* The effect of BMI on laboratory values of total cholesterol appears to increase significantly when children reach the 80<sup>th</sup> percentile for BMI.

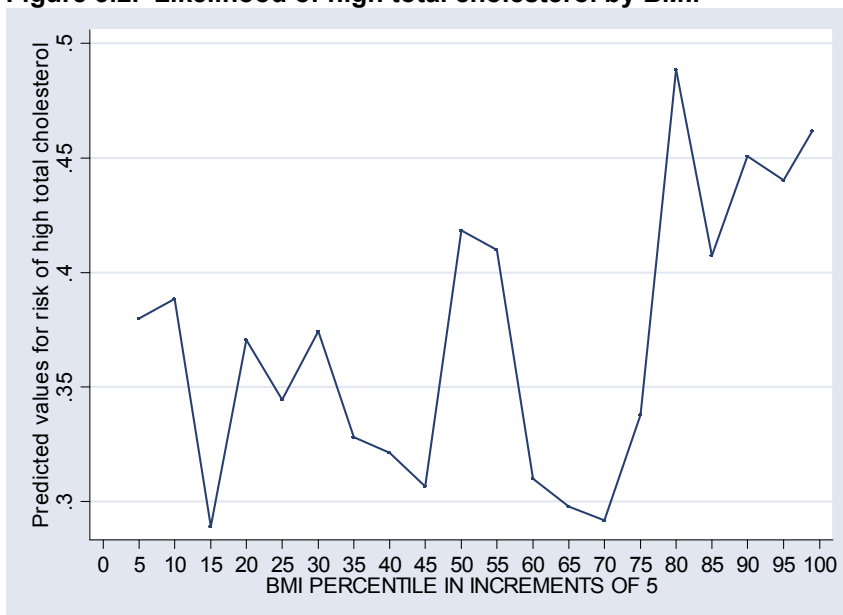
Figure 3.1 graphically shows the rise in total cholesterol seen at the 80<sup>th</sup> percentile.

**Figure 3.1. Total cholesterol level by BMI.**



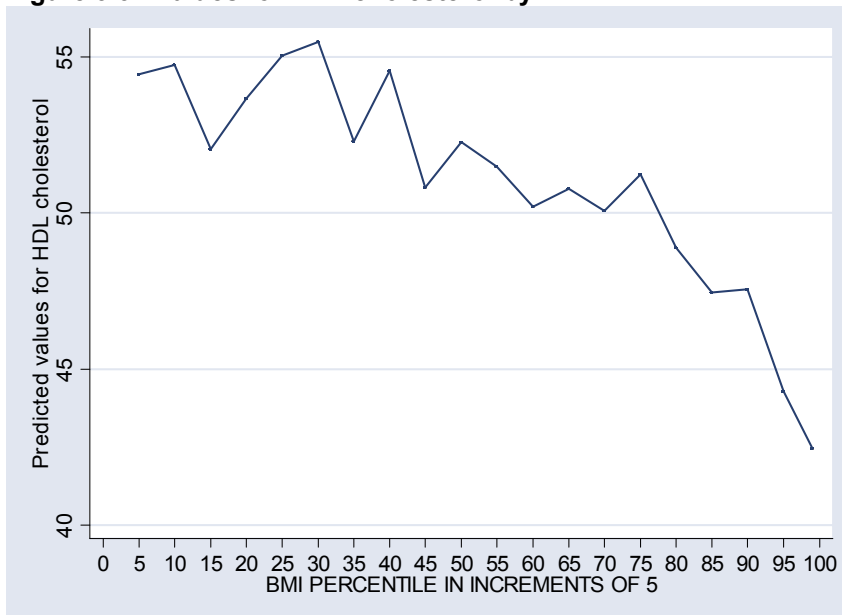
The effect of BMI on risk of high or borderline values of cholesterol also appears to increase at the 80<sup>th</sup> percentile. Figure 3.2 represents the risk of an abnormal value at each 5-point increment in BMI percentile, and shows the increase seen at the 80<sup>th</sup> percentile.

**Figure 3.2. Likelihood of high total cholesterol by BMI.**



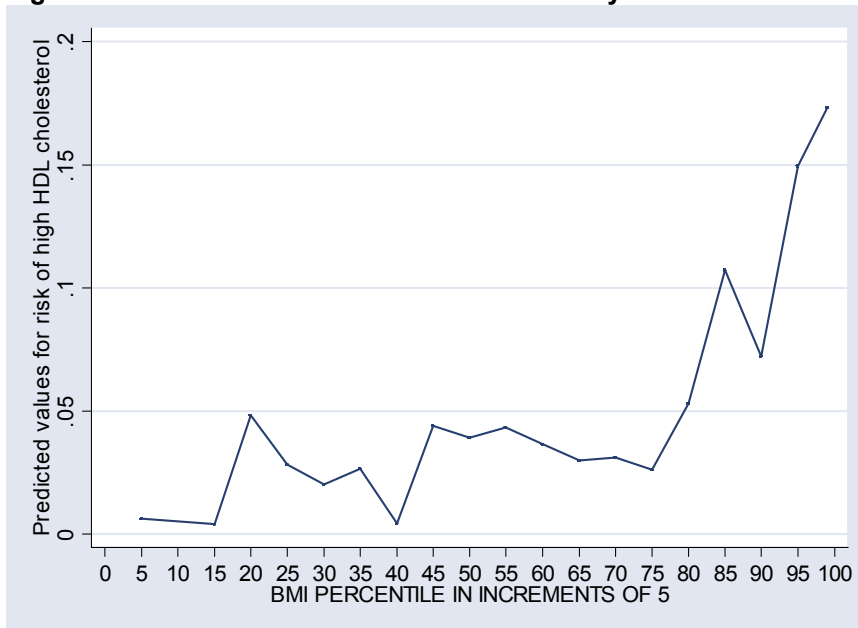
*HDL cholesterol.* The effect of BMI on laboratory values of HDL cholesterol appears to increase significantly at the 80<sup>th</sup> percentile, with a second significant increase in effect at the 95<sup>th</sup> percentile. Figure 3.3 represents the predicted values of HDL cholesterol for each 5-point percentile increment, and shows the drop in HDL cholesterol seen at the 80<sup>th</sup> percentile.

**Figure 3.3. Values for HDL cholesterol by BMI.**



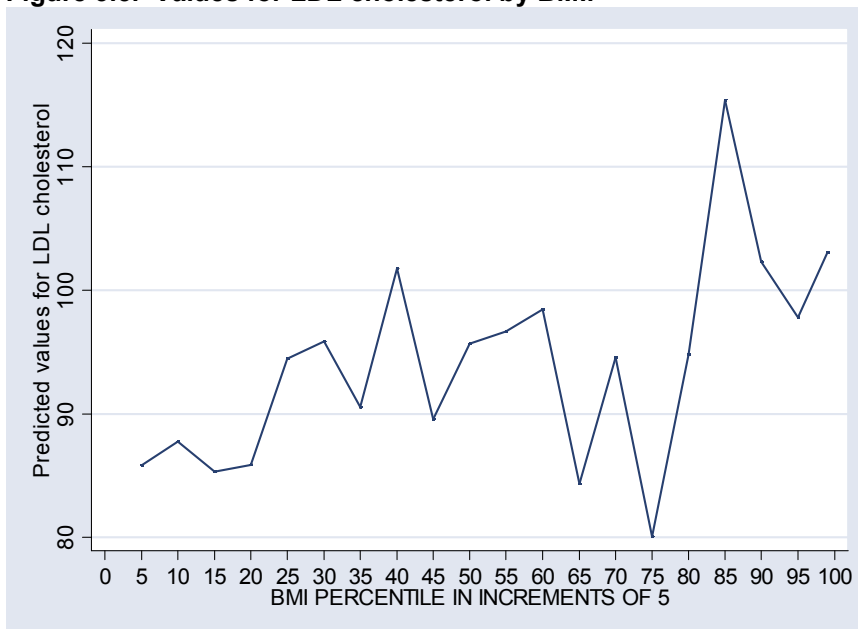
The effect of BMI on the likelihood of decreased (poor) HDL levels also appears to increase at about the 80<sup>th</sup> percentile, though the difference is not significant. Figure 3.4 shows the increase in likelihood of a poor HDL value at the 80<sup>th</sup> percentile and again at the 95<sup>th</sup> percentile.

**Figure 3.4. Likelihood of low HDL cholesterol by BMI.**



*LDL cholesterol.* The effect of BMI on LDL laboratory values appears to increase at about the 80<sup>th</sup> percentile (Figure 3.5).

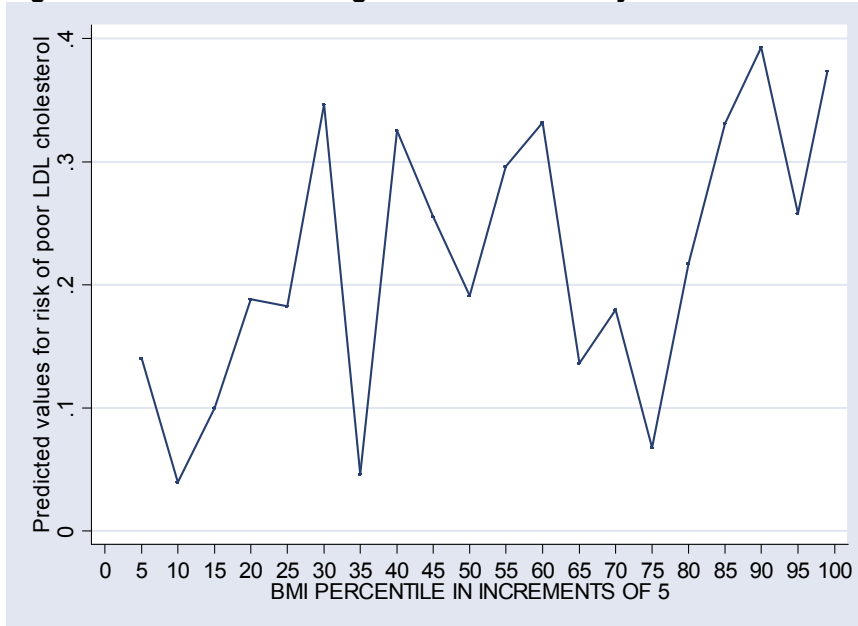
**Figure 3.5. Values for LDL cholesterol by BMI.**



The effect of BMI on the risk of an abnormal value for LDL, based on current definitions, is less clear. Again, there appears to be an increase at the 80<sup>th</sup>.

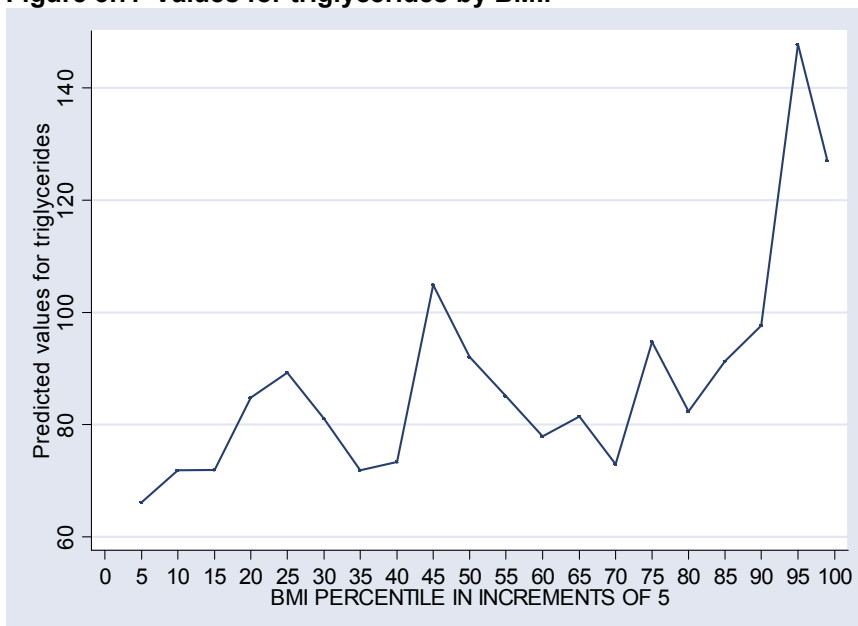
percentile, but the differences are not significant. Figure 3.6 clearly shows the wide variation in LDL cholesterol across the population.

**Figure 3.6. Likelihood of high LDL cholesterol by BMI.**



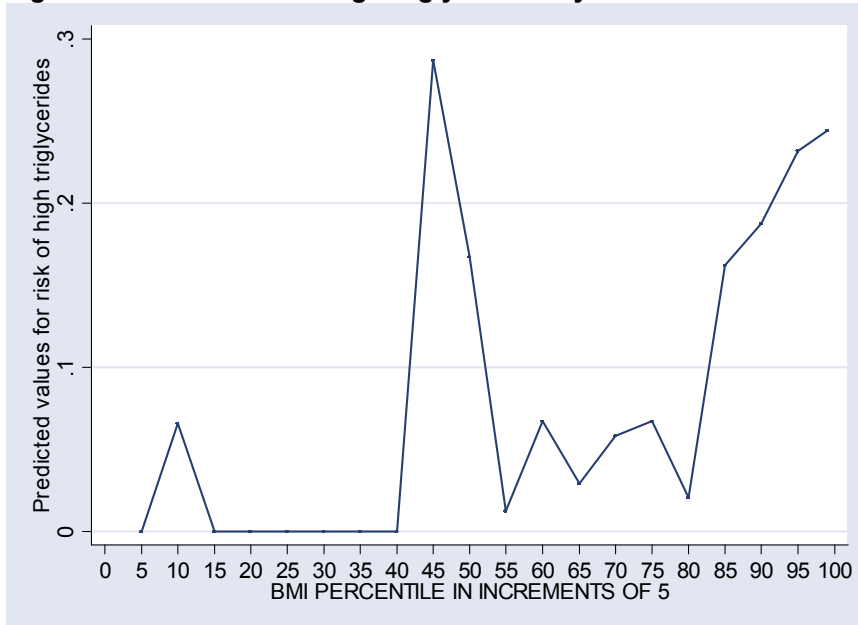
*Triglycerides.* There are no significant differences in the effect of BMI percentile on triglycerides below the 95<sup>th</sup> percentile. Figure 3.7 demonstrates the variation at lower BMI levels, with a sharp increase at the 95<sup>th</sup> percentile.

**Figure 3.7. Values for triglycerides by BMI.**



No significant differences are seen in the effect of BMI on the likelihood having poor triglyceride values. Figure 3.8 shows the expected increase at about the 85<sup>th</sup> percentile, as well as an unexplained spike at the 45<sup>th</sup> percentile.

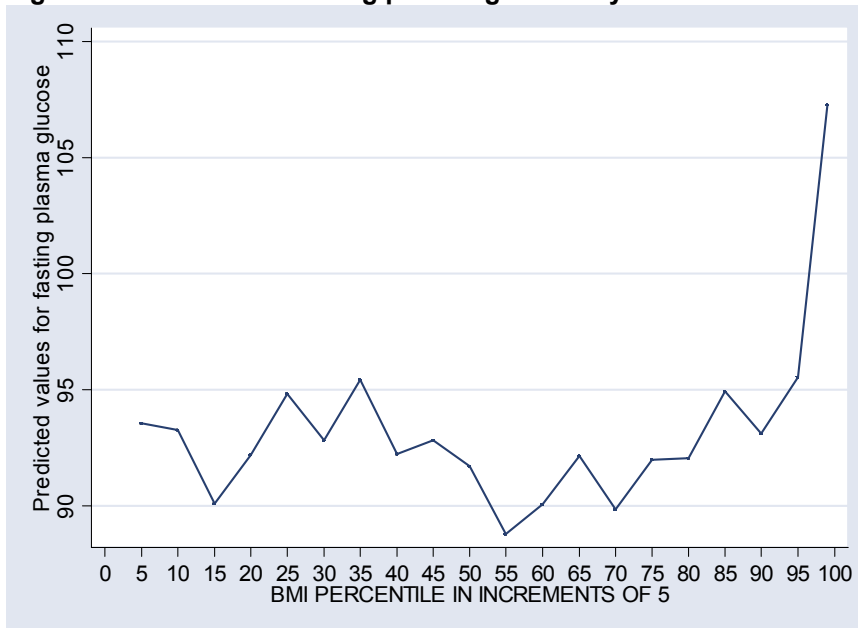
**Figure 3.8. Likelihood of high triglycerides by BMI.**



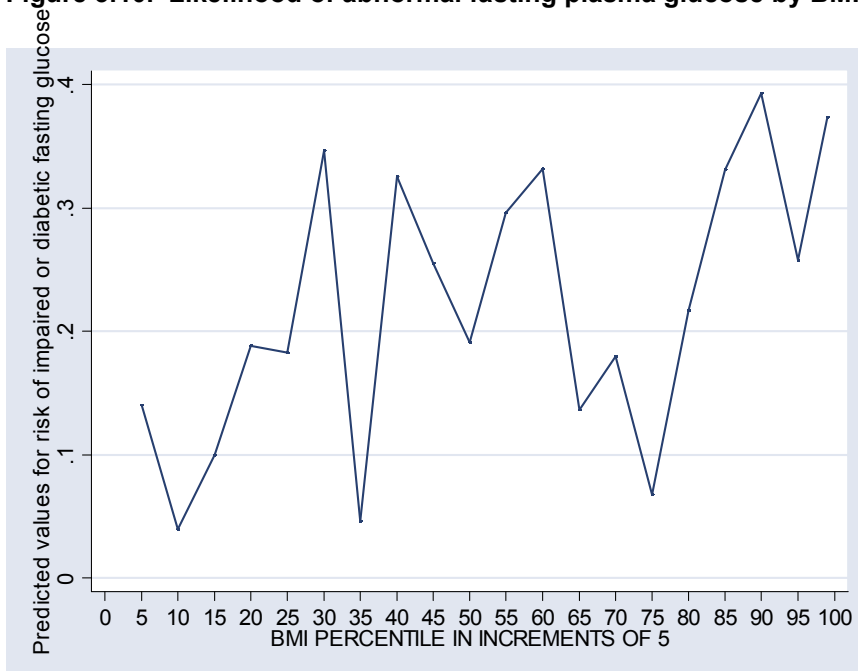
*Fasting plasma glucose.* No significant differences are seen in the effect of BMI on fasting plasma glucose values, except for a spike at the highest BMI percentiles. Figure 3.9 shows the variation in predicted values across the population.

Again, no significant differences are seen in prediction of abnormal glucose values, although a spike in effect is seen at about the 85<sup>th</sup> percentile. Figure 3.10 shows this variation across the population. When limiting to glucose values indicative of undiagnosed diabetes, only children in the upper percentiles are at risk (Figure 3.11).

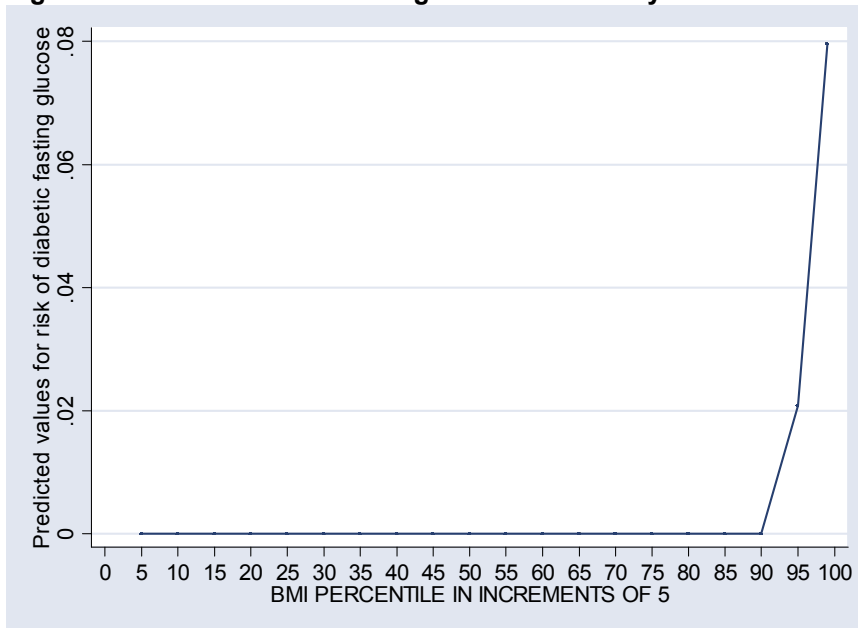
**Figure 3.9. Values for fasting plasma glucose by BMI.**



**Figure 3.10. Likelihood of abnormal fasting plasma glucose by BMI.**

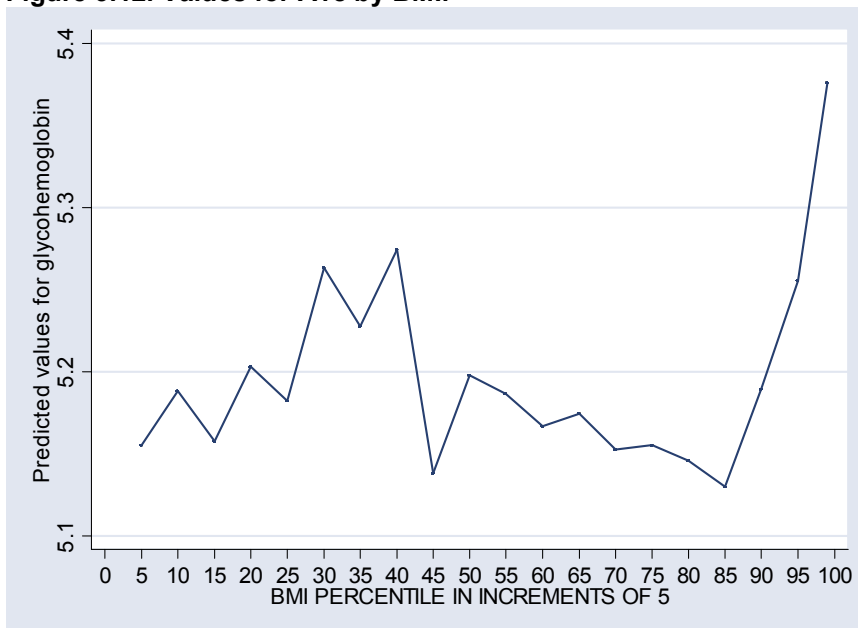


**Figure 3.11. Likelihood of undiagnosed diabetes by BMI.**



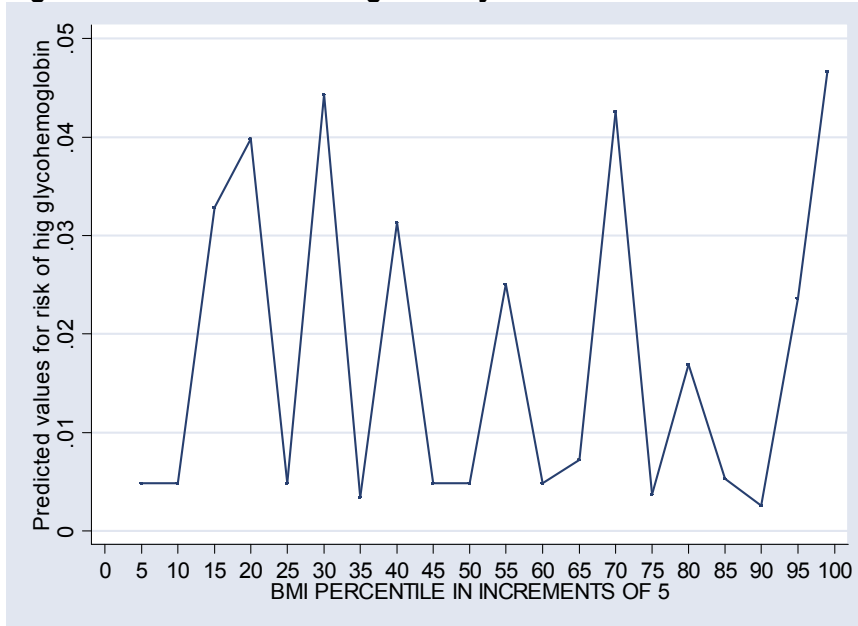
*A1c.* No significant differences are seen in the effect of weight on A1c values, although a spike is apparent at the upper percentiles. Figure 3.12 shows this variation across the population.

**Figure 3.12. Values for A1c by BMI.**



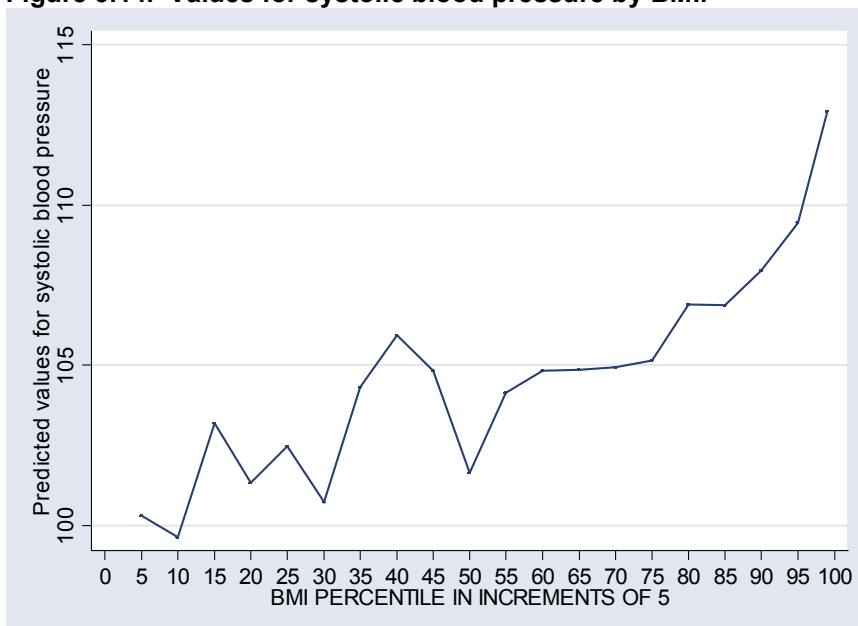
No significant differences are seen in the effect of weight on the likelihood of having a high A1c value, as shown in Figure 3.13.

**Figure 3.13. Likelihood of high A1c by BMI.**



*Hypertension.* A significant increase in effect of weight on systolic blood pressure is seen at about the 75<sup>th</sup> percentile (Figure 3.14). This is not true for diastolic blood pressure (Figure 3.15).

**Figure 3.14. Values for systolic blood pressure by BMI.**

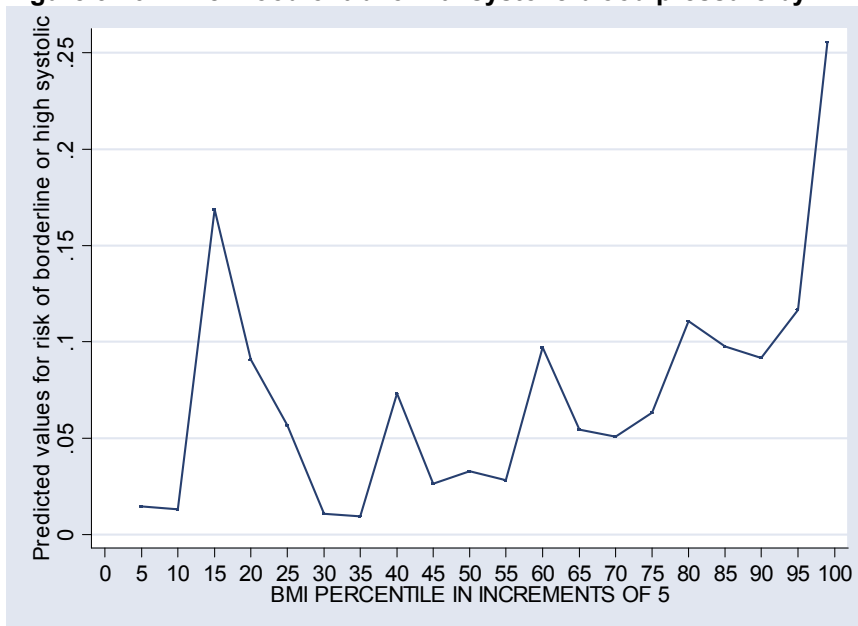


**Figure 3.15. Values for diastolic blood pressure by BMI.**

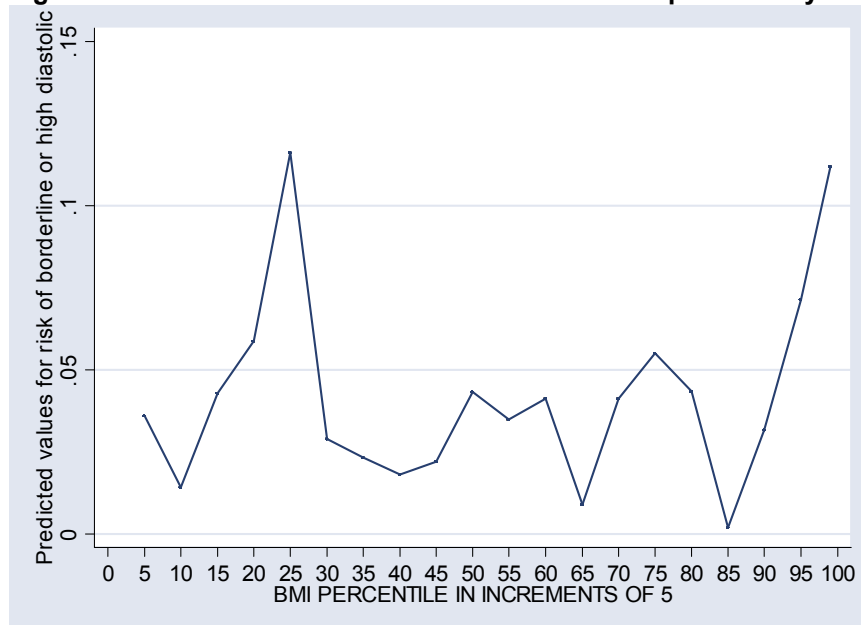


A similar pattern is seen for the effect of weight on the likelihood of having borderline or high blood pressure, with an increase seen at the 80<sup>th</sup> percentile for systolic blood pressure (Figure 3.16), and no significant differences seen for diastolic (Figure 3.17).

**Figure 3.16. Likelihood of abnormal systolic blood pressure by BMI.**

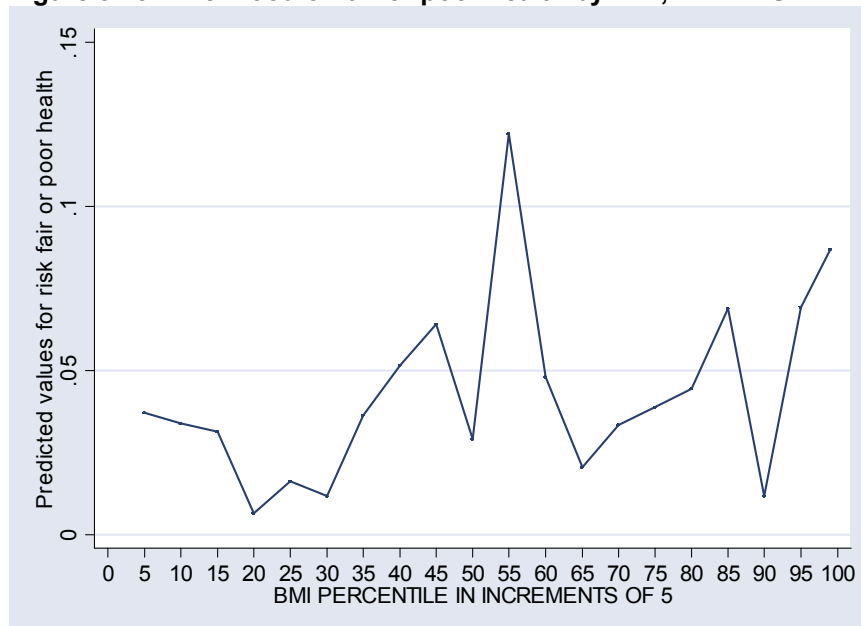


**Figure 3.17. Likelihood of abnormal diastolic blood pressure by BMI.**



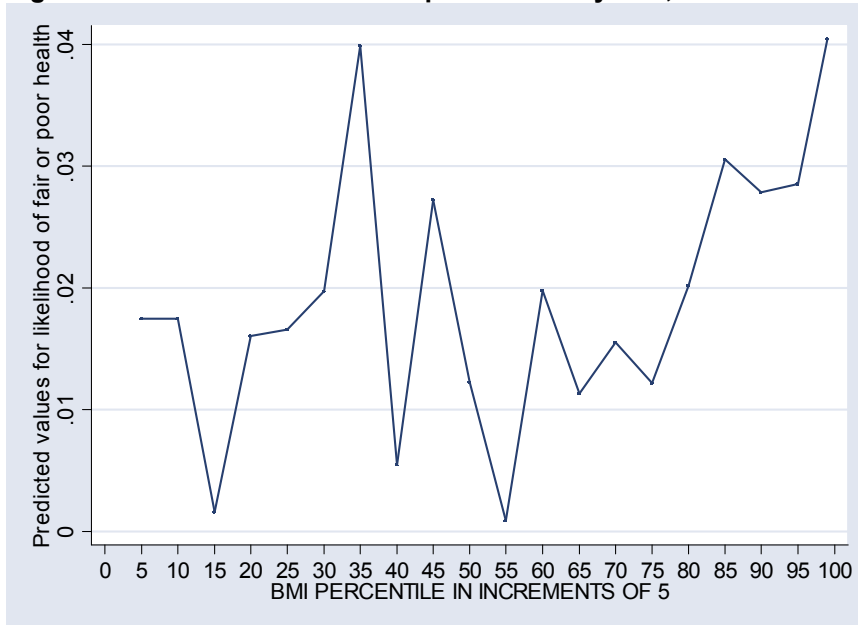
*Health status.* For NHANES, the effect of weight on the likelihood of reporting fair or poor health is significant at the highest percentiles, with an unexpected increase at about the 55<sup>th</sup> percentile (Figure 3.18).

**Figure 3.18. Likelihood of fair or poor health by BMI, NHANES.**



A similar pattern is seen for MEPS, with significant increases seen at about the 85<sup>th</sup> percentile, and unexpected increases in the middle percentiles (Figure 3.19).

**Figure 3.19. Likelihood of fair or poor health by BMI, MEPS.**



***Hypothesis 1a: Overweight children have more chronic conditions compared to healthy-weight children.***

#### *Bivariate analyses*

Approximately 9% of the total population has high total cholesterol, with another 29% having borderline cholesterol levels; 8% have high LDL cholesterol, with another 15% have borderline levels; 6% have low HDL levels; and 7% have high triglyceride levels (Table 3.3).

**Table 3.3. NHANES Medical conditions.**

|                                          | Total       | Overweight  | At Risk     | Healthy weight |         |
|------------------------------------------|-------------|-------------|-------------|----------------|---------|
| <i>Total cholesterol</i><br>(N=2595)     | 164.3 mg/dL | 169.3 mg/dL | 169.3 mg/dL | 161.7 mg/dL    | p<0.01  |
| High                                     | 9.4         | 15.7        | 12.4        | 7.2            | p<0.01  |
| Borderline                               | 29.0        | 28.9        | 30.9        | 28.5           |         |
| Normal                                   | 61.5        | 55.5        | 56.8        | 64.3           |         |
| <i>LDL</i><br>(N=1107)                   | 95.4 mg/dL  | 100.2 mg/dL | 104.0 mg/dL | 92.6 mg/dL     | p<0.001 |
| High                                     | 8.6         | 11.4        | 10.9        | 7.7            | p<0.05  |
| Borderline                               | 15.2        | 20.2        | 21.7        | 12.5           |         |
| Normal                                   | 76.2        | 68.4        | 67.4        | 79.9           |         |
| <i>HDL</i><br>(N=2595)                   | 49.8 mg/dL  | 43.9 mg/dL  | 47.5 mg/dL  | 51.9 mg/dL     | p<0.001 |
| Low                                      | 6.1         | 15.5        | 8.7         | 3.0            | p<0.001 |
| Normal                                   | 94.0        | 84.5        | 91.3        | 97.0           |         |
| <i>Triglycerides</i><br>(N=1183)         | 90.5 mg/dL  | 129.8 mg/dL | 99.2 mg/dL  | 80.3 mg/dL     | p<0.05  |
| High                                     | 3.4         | 6.7         | 6.1         | 2.1            | p<0.05  |
| Normal                                   | 96.5        | 93.3        | 93.9        | 97.9           |         |
| <i>Fasting plasma glucose</i><br>(N=765) | 93.0 mg/dL  | 97.1 mg/dL  | 93.9 mg/dL  | 92.0 mg/dL     | ns      |
| High                                     | 0.4         | 2.9         | 0.0         | 0.0            | p<0.05  |
| Impaired                                 | 11.1        | 13.0        | 19.1        | 9.3            |         |
| Normal                                   | 88.0        | 84.1        | 80.9        | 90.7           |         |
| <i>Glycohemoglobin</i><br>(N=1636)       | 5.2%        | 5.3         | 5.2         | 5.2            | ns      |
| High                                     | 1.0         | 3.7         | 0.3         | 0.5            | p<0.05  |
| Normal                                   | 99.0        | 96.3        | 99.7        | 99.5           |         |
| <i>Systolic BP</i><br>(N=2456)           | 29.3 %ile   | 39.2 %ile   | 32.7 %ile   | 26.0 %ile      | p<0.001 |
| High                                     | 3.4         | 9.0         | 4.5         | 1.6            | p<0.001 |
| Borderline                               | 3.8         | 5.4         | 4.3         | 3.3            |         |
| Normal                                   | 92.9        | 85.5        | 91.2        | 95.1           |         |
| <i>Diastolic BP</i><br>(N=2456)          | 26.6 %ile   | 26.8 %ile   | 23.0 %ile   | 27.3 %ile      | ns      |
| High                                     | 1.8         | 4.0         | 0.8         | 1.4            | ns      |
| Borderline                               | 2.6         | 4.1         | 1.1         | 2.6            |         |
| Normal                                   | 95.6        | 92.0        | 98.2        | 96.0           |         |
| <i>High BP</i><br>(N=2456)               |             |             |             |                |         |
| Yes                                      | 4.9         | 12.6        | 5.0         | 2.8            | p<0.001 |
| No                                       | 95.1        | 87.5        | 95.0        | 97.2           |         |

Significance tests compare overweight, at risk, and healthy-weight children, using adjusted Wald tests for continuous variables, and adjusted chi-squared tests on the cross-tabs for categorical values.

Unadjusted results show that children who are overweight or at risk for overweight are significantly more likely to have high total cholesterol, low LDL cholesterol, high HDL, and high triglycerides. When looking at continuous laboratory

values, overweight children and those at risk for overweight are have higher mean values of total cholesterol, HDL cholesterol, and triglycerides, and higher LDL cholesterol.

The mean FPG level is 93.0 mg/dL; 98% have a normal FPG, 1.5% have impaired FPG, and 0.4% have FPG high enough ( $> 126$  mg/dl) to indicate possible undiagnosed diabetes. The mean A1c is 5.2%, with 1% showing values high enough ( $> 5.7\%$ ) to indicate possible undiagnosed diabetes. Children who are overweight have higher FPG (97.1 mg/dL) than children who are at risk for overweight (93.9 mg/dL) or healthy weight (92.0 mg/dL), though this relationship is not significant ( $p = 0.06$ ). Overweight children are significantly more likely to be categorized as having a high FPG—almost 3% of overweight children versus no children in the other weight categories. Overweight children do not have a higher average A1c, though they are significantly more likely to have a high A1c—almost 4% of the population, versus less than one-half of one percent in the other weight categories.

The mean percentile for systolic blood pressure is significantly higher among overweight children. Overweight children are also significantly more likely have high systolic blood pressure (9.0%) when compared to normal weight children (1.6%) and those at risk for overweight (4.5%). There were no significant differences in diastolic blood pressure among the weight groups.

#### *Categorical measure of BMI*

Table 3.4 presents logistic regression results examining the effect of weight category on the outcomes of interests. Results are presented as unadjusted odds

ratios and odds ratios adjusted for age, sex, race, poverty status, and insurance type.

**Table 3.4. Unadjusted and adjusted odds ratios for likelihood of abnormal clinical values, compared to children of healthy weight.**

|                                                | Unadjusted       | Adjusted <sup>a</sup> |
|------------------------------------------------|------------------|-----------------------|
| <i>High Total cholesterol (N=2558)</i>         |                  |                       |
| Overweight                                     | 2.4 (1.7-3.5)**  | 2.4 (1.7-3.4)**       |
| At risk for overweight                         | 1.8 (1.1-2.9)*   | 1.7 (1.0-3.4)         |
| <i>High LDL (N=1094)</i>                       |                  |                       |
| Overweight                                     | 1.6 (1.0-2.5)    | 1.6 (0.8-2.9)         |
| At risk for overweight                         | 1.5 (0.6-3.5)    | 1.5 (0.6-3.8)         |
| <i>Low HDL (N=2558)</i>                        |                  |                       |
| Overweight                                     | 6.0 (2.1-16.7)** | 6.0 (2.1-17.5)**      |
| At risk for overweight                         | 3.1 (1.6-6.1)**  | 3.3 (1.6-6.6)**       |
| <i>High Triglycerides (N=1168)</i>             |                  |                       |
| Overweight                                     | 3.4 (1.0-11.4)*  | 3.8 (1.2-12.2)*       |
| At risk for overweight                         | 3.1 (1.0-9.2)*   | 2.9 (1.0-8.3)*        |
| <i>Abnormal Fasting plasma glucose (N=756)</i> |                  |                       |
| Overweight                                     | 1.8 (0.8-4.1)    | 1.9 (0.8-4.4)         |
| At risk for overweight                         | 2.3 (1.0-5.5)    | 1.9 (0.8-4.5)         |
| <i>High Glycohemoglobin (N=763)</i>            |                  |                       |
| Overweight                                     | 8.0 (0.8-75.8)   | 12.3 (0.8-178.1)      |
| At risk for overweight                         | 0.7 (0.0-10.8)   | 5.2 (0.6-42.5)        |
| <i>High Systolic BP (N=2398)</i>               |                  |                       |
| Overweight                                     | 6.2 (2.7-13.8)** | 5.7 (2.6-12.5)**      |
| At risk for overweight                         | 2.9 (1.4-6.1)**  | 3.0 (1.4-6.3)**       |
| <i>High Diastolic BP (N=2418)</i>              |                  |                       |
| Overweight                                     | 2.9 (1.2-7.4)*   | 3.0 (1.1-8.2)*        |
| At risk for overweight                         | 0.5 (0.2-1.8)    | 0.5 (0.1-1.9)         |
| <i>High BP (N=2418)</i>                        |                  |                       |
| Overweight                                     | 5.0 (2.6-9.8)**  | 4.8 (2.5-9.3)**       |
| At risk for overweight                         | 1.9 (0.9-3.8)    | 1.9 (1.0-3.8)         |

<sup>a</sup>Adjusted for age, sex, race, poverty status, and insurance type. \*p<0.05, \*\*p<0.01

Children who are overweight (OR = 2.41) and children at risk for overweight (OR = 1.83) are more likely to have high cholesterol than healthy weight children. Controlling for other factors weakens this relationship for children at risk, but not for overweight children. Children who are overweight (OR = 5.96) and those at risk for overweight (OR = 3.11) are significantly more likely to have low HDL cholesterol levels, when compare to healthy-weight children. These odds ratios are essentially unchanged when controlling for other factors. Children who are overweight (OR = 3.44) or who are at risk for overweight (OR = 3.08) are significantly more likely to

have high triglyceride levels. These relationships are not weakened when controlling for other factors. Weight is not a significant predictor of having high LDL cholesterol.

Results from ordered probit models also demonstrate that children who are overweight or at risk for overweight are more likely to have high or borderline total cholesterol (Table 3.5). In addition, children who are overweight or at risk for overweight are more likely to have high or borderline LDL cholesterol.

**Table 3.5. Unadjusted and adjusted results for the effect of weight on likelihood of abnormal clinic values; results from ordered probit.**

|                                   | Unadjusted | Adjusted <sup>a</sup> |
|-----------------------------------|------------|-----------------------|
| <i>Total cholesterol</i> (N=2558) |            |                       |
| Overweight                        | 0.29**     | 0.29**                |
| At risk for overweight            | 0.22*      | 0.19*                 |
| Cut 1 (borderline)                | 0.38       | 0.35                  |
| Cut 2 (high)                      | 1.41       | 1.40                  |
| <i>LDL cholesterol</i> (N=1094)   |            |                       |
| Overweight                        | 0.33**     | 0.33**                |
| At risk for overweight            | 0.34       | 0.31                  |
| Cut 1 (borderline)                | 0.83       | 0.84                  |
| Cut 2 (high)                      | 1.47       | 1.51                  |
| <i>Systolic BP</i> (N=2398)       |            |                       |
| Overweight                        | 0.63**     | 0.64**                |
| At risk for overweight            | 0.32*      | 0.38**                |
| Cut 1 (borderline)                | 1.67       | 1.91                  |
| Cut 2 (high)                      | 2.05       | 2.30                  |
| <i>Diastolic BP</i> (N=2418)      |            |                       |
| Overweight                        | 0.36*      | 0.40*                 |
| At risk for overweight            | -0.32      | -0.32                 |
| Cut 1 (borderline)                | 1.76       | 1.90                  |
| Cut 2 (high)                      | 2.16       | 2.31                  |
| <i>Fasting glucose</i> (N=756)    |            |                       |
| Overweight                        | 0.40       | 0.43*                 |
| At risk for overweight            | 0.43       | 0.34                  |
| Cut 1 (borderline)                | 1.33       | 1.56                  |
| Cut 2 (high)                      | 2.79       | 3.06                  |

<sup>a</sup>Adjusted for age, sex, race, poverty status, and insurance type. \*p<0.05, \*\*p<0.01

The effect of weight on A1c and FPG is not evident in the logistic regressions, although the greater likelihood of overweight children having a A1c above 5.7% nears significance (Table 3.4). Few children have abnormal values for these measures, creating extremely wide confidence intervals for these analyses. Ordered

probit analyses shows that overweight children are more likely to have high or borderline FPG (Table 3.5).

Children who are overweight are more likely than healthy weight children to have high systolic blood pressure (OR=6.2), high diastolic blood pressure (OR=2.9), and more likely to be hypertensive (OR=5.0) (Table 3.4). Children who are at risk for overweight are more likely to have high systolic blood pressure (OR=2.9), but are not more likely to have high diastolic blood pressure or be considered hypertensive overall. Adjusting for age, sex, race, poverty, and insurance status yields similar results. Results from ordered probit analyses also show that children who are overweight or at risk for overweight are more likely than healthy children to have high or borderline systolic blood pressure, and overweight children are more likely to have high or borderline diastolic blood pressure (Table 3.5).

BMI was also considered as a continuous measure, with similar results (Appendix B). In addition, when stratifying by age results were largely unchanged (Appendix C).

#### *Using 80<sup>th</sup> percentile as cutoff*

Previous specification tests showed that many of the conditions seemed to begin increasing at the 80<sup>th</sup> percentile, rather than the 85<sup>th</sup> and 95<sup>th</sup> percentiles that are traditional cutoffs for overweight and at risk for overweight. More prevalent among children at or above the 80<sup>th</sup> percentile for BMI are: high or borderline total cholesterol, high or borderline LDL cholesterol, low HDL cholesterol, high or borderline systolic blood pressure, and overall hypertension (data not shown). There are no significant differences for high triglycerides, FPG, A1c, or diastolic

blood pressure. Logistic regression analyses show that these differences are consistent even after controlling for demographic characteristics (Table 3.6).

**Table 3.6. Unadjusted and adjusted odds ratios for likelihood of abnormal clinical values, compared to children under the 80<sup>th</sup> percentile.**

|                                                | Unadjusted      | Adjusted <sup>a</sup> |
|------------------------------------------------|-----------------|-----------------------|
| <i>High Total cholesterol (N=2558)</i>         |                 |                       |
| 80 <sup>th</sup> percentile or above           | 2.0 (1.4-2.9)** | 1.9 (1.3-2.7)**       |
| <i>High LDL (N=1094)</i>                       |                 |                       |
| 80 <sup>th</sup> percentile or above           | 1.6 (0.9-2.6)   | 1.7 (1.0-2.9)         |
| <i>Low HDL (N=2412)</i>                        |                 |                       |
| 80 <sup>th</sup> percentile or above           | 4.4 (2.7-7.4)** | 4.6 (2.6-8.4)**       |
| <i>High Triglycerides (N=1168)</i>             |                 |                       |
| 80 <sup>th</sup> percentile or above           | 2.6 (0.9-7.2)   | 2.4 (0.9-6.8)         |
| <i>Abnormal Fasting plasma glucose (N=756)</i> |                 |                       |
| 80 <sup>th</sup> percentile or above           | 1.6 (0.8-3.0)   | 1.4 (0.8-2.7)         |
| <i>High Glycohemoglobin (N=763)</i>            |                 |                       |
| 80 <sup>th</sup> percentile or above           | 3.3 (0.4-27.3)  | 3.9 (0.4-36.1)        |
| <i>High Systolic BP (N=2398)</i>               |                 |                       |
| 80 <sup>th</sup> percentile or above           | 4.2 (1.9-9.3)** | 4.0 (1.8-8.7)**       |
| <i>High Diastolic BP (N=2418)</i>              |                 |                       |
| 80 <sup>th</sup> percentile or above           | 2.5 (1.0-6.3)*  | 2.6 (1.0-6.4)*        |
| <i>High BP (N=2418)</i>                        |                 |                       |
| 80 <sup>th</sup> percentile or above           | 3.4 (1.6-7.1)** | 3.3 (1.6-6.9)**       |

<sup>a</sup>Adjusted for age, sex, race, poverty status, and insurance type. \*p<0.05, \*\*p<0.01

### ***Hypothesis 1b: Overweight children will demonstrate poorer health than healthy-weight children.***

#### ***Parent-reported health status***

In NHANES, fewer parents of overweight children report that the child is in excellent health (36.7%), compared to healthy-weight children (53.3%) (Table 3.7). A similar trend is seen for MEPS, with fewer overweight children (41.8%) reporting excellent health, compared to healthy weight children (55.5%) (Table 3.8).

**Table 3.7. NHANES Health Status.**

|                                       | Total | Overweight | At Risk | Healthy weight |         |
|---------------------------------------|-------|------------|---------|----------------|---------|
| <b>Health Status (N=2875)</b>         |       |            |         |                |         |
| Excellent                             | 50.0  | 36.7       | 49.6    | 53.3           | p<0.001 |
| Very good                             | 26.9  | 28.0       | 29.2    | 26.6           |         |
| Good                                  | 18.4  | 28.0       | 17.6    | 15.9           |         |
| Fair                                  | 4.2   | 6.4        | 3.0     | 3.7            |         |
| Poor                                  | 0.6   | 0.9        | 0.5     | 0.5            |         |
| <b>Missed school days (N=2772)</b>    | 4.1   | 4.2        | 4.1     | 3.3            | ns      |
| Any                                   | 74.0  | 72.9       | 74.1    | 73.9           | ns      |
| More than mean                        | 35.3  | 40.2       | 38.8    | 32.7           | ns      |
| Two or more days                      | 46.6  | 50.2       | 49.9    | 44.4           |         |
| <b>Functional limitation (N=2874)</b> |       |            |         |                |         |
| Yes                                   | 4.7   | 9.5        | 4.2     | 3.4            | p<0.001 |
| None                                  | 95.3  | 90.5       | 95.8    | 96.6           |         |

Significance tests compare overweight, at risk, and healthy weight children, using adjusted Wald tests.

**Table 3.8. MEPS Health Status.**

|                                       | Total | Overweight | At Risk | Healthy weight | Missing weight |        |
|---------------------------------------|-------|------------|---------|----------------|----------------|--------|
| <b>Health Status (N=7355)</b>         |       |            |         |                |                |        |
| Excellent                             | 50.3  | 41.8       | 50.7    | 55.5           | 40.6           | p<.001 |
| Very good                             | 30.9  | 32.8       | 31.3    | 29.2           | 34.7           |        |
| Good                                  | 16.4  | 22.0       | 15.2    | 13.7           | 21.4           |        |
| Fair                                  | 2.1   | 2.9        | 2.4     | 1.5            | 3.1            |        |
| Poor                                  | 0.2   | 0.5        | 0.5     | 0.1            | 0.1            |        |
| <b>Missed school days (N=6860)</b>    | 3.4   |            |         |                |                | p<.05  |
| Any                                   | 64.3  | 65.7       | 66.4    | 64.5           | 59.5           | p<.05  |
| More than mean                        | 31.4  | 34.5       | 32.5    | 31.0           | 27.8           | ns     |
| Two or more days                      | 51.7  | 54.9       | 52.9    | 51.4           | 47.0           | p<.05  |
| <b>Functional limitation (N=7193)</b> |       |            |         |                |                |        |
| Yes                                   | 4.1   | 5.1        | 4.1     | 4.2            | 2.3            | ns     |

Significance tests compare overweight, at risk, and healthy weight children, using adjusted Wald tests.

Logistic regression analyses show that overweight children in NHANES are more likely to report fair or poor health, before adjusting for socioeconomic factors, while at risk for overweight children are less likely to report fair or poor health, after adjusting for socioeconomic factors (Table 3.9).

**Table 3.9. Unadjusted and adjusted odds ratios for likelihood of health status measures, compared to children of healthy weight. (NHANES).**

|                                                      | Unadjusted | Adjusted <sup>a</sup> |
|------------------------------------------------------|------------|-----------------------|
| <i>Fair or poor health (N=2875)</i>                  |            |                       |
| Overweight                                           | 1.82**     | 1.50                  |
| At risk for overweight                               | 0.84       | 0.68*                 |
| <i>Missed any days of school (N=2772)</i>            |            |                       |
| Overweight                                           | 0.95       | 1.06                  |
| At risk for overweight                               | 1.01       | 1.02                  |
| <i>Missed two or more days of school (N=2772)</i>    |            |                       |
| Overweight                                           | 1.26       | 1.36                  |
| At risk for overweight                               | 1.25       | 1.27                  |
| <i>Missed more than mean days of school (N=2772)</i> |            |                       |
| Overweight                                           | 1.38       | 1.47*                 |
| At risk for overweight                               | 1.30       | 1.29                  |
| <i>Functional limitation (N=2874)</i>                |            |                       |
| Overweight                                           | 3.03**     | 3.15**                |
| At risk for overweight                               | 1.26       | 1.16                  |

<sup>a</sup>Adjusted for age, sex, race, poverty status, and insurance type. \*p<0.05, \*\*p<0.01

In MEPS, children who are overweight or at risk for overweight are more likely to report fair or poor health, both before and after adjustment for socioeconomic factors (Table 3.10).

#### *Missed school days*

In NHANES, there is no significant relationship between weight category and mean number of school days missed, having missing any days of school, or having missed two or more days of school (Table 3.7). Although not significant (p = 0.06), there is a trend for overweight children to be more likely to miss more than the mean number of school days. The findings for MEPS are similar, with no significant

differences by weight category for having missed any days of school, more than the mean, or two or more days (Table 3.8).

**Table 3.10. Unadjusted and adjusted odds ratios for likelihood of health status measures, compared to children of healthy weight. (MEPS).**

|                                                      | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
|------------------------------------------------------|-------------------------|-----------------------|
| <i>Fair or poor health (N=7355)</i>                  |                         |                       |
| Overweight                                           | 2.17**                  | 1.90*                 |
| At risk for overweight                               | 1.77*                   | 1.65*                 |
| <i>Missed any days of school (N=6860)</i>            |                         |                       |
| Overweight                                           | 1.05                    | 1.18                  |
| At risk for overweight                               | 1.09                    | 1.15                  |
| <i>Missed two or more days of school (N=6860)</i>    |                         |                       |
| Overweight                                           | 1.15                    | 1.27**                |
| At risk for overweight                               | 1.06                    | 1.11                  |
| <i>Missed more than mean days of school (N=6860)</i> |                         |                       |
| Overweight                                           | 1.17                    | 1.26*                 |
| At risk for overweight                               | 1.07                    | 1.11                  |
| <i>Functional limitation (N=7193)</i>                |                         |                       |
| Overweight                                           | 1.22                    | 1.23                  |
| At risk for overweight                               | 1.09                    | 1.04                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

In NHANES, logistic regression analyses show no differences on any measure of missed school days before adjusting for socioeconomic status (Table 3.9). After adjustment, overweight children have greater odds of having missed more than the mean number of school days (aOR=1.47). Similar results are seen for MEPS, with no significant effects of weight on any measure of school days missed, before adjusting for socioeconomic status (Table 3.10). After adjustment, overweight children are more likely to miss two or more days of school (aOR=1.27) or more than the mean number of days (aOR=1.26).

#### *Functional limitations*

In NHANES, there is a greater prevalence of any walk, run, or play limitation among overweight children (9.5%) compared to healthy weight children (3.4%)

(Table 3.7). No significant differences in the prevalence of any functional limitation by weight are seen in MEPS (Table 3.8).

Logistic regression analysis for NHANES shows that overweight children are more likely to report a walk, run, or play limitation, compared to healthy weight children, both before (OR=3.03) and after (aOR=3.15) adjustment for socioeconomic factors (Table 3.9). Similar analyses for MEPS show no differences in the odds of overweight or at risk for overweight children reporting a functional limitation (Table 3.10).

***Hypothesis 2: Overweight children will use more medical care than healthy-weight children.***

#### *Bivariate analyses*

Most children (65.8%) have at least one outpatient visit in the previous year. Most of these visits are to physicians (62.5%), with fewer children having visits to nurse practitioners (6.4%), physician assistants (1.7%), physical or occupational therapy (1.1%), or hospital outpatient unit (6.2%). Fewer children have an emergency room visit (12.1%) or a hospital inpatient visit (2.1%). Compared to healthy weight children, fewer overweight children have a physician's office visit; there are no other significant differences by weight in the percentage of children with a visit of each type (data not shown).

Among those with any visit, the average number of outpatient visits is 3.6. The average number of emergency room visits and hospital inpatient stays is 1.2, among those with any visit for that care type. There are no significant differences in the number of visits by weight (data not shown).

Results for percentage with any expenditure are similar. The majority (83.5%) of children have some health care expenditure in the previous year. Most children have some outpatient expenditures (64.4%). More children have expenditures for a physician's office (61.4%) than for nurse practitioners (5.9%), physician assistants (1.7%), physical or occupational therapy (1.0%), or hospital outpatient unit (5.9%). Fewer children have expenditures for the emergency room (11.2%) or hospital inpatient use (2.0%). Overweight children are somewhat less likely to have any outpatient expenditure, any physician's office expenditure, any nurse practitioner expenditures, or any health care expenditure year (data not shown). There are no other significant differences in the likelihood of having any expenditure by weight.

Expenditures were analyzed in logged form. There are no significant differences by weight, though children at risk for overweight appear to have fewer physician assistant expenditures (data not shown).

### *Two-part models*

Logistic regressions of the effect of weight on the likelihood of having any visit show no effect of weight on any outpatient visits or on inpatient hospital stays (Table 3.11). No differences are seen after adjustment for socioeconomic factors, either. Children at risk for overweight have greater odds of having an emergency room visit both before (OR=1.26) and after (aOR=1.30) adjustment for socioeconomic factors; no differences are seen for overweight children. Among children with each type of visit, no differences are seen by weight in the number of visits (Table 3.12).

**Table 3.11. Unadjusted and adjusted odds ratios for likelihood of any visit, compared to healthy-weight children (N=7363).**

|                                      | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
|--------------------------------------|-------------------------|-----------------------|
| <i>Physician's office</i>            |                         |                       |
| Overweight                           | 0.89                    | 1.05                  |
| At risk for overweight               | 0.95                    | 1.01                  |
| <i>Nurse practitioner</i>            |                         |                       |
| Overweight                           | 0.92                    | 1.02                  |
| At risk for overweight               | 1.01                    | 1.08                  |
| <i>Physician's assistant</i>         |                         |                       |
| Overweight                           | 0.78                    | 1.06                  |
| At risk for overweight               | 1.29                    | 1.46                  |
| <i>Physical/Occupational Therapy</i> |                         |                       |
| Overweight                           | 0.57                    | 0.62                  |
| At risk for overweight               | 0.63                    | 0.68                  |
| <i>Hospital Outpatient</i>           |                         |                       |
| Overweight                           | 1.22                    | 1.32                  |
| At risk for overweight               | 1.14                    | 1.20                  |
| <i>All Outpatient</i>                |                         |                       |
| Overweight                           | 0.86                    | 1.02                  |
| At risk for overweight               | 0.98                    | 1.05                  |
| <i>Emergency Room</i>                |                         |                       |
| Overweight                           | 1.22                    | 1.23                  |
| At risk for overweight               | 1.26*                   | 1.30*                 |
| <i>Inpatient</i>                     |                         |                       |
| Overweight                           | 1.49                    | 1.51                  |
| At risk for overweight               | 1.13                    | 1.16                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

Logistic regressions of the effect of weight on the likelihood of having any expenditures show no effect of weight on any of the types of outpatient expenditures, either before or after adjusting for socioeconomic factors (Table 3.13). After adjusting for confounders, children at risk for overweight have greater odds of having any emergency room expenditures (aOR=1.26), though no differences exist for overweight children. Overweight children have lower odds of having any expenditure at all (OR=0.70) before adjusting for socioeconomic factors, with no difference after adjustment (aOR=0.92).

**Table 3.12. Unadjusted and adjusted coefficients for effect of weight on total number of visits, among those with any visit.**

|                                             | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
|---------------------------------------------|-------------------------|-----------------------|
| <i>Physician's office (N=4249)</i>          |                         |                       |
| Overweight                                  | 0.04                    | 0.14                  |
| At risk for overweight                      | -0.08                   | -0.02                 |
| Constant                                    | 3.04                    | 3.22                  |
| <i>Nurse practitioner (N=388)</i>           |                         |                       |
| Overweight                                  | 0.12                    | -0.88                 |
| At risk for overweight                      | 0.46                    | 0.61                  |
| Constant                                    | 3.00                    | 3.05                  |
| <i>Physician's assistant (N=104)</i>        |                         |                       |
| Overweight                                  | -0.85                   | -0.43                 |
| At risk for overweight                      | -1.60                   | -1.60                 |
| Constant                                    | 2.76                    | 1.68                  |
| <i>Physical/Occupational Therapy (N=62)</i> |                         |                       |
| Overweight                                  | 2.92                    | 1.22                  |
| At risk for overweight                      | -0.75                   | -0.85                 |
| Constant                                    | 7.87                    | 8.47                  |
| <i>Hospital Outpatient (N=397)</i>          |                         |                       |
| Overweight                                  | -0.39                   | -0.88                 |
| At risk for overweight                      | 0.29                    | -0.19                 |
| Constant                                    | 2.51                    | 2.39                  |
| <i>All Outpatient (N=4483)</i>              |                         |                       |
| Overweight                                  | 0.01                    | 0.10                  |
| At risk for overweight                      | -0.10                   | -0.02                 |
| Constant                                    | 3.66                    | 3.82                  |
| <i>Emergency Room (N=849)</i>               |                         |                       |
| Overweight                                  | 0.09                    | 0.11                  |
| At risk for overweight                      | 0.09                    | 0.10                  |
| Constant                                    | 1.19                    | 1.19                  |
| <i>Inpatient (N=143)</i>                    |                         |                       |
| Overweight                                  | -0.18                   | -0.19                 |
| At risk for overweight                      | 0.03                    | -0.03                 |
| Constant                                    | 1.24                    | 1.09                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

**Table 3.13. Unadjusted and adjusted odds ratios for likelihood of any expenditure, compared to healthy-weight children (N=7363).**

|                                      | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
|--------------------------------------|-------------------------|-----------------------|
| <i>Physician's office</i>            |                         |                       |
| Overweight                           | 0.89                    | 1.06                  |
| At risk for overweight               | 0.93                    | 1.00                  |
| <i>Nurse practitioner</i>            |                         |                       |
| Overweight                           | 0.90                    | 1.02                  |
| At risk for overweight               | 1.01                    | 1.09                  |
| <i>Physician's assistant</i>         |                         |                       |
| Overweight                           | 0.81                    | 1.10                  |
| At risk for overweight               | 1.33                    | 1.52                  |
| <i>Physical/Occupational Therapy</i> |                         |                       |
| Overweight                           | 0.65                    | 0.69                  |
| At risk for overweight               | 0.47                    | 0.50                  |
| <i>Hospital Outpatient</i>           |                         |                       |
| Overweight                           | 1.19                    | 1.31                  |
| At risk for overweight               | 1.14                    | 1.21                  |
| <i>All Outpatient</i>                |                         |                       |
| Overweight                           | 0.87                    | 1.04                  |
| At risk for overweight               | 0.96                    | 1.04                  |
| <i>Emergency Room</i>                |                         |                       |
| Overweight                           | 1.17                    | 1.19                  |
| At risk for overweight               | 1.22                    | 1.26*                 |
| <i>Inpatient</i>                     |                         |                       |
| Overweight                           | 1.54                    | 1.60                  |
| At risk for overweight               | 1.16                    | 1.21                  |
| <i>Total Expenditures</i>            |                         |                       |
| Overweight                           | 0.70**                  | 0.92                  |
| At risk for overweight               | 0.95                    | 1.08                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

There are few differences by weight for logged expenditures (Table 3.14).

Overweight children have more physician assistant expenditures, compared to healthy weight children, both before and after adjusting for socioeconomic factors.

Overweight children have 15% fewer total expenditures before adjusting for socioeconomic factors, and no significant difference after adjustment.

**Table 3.14. Unadjusted and adjusted coefficients for effect of weight on logged expenditures.**

|                                             | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
|---------------------------------------------|-------------------------|-----------------------|
| <i>Physician's office (N=4160)</i>          |                         |                       |
| Overweight                                  | 0.04                    | 0.07                  |
| At risk for overweight                      | -0.08                   | -0.05                 |
| Constant                                    | 5.02                    | 5.07                  |
| <i>Nurse practitioner (N=349)</i>           |                         |                       |
| Overweight                                  | -0.001                  | 0.08                  |
| At risk for overweight                      | -0.150                  | -0.13                 |
| Constant                                    | 4.123                   | 4.14                  |
| <i>Physician's assistant (N=100)</i>        |                         |                       |
| Overweight                                  | 0.85**                  | 0.81*                 |
| At risk for overweight                      | -0.24                   | -0.29                 |
| Constant                                    | 4.08                    | 4.20                  |
| <i>Physical/Occupational Therapy (N=53)</i> |                         |                       |
| Overweight                                  | 0.00                    | -0.20                 |
| At risk for overweight                      | 0.57                    | 0.61                  |
| Constant                                    | 5.41                    | 5.73                  |
| <i>Hospital Outpatient (N=378)</i>          |                         |                       |
| Overweight                                  | 0.27                    | 0.18                  |
| At risk for overweight                      | 0.02                    | -0.02                 |
| Constant                                    | 5.64                    | 5.57                  |
| <i>All Outpatient (N=4371)</i>              |                         |                       |
| Overweight                                  | 0.08                    | 0.11                  |
| At risk for overweight                      | -0.10                   | -0.08                 |
| Constant                                    | 5.12                    | 5.17                  |
| <i>Emergency Room (N=790)</i>               |                         |                       |
| Overweight                                  | -0.13                   | -0.03                 |
| At risk for overweight                      | -0.09                   | -0.03                 |
| Constant                                    | 5.54                    | 5.81                  |
| <i>Inpatient (N=135)</i>                    |                         |                       |
| Overweight                                  | -0.13                   | -0.22                 |
| At risk for overweight                      | 0.47                    | 0.50                  |
| Constant                                    | 8.08                    | 8.38                  |
| <i>Total (N=5781)</i>                       |                         |                       |
| Overweight                                  | -0.15*                  | -0.03                 |
| At risk for overweight                      | -0.07                   | 0.00                  |
| Constant                                    | 6.16                    | 6.35                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

***Hypothesis 3: Having a medical home will improve health outcomes for overweight children.***

**NHANES**

The vast majority of children in NHANES (90.7%) have a single usual source of care other than the emergency room (no table). Children aged 6-11 years are somewhat more likely to have a usual source of care (91.9%) than children aged 12-

17 (89.6%). White children are more likely to have a usual source of care (94.0%) than black children (90.0%), Hispanic children (82.2%), or children of other race (88.6%). White children are also more likely to use a doctor's office or clinic (93.7%) than black children (85.0%), Hispanic children (79.3%), or children of other race (85.3%). Those living below poverty or uninsured are less likely to have a single usual source of care, compared to those above poverty or with public or private insurance. Despite these differences, and the differences in the prevalence of overweight, there are no differences in the likelihood of having a usual source of care or the source of care by weight.

*Health conditions and medical home.* There are no significant differences in the prevalence of dyslipidemia, hyperglycemia, or hypertension by having a usual source of care or by the place where that care is received (Table 3.15). Inconsistent with the idea that sicker children are more likely to obtain care, more children with a usual source of care report excellent health (51.2%) than children without a usual source of care (38.5%). Children receiving care in a doctor's office or clinic are also more likely to report excellent health (51.3%) than those receiving care in a hospital outpatient department (40.1%), the emergency room (39.8%), or other location (33.1%). However, children with a usual source of care, compared to those without one, are more likely to miss any school (75.7% vs. 57.0%), more likely to miss two or more days (47.6% vs. 36.4%), and more likely to miss more than the mean number of days (36.4% vs. 24.4%). In each of these cases, children receiving care at a doctor's office or clinic are more likely to have missed school than those seen in a hospital outpatient department, the emergency room, or other location. There are no

**Table 3.15. NHANES Medical home; prevalence of medical condition by medical home status.**

|                                              | Any Single<br>Non-ER<br>USC | No USC | Office or<br>Clinic | Hospital<br>Outpatient | ER    | Other | None  |
|----------------------------------------------|-----------------------------|--------|---------------------|------------------------|-------|-------|-------|
| <i>Total cholesterol</i><br>(N=2595)         |                             |        |                     |                        |       |       |       |
| High                                         | 9.3                         | 10.3   | 9.3                 | 13.4                   | 15.7  | 16.4  | 9.0   |
| Borderline                                   | 29.5                        | 25.2   | 29.4                | 30.6                   | 21.0  | 21.9  | 25.8  |
| Normal                                       | 61.2                        | 64.6   | 61.3                | 56.0                   | 63.3  | 61.7  | 65.2  |
| <i>LDL</i><br>(N=1107)                       |                             |        |                     |                        |       |       |       |
| High                                         | 8.8                         | 6.1    | 8.9                 | 1.7                    | 7.7   | 100.0 | 5.9   |
| Borderline                                   | 15.1                        | 16.0   | 15.0                | 21.4                   | 21.9  | 0.0   | 15.4  |
| Normal                                       | 76.1                        | 77.9   | 76.1                | 76.9                   | 70.4  | 0.0   | 78.7  |
| <i>HDL</i><br>(N=2595)                       |                             |        |                     |                        |       |       |       |
| Low                                          | 6.3                         | 4.5    | 6.4                 | 3.0                    | 13.9  | 0.0   | 3.2   |
| Normal                                       | 93.7                        | 95.6   | 93.7                | 97.0                   | 86.1  | 100.0 | 96.8  |
| <i>Triglycerides</i><br>(N=1183)             |                             |        |                     |                        |       |       |       |
| High                                         | 3.5                         | 3.2    | 3.5                 | 4.1                    | 0.0   | 0.0   | 3.8   |
| Normal                                       | 96.5                        | 96.8   | 96.6                | 95.9                   | 100.0 | 100.0 | 96.2  |
| <i>Fasting plasma<br/>glucose</i><br>(N=765) |                             |        |                     |                        |       |       |       |
| High                                         | 0.5                         | 0.0    | 0.5                 | 0.0                    | 0.0   | 0.0   | 0.0   |
| Impaired                                     | 11.3                        | 9.6    | 11.5                | 0.0                    | 16.0  | 0.0   | 8.6   |
| Normal                                       | 88.2                        | 90.4   | 88.0                | 100.0                  | 84.0  | 100.0 | 91.5  |
| <i>Glycohemoglobin</i><br>(N=771)            |                             |        |                     |                        |       |       |       |
| High                                         | 1.1                         | 0.0    | 1.1                 | 0.0                    | 0.0   | 0.0   | 0.0   |
| Normal                                       | 98.9                        | 100.0  | 98.9                | 100.0                  | 100.0 | 100.0 | 100.0 |
| <i>Systolic BP</i><br>(N=2436)               |                             |        |                     |                        |       |       |       |
| High                                         | 3.2*                        | 4.4    | 3.3                 | 1.7                    | 2.9   | 0.0   | 4.8   |
| Borderline                                   | 4.1                         | 1.1    | 4.0                 | 8.1                    | 4.6   | 0.0   | 0.5   |
| Normal                                       | 92.7                        | 94.4   | 92.8                | 90.2                   | 92.5  | 100.0 | 94.7  |
| <i>Diastolic BP</i><br>(N=2456)              |                             |        |                     |                        |       |       |       |
| High                                         | 1.8                         | 1.5    | 1.8                 | 0.0                    | 0.0   | 0.0   | 1.8   |
| Borderline                                   | 2.8                         | 0.6    | 2.8                 | 0.0                    | 0.0   | 0.0   | 0.8   |
| Normal                                       | 95.4                        | 97.9   | 95.3                | 100.0                  | 100.0 | 100.0 | 97.4  |
| <i>Health Status</i><br>(N=2958)             |                             |        |                     |                        |       |       |       |
| Excellent                                    | 51.2**                      | 38.5   | 51.3*               | 40.1                   | 39.8  | 33.1  | 39.2  |
| Very Good                                    | 27.4                        | 21.8   | 27.3                | 30.3                   | 18.6  | 42.0  | 21.9  |
| Good                                         | 17.3                        | 29.1   | 17.1                | 24.2                   | 30.9  | 24.9  | 29.5  |
| Fair                                         | 3.7                         | 8.8    | 3.8                 | 4.2                    | 8.0   | 0.0   | 8.7   |
| Poor                                         | 0.4                         | 1.8    | 0.5                 | 1.3                    | 2.7   | 0.0   | 0.6   |
| <i>Missed any<br/>school</i><br>(N=2854)     |                             |        |                     |                        |       |       |       |
| Yes                                          | 75.7**                      | 57.0   | 76.1**              | 57.5                   | 66.5  | 62.6  | 54.7  |
| No                                           | 24.3                        | 43.1   | 23.9                | 42.6                   | 33.5  | 37.4  | 45.3  |
| <i>Missed two or<br/>more days</i>           |                             |        |                     |                        |       |       |       |

|                                                   | Any Single<br>Non-ER<br>USC | No USC | Office or<br>Clinic | Hospital<br>Outpatient | ER   | Other | None |
|---------------------------------------------------|-----------------------------|--------|---------------------|------------------------|------|-------|------|
| (N=2854)                                          |                             |        |                     |                        |      |       |      |
| Yes                                               | 47.6**                      | 36.4   | 48.0**              | 30.0                   | 56.9 | 33.4  | 32.6 |
| No                                                | 52.4                        | 63.6   | 52.0                | 69.8                   | 43.1 | 66.6  | 67.4 |
| <i>Missed more<br/>than mean days</i><br>(N=2854) |                             |        |                     |                        |      |       |      |
| Yes                                               | 36.4**                      | 24.4   | 36.8**              | 19.5                   | 41.9 | 27.6  | 20.7 |
| No                                                | 63.6                        | 75.6   | 63.2                | 80.5                   | 58.4 | 72.4  | 79.3 |
| <i>Any limitation</i><br>(N=2957)                 |                             |        |                     |                        |      |       |      |
| Yes                                               | 4.7                         | 4.8    | 4.6                 | 11.6                   | 3.5  | 12.5  | 5.1  |
| No                                                | 95.3                        | 95.2   | 95.4                | 88.4                   | 96.5 | 87.5  | 94.9 |

Significance tests compare across source of care, using adjusted Wald tests.

differences in the presence of a walk, run, or play limitation by having a usual source of care.

In order to examine the effect of a usual source of care for overweight children, these comparisons were performed for overweight children only. As for the full population, there are no differences in the prevalence of dyslipidemia, hyperglycemia, or hypertension by having a usual source of care or by the place where that care is received (data not shown). Overweight children with a USC are more likely to report excellent health than those without a usual source of care (36.9% vs. 32.8) and less likely to report poor health (0.3% vs. 5.5%). Overweight children with a USC, compared to overweight children without a usual source of care, are more likely to miss any school (76.3% vs. 45.4%), miss two or more days of school (52.8% vs. 28.2%), and miss more than the mean number of days (42.0% vs. 24.8%). There are no differences in the prevalence of a walk, run, or play limitation by having a usual source of care.

Logistic regression analyses show few effects of having a USC on the likelihood of dyslipidemia, hyperglycemia, or hypertension (Table 3.16). Children

who have a USC are less likely to report fair or poor health, before adjusting for socioeconomic factors (OR=0.37). This effect is not significant for overweight children, but is for children at risk for overweight and healthy weight. Children with a USC are more likely to miss any school (OR=2.35), miss two or more days (OR=1.59), or miss more than the mean number of days (OR=1.77), all of which remain significant after adjustment. Similar effects are seen for overweight, at risk for overweight, and healthy weight children, though the effects are less consistent. Having a usual source of care does not affect the odds of having a walk, run, or play limitation for the entire population or by weight.

**Table 3.16. NHANES effect of a usual source of care on health outcomes; for all children and overweight, at risk for overweight, and healthy weight children.**

|                                                   | All children    |                  | Overweight      |                  | At risk for overweight |                  | Healthy weight  |                  |
|---------------------------------------------------|-----------------|------------------|-----------------|------------------|------------------------|------------------|-----------------|------------------|
|                                                   | OR <sup>a</sup> | aOR <sup>b</sup> | OR <sup>a</sup> | aOR <sup>b</sup> | OR <sup>a</sup>        | aOR <sup>b</sup> | OR <sup>a</sup> | aOR <sup>b</sup> |
| <i>High total cholesterol</i><br>(N=2595)         |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 0.89            | 0.76             | 0.93            | 0.71             | 1.41                   | 1.27             | 0.79            | 0.66             |
| <i>High LDL</i><br>(N=1107)                       |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 1.48            | 1.61             | 2.09            | 2.22             | 1.79                   | 2.90             | 1.35            | 1.35             |
| <i>Low HDL</i><br>(N=2595)                        |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 1.44            | 1.66             | 1.76            | 0.85             | 1.13                   | 0.59             | 1.73            | 8.12*            |
| <i>High triglycerides</i><br>(N=1183)             |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 1.07            | 1.58             | 0.99            | 2.61             | 0.68                   | 1.23             | 2.63            | 4.84             |
| <i>Abnormal fasting plasma glucose</i><br>(N=765) |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 1.26            | 1.74             | 0.63            | 0.34             | 1.07                   | 0.84             | 2.14            | 4.39*            |
| <i>Glycohemoglobin</i><br>(N=771)                 |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | -               | -                | -               | -                | -                      | -                | -               | -                |
| <i>High systolic BP</i><br>(N=2436)               |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 0.72            | 0.79             | 1.11            | 1.28             | 1.29                   | 1.28             | 0.46            | 0.42             |
| <i>High diastolic BP</i><br>(N=2456)              |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 1.24            | 1.58             | 2.09            | 1.28             | <sup>c</sup>           | <sup>c</sup>     | 0.73            | 1.04             |
| <i>Fair or poor health</i><br>(N=2958)            |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                         | 0.37**          | 0.69             | 0.34            | 0.28             | 0.22*                  | 0.25*            | 0.43**          | 1.10             |

|                                               | All children    |                  | Overweight      |                  | At risk for overweight |                  | Healthy weight  |                  |
|-----------------------------------------------|-----------------|------------------|-----------------|------------------|------------------------|------------------|-----------------|------------------|
|                                               | OR <sup>a</sup> | aOR <sup>b</sup> | OR <sup>a</sup> | aOR <sup>b</sup> | OR <sup>a</sup>        | aOR <sup>b</sup> | OR <sup>a</sup> | aOR <sup>b</sup> |
| <i>Missed any school</i><br>(N=2854)          |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                     | 2.35**          | 1.77*            | 3.87*           | 2.93             | 2.08                   | 2.67*            | 2.00*           | 1.42             |
| <i>Missed two or more days</i><br>(N=2854)    |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                     | 1.59*           | 1.49*            | 2.85*           | 2.22             | 2.04                   | 2.92             | 1.21            | 1.13             |
| <i>Missed more than mean days</i><br>(N=2854) |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                     | 1.77**          | 1.72**           | 2.20            | 1.78             | 3.57                   | 5.57*            | 1.36            | 1.32             |
| <i>Any limitation</i><br>(N=2957)             |                 |                  |                 |                  |                        |                  |                 |                  |
| Has a USC                                     | 0.99            | 1.24             | 1.14            | 0.78             | 0.53                   | 0.39             | 1.69            | 2.61             |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. <sup>c</sup> Predicts success/failure perfectly so not included in model. \*p<.05, \*\*p<0.01

## MEPS

Table 3.17 shows the individual items used to construct the medical home domains of usual source of care, accessible, family-centered, comprehensive, coordinated, compassionate, and culturally effective.

Table 3.18 shows the average score for each item and each domain (ranging from 0-100), as constructed by assigning values to each possible response (e.g., yes=100, no=0). Children scoring 75 or higher on every domain are considered to have a medical home. Few children (12.5%) have a medical home as defined by the AAP, using this method to construct a variable that represents the entire concept of medical home.

**Table 3.17. Categorical Medical home variables (N=73.55).**

|                                                                          | Total (%) |
|--------------------------------------------------------------------------|-----------|
| <i>Usual source of care</i>                                              |           |
| <i>Has a usual source of care other than ER</i>                          | 87.6      |
| <i>Accessible (USC and <math>\geq 75</math> across domain)</i>           | 45.1      |
| <i>How long it takes to get to USC</i>                                   |           |
| <15 minutes                                                              | 49.0      |
| 15-30 minutes                                                            | 40.9      |
| 31-60 minutes                                                            | 9.1       |
| 61-90 minutes                                                            | 0.5       |
| 91-120 minutes                                                           | 0.2       |
| >120 minutes                                                             |           |
| <i>How difficult it is to get to USC</i>                                 |           |
| Not at all difficult                                                     | 77.5      |
| Not too difficult                                                        | 17.0      |
| Somewhat difficult                                                       | 4.3       |
| Very difficult                                                           | 1.2       |
| <i>USC has night/weekend hours</i>                                       | 53.6      |
| <i>Family-centered (USC and <math>\geq 75</math> across domain)</i>      | 59.5      |
| <i>Sees a particular provider</i>                                        | 80.7      |
| <i>Provider asks person to help decide</i>                               |           |
| Always                                                                   | 49.0      |
| Usually                                                                  | 23.1      |
| Sometimes                                                                | 12.8      |
| Never or don't know                                                      | 15.1      |
| <i>Provider gives person control of treatment</i>                        |           |
| Always                                                                   | 48.0      |
| Usually                                                                  | 24.0      |
| Sometimes                                                                | 14.4      |
| Never or don't know                                                      | 13.6      |
| <i>Provider explains options</i>                                         | 90.1      |
| <i>Comprehensive (USC and <math>\geq 75</math> across domain)</i>        | 86.2      |
| <i>Goes to USC for new health problems</i>                               | 98.5      |
| <i>Goes to USC for preventive care</i>                                   | 98.4      |
| <i>Goes to USC for referrals</i>                                         | 98.1      |
| <i>Goes to USC for ongoing health problems</i>                           | 98.0      |
| <i>Coordinated (USC and <math>\geq 75</math> across domain)</i>          | 61.7      |
| <i>Provider asks about other treatments</i>                              | 70.5      |
| <i>Compassionate (USC and <math>\geq 75</math> across domain)</i>        | 71.3      |
| <i>Provider shows respect for other treatments</i>                       |           |
| Always                                                                   | 58.9      |
| Usually                                                                  | 22.6      |
| Sometimes                                                                | 7.6       |
| Never or don't know                                                      | 11.0      |
| <i>Culturally effective (USC and <math>\geq 75</math> across domain)</i> | 86.5      |
| <i>Provider speaks person's language</i>                                 | 98.9      |
| <i>Medical home (USC and <math>\geq 75</math> across all domains)</i>    | 12.5%     |

**Table 3.18. Continuous medical home variables (N=7355).**

|                                                    | Total |
|----------------------------------------------------|-------|
| <i>Usual source of care</i>                        | 87.6  |
| <i>Has a usual source of care other than ER</i>    | 87.6  |
| <i>Accessible</i>                                  | 67.9  |
| <i>How long it takes to get to USC</i>             | 76.7  |
| <i>How difficult it is to get to USC</i>           | 80.0  |
| <i>USC has night/weekend hours</i>                 | 47.0  |
| <i>Family-centered</i>                             | 67.9  |
| <i>Sees a particular provider</i>                  | 71.0  |
| <i>Provider asks person to help decide</i>         | 60.9  |
| <i>Provider gives person control of treatment</i>  | 60.9  |
| <i>Provider explains options</i>                   | 78.9  |
| <i>Comprehensive</i>                               | 86.1  |
| <i>Goes to USC for new health problems</i>         | 86.3  |
| <i>Goes to USC for preventive care</i>             | 86.2  |
| <i>Goes to USC for referrals</i>                   | 85.9  |
| <i>Goes to USC for ongoing health problems</i>     | 85.9  |
| <i>Coordinated</i>                                 | 61.7  |
| <i>Provider asks about other treatments</i>        | 61.7  |
| <i>Compassionate</i>                               | 68.1  |
| <i>Provider shows respect for other treatments</i> | 68.1  |
| <i>Culturally effective</i>                        | 86.5  |
| <i>Provider speaks person's language</i>           | 86.5  |
| <i>Total Medical Home Score</i>                    | 72.3  |

White children (13.8%) and black children (15.1%) are more likely to have a medical home compared to Hispanic children (8.3%) and those of other race (4.5%). No other differences are seen using the binary measure of medical home (data not shown). The continuous measure of medical home, which represents the average score for all domains, allows detection of some additional differences. Higher medical home scores are seen for younger children, girls, white children, those above poverty, and those with either private or public insurance coverage. There are no differences by weight in having a medical home or the medical home score.

There are also few differences by weight for each item used to construct the medical home variables (data not shown). Overweight children are slightly less likely to report a usual source of care other than the emergency room, more likely to report it is very difficult to get to their USC, more likely to report that their provider

always asks them to help decide on treatments, and more likely to report that the provider always shows respect for other treatments. There are also few differences by weight in the scores for each item and domain (data not shown). Overweight children score slightly lower on how long it takes to get to their USC and how difficult it is to get to their USC, and thus score lower on the accessibility domain.

*Effect of medical home on health outcomes.* Children reporting excellent health are more likely to have a medical home (14.7%), compared to children reporting very good (10.0%), good (10.0%), fair (14.6), or poor health (8.2%). Children who have missed any school due to illness or injury are no more likely to have a medical home than those who have not missed school (data not shown). There are no differences in having a medical home by whether or not the child has a functional limitation.

Logistic regression was used to examine the effects of weight and having a medical home on measures of health status (Table 3.19). The first set of regressions examined weight and the single measure of medical home. Having a medical home did not have a significant effect on the likelihood of reporting fair or poor health, missing any school, missing two or more days of school, missing more than the mean number of days, or having any functional limitation. The second set of regressions included weight and the individual domains that comprise medical home. In these analyses, none of the individual domains consistently showed a relationship to the likelihood of reporting fair or poor health, missing any school, missing two or more days of school, missing more than the mean days of school, or reporting any functional limitation, either before or after adjustment for

socioeconomic factors. The only exception is that having a culturally effective medical home increased the likelihood of missing school on all three measures of missed school.

**Table 3.19. Effect of weight and medical home domains on health outcomes (N=7301).**

|                                   | Complete medical home<br>score |                       | Individual domains      |                       |
|-----------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Fair or poor health</i>        |                                |                       |                         |                       |
| Overweight                        | 2.34**                         | 1.90*                 | 1.56                    | 1.35                  |
| At risk for overweight            | 1.72*                          | 1.57                  | 1.21                    | 1.21                  |
| Medical home                      | 1.11                           | 1.18                  | -                       | -                     |
| Usual source of care              | -                              | -                     | 2.12                    | 1.89                  |
| Accessible                        | -                              | -                     | 0.71                    | 0.83                  |
| Family-centered                   | -                              | -                     | 0.98                    | 1.04                  |
| Comprehensive                     | -                              | -                     | 0.39                    | 0.40                  |
| Coordinated                       | -                              | -                     | 1.16                    | 1.10                  |
| Compassionate                     | -                              | -                     | 0.98                    | 1.01                  |
| Culturally effective              | -                              | -                     | 1.24                    | 1.55                  |
| <i>Missed any school</i>          |                                |                       |                         |                       |
| Overweight                        | 1.16                           | 1.41**                | 1.24                    | 1.43                  |
| At risk for overweight            | 1.15                           | 1.26*                 | 1.41                    | 1.42                  |
| Medical home                      | 1.30                           | 1.23                  | -                       | -                     |
| Usual source of care              | -                              | -                     | 0.89                    | 1.05                  |
| Accessible                        | -                              | -                     | 1.18                    | 1.09                  |
| Family-centered                   | -                              | -                     | 1.01                    | 0.94                  |
| Comprehensive                     | -                              | -                     | 1.34                    | 1.25                  |
| Coordinated                       | -                              | -                     | 0.85                    | 0.90                  |
| Compassionate                     | -                              | -                     | 0.92                    | 0.94                  |
| Culturally effective              | -                              | -                     | 2.27*                   | 1.85                  |
| <i>Missed two or more days</i>    |                                |                       |                         |                       |
| Overweight                        | 1.25*                          | 1.44**                | 1.45                    | 1.60*                 |
| At risk for overweight            | 1.08                           | 1.15                  | 1.52                    | 1.54                  |
| Medical home                      | 1.29                           | 1.24                  | -                       | -                     |
| Usual source of care              | -                              | -                     | 0.90                    | 1.02                  |
| Accessible                        | -                              | -                     | 1.13                    | 1.07                  |
| Family-centered                   | -                              | -                     | 1.04                    | 0.99                  |
| Comprehensive                     | -                              | -                     | 1.07                    | 1.02                  |
| Coordinated                       | -                              | -                     | 0.92                    | 0.96                  |
| Compassionate                     | -                              | -                     | 0.85                    | 0.87                  |
| Culturally effective              | -                              | -                     | 2.60**                  | 2.24**                |
| <i>Missed more than mean days</i> |                                |                       |                         |                       |
| Overweight                        | 1.24*                          | 1.37**                | 1.86*                   | 1.99**                |
| At risk for overweight            | 1.09                           | 1.15                  | 1.82*                   | 1.82*                 |
| Medical home                      | 1.24                           | 1.19                  | -                       | -                     |
| Usual source of care              | -                              | -                     | 0.44                    | 0.50                  |
| Accessible                        | -                              | -                     | 1.19*                   | 1.15                  |
| Family-centered                   | -                              | -                     | 1.13                    | 1.08                  |
| Comprehensive                     | -                              | -                     | 1.06                    | 1.03                  |
| Coordinated                       | -                              | -                     | 0.91                    | 0.94                  |
| Compassionate                     | -                              | -                     | 0.88                    | 0.89                  |
| Culturally effective              | -                              | -                     | 4.94**                  | 4.21**                |
| <i>Any limitation</i>             |                                |                       |                         |                       |

|                        | Complete medical home score |                       | Individual domains      |                       |
|------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                        | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Overweight             | 1.24                        | 1.12                  | <sup>c</sup>            | <sup>c</sup>          |
| At risk for overweight | 0.80                        | 0.79                  |                         |                       |
| Medical home           | 0.62                        | 0.63                  |                         |                       |
| Usual source of care   | -                           | -                     |                         |                       |
| Accessible             | -                           | -                     |                         |                       |
| Family-centered        | -                           | -                     |                         |                       |
| Comprehensive          | -                           | -                     |                         |                       |
| Coordinated            | -                           | -                     |                         |                       |
| Compassionate          | -                           | -                     |                         |                       |
| Culturally effective   | -                           | -                     |                         |                       |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. All models include non-significant interactions between medical home or medical home components, values not shown in this table. <sup>c</sup>Not calculable. \*p<.05, \*\*p<0.01

*Effect of medical home on utilization and expenditures.* The effect of a medical home and the effect of a medical home for overweight children were analyzed for each type of care. There are few significant differences in the less commonly used types of care, so only physician's office, total outpatient, emergency room, and total expenditures are presented here. Complete results for all care types are available in Appendix D. All models included interaction terms for having a medical home and each weight category, or each of the domains and the weight categories. None of the interaction effects were significant for the composite medical home variable and no consistent significant effects were seen for the individual domains, so the interactions terms are not presented in the tables.

For physician's office visits, having a medical home increases the odds of having any visit, both before (OR=1.70) and after (aOR=1.64) adjusting for confounding factors (Table 3.20). When looking at the individual domains, having a usual source of care (aOR=2.11) and reporting a high level of accessibility (aOR=1.30) are associated with greater odds of having any visit. Among children with any visits, the composite medical home score was not significant; however,

reporting a usual source is associated with an average of 1.22 fewer visits, after adjusting for confounders. Overweight and at risk for overweight children also have fewer visits, given that they have had any visit. Similarly, having a medical home is associated with increased odds of having any physician's office expenditure, both before (OR=1.71) and after (aOR=1.66) adjusting for confounding factors. Only reporting high levels of accessibility are associated with increased odds of having any expenditure. Given any physician's office expenditure, children reporting that is family-centered and culturally competent have higher expenditures.

**Table 3.20. Effect of medical home and medical home components on visits and expenditures in physician's offices (N=7301).**

|                                      | Complete medical home<br>score |                       | Individual domains      |                       |
|--------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Likelihood of any visit</i>       |                                |                       |                         |                       |
| <b>Overweight</b>                    | 0.86                           | 1.02                  | 1.04                    | 1.19                  |
| <b>At risk for overweight</b>        | 0.97                           | 1.05                  | 0.94                    | 0.93                  |
| <b>Medical home</b>                  | 1.70**                         | 1.64**                | -                       | -                     |
| Medical home X overweight            | 1.21                           | 1.18                  | -                       | -                     |
| Medical home X at risk               | 0.63                           | 0.61                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | 2.11**                  | 2.24**                |
| USC X overweight                     | -                              | -                     | 0.39                    | 0.34                  |
| USC X at risk                        | -                              | -                     | 0.36                    | 0.35                  |
| <b>Accessible</b>                    | -                              | -                     | 1.39**                  | 1.30**                |
| Accessible X overweight              | -                              | -                     | 0.82                    | 0.81                  |
| Accessible X at risk                 | -                              | -                     | 1.00                    | 0.97                  |
| <b>Family-centered</b>               | -                              | -                     | 1.15                    | 1.11                  |
| Family-centered X overweight         | -                              | -                     | 0.97                    | 0.89                  |
| Family-centered X at risk            | -                              | -                     | 1.05                    | 1.05                  |
| <b>Comprehensive</b>                 | -                              | -                     | 1.28                    | 1.19                  |
| Comprehensive X overweight           | -                              | -                     | 1.67                    | 1.74                  |
| Comprehensive X at risk              | -                              | -                     | 0.96                    | 0.95                  |
| <b>Coordinated</b>                   | -                              | -                     | 1.01                    | 1.05                  |
| Coordinated X overweight             | -                              | -                     | 1.29                    | 1.37                  |
| Coordinated X at risk                | -                              | -                     | 0.85                    | 0.87                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.95                    | 0.96                  |
| Compassionate X overweight           | -                              | -                     | 1.22                    | 1.20                  |
| Compassionate X at risk              | -                              | -                     | 0.98                    | 0.99                  |
| <b>Culturally effective</b>          | -                              | -                     | 1.14                    | 1.00                  |
| Culturally effective X<br>overweight | -                              | -                     | 1.05                    | 1.21                  |
| Culturally effective X at risk       | -                              | -                     | 3.45                    | 3.85                  |
| <i>Number of visits</i>              |                                |                       |                         |                       |
| <b>Overweight</b>                    | 0.09                           | 0.17                  | -0.69**                 | -0.73**               |
| <b>At risk for overweight</b>        | -0.29                          | -0.22                 | -0.75**                 | -0.81**               |
| <b>Medical home</b>                  | -0.19                          | -0.21                 | -                       | -                     |

|                                      | Complete medical home score |                       | Individual domains      |                       |
|--------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Medical home X overweight            | -0.20                       | -0.21                 | -                       | -                     |
| Medical home X at risk               | 0.57                        | 0.57                  | -                       | -                     |
| <b>Usual source of care</b>          | -                           | -                     | -1.25**                 | -1.22**               |
| USC X overweight                     | -                           | -                     | 3.08                    | 2.64                  |
| USC X at risk                        | -                           | -                     | 0.28                    | 0.06                  |
| <b>Accessible</b>                    | -                           | -                     | 0.00                    | -0.06                 |
| Accessible X overweight              | -                           | -                     | 0.02                    | 0.01                  |
| Accessible X at risk                 | -                           | -                     | 0.18                    | 0.17                  |
| <b>Family-centered</b>               | -                           | -                     | 0.28                    | 0.23                  |
| Family-centered X overweight         | -                           | -                     | 0.43                    | 0.37                  |
| Family-centered X at risk            | -                           | -                     | -0.95                   | -0.94                 |
| <b>Comprehensive</b>                 | -                           | -                     | 0.64*                   | 0.55*                 |
| Comprehensive X overweight           | -                           | -                     | -2.22                   | -1.83                 |
| Comprehensive X at risk              | -                           | -                     | 0.07                    | 0.19                  |
| <b>Coordinated</b>                   | -                           | -                     | 0.17                    | 0.20                  |
| Coordinated X overweight             | -                           | -                     | -0.26                   | -0.27                 |
| Coordinated X at risk                | -                           | -                     | 0.12                    | 0.17                  |
| <b>Compassionate</b>                 | -                           | -                     | 0.16                    | 0.13                  |
| Compassionate X overweight           | -                           | -                     | -0.27                   | -0.18                 |
| Compassionate X at risk              | -                           | -                     | -0.58                   | -0.51                 |
| <b>Culturally effective</b>          | -                           | -                     | 0.91**                  | 0.81**                |
| Culturally effective X overweight    | -                           | -                     | 0.00                    | 0.17                  |
| Culturally effective X at risk       | -                           | -                     | 1.34**                  | 1.47**                |
| Constant                             | 3.09                        | 3.25                  | 2.37                    | 2.71                  |
| <i>Likelihood of any expenditure</i> |                             |                       |                         |                       |
| <b>Overweight</b>                    | 0.87                        | 1.03                  | 1.08                    | 1.24                  |
| <b>At risk for overweight</b>        | 0.95                        | 1.03                  | 0.84                    | 0.82                  |
| <b>Medical home</b>                  | 1.71**                      | 1.66**                | -                       | -                     |
| Medical home X overweight            | 1.24                        | 1.21                  | -                       | -                     |
| Medical home X at risk               | 0.66                        | 0.65                  | -                       | -                     |
| <b>Usual source of care</b>          | -                           | -                     | 1.75                    | 1.84                  |
| USC X overweight                     | -                           | -                     | 0.52                    | 0.46                  |
| USC X at risk                        | -                           | -                     | 0.55                    | 0.53                  |
| <b>Accessible</b>                    | -                           | -                     | 1.36**                  | 1.27**                |
| Accessible X overweight              | -                           | -                     | 0.87                    | 0.86                  |
| Accessible X at risk                 | -                           | -                     | 1.09                    | 1.06                  |
| <b>Family-centered</b>               | -                           | -                     | 1.15                    | 1.10                  |
| Family-centered X overweight         | -                           | -                     | 0.97                    | 0.89                  |
| Family-centered X at risk            | -                           | -                     | 1.05                    | 1.06                  |
| <b>Comprehensive</b>                 | -                           | -                     | 1.43                    | 1.34                  |
| Comprehensive X overweight           | -                           | -                     | 1.43                    | 1.47                  |
| Comprehensive X at risk              | -                           | -                     | 0.81                    | 0.80                  |
| <b>Coordinated</b>                   | -                           | -                     | 1.01                    | 1.05                  |
| Coordinated X overweight             | -                           | -                     | 1.28                    | 1.35                  |
| Coordinated X at risk                | -                           | -                     | 0.85                    | 0.87                  |
| <b>Compassionate</b>                 | -                           | -                     | 1.02                    | 1.03                  |
| Compassionate X overweight           | -                           | -                     | 1.14                    | 1.12                  |
| Compassionate X at risk              | -                           | -                     | 0.89                    | 0.90                  |
| <b>Culturally effective</b>          | -                           | -                     | 1.23                    | 1.06                  |
| Culturally effective X overweight    | -                           | -                     | 0.93                    | 1.07                  |
| Culturally effective X at risk       | -                           | -                     | 3.13                    | 3.51                  |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Logged expenditures</i>        |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.08                        | 0.11                  | -0.23                   | -0.25                 |
| <b>At risk for overweight</b>     | -0.14*                      | -0.11                 | -0.34*                  | -0.39*                |
| <b>Medical home</b>               | 0.07                        | 0.07                  | -                       | -                     |
| Medical home X overweight         | -0.16                       | -0.16                 | -                       | -                     |
| Medical home X at risk            | 0.17                        | 0.17                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | -0.33                   | -0.37                 |
| USC X overweight                  | -                           | -                     | 0.98                    | 0.89                  |
| USC X at risk                     | -                           | -                     | -0.64                   | -0.66                 |
| <b>Accessible</b>                 | -                           | -                     | 0.05                    | 0.02                  |
| Accessible X overweight           | -                           | -                     | -0.02                   | -0.01                 |
| Accessible X at risk              | -                           | -                     | -0.04                   | -0.04                 |
| <b>Family-centered</b>            | -                           | -                     | 0.12*                   | 0.11*                 |
| Family-centered X overweight      | -                           | -                     | 0.28*                   | 0.25*                 |
| Family-centered X at risk         | -                           | -                     | -0.44**                 | -0.44**               |
| <b>Comprehensive</b>              | -                           | -                     | 0.01                    | -0.01                 |
| Comprehensive X overweight        | -                           | -                     | -0.56                   | -0.43                 |
| Comprehensive X at risk           | -                           | -                     | 0.35                    | 0.34                  |
| <b>Coordinated</b>                | -                           | -                     | 0.00                    | 0.02                  |
| Coordinated X overweight          | -                           | -                     | 0.01                    | 0.00                  |
| Coordinated X at risk             | -                           | -                     | 0.17                    | 0.18                  |
| <b>Compassionate</b>              | -                           | -                     | 0.03                    | 0.02                  |
| Compassionate X overweight        | -                           | -                     | -0.15                   | -0.13                 |
| Compassionate X at risk           | -                           | -                     | 0.00                    | 0.03                  |
| <b>Culturally effective</b>       | -                           | -                     | 0.39*                   | 0.37*                 |
| Culturally effective X overweight | -                           | -                     | -0.19                   | -0.19                 |
| Culturally effective X at risk    | -                           | -                     | 0.80**                  | 0.87**                |
| Constant                          | 5.02                        | 5.06                  | 4.81                    | 4.96                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. All models include non-significant interactions between medical home or medical home components, values not shown in this table. \*p<.05, \*\*p<0.01

Results for total outpatient visits are similar to physician's office visits (Table 3.21). Children who have a medical home are more likely to have any outpatient visit, both before (OR= 1.60) and after (aOR=1.54) adjusting for confounders. Before adjusting for demographic characteristics, overweight children have lower odds of having any outpatient visit (OR=0.84). When looking at the individual domains, reporting that care is accessible is associated with greater odds of having any outpatient visit. Among children who have had any visit, there is no significant effect of having a medical home or any of the domains, except culturally effective

care, which is associated with a greater number of visits. As with visits, having a medical home is associated with greater odds of having any outpatient expenditure and overweight children have lower odds of having any outpatient expenditure, before controlling for demographic factors. Reporting accessible care is also associated with greater odds of having any expenditure. Finally, reporting culturally effective care is associated with increased total outpatient expenditures, but only before controlling for demographic factors.

**Table 3.21. Effect of medical home and medical home components on all outpatient visits and expenditures (N=7301).**

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Likelihood of any visit</i>    |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.84*                       | 1.00                  | 0.95                    | 1.09                  |
| <b>At risk for overweight</b>     | 0.96                        | 1.05                  | 0.90                    | 0.88                  |
| <b>Medical home</b>               | 1.60**                      | 1.54*                 | -                       | -                     |
| Medical home X overweight         | 1.14                        | 1.12                  | -                       | -                     |
| Medical home X at risk            | 0.88                        | 0.87                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 1.81                    | 1.92                  |
| USC X overweight                  | -                           | -                     | 0.39                    | 0.34                  |
| USC X at risk                     | -                           | -                     | 0.33                    | 0.32                  |
| <b>Accessible</b>                 | -                           | -                     | 1.38**                  | 1.29**                |
| Accessible X overweight           | -                           | -                     | 0.80                    | 0.78                  |
| Accessible X at risk              | -                           | -                     | 1.06                    | 1.02                  |
| <b>Family-centered</b>            | -                           | -                     | 1.13                    | 1.08                  |
| Family-centered X overweight      | -                           | -                     | 1.01                    | 0.94                  |
| Family-centered X at risk         | -                           | -                     | 0.93                    | 0.94                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.24                    | 1.15                  |
| Comprehensive X overweight        | -                           | -                     | 1.93                    | 2.09                  |
| Comprehensive X at risk           | -                           | -                     | 0.98                    | 0.99                  |
| <b>Coordinated</b>                | -                           | -                     | 1.02                    | 1.07                  |
| Coordinated X overweight          | -                           | -                     | 1.24                    | 1.32                  |
| Coordinated X at risk             | -                           | -                     | 0.97                    | 0.99                  |
| <b>Compassionate</b>              | -                           | -                     |                         |                       |
|                                   |                             |                       | 0.92                    | 0.93                  |
| Compassionate X overweight        | -                           | -                     | 1.18                    | 1.15                  |
| Compassionate X at risk           | -                           | -                     | 1.16                    | 1.17                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.35                    | 1.17                  |
| Culturally effective X overweight | -                           | -                     | 0.99                    | 1.14                  |
| Culturally effective X at risk    | -                           | -                     | 3.45                    | 3.82                  |
| <i>Number of visits</i>           |                             |                       |                         |                       |
| <b>Overweight</b>                 | -0.06                       | 0.00                  | -0.47                   | -0.50                 |
| <b>At risk for overweight</b>     | -0.31                       | -0.22                 | -0.57                   | -0.60                 |
| <b>Medical home</b>               | -0.14                       | -0.20                 | -                       | -                     |
| Medical home X overweight         | 0.66                        | 0.64                  | -                       | -                     |

|                                      | Complete medical home<br>score |                       | Individual domains      |                       |
|--------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Medical home X at risk               | 0.32                           | 0.27                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | -1.29                   | -1.04                 |
| USC X overweight                     | -                              | -                     | 3.34                    | 2.92                  |
| USC X at risk                        | -                              | -                     | -1.16                   | -1.29                 |
| <b>Accessible</b>                    | -                              | -                     | 0.04                    | -0.04                 |
| Accessible X overweight              | -                              | -                     | 0.18                    | 0.19                  |
| Accessible X at risk                 | -                              | -                     | 0.51                    | 0.48                  |
| <b>Family-centered</b>               | -                              | -                     | 0.13                    | 0.09                  |
| Family-centered X overweight         | -                              | -                     | 0.97                    | 0.92                  |
| Family-centered X at risk            | -                              | -                     | -1.65                   | -1.67                 |
| <b>Comprehensive</b>                 | -                              | -                     | 0.73                    | 0.62                  |
| Comprehensive X overweight           | -                              | -                     | -2.75                   | -2.26                 |
| Comprehensive X at risk              | -                              | -                     | 0.44                    | 0.45                  |
| <b>Coordinated</b>                   | -                              | -                     | 0.22                    | 0.27                  |
| Coordinated X overweight             | -                              | -                     | -0.32                   | -0.31                 |
| Coordinated X at risk                | -                              | -                     | 0.30                    | 0.33                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.13                    | 0.09                  |
| Compassionate X overweight           | -                              | -                     | -0.28                   | -0.24                 |
| Compassionate X at risk              | -                              | -                     | 0.15                    | 0.27                  |
| <b>Culturally effective</b>          | -                              | -                     | 1.39**                  | 1.07**                |
| Culturally effective X<br>overweight | -                              | -                     | -0.40                   | -0.39                 |
| Culturally effective X at risk       | -                              | -                     | 1.79*                   | 1.90*                 |
| Constant                             | 3.72                           | 3.84                  | 2.55                    | 2.90                  |
| <i>Likelihood of any expenditure</i> |                                |                       |                         |                       |
| <b>Overweight</b>                    | 0.85*                          | 1.02                  | 1.00                    | 1.15                  |
| <b>At risk for overweight</b>        | 0.95                           | 1.04                  | 0.85                    | 0.83                  |
| <b>Medical home</b>                  | 1.64**                         | 1.57**                | -                       | -                     |
| Medical home X overweight            | 1.18                           | 1.15                  | -                       | -                     |
| Medical home X at risk               | 0.83                           | 0.82                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | 1.65                    | 1.74                  |
| USC X overweight                     | -                              | -                     | 0.49                    | 0.43                  |
| USC X at risk                        | -                              | -                     | 0.45                    | 0.44                  |
| <b>Accessible</b>                    | -                              | -                     | 1.36**                  | 1.27**                |
| Accessible X overweight              | -                              | -                     | 0.87                    | 0.85                  |
| Accessible X at risk                 | -                              | -                     | 1.15                    | 1.11                  |
| <b>Family-centered</b>               | -                              | -                     | 1.12                    | 1.07                  |
| Family-centered X overweight         | -                              | -                     | 1.04                    | 0.95                  |
| Family-centered X at risk            | -                              | -                     | 0.95                    | 0.95                  |
| <b>Comprehensive</b>                 | -                              | -                     | 1.32                    | 1.23                  |
| Comprehensive X overweight           | -                              | -                     | 1.72                    | 1.81                  |
| Comprehensive X at risk              | -                              | -                     | 0.85                    | 0.85                  |
| <b>Coordinated</b>                   | -                              | -                     | 1.03                    | 1.09                  |
| Coordinated X overweight             | -                              | -                     | 1.23                    | 1.31                  |
| Coordinated X at risk                | -                              | -                     | 0.95                    | 0.98                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.98                    | 0.99                  |
| Compassionate X overweight           | -                              | -                     | 1.06                    | 1.03                  |
| Compassionate X at risk              | -                              | -                     | 1.02                    | 1.03                  |
| <b>Culturally effective</b>          | -                              | -                     | 1.36                    | 1.17                  |
| Culturally effective X<br>overweight | -                              | -                     | 0.91                    | 1.04                  |
| Culturally effective X at risk       | -                              | -                     | 3.27                    | 3.66                  |
| <i>Logged expenditures</i>           |                                |                       |                         |                       |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Overweight</b>                 | 0.11                        | 0.13                  | 0.09                    | 0.08                  |
| <b>At risk for overweight</b>     | -0.15*                      | -0.13                 | -0.33                   | -0.36                 |
| <b>Medical home</b>               | 0.07                        | 0.06                  | -                       | -                     |
| Medical home X overweight         | -0.03                       | -0.03                 | -                       | -                     |
| Medical home X at risk            | 0.05                        | 0.03                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | -0.20                   | -0.22                 |
| USC X overweight                  | -                           | -                     | 0.56                    | 0.45                  |
| USC X at risk                     | -                           | -                     | -0.35                   | -0.36                 |
| <b>Accessible</b>                 | -                           | -                     | 0.02                    | 0.00                  |
| Accessible X overweight           | -                           | -                     | 0.00                    | 0.01                  |
| Accessible X at risk              | -                           | -                     | -0.03                   | -0.03                 |
| <b>Family-centered</b>            | -                           | -                     | 0.09                    | 0.08                  |
| Family-centered X overweight      | -                           | -                     | 0.34*                   | 0.32*                 |
| Family-centered X at risk         | -                           | -                     | -0.34                   | -0.34*                |
| <b>Comprehensive</b>              | -                           | -                     | 0.11                    | 0.08                  |
| Comprehensive X overweight        | -                           | -                     | -0.64                   | -0.50                 |
| Comprehensive X at risk           | -                           | -                     | 0.00                    | -0.03                 |
| <b>Coordinated</b>                | -                           | -                     | -0.01                   | 0.01                  |
| Coordinated X overweight          | -                           | -                     | -0.01                   | -0.01                 |
| Coordinated X at risk             | -                           | -                     | 0.11                    | 0.11                  |
| <b>Compassionate</b>              | -                           | -                     | 0.03                    | 0.02                  |
| Compassionate X overweight        | -                           | -                     | -0.10                   | -0.08                 |
| Compassionate X at risk           | -                           | -                     | -0.09                   | -0.07                 |
| <b>Culturally effective</b>       | -                           | -                     | 0.39*                   | 0.35                  |
| Culturally effective X overweight | -                           | -                     | -0.09                   | -0.08                 |
| Culturally effective X at risk    | -                           | -                     | 0.86**                  | 0.93**                |
| Constant                          | 5.11                        | 5.16                  | 4.76                    | 4.89                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. All models include interactions between medical home or medical home components, values not shown in this table. \*p<.05, \*\*p<0.01

Overweight children are more likely to have any emergency room visit, both before (OR=1.32) and after (aOR=1.33) controlling for demographic factors. Neither having a medical home nor any of the medical home domains are associated with the likelihood of having any emergency room visit (Table 3.22). There is no effect of the composite medical home variable on the total number of emergency room visits, among children with any emergency room visit. However, children reporting that health care is accessible have, on average, fewer emergency room visits, and those reporting that care is comprehensive have more. There are few significant effects of

either having medical home or the medical home domains on total emergency room expenditures.

**Table 3.22. Effect of medical home and medical home components on emergency room visits and expenditures (N=7301).**

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Likelihood of any visit</i>    |                             |                       |                         |                       |
| <b>Overweight</b>                 | 1.32*                       | 1.33*                 | 1.46                    | 1.41                  |
| <b>At risk for overweight</b>     | 1.19                        | 1.24                  | 1.69                    | 1.67                  |
| <b>Medical home</b>               | 1.08                        | 1.05                  | -                       | -                     |
| Medical home X overweight         | 0.68                        | 0.66                  | -                       | -                     |
| Medical home X at risk            | 1.09                        | 1.05                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 1.48                    | 1.65                  |
| USC X overweight                  | -                           | -                     | 0.08                    | 0.09                  |
| USC X at risk                     | -                           | -                     | 0.75                    | 0.83                  |
| <b>Accessible</b>                 | -                           | -                     | 1.13                    | 1.12                  |
| Accessible X overweight           | -                           | -                     | 0.71                    | 0.70                  |
| Accessible X at risk              | -                           | -                     | 0.72                    | 0.72                  |
| <b>Family-centered</b>            | -                           | -                     | 1.20                    | 1.21                  |
| Family-centered X overweight      | -                           | -                     | 0.83                    | 0.82                  |
| Family-centered X at risk         | -                           | -                     | 0.94                    | 0.92                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.66                    | 0.66                  |
| Comprehensive X overweight        | -                           | -                     | 3.94                    | 4.22                  |
| Comprehensive X at risk           | -                           | -                     | 3.52                    | 3.33                  |
| <b>Coordinated</b>                | -                           | -                     | 0.81                    | 0.82                  |
| Coordinated X overweight          | -                           | -                     | 1.25                    | 1.25                  |
| Coordinated X at risk             | -                           | -                     | 1.37                    | 1.38                  |
| <b>Compassionate</b>              | -                           | -                     | 0.80                    | 0.77                  |
| Compassionate X overweight        | -                           | -                     | 0.88                    | 0.83                  |
| Compassionate X at risk           | -                           | -                     | 0.67                    | 0.71                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.75                    | 1.40                  |
| Culturally effective X overweight | -                           | -                     | 3.45                    | 3.15                  |
| Culturally effective X at risk    | -                           | -                     | 0.38                    | 0.37                  |
| <i>Number of visits</i>           |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.06                        | 0.07                  | -0.03                   | -0.05                 |
| <b>At risk for overweight</b>     | 0.01                        | 0.02                  | -0.07                   | -0.06                 |
| <b>Medical home</b>               | -0.09                       | -0.08                 | -                       | -                     |
| Medical home X overweight         | 0.21                        | 0.21                  | -                       | -                     |
| Medical home X at risk            | 0.07                        | 0.06                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | -0.44**                 | -0.48**               |
| USC X overweight                  | -                           | -                     | 1.22**                  | 1.34**                |
| USC X at risk                     | -                           | -                     | -0.27                   | -0.26                 |
| <b>Accessible</b>                 | -                           | -                     | -0.05                   | -0.05                 |
| Accessible X overweight           | -                           | -                     | 0.15                    | 0.14                  |
| Accessible X at risk              | -                           | -                     | 0.21                    | 0.23                  |
| <b>Family-centered</b>            | -                           | -                     | -0.06                   | -0.07                 |
| Family-centered X overweight      | -                           | -                     | -0.13                   | -0.14                 |
| Family-centered X at risk         | -                           | -                     | -0.24                   | -0.24                 |
| <b>Comprehensive</b>              | -                           | -                     | 0.22**                  | 0.20**                |
| Comprehensive X overweight        | -                           | -                     | 0.22                    | 0.13                  |
| Comprehensive X at risk           | -                           | -                     | 0.15                    | 0.15                  |

|                                      | Complete medical home<br>score |                       | Individual domains      |                       |
|--------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Coordinated</b>                   | -                              | -                     | 0.08                    | 0.10                  |
| Coordinated X overweight             | -                              | -                     | 0.12                    | 0.08                  |
| Coordinated X at risk                | -                              | -                     | -0.32                   | -0.32                 |
| <b>Compassionate</b>                 | -                              | -                     | 0.03                    | 0.04                  |
| Compassionate X overweight           | -                              | -                     | -0.04                   | -0.02                 |
| Compassionate X at risk              | -                              | -                     | 0.19                    | 0.20                  |
| <b>Culturally effective</b>          | -                              | -                     | 0.15                    | 0.20**                |
| Culturally effective X<br>overweight | -                              | -                     | -1.34**                 | -1.32                 |
| Culturally effective X at risk       | -                              | -                     | 0.45                    | 0.42                  |
| Constant                             | 1.20                           | 1.19                  | 1.25                    | 1.25                  |
| <i>Likelihood of any expenditure</i> |                                |                       |                         |                       |
| <b>Overweight</b>                    | 1.26                           | 1.27                  | 1.61                    | 1.56                  |
| <b>At risk for overweight</b>        | 1.15                           | 1.20                  | 1.80*                   | 1.77                  |
| <b>Medical home</b>                  | 1.14                           | 1.11                  | -                       | -                     |
| Medical home X overweight            | 0.72                           | 0.69                  | -                       | -                     |
| Medical home X at risk               | 1.14                           | 1.11                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | 0.71                    | 0.75                  |
| USC X overweight                     | -                              | -                     | 0.18                    | 0.20                  |
| USC X at risk                        | -                              | -                     | 1.91                    | 2.15                  |
| <b>Accessible</b>                    | -                              | -                     | 1.12                    | 1.11                  |
| Accessible X overweight              | -                              | -                     | 0.80                    | 0.80                  |
| Accessible X at risk                 | -                              | -                     | 0.74                    | 0.73                  |
| <b>Family-centered</b>               | -                              | -                     | 1.23                    | 1.24                  |
| Family-centered X overweight         | -                              | -                     | 0.75                    | 0.74                  |
| Family-centered X at risk            | -                              | -                     | 0.88                    | 0.85                  |
| <b>Comprehensive</b>                 | -                              | -                     | 0.69                    | 0.69                  |
| Comprehensive X overweight           | -                              | -                     | 3.41                    | 3.55                  |
| Comprehensive X at risk              | -                              | -                     | 3.12                    | 2.91                  |
| <b>Coordinated</b>                   | -                              | -                     | 0.80                    | 0.81                  |
| Coordinated X overweight             | -                              | -                     | 1.42                    | 1.42                  |
| Coordinated X at risk                | -                              | -                     | 1.25                    | 1.26                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.84                    | 0.81                  |
| Compassionate X overweight           | -                              | -                     | 0.88                    | 0.83                  |
| Compassionate X at risk              | -                              | -                     | 0.68                    | 0.72                  |
| <b>Culturally effective</b>          | -                              | -                     | 3.76                    | 3.10                  |
| Culturally effective X<br>overweight | -                              | -                     | 1.43                    | 1.30                  |
| Culturally effective X at risk       | -                              | -                     | 0.16                    | 0.16                  |
| <i>Logged expenditures</i>           |                                |                       |                         |                       |
| <b>Overweight</b>                    | -0.15                          | -0.07                 | -0.09                   | -0.11                 |
| <b>At risk for overweight</b>        | -0.12                          | -0.06                 | -0.35                   | -0.33                 |
| <b>Medical home</b>                  | 0.14                           | 0.00                  | -                       | -                     |
| Medical home X overweight            | -0.01                          | 0.11                  | -                       | -                     |
| Medical home X at risk               | -0.03                          | 0.04                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | -0.48                   | -0.64                 |
| USC X overweight                     | -                              | -                     | 1.85*                   | 2.61**                |
| USC X at risk                        | -                              | -                     | 1.19                    | 1.51                  |
| <b>Accessible</b>                    | -                              | -                     | 0.24*                   | 0.16                  |
| Accessible X overweight              | -                              | -                     | -0.05                   | -0.05                 |
| Accessible X at risk                 | -                              | -                     | -0.08                   | -0.13                 |
| <b>Family-centered</b>               | -                              | -                     | 0.20                    | 0.10                  |
| Family-centered X overweight         | -                              | -                     | 0.07                    | 0.01                  |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Family-centered X at risk         | -                           | -                     | 0.12                    | 0.27                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.03                    | 0.09                  |
| Comprehensive X overweight        | -                           | -                     | 0.81*                   | 1.08**                |
| Comprehensive X at risk           | -                           | -                     | 0.10                    | -0.30                 |
| <b>Coordinated</b>                | -                           | -                     | -0.11                   | -0.09                 |
| Coordinated X overweight          | -                           | -                     | 0.41                    | 0.45                  |
| Coordinated X at risk             | -                           | -                     | -0.18                   | -0.15                 |
| <b>Compassionate</b>              | -                           | -                     | -0.08                   | -0.03                 |
| Compassionate X overweight        | -                           | -                     | -0.05                   | 0.09                  |
| Compassionate X at risk           | -                           | -                     | -0.03                   | -0.03                 |
| <b>Culturally effective</b>       | -                           | -                     | 0.44                    | 0.47                  |
| Culturally effective X overweight | -                           | -                     | -2.97**                 | -3.98**               |
| Culturally effective X at risk    | -                           | -                     | -0.86                   | -0.85                 |
| Constant                          | 5.54                        | 5.82                  | 5.42                    | 5.82                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. All models include interactions between medical home or medical home components, values not shown in this table. \*p<.05, \*\*p<0.01

Having a medical home is associate with greater total health care expenditures, both before (OR=1.95) and after (aOR=1.77) adjusting for confounding factors (Table 3.23). Before adjusting for demographics, overweight children are less likely to have any health care expenditure (OR=0.70). Reporting that care is accessible (OR=1.37) and culturally effective (OR=1.95) is associated with greater odds of having any health care expenditure, before adjusting for confounders. Among children with health care expenditures, the only significant effect of having a medical home or its domains is that children reporting that care is culturally effective have greater expenditures, before controlling for demographics.

**Table 3.23. Effect of medical home and medical home components on all health care expenditures (N=7301)..**

|                                      | Complete medical home score |                       | Individual domains      |                       |
|--------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Likelihood of any expenditure</i> |                             |                       |                         |                       |
| <b>Overweight</b>                    | 0.70**                      | 0.92                  | 0.90                    | 1.11                  |
| <b>At risk for overweight</b>        | 0.98                        | 1.14                  | 1.09                    | 1.08                  |
| <b>Medical home</b>                  | 1.95**                      | 1.77**                | -                       | -                     |
| Medical home X overweight            | 0.95                        | 0.93                  | -                       | -                     |
| Medical home X at risk               | 0.65                        | 0.60                  | -                       | -                     |
| <b>Usual source of care</b>          | -                           | -                     | 2.34                    | 2.55                  |

|                                      | Complete medical home<br>score |                       | Individual domains      |                       |
|--------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| USC X overweight                     | -                              | -                     | 0.39                    | 0.35                  |
| USC X at risk                        | -                              | -                     | 3.29                    | 3.09                  |
| <b>Accessible</b>                    | -                              | -                     | 1.37**                  | 1.20                  |
| Accessible X overweight              | -                              | -                     | 0.80                    | 0.76                  |
| Accessible X at risk                 | -                              | -                     | 1.42                    | 1.34                  |
| <b>Family-centered</b>               | -                              | -                     | 1.20                    | 1.10                  |
| Family-centered X overweight         | -                              | -                     | 1.05                    | 0.92                  |
| Family-centered X at risk            | -                              | -                     | 0.95                    | 0.95                  |
| <b>Comprehensive</b>                 | -                              | -                     | 0.81                    | 0.73                  |
| Comprehensive X overweight           | -                              | -                     | 1.93                    | 2.06                  |
| Comprehensive X at risk              | -                              | -                     | 0.18                    | 0.19                  |
| <b>Coordinated</b>                   | -                              | -                     | 1.03                    | 1.14                  |
| Coordinated X overweight             | -                              | -                     | 0.97                    | 1.03                  |
| Coordinated X at risk                | -                              | -                     | 0.67                    | 0.67                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.98                    | 0.99                  |
| Compassionate X overweight           | -                              | -                     | 1.33                    | 1.30                  |
| Compassionate X at risk              | -                              | -                     | 1.26                    | 1.31                  |
| <b>Culturally effective</b>          | -                              | -                     | 1.95**                  | 1.50                  |
| Culturally effective X<br>overweight | -                              | -                     | 0.88                    | 1.05                  |
| Culturally effective X at risk       | -                              | -                     | 1.53                    | 1.77                  |
| <i>Logged expenditures</i>           |                                |                       |                         |                       |
| <b>Overweight</b>                    | -0.11                          | -0.01                 | -0.19                   | -0.12                 |
| <b>At risk for overweight</b>        | -0.16*                         | -0.08                 | -0.08                   | -0.08                 |
| <b>Medical home</b>                  | 0.06                           | 0.05                  | -                       | -                     |
| Medical home X overweight            | -0.04                          | -0.07                 | -                       | -                     |
| Medical home X at risk               | 0.49*                          | 0.47*                 | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | -0.09                   | 0.01                  |
| USC X overweight                     | -                              | -                     | 0.63                    | 0.70                  |
| USC X at risk                        | -                              | -                     | -0.39                   | -0.51                 |
| <b>Accessible</b>                    | -                              | -                     | 0.07                    | 0.01                  |
| Accessible X overweight              | -                              | -                     | 0.07                    | 0.06                  |
| Accessible X at risk                 | -                              | -                     | 0.05                    | 0.02                  |
| <b>Family-centered</b>               | -                              | -                     | 0.09                    | 0.05                  |
| Family-centered X overweight         | -                              | -                     | 0.08                    | 0.02                  |
| Family-centered X at risk            | -                              | -                     | 0.06                    | 0.07                  |
| <b>Comprehensive</b>                 | -                              | -                     | 0.17                    | 0.08                  |
| Comprehensive X overweight           | -                              | -                     | -0.72                   | -0.68                 |
| Comprehensive X at risk              | -                              | -                     | 0.21                    | 0.26                  |
| <b>Coordinated</b>                   | -                              | -                     | -0.06                   | 0.00                  |
| Coordinated X overweight             | -                              | -                     | -0.01                   | 0.02                  |
| Coordinated X at risk                | -                              | -                     | 0.05                    | 0.07                  |
| <b>Compassionate</b>                 | -                              | -                     | 0.04                    | 0.04                  |
| Compassionate X overweight           | -                              | -                     | -0.02                   | -0.01                 |
| Compassionate X at risk              | -                              | -                     | -0.19                   | -0.18                 |
| <b>Culturally effective</b>          | -                              | -                     | 0.43**                  | 0.28                  |
| Culturally effective X<br>overweight | -                              | -                     | 0.08                    | 0.02                  |
| Culturally effective X at risk       | -                              | -                     | 0.26                    | 0.38                  |
| Constant                             | 6.16                           | 6.33                  | 5.60                    | 5.93                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. All models include interactions between medical home or medical home components, values not shown in this table. \*p<.05, \*\*p<0.01

## **CHAPTER 4**

### **DISCUSSION**

Current efforts to address childhood overweight have had little effect. One reason is that childhood overweight may not be viewed as a serious and immediate problem. These results demonstrate the medical needs of overweight children and give new urgency to the need to develop ways to reduce the health burden of overweight in children. Because of the increased risk of medical conditions in this population, policies will need to consider not only children, but parents and health care providers as well.

#### ***Health conditions of overweight children***

These results from two nationally representative surveys suggested that overweight children have more chronic conditions, poorer health, and lower health care expenditures than healthy weight children. Compared to normal-weight children, overweight children were found to have substantially higher prevalence of three specific weight-related chronic conditions (i.e., dyslipidemia, hypertension, and dysglycemia) and poorer health status. Although previous studies have reported associations of overweight with hypertension,<sup>19, 20, 32, 33</sup> hyperlipidemia,<sup>27, 28, 31-34</sup> and dysglycemia<sup>27, 37</sup>, this study is the first to use nationally representative, population-based samples to compare the prevalence of these conditions in healthy weight, at

risk for overweight, and overweight children. The overall prevalence of dysglycemia, hypertension, and dyslipidemia in this study is similar to that identified in previous studies;<sup>32, 127</sup> the work contributes to earlier studies by demonstrating a marked increase in the prevalence of these conditions in overweight children compared with healthy-weight children in a recent national sample.

### ***Health status of overweight children***

As hypothesized, consistent with previous studies,<sup>88-90</sup> overweight children reported poorer health compared with healthy-weight children. This finding is not surprising, given the associations previously reported between overweight and multiple medical problems including type 2 diabetes,<sup>38, 39</sup> hepatic steatosis,<sup>40-43</sup> cholelithiasis,<sup>44-46</sup> pseudotumor cerebri,<sup>47, 48</sup> sleep apnea,<sup>49, 50</sup> orthopedic conditions,<sup>51-53</sup> and polycystic ovarian syndrome.<sup>54</sup> Curiously, despite reports of poorer health, overweight children did not report missing more days of school than healthy-weight children. If children continue to attend school despite poor health, they may not be able to learn and perform optimally. Given that previous studies have described the associations between poorer school performance and overweight,<sup>129, 130</sup> the specific reasons for reported poor health in overweight children deserve elucidation in future studies.

### ***Use of medical care***

Interestingly, despite having more chronic conditions and poorer health, overweight children have lower health care expenditures than normal-weight children. This is likely due to the greater prevalence of poverty and minority status

among overweight children, given that there are no observed significant differences in care expenditures by overweight, at-risk and healthy weight children after adjusting for race, insurance, and poverty status. Additionally, though there were no statistically significant differences in specific types of care expenditures, the data suggested that overweight children may be more likely to accumulate expenditures due to inpatient care, and less likely to accumulate them in outpatient office settings. Finally, health problems such as hypertension may be asymptomatic and undiagnosed.

It was not possible to directly examine unmet needs for care for weight-related conditions with the data currently available. However, because both NHANES and MEPS are nationally representative samples, some comment can be made on the findings from the two surveys, taken together. The greater prevalence of illness seen using the objective measures from NHANES should indicate increased needs for medical care among overweight children. Because there is no indication that overweight children are actually receiving more medical care than their healthy-weight peers, they likely have needs for medical care that are not being met.

These causes of unmet needs for weight-related conditions may be due to factors associated with the child, the family, and/or health care providers. Because overweight children are more likely to be poor or minority, they may have less access to medical care. In the absence of recommendations by a physician or other provider, children and parents may simply not recognize any increased need for medical care.

Increasing access may not be sufficient. Parents rely on providers to screen for and diagnose weight-related conditions. Unfortunately, providers do not appear to screen for dyslipidemia<sup>83</sup> and type 2 diabetes,<sup>79</sup> so these conditions may go unrecognized by either the provider or the parents. Our findings suggest that failing to screen may be especially concerning among overweight children.

Treatment of weight-related medical conditions in childhood is very important. Although there is limited evidence that treatment of weight-related conditions in children directly reduces adult mortality, there is evidence that children with dyslipidemia,<sup>131</sup> dysglycemia,<sup>132</sup> and hypertension<sup>133</sup> are more likely to become adults with these conditions, and adults with these conditions are more likely to suffer from cardiovascular disease.<sup>134-136</sup> Adequate treatment of these conditions in childhood may be a way to reduce adult morbidity and mortality related to cardiovascular disease. However, treatment will require increased use of medical care by overweight children to screen for and diagnose weight-related conditions, as well as increased use of care to treat conditions once diagnosed.

## ***Medical home***

### ***Medical homes for overweight children***

Overweight children do not differ significantly from healthy-weight children in whether or not they meet all the criteria for a medical home. The differences that are apparent when examining the individual domains of the medical home demonstrate that there are differences, but that they are likely due to socioeconomic status. Children who are overweight or at risk are somewhat less likely to report having a medical home and have lower scores on the accessible domain, components of the

medical home which are related to socioeconomic factors. This means that overweight children are less likely to have a medical home, but it is unlikely that this is due to their weight, but simply their socioeconomic status.

#### *Medical homes and health care use of overweight children*

The comprehensive measure of medical home provides little information about the effects of a medical home or its components on health care use. Because the measures used focus heavily on factors associated with a primary care provider, it is not surprising that a medical home is consistently associated with only physician office visits and all outpatient care. Increased use of care is most consistently associated with accessibility, indicating a need to focus largely on improving accessibility to children.

For overweight children, medical homes do not appear to narrow the gap seen in health care use before adjusting for socioeconomic factors. Even controlling for having a medical home and each of the domains of a medical home, overweight children are less likely than other children to have any health care expenditure. This brings into question whether a medical home, in its broadest sense, would actually increase use of care by overweight children. The greatest barrier may be simply receiving appropriate care.

#### *Medical homes and health outcomes*

Having a medical home is related to better self-reported health status, compared to children without a medical home. This is somewhat surprising in a cross-sectional survey such as this, because sicker children tend use more care and

are more likely to have a usual source of care and a medical home. The individual domains, however, have no effect on any of the outcomes examined.

Controlling for medical home and each of the medical home domains, overweight children remain significantly more likely to report fair or poor health and miss more days of school. This suggests that a medical home as currently experienced does not provide health benefits to overweight children. It may be more important for overweight children to have a physician who is attentive to the health needs of overweight children, as opposed to meeting all of the specific factors that make up a medical home. Given that a physician does provide care focused on the child's weight, it is possible that the individual components of a medical home would have a greater effect on health outcomes, but this can not be examined with the current data.

The lack of differences in medical conditions by the simple measure of a usual source of care provides support for the idea that the clinical care currently received by children is not addressing the weight-related health needs of these children. There are no longitudinal data to examine a usual source of care and changes in clinical measures, but a cross-sectional survey can provide some insights into the relationship. One possibility is that children who are sick are more likely to seek out a usual source of care, in which case there would be greater illness among children with a usual source of care. However, the vast majority of children in this sample have a usual source of care, so it seems unlikely that illness is a significant driver of securing a usual source of care.

Because these weight-related conditions require clinical screening in order to receive treatment, it seems more likely that an objective measure of illness as used with NHANES would help identify those children receiving treatment. In other words, children without a usual source of care should be less likely to receive any treatment and thus more likely to demonstrate health conditions. The results here indicate that this does not appear to be happening, either. The most probable explanation is that neither children with nor without medical homes are receiving significant levels of treatment for weight-related health conditions.

### ***Are overweight children CSHCN?***

Based on the definition of CSHCN from the Maternal and Child Health Bureau,<sup>1</sup> the findings here suggest that overweight children could be considered CSHCN. They are clearly at increased risk for chronic health conditions that require more health care than that needed by healthy-weight children. The question is whether policy should extend the CSHCN designation to overweight children.

Many policies that are currently in place or being debated by politicians and the public focus on the behavior of the child, the parent, and health care providers. However, each of these options addresses only a small portion of the problem. For example, school-based nutrition policies often seek to improve the nutritional content of school lunches or to remove vending machines or other opportunities for unhealthy food consumption. However, such policies address only a single factor contributing to overweight—the child’s diet during school hours. Other policies aim to alter adult behavior, and thus through the parents, children’s behavior. These include ideas such as taxes on “junk food” and bans on trans fats in restaurant-

prepared foods. Such strategies are unlikely to address the problem of overweight in children. Perhaps more importantly, these policies fail to consider the potential role of health care providers in addressing the health needs of overweight children. Unless policies are able to completely eliminate overweight, providing appropriate health care for overweight children remains an essential part of reducing not just overweight itself but the health costs of overweight.

What types of strategies can be implemented to bridge the gap documented here between the need for care among overweight children based on their high prevalence of medical conditions, and the amount and type of care they actually receive? Overweight children may benefit from access to health care to both screen for weight-related conditions and address the underlying overweight problems. However, this is unlikely to occur today because children who are overweight are disproportionately poor and face barriers to health care access.

Designating overweight children as children with CSHCN is a policy option that places emphasis on the role of health care providers in treating overweight children. Overweight children could benefit significantly from medical care that focuses on treating weight-related chronic illnesses and addressing the underlying weight problems. The CSHCN designation would potentially improve access to care, help secure a medical home, and make available public programs that address the health needs of designees, all factors useful in improving the health of overweight children. Since there is evidence that CSHCN with medical homes have lower health care costs<sup>108</sup> and fewer unmet health needs,<sup>109</sup> designating overweight children as CSHCN could be a useful strategy for accessing appropriate care.

CSHCN designation could also benefit providers. Few data describe the extent to which physicians screen and diagnose overweight children for weight-related conditions. Although some studies suggest that blood pressure screening is routine, far fewer providers frequently screen overweight children for dyslipidemia<sup>83</sup> and type 2 diabetes.<sup>79</sup> One of the greatest challenges faced by many physicians is not feeling able to adequately treat overweight as a health condition. The most severely overweight children may require referrals to intensive nutritional or specialty care intervention.<sup>128</sup> Just as a pediatrician would refer a child with severe asthma to a specialist, overweight children should be referred to specialized care, such as a nutritionist. If a CSHCN designation could help secure reimbursement for such specialized services, it would give physicians an additional tool for treating overweight by helping them refer overweight children to additional care. Also, with the focus on chronic conditions provided by the CSHCN designation, physicians may be more aware of the need to screen for and treat specific weight-related conditions. Notably, once a diagnosis is made based on clinical findings, overweight youth may be more motivated to pursue lifestyle changes, and physicians and parents more likely to encourage healthier behaviors.

CSHCN designation for overweight children could bring to the forefront the importance of addressing of overweight in children and directing health care resources towards overweight children. The prevalence of overweight in children and its association with chronic illness demonstrate that a significant proportion of the population has or is at risk for a serious chronic illness. Addressing weight in

childhood is essential not only for the short-term health of children but the long-term health of the adults they will become.

### *Overweight children as CSHCN and medical homes*

Because one of the primary objectives of the CSHCN designation is to secure a medical home for these children, an important issue is whether or not a medical home will actually improve health outcomes for overweight children. The results here provide only limited evidence that a comprehensive medical home is significantly associated with better health outcomes. In particular, accessibility seems to be the primary driver of any differences in use of care, not the other broad aspects of the medical home. However, children with medical homes are somewhat more likely to make use of outpatient care, so there is potential for a medical home to help overweight children receive the care that they need.

One reason why having a medical home may not improve outcomes for overweight children may be that physicians are likely not providing significant levels of weight-focused health care. In order for a medical home to improve the health outcomes of overweight children, it will have to include a physician willing and able to address weight-related health needs. Physicians often express frustration in dealing with overweight children, because they do not feel they have effective tools to address overweight and have difficulties in referring overweight children to more specialized care, such as a dietician, because of insurance restrictions. The benefits of a medical home can not be realized for overweight children if physicians do not actively address weight-related health problems.

Another reason a medical home may not appear to be beneficial is that the multiple components that define a medical home may only be needed by the sickest children. A medical home makes sense for CSHCN with needs for specialty care, physical or occupational therapy, and whose care involves many decisions about treatment. For children, like most overweight children, who are generally healthy enough to lead normal lives, access to a usual source of care and simple referrals to other providers may be all they need to benefit from the health care system.

### *Special challenges to CSHCN designation for overweight*

There are several potential challenges to a CSHCN need designation for overweight. First, it “medicalizes” overweight, suggesting that the solution lies within the medical system. Defining overweight as a medical problem has been resisted by many because it de-emphasizes behavioral and lifestyle changes that are necessary for weight loss. Second, would children who successfully lose weight also lose the benefits of the CSHCN designation? While one would not argue that a child with well-controlled diabetes still has diabetes (and therefore requires access to a medical home), would the same hold for overweight? If losing weight decreases access to care that would be unavailable without the CSHCN designation, a powerful disincentive to losing weight would exist. Third, physicians are trained to diagnose and manage diseases, but not necessarily overweight. Given the prevalence of overweight, physicians may be overwhelmed by the increased volume of children who seek care for overweight, a condition that requires skills for which they feel inadequately trained. It is not clear if the infrastructure is adequately developed to permit referral of overweight children to outside sources of care, such

as nutritionists. Adding to the potential for physicians to be overwhelmed is that, as shown in these analyses, overweight children are at increased risk for having chronic conditions that require medical attention.

#### *Consequences of CSHCN designation for overweight*

In addition to the specific difficulties in implementation described above, the CSHCN designation for overweight children may have other consequences. First, it may not help children lose weight because there are no evidence-based recommendations available. The primary treatment goal would be lifestyle modifications, something that should be done for an overweight child, even without a CSHCN designation that focuses on the risk of other health conditions. Moreover, there are no strategies that have been demonstrated to successfully modify diet or exercise in children. The complexity of implementing strategies for children might be compounded as they would have to be tailored to the age of the child and involve parents.

Second, expanding CSHCN designation to overweight would clearly increase the number of CSHCN; this proportion would be even higher if the BMI threshold was reduced from the 85<sup>th</sup> to the 80<sup>th</sup> percentile. Such a policy could decrease resources and available programs from currently designated CSHCN, a group that already has significant chronic health-related problems. In particular, Title V programs might be expected to expand their focus to include overweight children; however, unless there were additional funds available, it would have to be done without harming current programs.

Despite these concerns about implementing the CSHCN designation for overweight children, such a designation alone could be helpful. Being considered a CSHCN can provide additional resources for health care, but it is not guaranteed. In addition, the CSHCN designation could increase awareness of parents, providers, and the public regarding the potential health consequences of overweight in children. Ultimately, this could help support policies that promote healthier lifestyle among children, for example, regulating advertising that markets unhealthy foods to children and promoting healthier foods in schools.

### ***Defining overweight***

Another issue raised by the analyses here is whether or not the current methods of measuring overweight are useful for addressing health problems. Children are considered overweight when they are at or above the 95<sup>th</sup> percentile for age and gender, and at risk for overweight between the 85<sup>th</sup> and 95<sup>th</sup> percentiles. However, most of the clinical values begin to deteriorate at about the 80<sup>th</sup> percentile, and children at or above this level are at significantly greater risk of poor health outcomes. There is a generally a linear relationship between the presence of health conditions and the degree of overweight, particularly beyond the 80<sup>th</sup> percentile. Future research will need to better define this linear relationship in order to precisely identify the children who are a greatest risk for chronic conditions related to their weight.

## ***Limitations***

The most significant limitation of this study is its cross-sectional nature. Ideally, the effects of weight on health outcomes and care use would be looked at longitudinally, so that changes in outcomes could be attributed to changes in weight. However, it is unlikely that endogeneity poses a significant problem for this portion of the analyses. The causative link between weight and health conditions in adults is clear, and there is no reason to expect that the presence of these conditions would cause overweight in children. So, it is a reasonable assumption that weight is driving the differences in health conditions among overweight, at risk for overweight, and healthy weight children.

The problem is not so simply resolved for the analyses that focus on use of care and the medical home. For the majority of the use of care analyses, the results indicate that weight is related to use of care only before considering socioeconomic factors. Overweight is associated with less use of care not because the children are overweight, but because they are poor, and there is less concern about endogeneity in this case—poverty among children is unlikely to be caused by not using health care.

For the medical home analyses, endogeneity is certainly a concern. However, the primary relationship seen is that those with a medical home report better health status, indicating the direction of the relationship is most likely from medical home to health status. If health status was causing the differences in medical home, it is more likely that children with poorer health status would be more likely to have a medical home or a usual source of care, as these children would

need to seek out care more frequently. Also, this is the first study to use national data to examine the relationships among weight, a medical home, and use of health care. Weight is a relatively stable measure across time, and there are no data currently available that track cohorts of children long enough to identify changes in weight and medical home status and resulting differences in use of care.

A second important limitation is that it is not possible to statistically compare the two data sets. Despite results showing that overweight children have more medical conditions, it is not possible to determine specifically if those with medical conditions are receiving more care than those without. Unfortunately no data exist that combine the objective measures of NHANES and the health care use data of MEPS. However, both data sets are nationally representative, permitting some comment on the findings even without direct statistical analysis.

As a replication of a previous attempt to use currently available national surveys to assess having a medical home, as defined by the American Academy of Pediatrics,<sup>126</sup> this study raises additional questions about whether this method is useful in a broad population. The previous work focused primarily on measurement for CSHCN, whereas this study focuses on the general childhood population. The findings here indicate that MEPS may not be as useful as other surveys, as many fewer children, about 12%, meet the criteria for having a medical home, compared to the previous work, about 44%. Without information on the specific items used by Bethell, it is impossible to determine the exact areas of diversion. More importantly, this may indicate that such a broad view of medical home is less applicable to the general childhood population.

## ***Conclusions***

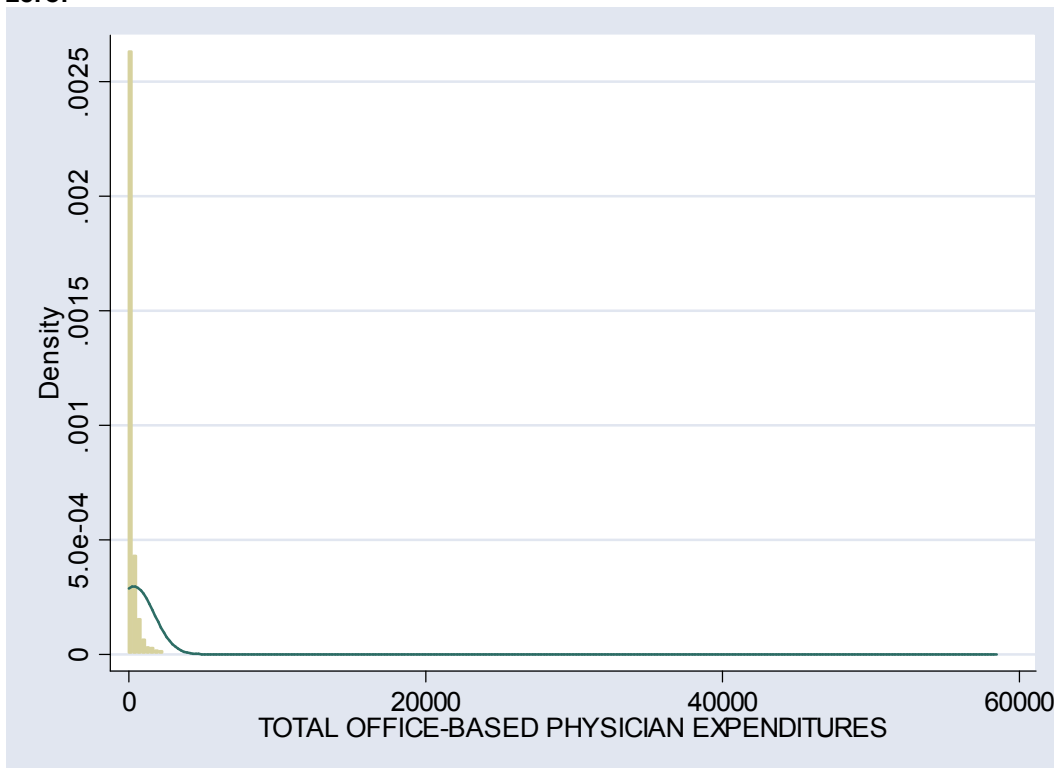
In conclusion, our data from two nationally representative surveys suggests that overweight children have more chronic conditions, poorer health, and fewer health care expenditures than healthy weight children. To address the gap between the care needed to address chronic conditions and poor health, and the care overweight children actually receive, it may be beneficial to consider designating overweight children as CSHCN. Including overweight children under the umbrella of CSHCN is one potential strategy for highlighting the chronic nature of overweight for clinicians, improving access to care, and enhancing health care resources available to overweight children. Such strategies to address overweight during childhood are critical to prevent chronic conditions, improve health status, and reduce health care expenditures, both during childhood and into adulthood.

## APPENDIX A

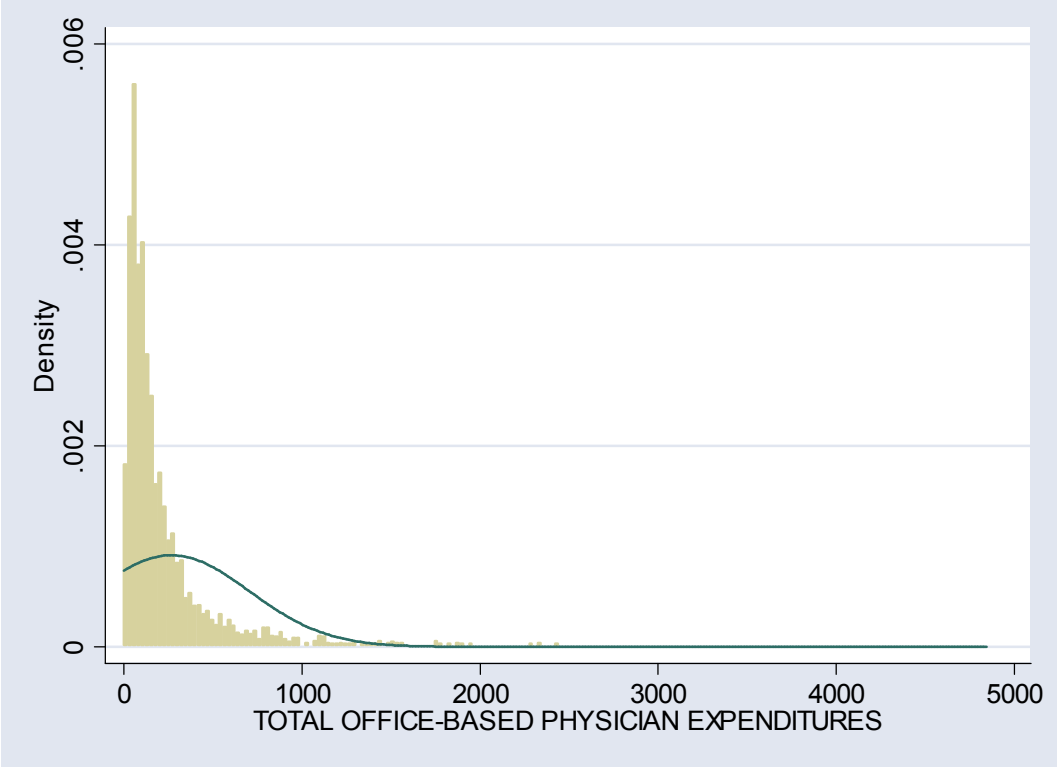
### Distribution of expenditure values

For physician expenditures, there is a strong skew due to several outliers (Figure A.1). Dropping 20 extreme values above \$5,000 reveals a more normal distribution with the expected skew towards higher values (Figure A.2). This indicates a need to log the dependent variable of physician expenditures. The distribution of logged values shows a normal distribution (Figure A.3). Physician expenditures will be used logged, all observations included.

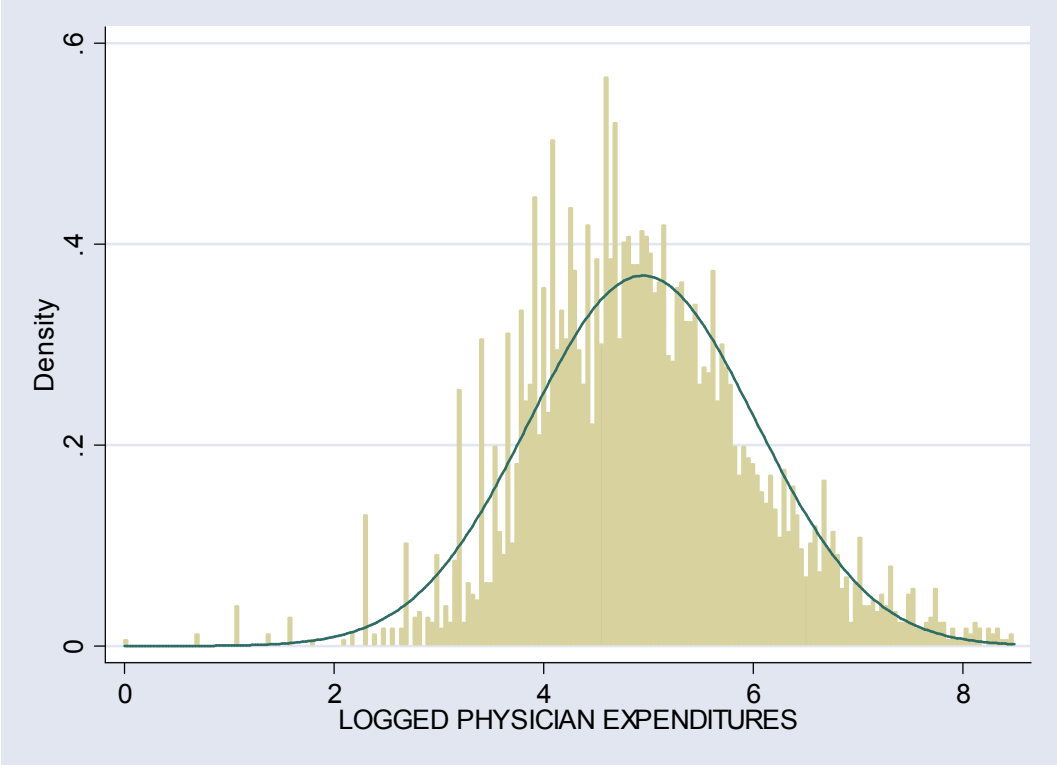
**Figure A.1. Distribution of total office-based physician expenditures, not including values of zero.**



**Figure A.2. Distribution of office-based physician expenditures, up to \$5000, not including values of zero.**

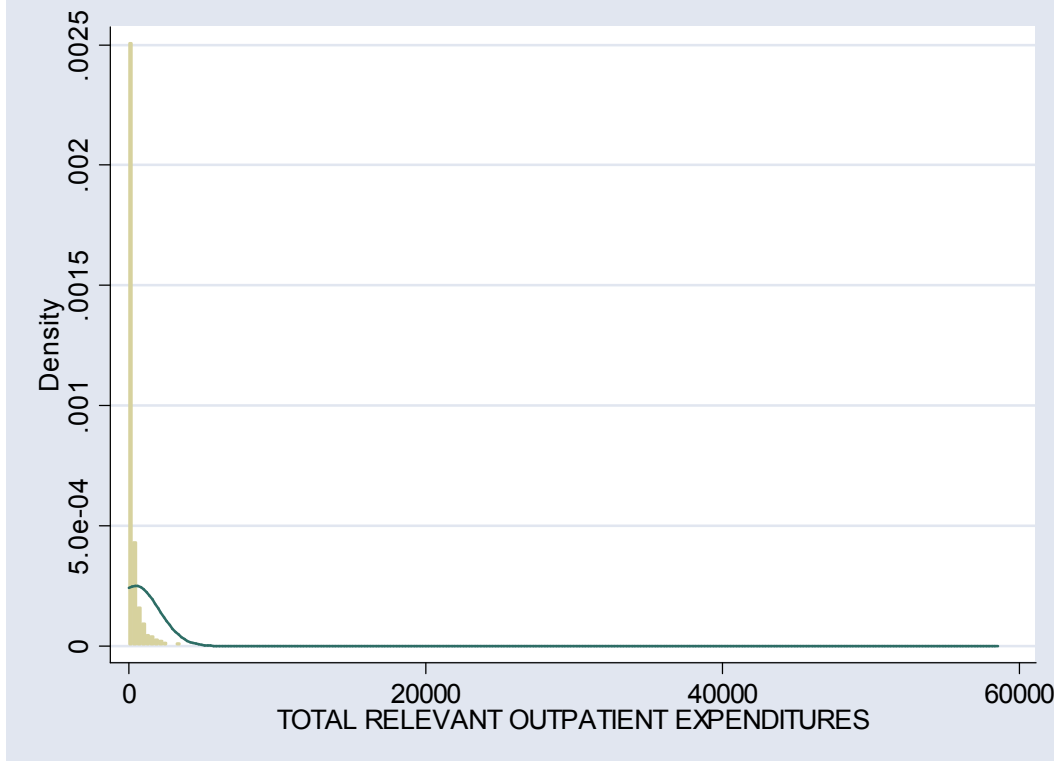


**Figure A.3. Distribution of logged office-based physician expenditures.**

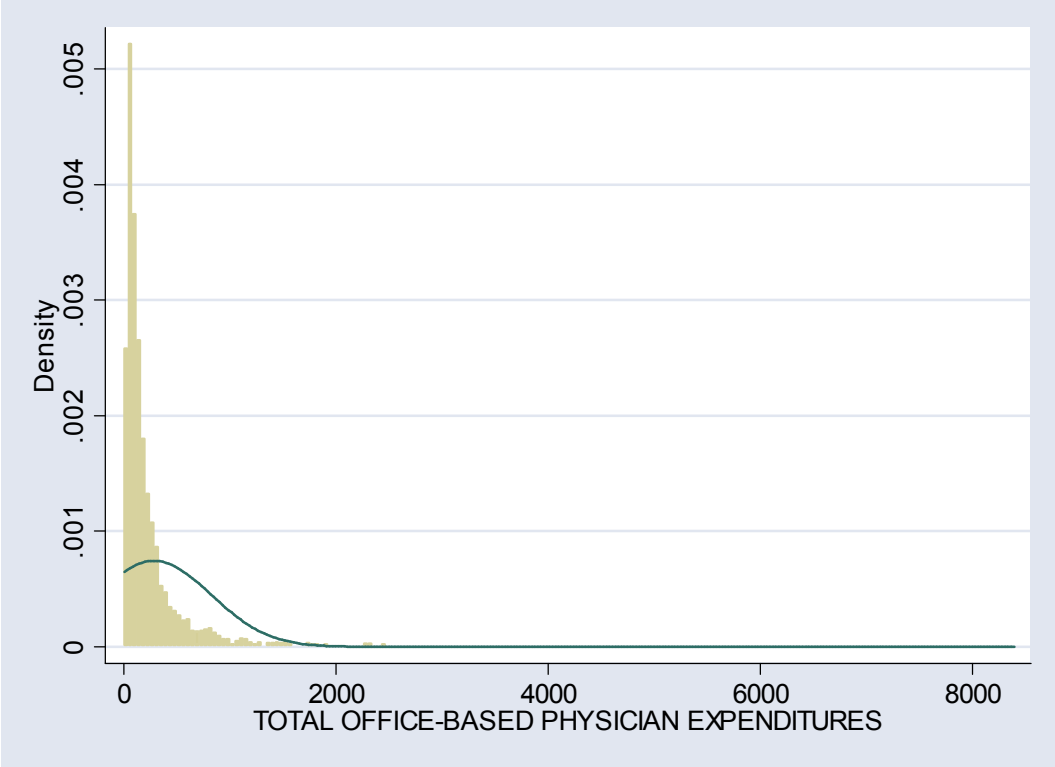


For outpatient expenditures, there is also a strong skew to several outliers (Figure A.4). Dropping 14 extreme values above \$10,000 shows a more normal distribution with a strong skew towards higher values (Figure A.5). A normal distribution is evident for logged expenditures, and will be used in all analyses (Figure A.6).

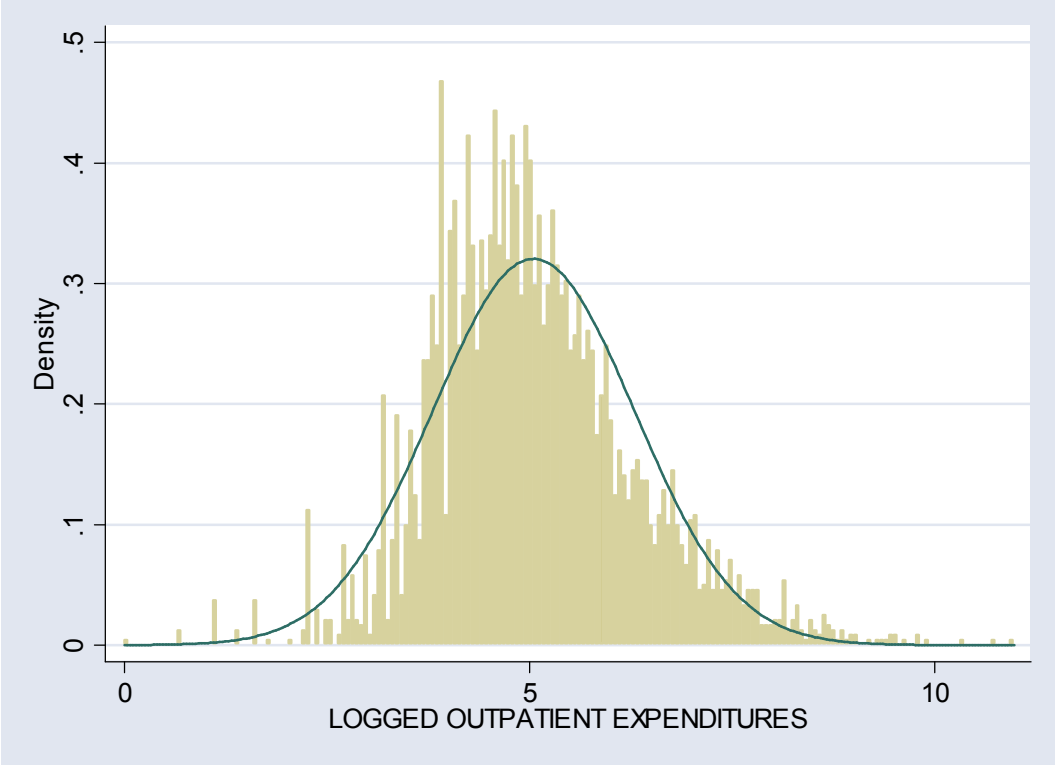
**Figure A.4. Distribution of total outpatient expenditures, not including values of zero.**



**Figure A.5. Distribution of total outpatient expenditures, up to \$8000, not including values of zero.**

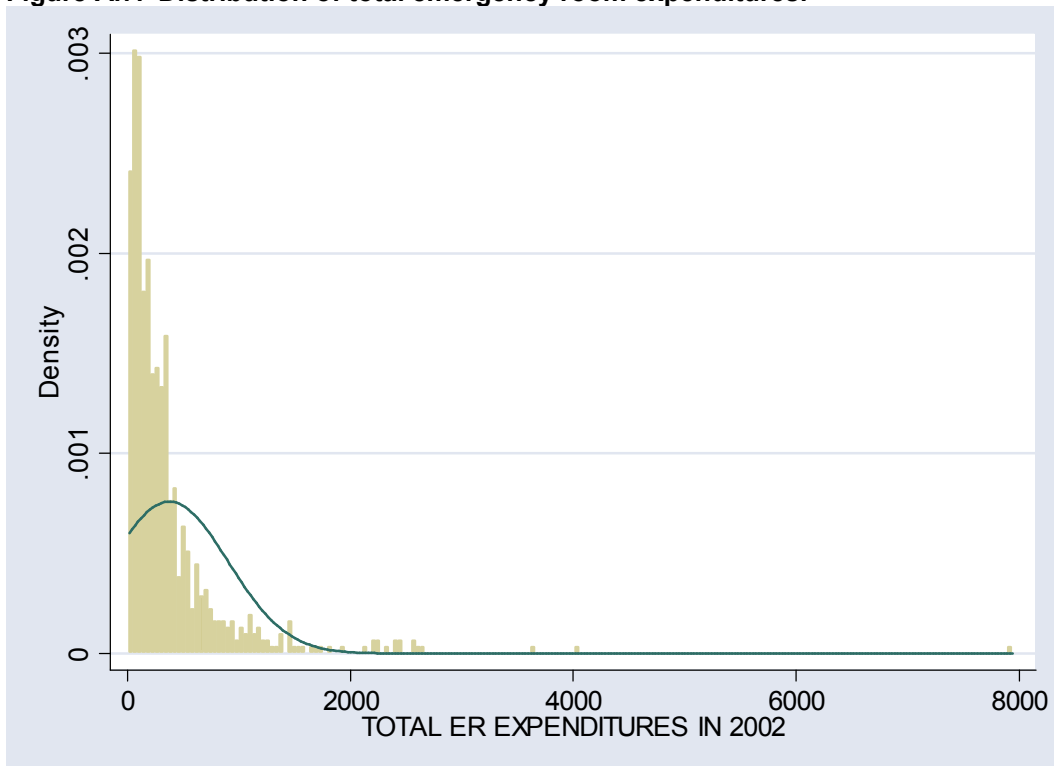


**Figure A.6. Distribution of logged total outpatient expenditures.**

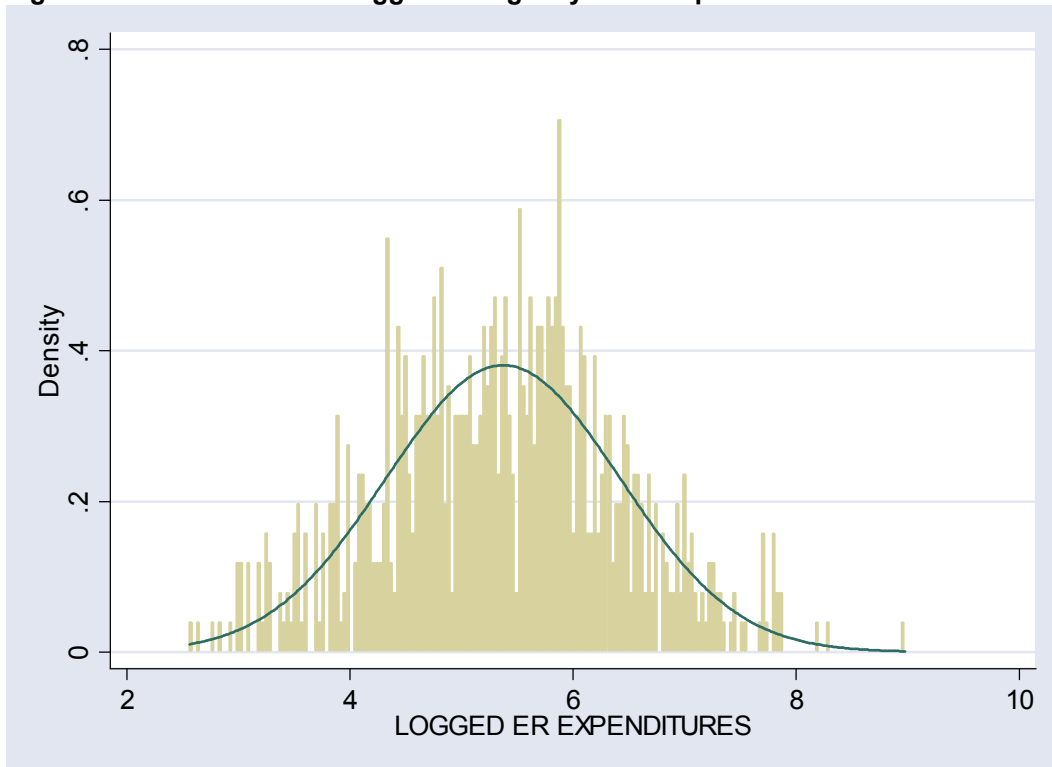


Examining emergency room expenditures reveals a similar pattern of skews to the right (Figure A.7). There are no extreme outliers as seen with outpatient expenditures, although logged expenditures show a much more normal distribution (Figure A.8) and will be used for all analyses.

**Figure A.7. Distribution of total emergency room expenditures.**



**Figure A.8. Distribution of logged emergency room expenditures.**



Hospital expenditures also demonstrate a skew to the right, though there are no extreme outliers (Figure A.9). Logged expenditures show a more normal distribution and will be used for all analyses (Figure A.10).

Figure A.9. Distribution of total inpatient hospital expenditures.

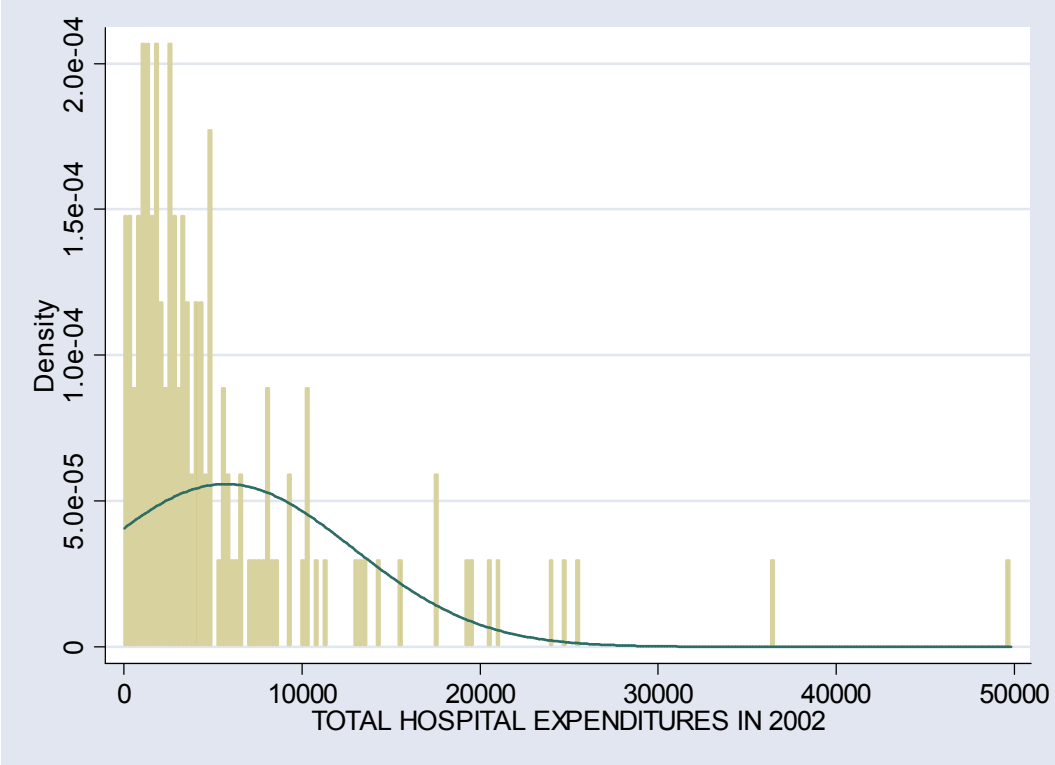
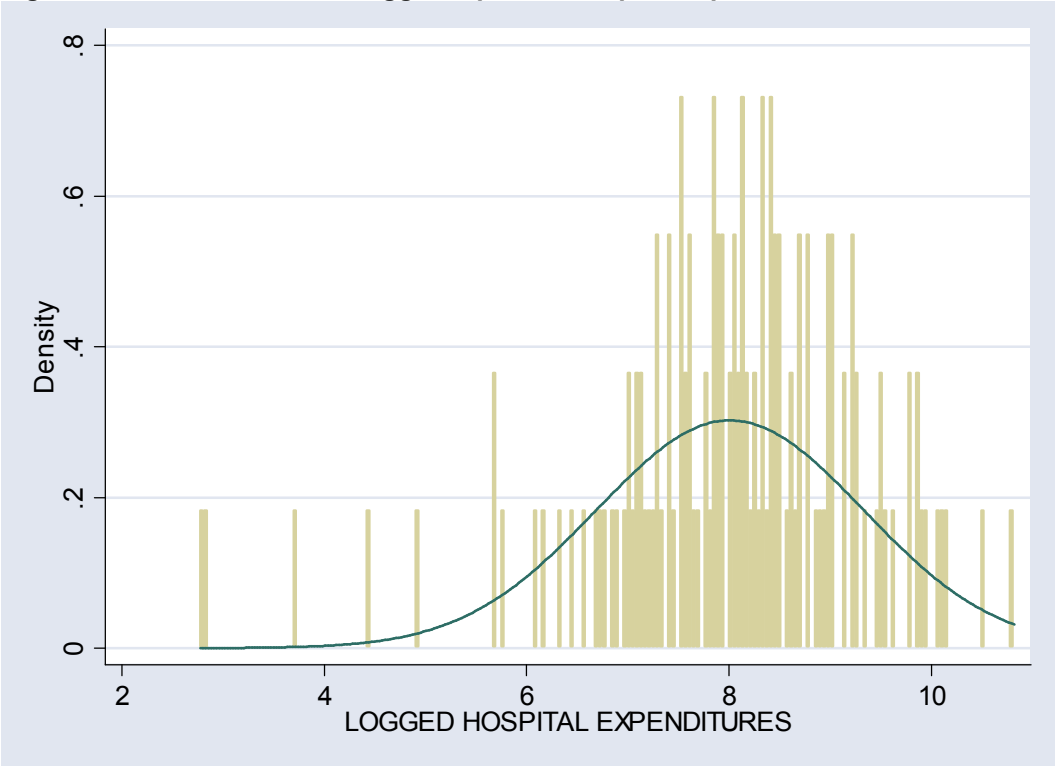
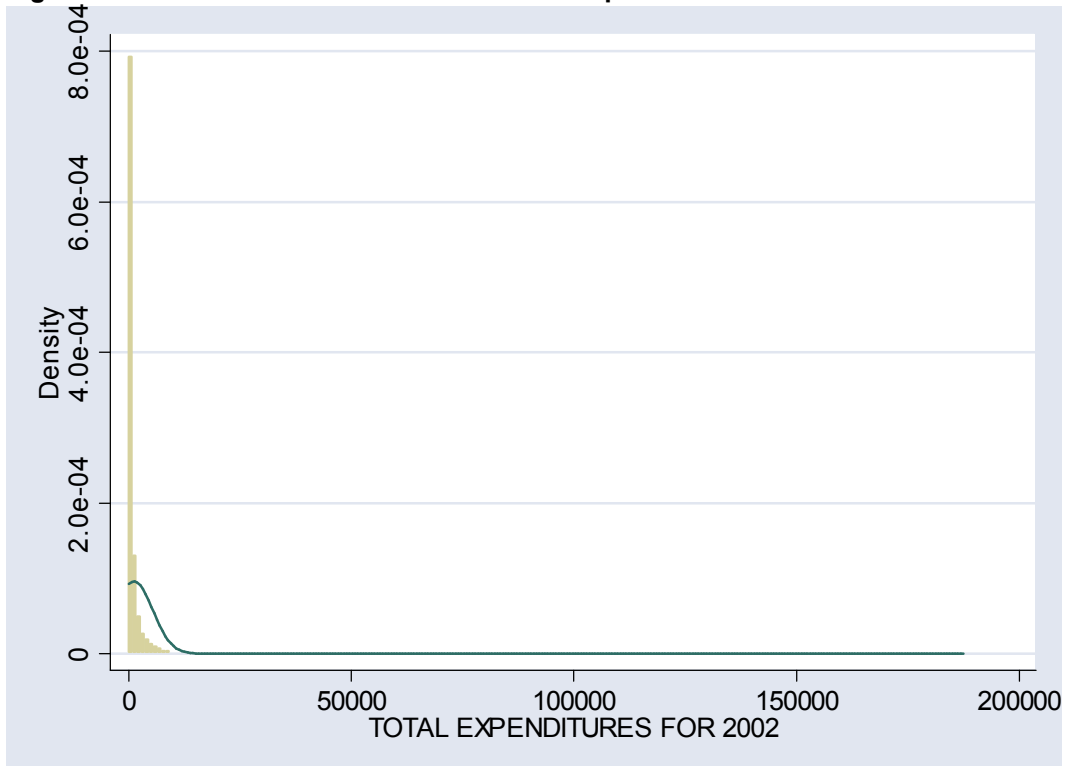


Figure A.10. Distribution of logged inpatient hospital expenditures.

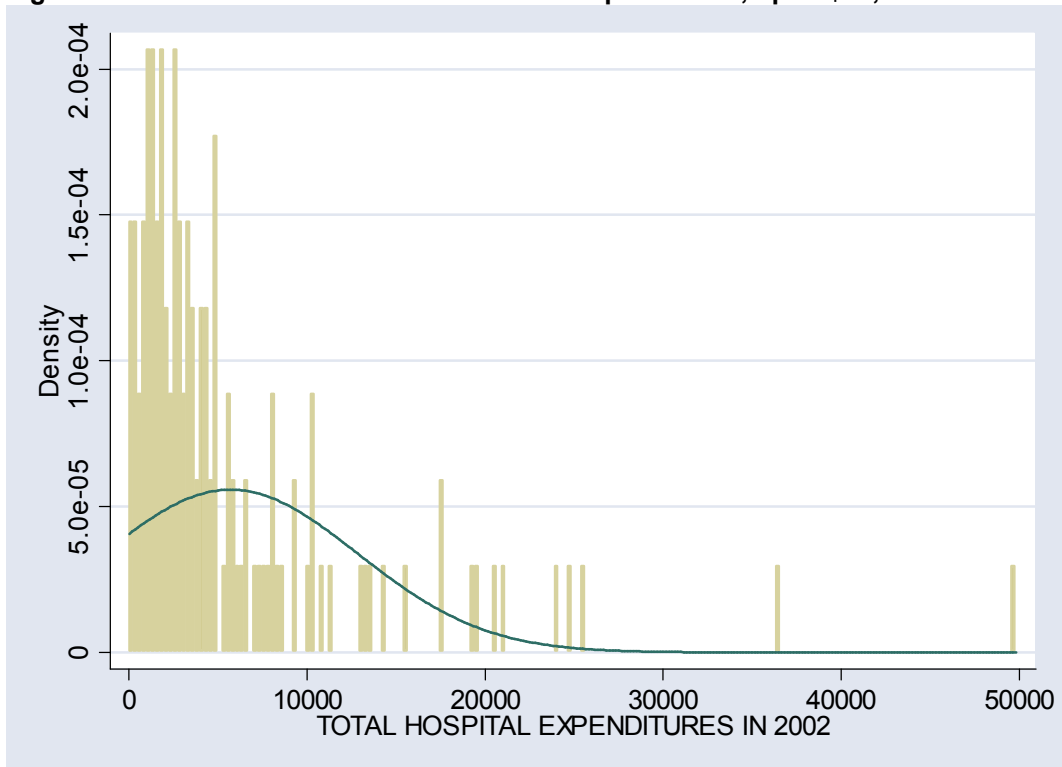


Total expenditures reveal several extreme outliers (Figure A.11). Removing two outliers shows a more normal distribution with a skew to the right (Figure A.12). Logged expenditures have a clear normal distribution and will be used throughout the analyses (Figure A.13).

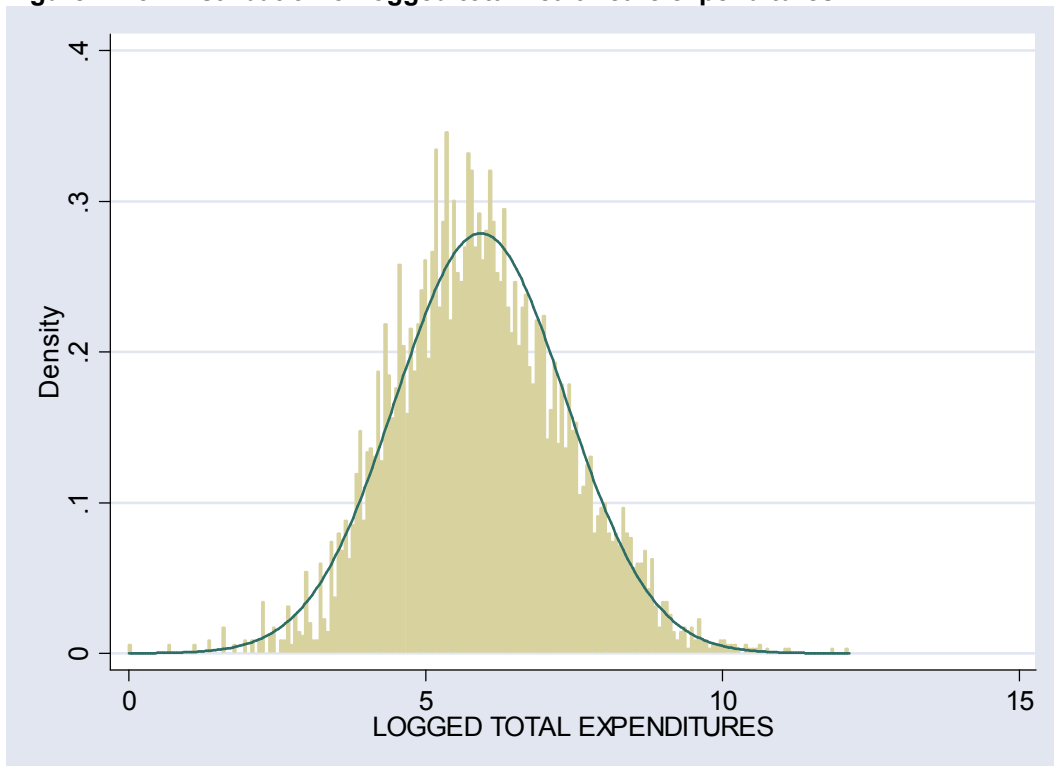
**Figure A.11. Distribution of total health care expenditures.**



**Figure A.12. Distribution of total health care expenditures, up to \$50,000.**



**Figure A.13. Distribution of logged total health care expenditures.**



## APPENDIX B

### Continuous measure of BMI

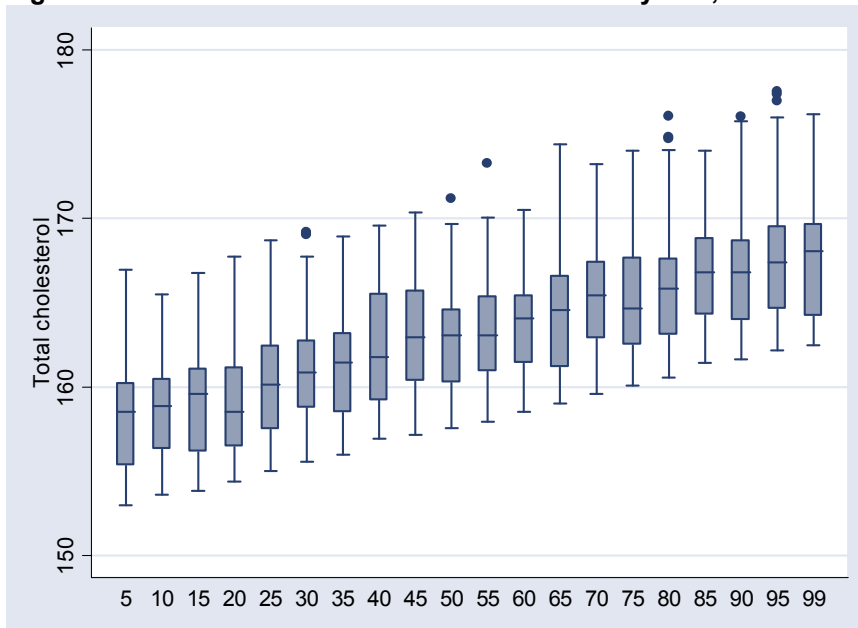
BMI is a significant predictor of total cholesterol levels, a finding that remains when controlling for other factors (Table B.1). A plot of the predicted values (Figure B.1) shows the increasing total cholesterol values that would be expected across the BMI range as well as the increasing likelihood of high cholesterol (Figure B.2).

**Table B.1. Coefficients for the effect of BMI percentile on clinical measures, from OLS, corrected for survey design.**

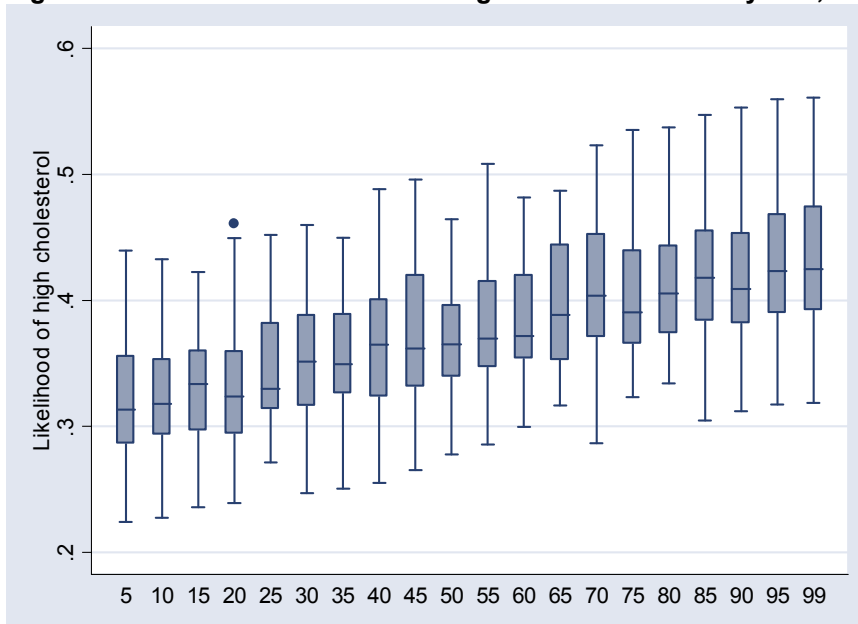
|                                       | Unadjusted | Adjusted <sup>a</sup> |
|---------------------------------------|------------|-----------------------|
| <i>Total cholesterol</i> (N=2558)     |            |                       |
| BMI Percentile                        | 0.11**     | 0.10**                |
| Constant                              | 157.26     | 158.99                |
| <i>LDL</i> (N=1094)                   |            |                       |
| BMI Percentile                        | 0.11**     | 0.12**                |
| Constant                              | 88.62      | 88.33                 |
| <i>HDL</i> (N=2558)                   |            |                       |
| BMI Percentile                        | -0.11**    | -0.12**               |
| Constant                              | 57.06      | 58.63                 |
| <i>Triglycerides</i> (N=1168)         |            |                       |
| BMI Percentile                        | 0.43**     | 0.45*                 |
| Constant                              | 64.16      | 59.41                 |
| <i>Fasting plasma glucose</i> (N=756) |            |                       |
| BMI Percentile                        | 0.03       | 0.04                  |
| Constant                              | 91.18      | 88.44                 |
| <i>Glycohemoglobin</i> (N=763)        |            |                       |
| BMI Percentile                        | 0.001      | 0.001                 |
| Constant                              | 5.123      | 5.066                 |
| <i>Systolic BP</i> (N=2398)           |            |                       |
| BMI Percentile                        | 0.18**     | 0.18**                |
| Constant                              | 17.77      | 16.85                 |
| <i>Diastolic BP</i> (N=2418)          |            |                       |
| BMI Percentile                        | -0.03      | -0.02                 |
| Constant                              | 28.22      | 28.20                 |

<sup>a</sup> Adjusted for age, sex, race, poverty status, and insurance type. \*p<0.05, \*\*p<0.01

**Figure B.1. Predicted values of total cholesterol by BMI, from OLS.**

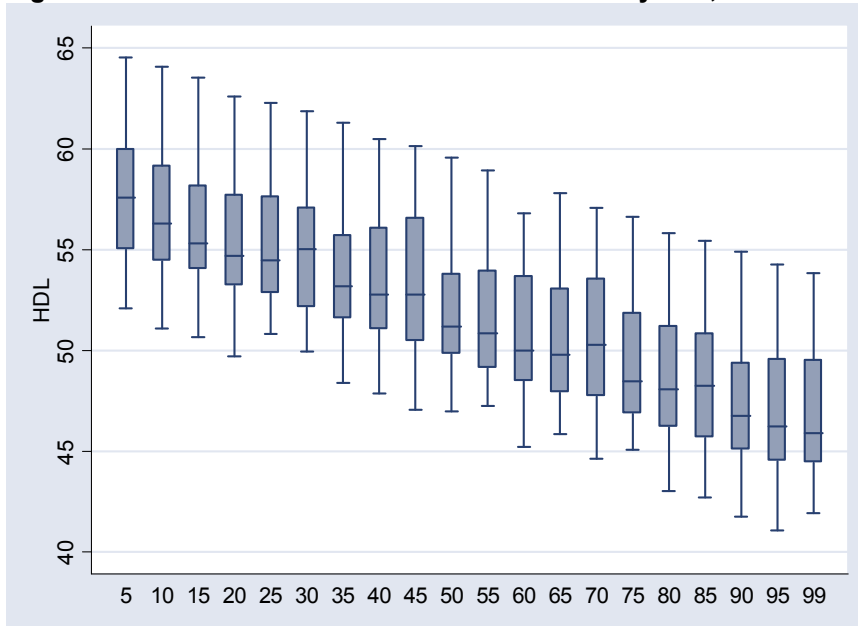


**Figure B.2. Predicted likelihood of high total cholesterol by BMI, from logistic regression.**

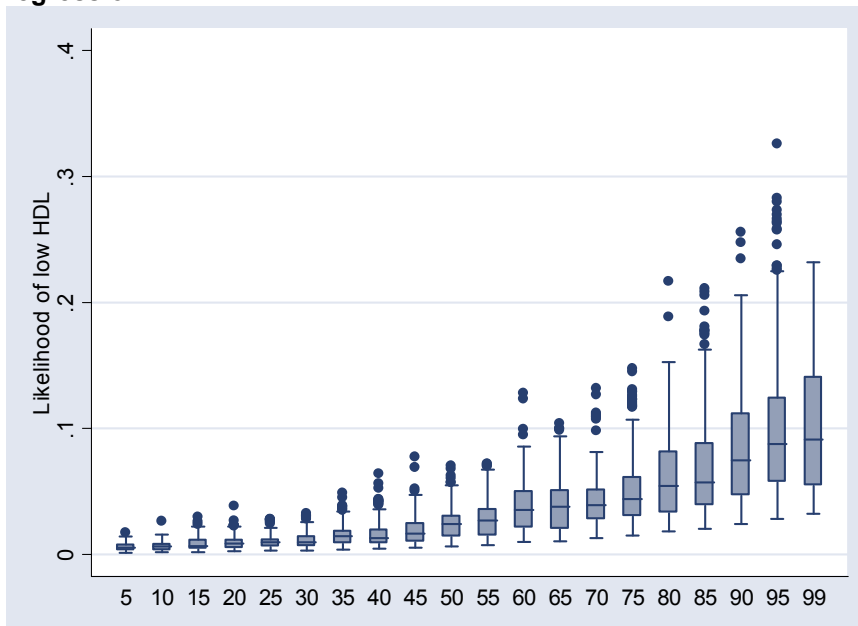


BMI is also a significant predictor of lower HDL values, even when adjusting for other factors. The decreasing HDL values expected across the range of BMI is apparent in the plot of expected values (Figure B.3) and the plot of the expected likelihood of low HDL (Figure B.4).

**Figure B.3. Predicted values of HDL cholesterol by BMI, from OLS.**

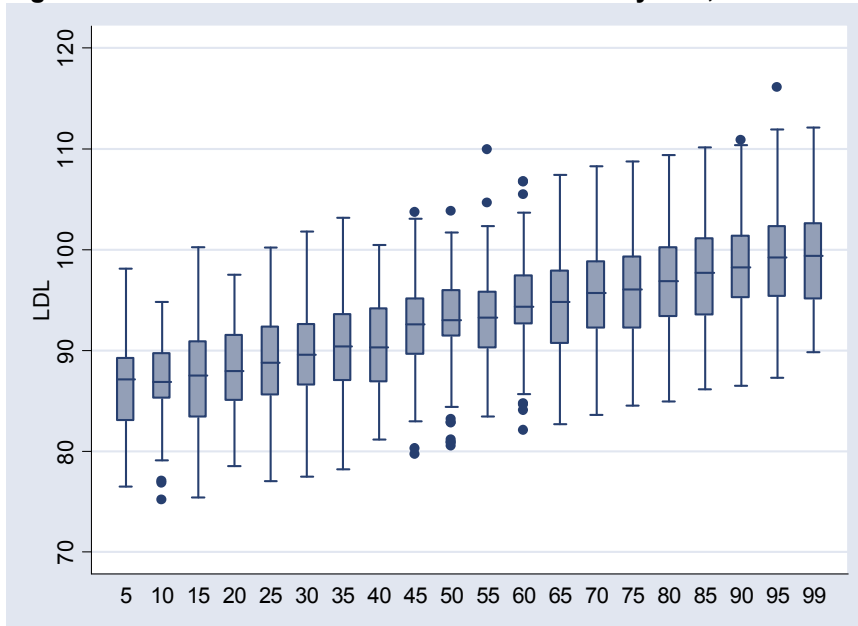


**Figure B.4. Predicted values of the likelihood of low HDL cholesterol by BMI, from logistic regression.**

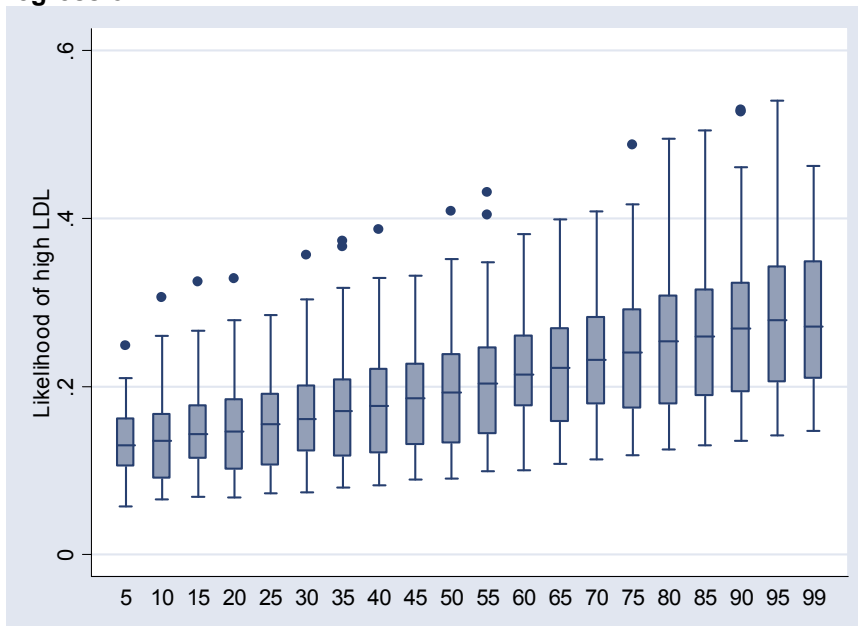


The same pattern is apparent for both LDL cholesterol (Figures B.5 and B.6) and triglycerides (Figures B.7 and B.8).

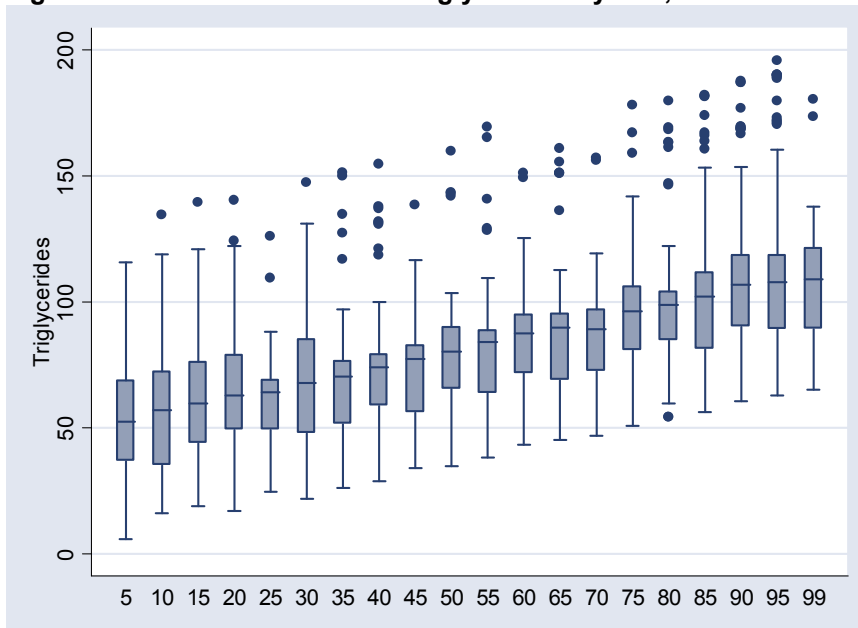
**Figure B.5. Predicted values of LDL cholesterol by BMI, from OLS.**



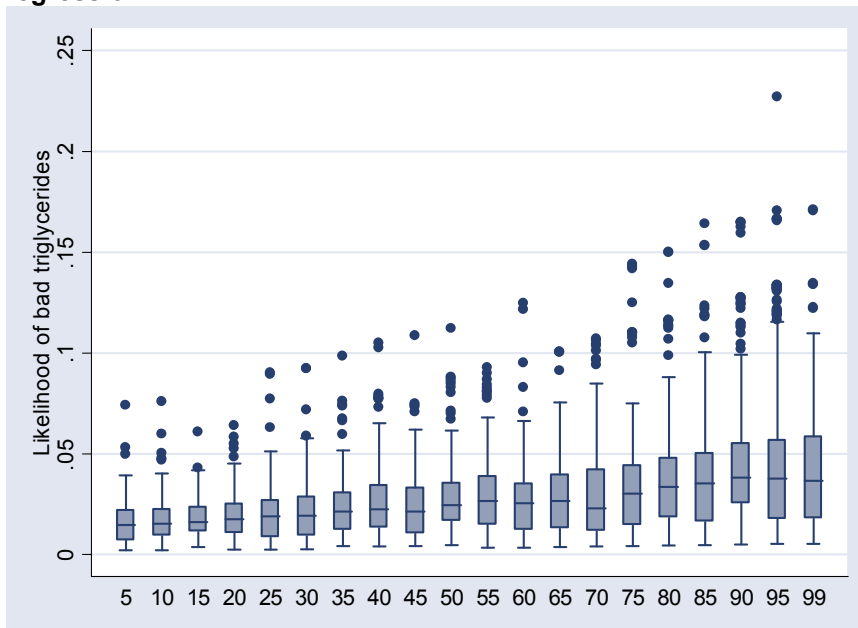
**Figure B.6. Predicted values of the likelihood of high LDL cholesterol by BMI, from logistic regression.**



**Figure B.7. Predicted values of triglycerides by BMI, from OLS.**



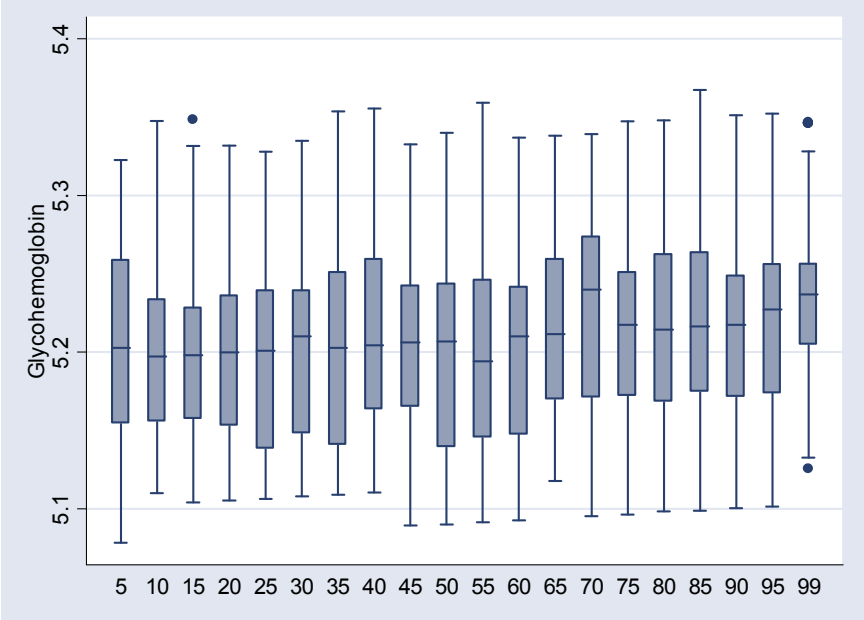
**Figure B.8. Predicted values of the likelihood of high triglycerides by BMI, from logistic regression.**



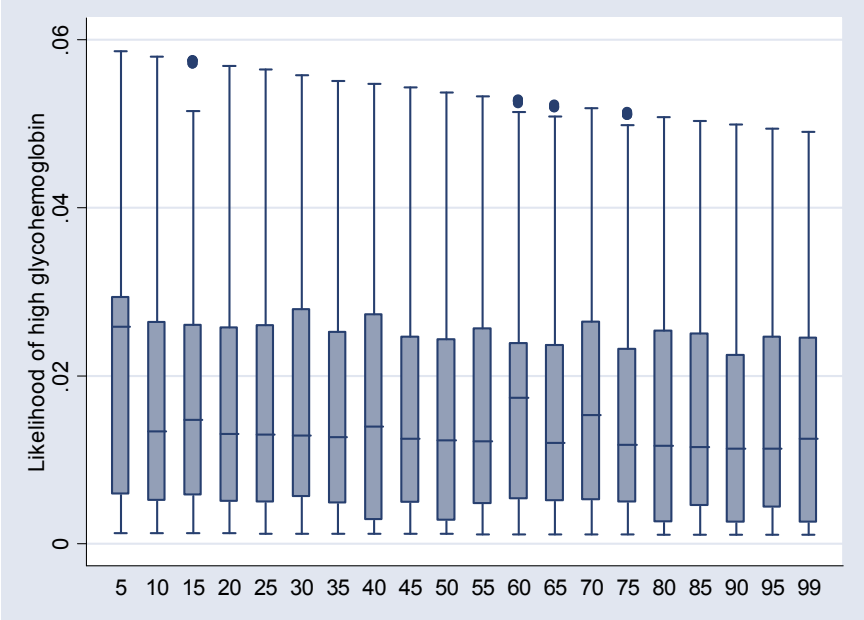
There is no significant relationship between a continuous measure of BMI and A1c. The plot of expected values is flat (Figure B.9) as is the plot of the predicted

likelihood of high A1c (Figure B.10). This is not unexpected, since abnormal values clustered at the upper BMI percentiles.

**Figure B.9. Predicted values of glycohemoglobin by BMI, from OLS.**

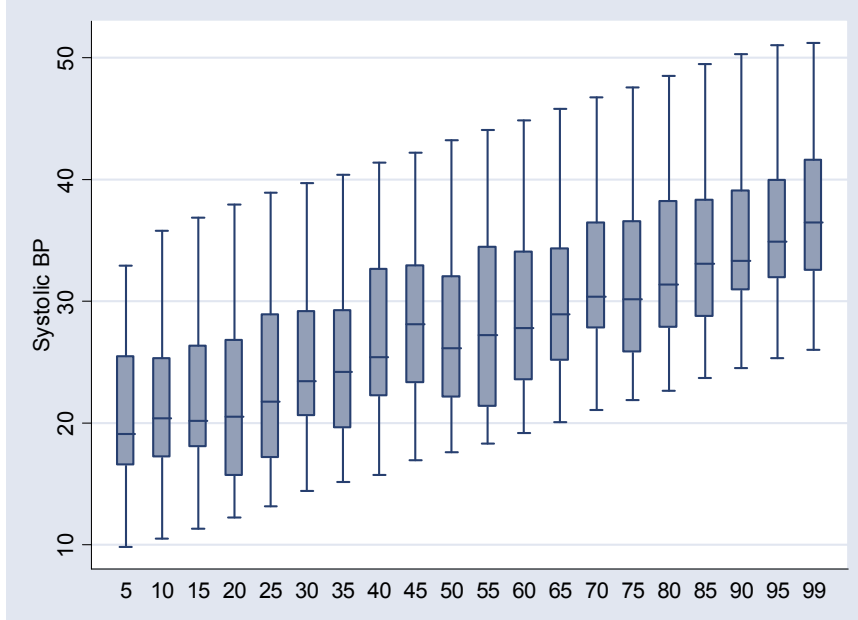


**Figure B.10. Predicted values of the likelihood of high glycohemoglobin by BMI, from logistic regression.**

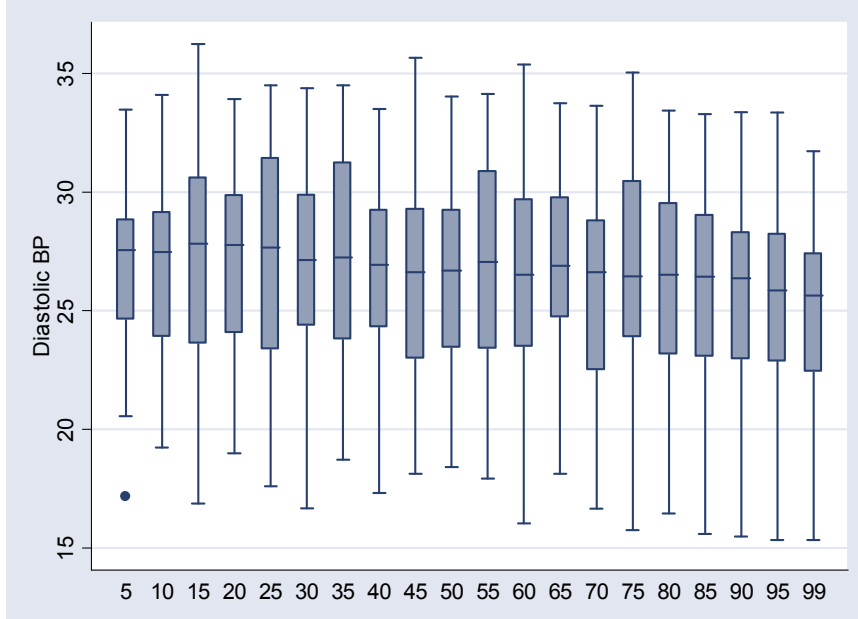


BMI percentile has a significant effect on systolic blood pressure values, though not diastolic blood pressure. The plots of expected values show the higher predicted systolic blood pressure at increasing BMI percentiles and the flat relationship for diastolic blood pressure (Figures B.11 and B.12).

**Figure B.11. Predicted values of systolic blood pressure percentile by BMI, from OLS.**

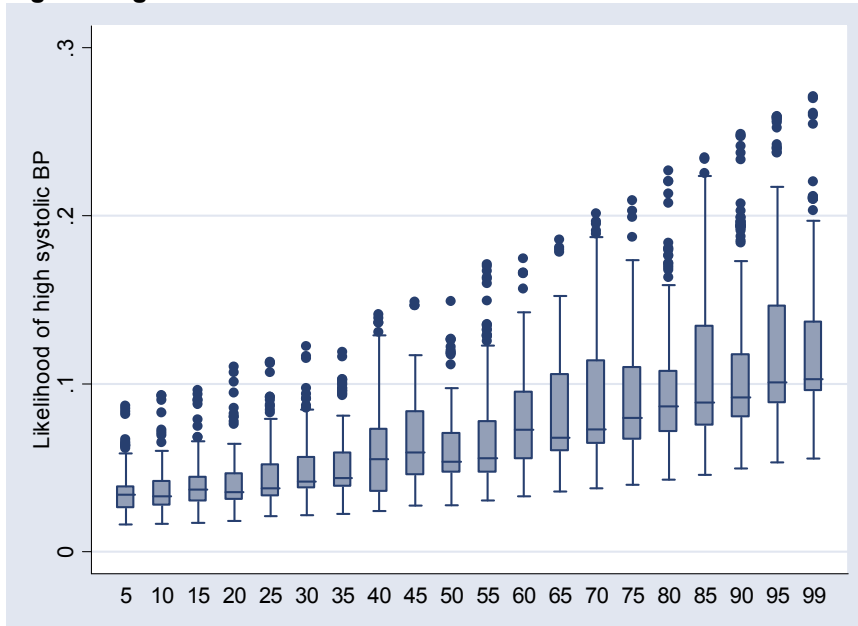


**Figure B.12. Predicted values of diastolic blood pressure percentile by BMI, from OLS.**

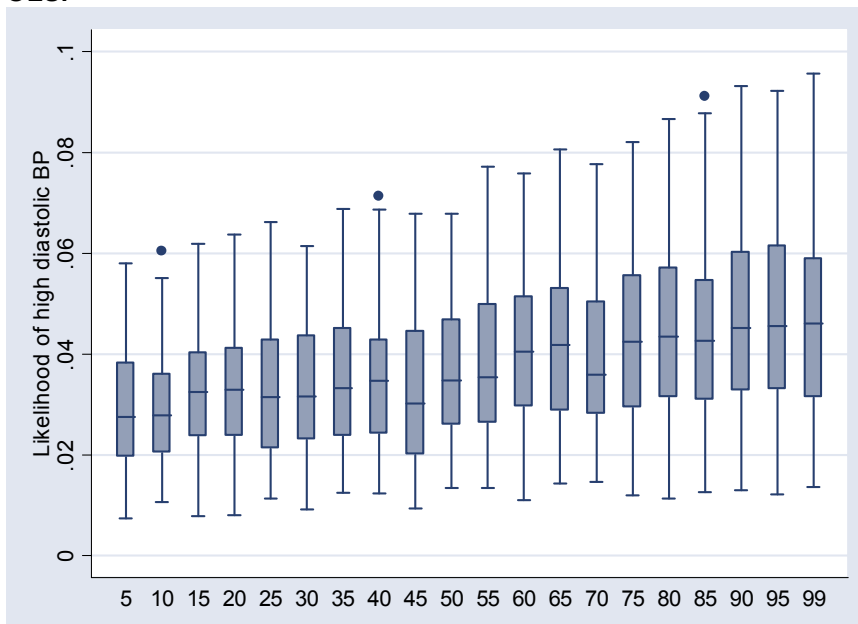


The same pattern is seen for the predicted likelihood of high systolic and diastolic blood pressure (Figures B.13 and B.14). Predicted values for clinical measures and the likelihood of abnormal clinical measures, by 5-point increments of BMI percentile.

**Figure B.13. Predicted values of the likelihood of high systolic blood pressure by BMI, from logistic regression.**



**Figure B.14. Predicted values of the likelihood of high diastolic blood pressure by BMI, from OLS.**



## APPENDIX C

### Age stratified analyses

In order to determine if the effect of weight is limited to certain age groups, similar analyses were conducted, stratified by two age groups: 6-11 years and 12-17 years. For children aged 12-17, children overweight and at risk for overweight have greater prevalence of high total cholesterol, low HDL cholesterol, and high diastolic blood pressure (Table C.1). There are no significant differences by weight children aged 6-11, although the trend of more conditions among overweight children is apparent. Overweight and at risk for overweight children in both age groups have greater prevalence of high systolic blood pressure.

**Table C.1. Age-stratified prevalence of medical conditions.**

|                                      | Ages 6-11  |         |                | Ages 12-17 |         |                |
|--------------------------------------|------------|---------|----------------|------------|---------|----------------|
|                                      | Overweight | At Risk | Healthy weight | Overweight | At Risk | Healthy weight |
| <i>Total cholesterol</i><br>(N=2595) |            |         |                |            |         |                |
| High                                 | 16.4       | 10.2    | 6.7            | 15.0**     | 14.6    | 7.6            |
| Borderline                           | 29.3       | 31.4    | 32.0           | 28.5       | 30.4    | 25.5           |
| Normal                               | 54.3       | 58.4    | 61.3           | 56.5       | 55.1    | 67.0           |
| <i>LDL</i><br>(N=1107)               |            |         |                |            |         |                |
| High                                 | 17.7       | 8.3     | 9.6            | 7.2        | 13.3    | 6.1            |
| Borderline                           | 20.2       | 20.2    | 11.8           | 20.2       | 23.3    | 13.0           |
| Normal                               | 62.2       | 71.5    | 78.6           | 72.6       | 63.4    | 80.9           |
| <i>HDL</i><br>(N=2595)               |            |         |                |            |         |                |
| Low                                  | 12.2       | 6.4     | 2.7            | 18.2**     | 11.2    | 2.3            |
| Normal                               | 87.8       | 93.7    | 97.3           | 81.8       | 88.9    | 96.7           |
| <i>Triglycerides</i><br>(N=1183)     |            |         |                |            |         |                |
| High                                 | 7.1*       | 9.3     | 2.2            | 6.5        | 3.0     | 2.0            |
| Normal                               | 92.9       | 90.7    | 97.9           | 93.5       | 97.0    | 98.0           |
| <i>Systolic BP</i><br>(N=2456)       |            |         |                |            |         |                |
| High                                 | 10.1*      | 4.2     | 2.2            | 8.3**      | 4.6     | 1.2            |
| Borderline                           | 5.0        | 3.8     | 4.9            | 5.7        | 4.6     | 2.3            |
| Normal                               | 84.9       | 91.9    | 93.0           | 86.0       | 90.7    | 96.4           |
| <i>Diastolic BP</i><br>(N=2456)      |            |         |                |            |         |                |

|            | Ages 6-11  |         |                | Ages 12-17 |         |                |
|------------|------------|---------|----------------|------------|---------|----------------|
|            | Overweight | At Risk | Healthy weight | Overweight | At Risk | Healthy weight |
| High       | 2.0        | 1.2     | 0.5            | 5.4*       | 0.5     | 2.0            |
| Borderline | 5.1        | 1.7     | 2.0            | 3.4        | 0.7     | 2.9            |
| Normal     | 93.0       | 97.1    | 97.5           | 91.3       | 98.9    | 95.1           |

Significance tests are adjusted Wald tests for continuous variables, and adjusted chi-squared tests on the cross-tabs for categorical values.

Logistic regression analyses show that overweight children in both age groups, and at risk for overweight children among the 12-17 age group are more likely to have high total cholesterol (Table C.2). Overweight children in the 6-11 age group are more likely to have high LDL cholesterol. Likelihood of low LDL cholesterol is greater for overweight and at risk for overweight children only in the 12-17 age group. Overweight and at risk for overweight children in the younger age group are more likely to have high triglycerides. Greater likelihood of high systolic blood pressure is seen only in overweight children in the 6-11 age group, but in both overweight and at risk for overweight children in the 12-17 age group. Overall hypertension is seen among overweight children in both groups, with a stronger effect seen for children in the 6-11 age group.

**Table C.2. Age-stratified unadjusted and adjusted odds ratios for likelihood of abnormal clinical values, compared to children of healthy weight.**

|                                        | Ages 6-11  |                       | Ages 12-17 |                       |
|----------------------------------------|------------|-----------------------|------------|-----------------------|
|                                        | Unadjusted | Adjusted <sup>a</sup> | Unadjusted | Adjusted <sup>a</sup> |
| <i>High Total cholesterol (N=2558)</i> |            |                       |            |                       |
| Overweight                             | 2.72**     | 2.48**                | 2.17**     | 2.30**                |
| At risk for overweight                 | 1.58       | 1.34                  | 2.09*      | 2.03*                 |
| <i>High LDL (N=1094)</i>               |            |                       |            |                       |
| Overweight                             | 2.01*      | 2.72*                 | 1.19       | 1.08                  |
| At risk for overweight                 | 0.86       | 0.87                  | 2.37       | 1.87                  |
| <i>Low HDL (N=2558)</i>                |            |                       |            |                       |
| Overweight                             | 5.09       | 5.39                  | 6.61**     | 6.67**                |
| At risk for overweight                 | 2.47       | 2.69                  | 3.72**     | 3.78**                |
| <i>High Triglycerides (N=1168)</i>     |            |                       |            |                       |
| Overweight                             | 3.50       | 4.76**                | 3.43       | 4.14                  |
| At risk for overweight                 | 4.64*      | 4.30*                 | 1.52       | 1.20                  |
| <i>High Systolic BP (N=2398)</i>       |            |                       |            |                       |
| Overweight                             | 5.09*      | 5.99**                | 7.27**     | 6.59**                |

|                                   | Ages 6-11  |                       | Ages 12-17 |                       |
|-----------------------------------|------------|-----------------------|------------|-----------------------|
|                                   | Unadjusted | Adjusted <sup>a</sup> | Unadjusted | Adjusted <sup>a</sup> |
| At risk for overweight            | 2.01       | 2.18                  | 3.91**     | 3.65**                |
| <i>High Diastolic BP (N=2418)</i> |            |                       |            |                       |
| Overweight                        | 4.02       | 5.11                  | 2.85*      | 2.73                  |
| At risk for overweight            | 2.41       | 2.28                  | 0.24*      | 0.17                  |
| <i>High BP (N=2418)</i>           |            |                       |            |                       |
| Overweight                        | 6.01**     | 7.26**                | 4.62*      | 4.26**                |
| At risk for overweight            | 2.31       | 2.59                  | 1.66       | 1.54                  |

<sup>a</sup>Adjusted for age, sex, race, poverty status, and insurance type.

\*p<.05, \*\*p<0.01

In order to determine if the effect of weight on health care expenditures differs by age, two-part models of the effect of weight on expenditures were performed, stratified by age, for selected types of care. Before adjustment for socioeconomic factors, overweight children in the 6-11 age group have lower odds of having any outpatient expenditure (OR=0.81), with no difference remaining after adjustment (aOR=0.98) (Table C.3). Overweight children aged 12-17 years have greater odds of having inpatient expenditures both before (OR=2.29) and after (aOR=2.41) adjustment. Children aged 6-11 years show no differences in odds of having inpatient expenditures. Before adjustment, overweight children have lower odds of having any health care expenditure among children aged 6-11 (OR=0.56) and children aged 12-17 (OR=0.74). No differences in odds of having any expenditure persist after adjusting for socioeconomic factors.

**Table C.3. Age stratified unadjusted and adjusted odds ratios for likelihood of any expenditure, compared to healthy-weight children (N=7363).**

|                           | Unadjusted <sup>a</sup> |            | Adjusted <sup>b</sup> |            |
|---------------------------|-------------------------|------------|-----------------------|------------|
|                           | Ages 6-11               | Ages 12-17 | Ages 6-11             | Ages 12-17 |
| <i>Physician's office</i> |                         |            |                       |            |
| Overweight                | 0.83                    | 0.97       | 0.98                  | 1.13       |
| At risk for overweight    | 1.00                    | 0.87       | 1.08                  | 0.93       |
| <i>All Outpatient</i>     |                         |            |                       |            |
| Overweight                | 0.81*                   | 0.97       | 0.98                  | 1.11       |
| At risk for overweight    | 1.01                    | 0.91       | 1.10                  | 0.98       |
| <i>Emergency Room</i>     |                         |            |                       |            |
| Overweight                | 1.22                    | 1.11       | 1.24                  | 1.10       |
| At risk for overweight    | 1.24                    | 1.20       | 1.29                  | 1.24       |
| <i>Inpatient</i>          |                         |            |                       |            |
| Overweight                | 1.06                    | 2.29*      | 1.11                  | 2.41*      |

|                           | Unadjusted <sup>a</sup> |            | Adjusted <sup>b</sup> |            |
|---------------------------|-------------------------|------------|-----------------------|------------|
|                           | Ages 6-11               | Ages 12-17 | Ages 6-11             | Ages 12-17 |
| At risk for overweight    | 0.80                    | 1.54       | 0.84                  | 1.61       |
| <b>Total Expenditures</b> |                         |            |                       |            |
| Overweight                | 0.56**                  | 0.86       | 0.74*                 | 1.05       |
| At risk for overweight    | 0.97                    | 0.89       | 1.12                  | 1.00       |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight.

\*p<.05, \*\*p<0.01

Children aged 6-11 have 21% greater outpatient expenditures, before adjusting for socioeconomic factors (Table C.4). No other significant effects of weight on total expenditures are evident.

**Table C.4. Age stratified unadjusted and adjusted coefficients for effect of weight on logged expenditures, among those with any expenditure.**

|                                    | Unadjusted <sup>a</sup> |            | Adjusted <sup>b</sup> |            |
|------------------------------------|-------------------------|------------|-----------------------|------------|
|                                    | Ages 6-11               | Ages 12-17 | Ages 6-11             | Ages 12-17 |
| <b>Physician's office (N=4160)</b> |                         |            |                       |            |
| Overweight                         | 0.09                    | 0.05       | 0.15                  | 0.03       |
| At risk for overweight             | 0.01                    | -0.13      | 0.05                  | -0.12      |
| Constant                           | 4.91                    | 5.09       | 4.99                  | 5.12       |
| <b>All Outpatient (N=4371)</b>     |                         |            |                       |            |
| Overweight                         | 0.17                    | 0.03       | 0.21*                 | 0.05       |
| At risk for overweight             | 0.02                    | -0.18      | 0.05                  | -0.17      |
| Constant                           | 5.00                    | 5.19       | 5.05                  | 5.25       |
| <b>Emergency Room (N=790)</b>      |                         |            |                       |            |
| Overweight                         | -0.12                   | 0.02       | -0.06                 | 0.09       |
| At risk for overweight             | 0.07                    | -0.19      | 0.09                  | -0.09      |
| Constant                           | 5.37                    | 5.65       | 5.61                  | 5.95       |
| <b>Inpatient (N=135)</b>           |                         |            |                       |            |
| Overweight                         | -0.15                   | -0.11      | -0.31                 | -0.25      |
| At risk for overweight             | 0.54                    | 0.45       | 0.46                  | 0.48       |
| Constant                           | 8.13                    | 8.04       | 8.21                  | 8.43       |
| <b>Total (N=5781)</b>              |                         |            |                       |            |
| Overweight                         | -0.09                   | -0.08      | 0.02                  | 0.03       |
| At risk for overweight             | -0.04                   | -0.04      | 0.03                  | 0.02       |
| Constant                           | 5.96                    | 6.29       | 6.09                  | 6.54       |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight.

\*p<.05, \*\*p<0.01

## **APPENDIX D**

### **Full medical home and expenditure models**

Two sets of logistic regressions were used to examine the effect of medical home on the likelihood of having any visit: one using the composite medical home variable, the other using the individual domains that comprise the medical home (Table D.1). Having a medical home was associated with a greater likelihood of having a physician's office visit and having any outpatient visit, both before and after adjusting for socioeconomic factors. There are no differences by having a medical home on the likelihood of having a visit to a nurse practitioner, to a physician assistant, for physical or occupational therapy, to a hospital outpatient department, to the emergency room, or for an inpatient hospital stay. Controlling for the presence of a medical home, overweight children are less likely to have any outpatient visit (OR=0.86), compared to healthy weight children, before adjusting for socioeconomic factors. When analyzing the individual domains, reporting that the usual source of care is accessible is associated with greater likelihood of having a physician's office visit or any outpatient visit, both before and after adjusting for confounders. As with the single medical home item, there are no effects of the individual domains on the likelihood of having a visit to a nurse practitioner, to a physician assistant, for physical or occupational therapy, to a hospital outpatient department, or for an inpatient hospital stay. Those reporting that their usual source of care is compassionate are less likely to have an emergency room visit.

**Table D.1. Effect of weight and medical home domains on likelihood of any visit (N=7301).**

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Physician's office</i>         |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.86                        | 1.02                  | 1.04                    | 1.19                  |
| <b>At risk for overweight</b>     | 0.97                        | 1.05                  | 0.94                    | 0.93                  |
| <b>Medical home</b>               | 1.70**                      | 1.64**                | -                       | -                     |
| Medical home X overweight         | 1.21                        | 1.18                  | -                       | -                     |
| Medical home X at risk            | 0.63                        | 0.61                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 2.11**                  | 2.24**                |
| USC X overweight                  | -                           | -                     | 0.39                    | 0.34                  |
| USC X at risk                     | -                           | -                     | 0.36                    | 0.35                  |
| <b>Accessible</b>                 | -                           | -                     | 1.39**                  | 1.30**                |
| Accessible X overweight           | -                           | -                     | 0.82                    | 0.81                  |
| Accessible X at risk              | -                           | -                     | 1.00                    | 0.97                  |
| <b>Family-centered</b>            | -                           | -                     | 1.15                    | 1.11                  |
| Family-centered X overweight      | -                           | -                     | 0.97                    | 0.89                  |
| Family-centered X at risk         | -                           | -                     | 1.05                    | 1.05                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.28                    | 1.19                  |
| Comprehensive X overweight        | -                           | -                     | 1.67                    | 1.74                  |
| Comprehensive X at risk           | -                           | -                     | 0.96                    | 0.95                  |
| <b>Coordinated</b>                | -                           | -                     | 1.01                    | 1.05                  |
| Coordinated X overweight          | -                           | -                     | 1.29                    | 1.37                  |
| Coordinated X at risk             | -                           | -                     | 0.85                    | 0.87                  |
| <b>Compassionate</b>              | -                           | -                     | 0.95                    | 0.96                  |
| Compassionate X overweight        | -                           | -                     | 1.22                    | 1.20                  |
| Compassionate X at risk           | -                           | -                     | 0.98                    | 0.99                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.14                    | 1.00                  |
| Culturally effective X overweight | -                           | -                     | 1.05                    | 1.21                  |
| Culturally effective X at risk    | -                           | -                     | 3.45                    | 3.85                  |
| <i>Nurse practitioner</i>         |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.79                        | 0.92                  | 0.17*                   | 0.19*                 |
| <b>At risk for overweight</b>     | 0.91                        | 0.98                  | 0.85                    | 0.85                  |
| <b>Medical home</b>               | 0.73                        | 0.69                  | -                       | -                     |
| Medical home X overweight         | 1.37                        | 1.36                  | -                       | -                     |
| Medical home X at risk            | 3.15*                       | 3.09*                 | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 0.00                    | 0.00                  |
| USC X overweight                  | -                           | -                     | 5.82                    | 5.86                  |
| USC X at risk                     | -                           | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>                 | -                           | -                     | 0.72*                   | 0.68*                 |
| Accessible X overweight           | -                           | -                     | 0.99                    | 0.94                  |
| Accessible X at risk              | -                           | -                     | 2.27*                   | 2.18                  |
| <b>Family-centered</b>            | -                           | -                     | 0.94                    | 0.89                  |
| Family-centered X overweight      | -                           | -                     | 1.53                    | 1.47                  |
| Family-centered X at risk         | -                           | -                     | 1.76                    | 1.73                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.62                    | 1.48                  |
| Comprehensive X overweight        | -                           | -                     | 0.99                    | 1.09                  |
| Comprehensive X at risk           | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                           | -                     | 1.11                    | 1.15                  |
| Coordinated X overweight          | -                           | -                     | 0.82                    | 0.85                  |
| Coordinated X at risk             | -                           | -                     | 0.88                    | 0.92                  |
| <b>Compassionate</b>              | -                           | -                     | 1.03                    | 1.04                  |
| Compassionate X overweight        | -                           | -                     | 0.64                    | 0.63                  |
| Compassionate X at risk           | -                           | -                     | 1.03                    | 1.02                  |
| <b>Culturally effective</b>       | -                           | -                     | -                       | -                     |

|                                      | Complete medical home score |                       | Individual domains      |                       |
|--------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Culturally effective X overweight    | -                           | -                     | 1.26                    | 1.24                  |
| Culturally effective X at risk       | -                           | -                     | 1.05                    | 1.03                  |
| <i>Physician's assistant</i>         |                             |                       |                         |                       |
| <b>Overweight</b>                    | 0.52                        | 0.69                  | 0.67                    | 0.93                  |
| <b>At risk for overweight</b>        | 1.11                        | 1.25                  | 1.01                    | 0.99                  |
| <b>Medical home</b>                  | 0.84                        | 0.78                  | -                       | -                     |
| Medical home X overweight            | 5.46*                       | 5.29*                 | -                       | -                     |
| Medical home X at risk               | 1.01                        | 0.97                  | -                       | -                     |
| <b>Usual source of care</b>          | -                           | -                     | 0.00                    | 0.00                  |
| USC X overweight                     | -                           | -                     | 0.00                    | 0.00                  |
| USC X at risk                        | -                           | -                     | 21.46                   | 24.62                 |
| <b>Accessible</b>                    | -                           | -                     | 0.96                    | 0.86                  |
| Accessible X overweight              | -                           | -                     | 2.61                    | 2.40                  |
| Accessible X at risk                 | -                           | -                     | 1.17                    | 1.08                  |
| <b>Family-centered</b>               | -                           | -                     | 0.65                    | 0.60                  |
| Family-centered X overweight         | -                           | -                     | 5.69*                   | 5.36*                 |
| Family-centered X at risk            | -                           | -                     | 0.43                    | 0.41                  |
| <b>Comprehensive</b>                 | -                           | -                     | 1.86                    | 1.55                  |
| Comprehensive X overweight           | -                           | -                     | -                       | -                     |
| Comprehensive X at risk              | -                           | -                     | 0.04*                   | 0.04*                 |
| <b>Coordinated</b>                   | -                           | -                     | 0.93                    | 1.00                  |
| Coordinated X overweight             | -                           | -                     | 3.10                    | 3.45                  |
| Coordinated X at risk                | -                           | -                     | 2.05                    | 2.16                  |
| <b>Compassionate</b>                 | -                           | -                     | 1.67                    | 1.72                  |
| Compassionate X overweight           | -                           | -                     | 0.25                    | 0.25                  |
| Compassionate X at risk              | -                           | -                     | 0.47                    | 0.44                  |
| <b>Culturally effective</b>          | -                           | -                     | -                       | 2715508.00            |
| Culturally effective X overweight    | -                           | -                     | 0.36                    | 0.40                  |
| Culturally effective X at risk       | -                           | -                     | 2.03                    | 2.26                  |
| <i>Physical/Occupational Therapy</i> |                             |                       |                         |                       |
| <b>Overweight</b>                    | 0.66                        | 0.70                  | 1.33                    | 1.41                  |
| <b>At risk for overweight</b>        | 0.47                        | 0.49                  | 0.00                    | 0.00                  |
| <b>Medical home</b>                  | 0.57                        | 0.55                  | -                       | -                     |
| Medical home X overweight            | c                           | c                     | -                       | -                     |
| Medical home X at risk               | c                           | c                     | -                       | -                     |
| <b>Usual source of care</b>          | -                           | -                     | 0.00                    | 0.00                  |
| USC X overweight                     | -                           | -                     | 0.00                    | 0.00                  |
| USC X at risk                        | -                           | -                     | 7.43                    | 9.28                  |
| <b>Accessible</b>                    | -                           | -                     | 1.00                    | 0.87                  |
| Accessible X overweight              | -                           | -                     | 0.92                    | 0.99                  |
| Accessible X at risk                 | -                           | -                     | 0.11                    | 0.10                  |
| <b>Family-centered</b>               | -                           | -                     | 0.76                    | 0.75                  |
| Family-centered X overweight         | -                           | -                     | -                       | -                     |
| Family-centered X at risk            | -                           | -                     | 0.09*                   | 0.09*                 |
| <b>Comprehensive</b>                 | -                           | -                     | -                       | -                     |
| Comprehensive X overweight           | -                           | -                     | 1.38                    | 1.06                  |
| Comprehensive X at risk              | -                           | -                     | 2.10                    | 3.57                  |
| <b>Coordinated</b>                   | -                           | -                     | 0.42*                   | 0.45*                 |
| Coordinated X overweight             | -                           | -                     | 0.75                    | 0.84                  |
| Coordinated X at risk                | -                           | -                     | 6.00                    | 6.18                  |
| <b>Compassionate</b>                 | -                           | -                     | 1.59                    | 1.50                  |
| Compassionate X overweight           | -                           | -                     | -                       | -                     |

|                                | Complete medical home score |                       | Individual domains      |                       |
|--------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Compassionate X at risk        | -                           | -                     | -                       | -                     |
| <b>Culturally effective</b>    | -                           | -                     | -                       | -                     |
| Culturally effective X         | -                           | -                     |                         |                       |
| overweight                     |                             |                       | 0.19                    | 0.30                  |
| Culturally effective X at risk | -                           | -                     | 4.75                    | 7.08                  |
| <i>Hospital Outpatient</i>     |                             |                       |                         |                       |
| <b>Overweight</b>              | 1.23                        | 1.31                  | 1.48                    | 1.57                  |
| <b>At risk for overweight</b>  | 0.83                        | 0.87                  | 0.73                    | 0.71                  |
| <b>Medical home</b>            | 1.03                        | 1.01                  | -                       | -                     |
| Medical home X overweight      | 1.44                        | 1.41                  | -                       | -                     |
| Medical home X at risk         | 2.49                        | 2.57                  | -                       | -                     |
| <b>Usual source of care</b>    | -                           | -                     | 1.28                    | 1.45                  |
| USC X overweight               | -                           | -                     | 3.17                    | 3.33                  |
| USC X at risk                  | -                           | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>              | -                           | -                     | 1.15                    | 1.10                  |
| Accessible X overweight        | -                           | -                     | 1.02                    | 1.01                  |
| Accessible X at risk           | -                           | -                     | 0.88                    | 0.89                  |
| <b>Family-centered</b>         | -                           | -                     | 1.06                    | 1.02                  |
| Family-centered X overweight   | -                           | -                     | 1.46                    | 1.41                  |
| Family-centered X at risk      | -                           | -                     | 0.72                    | 0.71                  |
| <b>Comprehensive</b>           | -                           | -                     | 0.92                    | 0.87                  |
| Comprehensive X overweight     | -                           | -                     | 0.28                    | 0.31                  |
| Comprehensive X at risk        | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>             | -                           | -                     | 0.97                    | 1.02                  |
| Coordinated X overweight       | -                           | -                     | 1.16                    | 1.18                  |
| Coordinated X at risk          | -                           | -                     | 1.34                    | 1.38                  |
| <b>Compassionate</b>           | -                           | -                     | 0.85                    | 0.86                  |
| Compassionate X overweight     | -                           | -                     | 1.02                    | 0.97                  |
| Compassionate X at risk        | -                           | -                     | 1.11                    | 1.13                  |
| <b>Culturally effective</b>    | -                           | -                     | 1.62                    | 1.32                  |
| Culturally effective X         | -                           | -                     |                         |                       |
| overweight                     |                             |                       | 0.59                    | 0.55                  |
| Culturally effective X at risk | -                           | -                     | -                       | -                     |
| <i>All Outpatient</i>          |                             |                       |                         |                       |
| <b>Overweight</b>              | 0.84*                       | 1.00                  | 0.95                    | 1.09                  |
| <b>At risk for overweight</b>  | 0.96                        | 1.05                  | 0.90                    | 0.88                  |
| <b>Medical home</b>            | 1.60**                      | 1.54*                 | -                       | -                     |
| Medical home X overweight      | 1.14                        | 1.12                  | -                       | -                     |
| Medical home X at risk         | 0.88                        | 0.87                  | -                       | -                     |
| <b>Usual source of care</b>    | -                           | -                     | 1.81                    | 1.92                  |
| USC X overweight               | -                           | -                     | 0.39                    | 0.34                  |
| USC X at risk                  | -                           | -                     | 0.33                    | 0.32                  |
| <b>Accessible</b>              | -                           | -                     | 1.38**                  | 1.29**                |
| Accessible X overweight        | -                           | -                     | 0.80                    | 0.78                  |
| Accessible X at risk           | -                           | -                     | 1.06                    | 1.02                  |
| <b>Family-centered</b>         | -                           | -                     | 1.13                    | 1.08                  |
| Family-centered X overweight   | -                           | -                     | 1.01                    | 0.94                  |
| Family-centered X at risk      | -                           | -                     | 0.93                    | 0.94                  |
| <b>Comprehensive</b>           | -                           | -                     | 1.24                    | 1.15                  |
| Comprehensive X overweight     | -                           | -                     | 1.93                    | 2.09                  |
| Comprehensive X at risk        | -                           | -                     | 0.98                    | 0.99                  |
| <b>Coordinated</b>             | -                           | -                     | 1.02                    | 1.07                  |
| Coordinated X overweight       | -                           | -                     | 1.24                    | 1.32                  |
| Coordinated X at risk          | -                           | -                     | 0.97                    | 0.99                  |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Compassionate</b>              | -                           | -                     | 0.92                    | 0.93                  |
| Compassionate X overweight        | -                           | -                     | 1.18                    | 1.15                  |
| Compassionate X at risk           | -                           | -                     | 1.16                    | 1.17                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.35                    | 1.17                  |
| Culturally effective X overweight | -                           | -                     | 0.99                    | 1.14                  |
| Culturally effective X at risk    | -                           | -                     | 3.45                    | 3.82                  |
| <b>Emergency Room</b>             |                             |                       |                         |                       |
| <b>Overweight</b>                 | 1.32*                       | 1.33*                 | 1.46                    | 1.41                  |
| <b>At risk for overweight</b>     | 1.19                        | 1.24                  | 1.69                    | 1.67                  |
| <b>Medical home</b>               | 1.08                        | 1.05                  | -                       | -                     |
| Medical home X overweight         | 0.68                        | 0.66                  | -                       | -                     |
| Medical home X at risk            | 1.09                        | 1.05                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 1.48                    | 1.65                  |
| USC X overweight                  | -                           | -                     | 0.08                    | 0.09                  |
| USC X at risk                     | -                           | -                     | 0.75                    | 0.83                  |
| <b>Accessible</b>                 | -                           | -                     | 1.13                    | 1.12                  |
| Accessible X overweight           | -                           | -                     | 0.71                    | 0.70                  |
| Accessible X at risk              | -                           | -                     | 0.72                    | 0.72                  |
| <b>Family-centered</b>            | -                           | -                     | 1.20                    | 1.21                  |
| Family-centered X overweight      | -                           | -                     | 0.83                    | 0.82                  |
| Family-centered X at risk         | -                           | -                     | 0.94                    | 0.92                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.66                    | 0.66                  |
| Comprehensive X overweight        | -                           | -                     | 3.94                    | 4.22                  |
| Comprehensive X at risk           | -                           | -                     | 3.52                    | 3.33                  |
| <b>Coordinated</b>                | -                           | -                     | 0.81                    | 0.82                  |
| Coordinated X overweight          | -                           | -                     | 1.25                    | 1.25                  |
| Coordinated X at risk             | -                           | -                     | 1.37                    | 1.38                  |
| <b>Compassionate</b>              | -                           | -                     | 0.80                    | 0.77                  |
| Compassionate X overweight        | -                           | -                     | 0.88                    | 0.83                  |
| Compassionate X at risk           | -                           | -                     | 0.67                    | 0.71                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.75                    | 1.40                  |
| Culturally effective X overweight | -                           | -                     | 3.45                    | 3.15                  |
| Culturally effective X at risk    | -                           | -                     | 0.38                    | 0.37                  |
| <b>Inpatient</b>                  |                             |                       |                         |                       |
| <b>Overweight</b>                 | 1.70                        | 1.73                  | 0.23                    | 0.22                  |
| <b>At risk for overweight</b>     | 0.78                        | 0.82                  | 0.92                    | 0.91                  |
| <b>Medical home</b>               | 0.75                        | 0.72                  | -                       | -                     |
| Medical home X overweight         | 0.42                        | 0.43                  | -                       | -                     |
| Medical home X at risk            | 2.46                        | 2.28                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 0.00                    | 0.00                  |
| USC X overweight                  | -                           | -                     | 40.53                   | 23.18                 |
| USC X at risk                     | -                           | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>                 | -                           | -                     | 0.90                    | 0.89                  |
| Accessible X overweight           | -                           | -                     | 1.14                    | 1.16                  |
| Accessible X at risk              | -                           | -                     | 1.20                    | 1.32                  |
| <b>Family-centered</b>            | -                           | -                     | 1.85                    | 1.82                  |
| Family-centered X overweight      | -                           | -                     | 0.51                    | 0.51                  |
| Family-centered X at risk         | -                           | -                     | 1.03                    | 1.08                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.26                    | 1.21                  |
| Comprehensive X overweight        | -                           | -                     | 0.07                    | 0.10                  |
| Comprehensive X at risk           | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                           | -                     | 1.09                    | 1.06                  |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Coordinated X overweight          | -                           | -                     | 0.56                    | 0.59                  |
| Coordinated X at risk             | -                           | -                     | 0.85                    | 0.87                  |
| <b>Compassionate</b>              | -                           | -                     | 0.61                    | 0.59                  |
| Compassionate X overweight        | -                           | -                     | 6.03                    | 6.03                  |
| Compassionate X at risk           | -                           | -                     | 0.39                    | 0.39                  |
| <b>Culturally effective</b>       | -                           | -                     | -                       | -                     |
| Culturally effective X overweight | -                           | -                     | 1.20                    | 1.41                  |
| Culturally effective X at risk    | -                           | -                     | 1.00                    | 1.46                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. <sup>c</sup>Predicts success/failure perfectly so not included in model. \*p<0.05, \*\*p<0.01

The effect of having a medical home on the number of visits, contingent on having any visit was also examined. Given that a child had any visit, neither weight not the single medical home variable had any effect on the number of visits to a physician's office, nurse practitioner, physician assistant, physical or occupational therapist, total outpatient, emergency room, or inpatient care (Table D.2). Having a medical home did reduce the number of visits to a hospital outpatient department both before (b=-1.06) and after (b=-0.87) adjustment for socioeconomic factors. Examining the individual domains also reveals few effects of medical home factors on the number of visits. Having a usual source of care reduces the number of emergency room visits both before (b=-0.36) and after (b=-0.38) adjusting for socioeconomic factors. Reporting that the USC is culturally effective increases the number of physician's office visits, total outpatient visits, and emergency room visits, both before and after adjusting for socioeconomic factors. Controlling for medical home, there are no differences in the number of visits for overweight or at risk for overweight children, compared to healthy weight children.

**Table D.2. Effect of weight and medical home domains on number of visits, among those with any visit.**

|                                    | Complete medical home<br>score |                       | Individual domains      |                       |
|------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                    | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Physician's office (N=4160)</i> |                                |                       |                         |                       |
| <b>Overweight</b>                  | 0.09                           | 0.17                  | -0.69**                 | -0.73**               |
| <b>At risk for overweight</b>      | -0.29                          | -0.22                 | -0.75**                 | -0.81**               |
| <b>Medical home</b>                | -0.19                          | -0.21                 | -                       | -                     |
| Medical home X overweight          | -0.20                          | -0.21                 | -                       | -                     |
| Medical home X at risk             | 0.57                           | 0.57                  | -                       | -                     |
| <b>Usual source of care</b>        | -                              | -                     | -1.25**                 | -1.22**               |
| USC X overweight                   | -                              | -                     | 3.08                    | 2.64                  |
| USC X at risk                      | -                              | -                     | 0.28                    | 0.06                  |
| <b>Accessible</b>                  | -                              | -                     | 0.00                    | -0.06                 |
| Accessible X overweight            | -                              | -                     | 0.02                    | 0.01                  |
| Accessible X at risk               | -                              | -                     | 0.18                    | 0.17                  |
| <b>Family-centered</b>             | -                              | -                     | 0.28                    | 0.23                  |
| Family-centered X overweight       | -                              | -                     | 0.43                    | 0.37                  |
| Family-centered X at risk          | -                              | -                     | -0.95                   | -0.94                 |
| <b>Comprehensive</b>               | -                              | -                     | 0.64*                   | 0.55*                 |
| Comprehensive X overweight         | -                              | -                     | -2.22                   | -1.83                 |
| Comprehensive X at risk            | -                              | -                     | 0.07                    | 0.19                  |
| <b>Coordinated</b>                 | -                              | -                     | 0.17                    | 0.20                  |
| Coordinated X overweight           | -                              | -                     | -0.26                   | -0.27                 |
| Coordinated X at risk              | -                              | -                     | 0.12                    | 0.17                  |
| <b>Compassionate</b>               | -                              | -                     | 0.16                    | 0.13                  |
| Compassionate X overweight         | -                              | -                     | -0.27                   | -0.18                 |
| Compassionate X at risk            | -                              | -                     | -0.58                   | -0.51                 |
| <b>Culturally effective</b>        | -                              | -                     | 0.91**                  | 0.81**                |
| Culturally effective X overweight  | -                              | -                     | 0.00                    | 0.17                  |
| Culturally effective X at risk     | -                              | -                     | 1.34**                  | 1.47**                |
| Constant                           | 3.09                           | 3.25                  | 2.37                    | 2.71                  |
| <i>Nurse practitioner (N=349)</i>  |                                |                       |                         |                       |
| <b>Overweight</b>                  | -0.83                          | -1.33                 | 0.16                    | -4.43                 |
| <b>At risk for overweight</b>      | 0.86                           | 0.86                  | 1.58                    | 2.81                  |
| <b>Medical home</b>                | 1.50                           | 0.94                  | -                       | -                     |
| Medical home X overweight          | 9.18                           | 6.52                  | -                       | -                     |
| Medical home X at risk             | -2.61                          | -1.91                 | -                       | -                     |
| <b>Usual source of care</b>        | -                              | -                     | -1.03                   | -0.23                 |
| USC X overweight                   | -                              | -                     | -2.05                   | -                     |
| USC X at risk                      | -                              | -                     | -2.83                   | -4.54                 |
| <b>Accessible</b>                  | -                              | -                     | 1.09                    | 1.19                  |
| Accessible X overweight            | -                              | -                     | 2.27                    | 2.32                  |
| Accessible X at risk               | -                              | -                     | 3.20                    | 3.23                  |
| <b>Family-centered</b>             | -                              | -                     | -1.52                   | -1.08                 |
| Family-centered X overweight       | -                              | -                     | 5.25                    | 3.85                  |
| Family-centered X at risk          | -                              | -                     | -3.96                   | -5.00                 |
| <b>Comprehensive</b>               | -                              | -                     | 3.12                    | 1.79                  |
| Comprehensive X overweight         | -                              | -                     | -1.58                   | -2.61                 |
| Comprehensive X at risk            | -                              | -                     | -                       | -                     |
| <b>Coordinated</b>                 | -                              | -                     | 0.15                    | 0.22                  |
| Coordinated X overweight           | -                              | -                     | -1.11                   | -2.42                 |
| Coordinated X at risk              | -                              | -                     | 2.11                    | 2.45                  |
| <b>Compassionate</b>               | -                              | -                     | 0.88                    | 0.43                  |
| Compassionate X overweight         | -                              | -                     | -0.57                   | -0.38                 |

|                                             | Complete medical home score |                       | Individual domains      |                       |
|---------------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                             | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Compassionate X at risk                     | -                           | -                     | 1.39                    | 2.56                  |
| <b>Culturally effective</b>                 | -                           | -                     | -                       | -                     |
| Culturally effective X overweight           | -                           | -                     | -                       | 4.33                  |
| Culturally effective X at risk              | -                           | -                     | -                       | -                     |
| Constant                                    | 2.94                        | 3.01                  | 0.84                    | 1.35                  |
| <i>Physician's assistant (N=100)</i>        |                             |                       |                         |                       |
| <b>Overweight</b>                           | -1.23                       | -0.94                 | 0.59                    | 0.93                  |
| <b>At risk for overweight</b>               | -1.97                       | -2.10                 | -0.41                   | -0.07                 |
| <b>Medical home</b>                         | -1.55                       | -0.61                 | -                       | -                     |
| Medical home X overweight                   | 2.03                        | 1.52                  | -                       | -                     |
| Medical home X at risk                      | 1.55                        | 2.42                  | -                       | -                     |
| <b>Usual source of care</b>                 | -                           | -                     | -                       | -                     |
| USC X overweight                            | -                           | -                     | -                       | -                     |
| USC X at risk                               | -                           | -                     | -                       | 5.43                  |
| <b>Accessible</b>                           | -                           | -                     | -2.22                   | -0.92                 |
| Accessible X overweight                     | -                           | -                     | 3.34                    | 2.12                  |
| Accessible X at risk                        | -                           | -                     | 2.05                    | 2.49                  |
| <b>Family-centered</b>                      | -                           | -                     | 1.92                    | 1.33                  |
| Family-centered X overweight                | -                           | -                     | -1.88                   | -1.59                 |
| Family-centered X at risk                   | -                           | -                     | -2.19                   | -3.78                 |
| <b>Comprehensive</b>                        | -                           | -                     | 1.99                    | 2.08                  |
| Comprehensive X overweight                  | -                           | -                     | -0.03                   | -                     |
| Comprehensive X at risk                     | -                           | -                     | -1.85                   | -7.03                 |
| <b>Coordinated</b>                          | -                           | -                     | 1.14                    | -0.64                 |
| Coordinated X overweight                    | -                           | -                     | -2.03*                  | -0.74                 |
| Coordinated X at risk                       | -                           | -                     | -1.03                   | 1.40                  |
| <b>Compassionate</b>                        | -                           | -                     | 1.42                    | 0.91                  |
| Compassionate X overweight                  | -                           | -                     | -0.76                   | 0.05                  |
| Compassionate X at risk                     | -                           | -                     | -1.12                   | -1.18                 |
| <b>Culturally effective</b>                 | -                           | -                     | -2.64                   | -0.23                 |
| Culturally effective X overweight           | -                           | -                     | -                       | -1.26                 |
| Culturally effective X at risk              | -                           | -                     | 2.56                    | -                     |
| Constant                                    | 2.97                        | 1.66                  | 1.41                    | -0.66                 |
| <i>Physical/Occupational Therapy (N=53)</i> |                             |                       |                         |                       |
| <b>Overweight</b>                           | 4.36                        | 2.50                  | -2.47                   | -14.77                |
| <b>At risk for overweight</b>               | -0.86                       | -1.68                 | 3.46                    | -0.47                 |
| <b>Medical home</b>                         | 17.54                       | 12.06                 | -                       | -                     |
| Medical home X overweight                   | -                           | -                     | -                       | -                     |
| Medical home X at risk                      | -                           | -                     | -                       | -                     |
| <b>Usual source of care</b>                 | -                           | -                     | -                       | -                     |
| USC X overweight                            | -                           | -                     | -                       | -                     |
| USC X at risk                               | -                           | -                     | -                       | -                     |
| <b>Accessible</b>                           | -                           | -                     | 5.66                    | 0.83                  |
| Accessible X overweight                     | -                           | -                     | -14.79                  | 0.63                  |
| Accessible X at risk                        | -                           | -                     | -11.56                  | -5.89                 |
| <b>Family-centered</b>                      | -                           | -                     | 1.42                    | 2.41                  |
| Family-centered X overweight                | -                           | -                     | -                       | 8.07                  |
| Family-centered X at risk                   | -                           | -                     | 2.68                    | 2.53                  |
| <b>Comprehensive</b>                        | -                           | -                     | -                       | -                     |
| Comprehensive X overweight                  | -                           | -                     | -                       | -                     |
| Comprehensive X at risk                     | -                           | -                     | -                       | -                     |

|                                    | Complete medical home<br>score |                       | Individual domains      |                       |
|------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                    | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Coordinated</b>                 | -                              | -                     | 1.13                    | -4.14                 |
| Coordinated X overweight           | -                              | -                     | 1.66                    | 17.45                 |
| Coordinated X at risk              | -                              | -                     | -1.24                   | 3.20                  |
| <b>Compassionate</b>               | -                              | -                     | -1.44                   | 1.27                  |
| Compassionate X overweight         | -                              | -                     | 12.47                   | -                     |
| Compassionate X at risk            | -                              | -                     | -                       | -                     |
| <b>Culturally effective</b>        | -                              | -                     | -0.49                   | 1.39                  |
| Culturally effective X overweight  | -                              | -                     | -                       | -                     |
| Culturally effective X at risk     | -                              | -                     | -                       | -                     |
| Constant                           |                                |                       | 5.47                    | 6.16                  |
| <i>Hospital Outpatient (N=378)</i> |                                |                       |                         |                       |
| <b>Overweight</b>                  | -0.55                          | -1.09                 | 1.66                    | 0.70                  |
| <b>At risk for overweight</b>      | 0.96                           | 0.25                  | 0.20                    | 0.06                  |
| <b>Medical home</b>                | -1.15*                         | -1.25*                | -                       | -                     |
| Medical home X overweight          | 1.08                           | 1.48                  | -                       | -                     |
| Medical home X at risk             | -0.92                          | 0.00                  | -                       | -                     |
| <b>Usual source of care</b>        | -                              | -                     | 2.33                    | 1.17                  |
| USC X overweight                   | -                              | -                     | -0.61                   | -3.71                 |
| USC X at risk                      | -                              | -                     | -1.30                   | -0.01                 |
| <b>Accessible</b>                  | -                              | -                     | -0.17                   | 1.18                  |
| Accessible X overweight            | -                              | -                     | 1.11                    | 3.13                  |
| Accessible X at risk               | -                              | -                     | 2.38                    | 0.57                  |
| <b>Family-centered</b>             | -                              | -                     | 0.40                    | -1.24                 |
| Family-centered X overweight       | -                              | -                     | -1.80                   | -5.53                 |
| Family-centered X at risk          | -                              | -                     | -5.11                   | -2.24                 |
| <b>Comprehensive</b>               | -                              | -                     | -3.15                   | 4.26                  |
| Comprehensive X overweight         | -                              | -                     | 3.17                    | -0.01                 |
| Comprehensive X at risk            | -                              | -                     | -                       | -                     |
| <b>Coordinated</b>                 | -                              | -                     | 1.20                    | 0.87                  |
| Coordinated X overweight           | -                              | -                     | -0.94                   | -0.68                 |
| Coordinated X at risk              | -                              | -                     | -1.58                   | -1.62                 |
| <b>Compassionate</b>               | -                              | -                     | -1.70                   | -1.92                 |
| Compassionate X overweight         | -                              | -                     | 0.30                    | 0.40                  |
| Compassionate X at risk            | -                              | -                     | 5.68                    | 5.78                  |
| <b>Culturally effective</b>        | -                              | -                     | 2.58                    | 3.40                  |
| Culturally effective X overweight  | -                              | -                     | -3.51                   | -1.71                 |
| Culturally effective X at risk     | -                              | -                     | -                       | -1.83                 |
| Constant                           |                                |                       | 1.15                    | 0.50                  |
| <i>All Outpatient (N=4371)</i>     |                                |                       |                         |                       |
| <b>Overweight</b>                  | -0.06                          | 0.00                  | -0.47                   | -0.50                 |
| <b>At risk for overweight</b>      | -0.31                          | -0.22                 | -0.57                   | -0.60                 |
| <b>Medical home</b>                | -0.14                          | -0.20                 | -                       | -                     |
| Medical home X overweight          | 0.66                           | 0.64                  | -                       | -                     |
| Medical home X at risk             | 0.32                           | 0.27                  | -                       | -                     |
| <b>Usual source of care</b>        | -                              | -                     | -1.29                   | -1.04                 |
| USC X overweight                   | -                              | -                     | 3.34                    | 2.92                  |
| USC X at risk                      | -                              | -                     | -1.16                   | -1.29                 |
| <b>Accessible</b>                  | -                              | -                     | 0.04                    | -0.04                 |
| Accessible X overweight            | -                              | -                     | 0.18                    | 0.19                  |
| Accessible X at risk               | -                              | -                     | 0.51                    | 0.48                  |
| <b>Family-centered</b>             | -                              | -                     | 0.13                    | 0.09                  |
| Family-centered X overweight       | -                              | -                     | 0.97                    | 0.92                  |
| Family-centered X at risk          | -                              | -                     | -1.65                   | -1.67                 |

|                                   | Complete medical home<br>score |                       | Individual domains      |                       |
|-----------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Comprehensive</b>              | -                              | -                     | 0.73                    | 0.62                  |
| Comprehensive X overweight        | -                              | -                     | -2.75                   | -2.26                 |
| Comprehensive X at risk           | -                              | -                     | 0.44                    | 0.45                  |
| <b>Coordinated</b>                | -                              | -                     | 0.22                    | 0.27                  |
| Coordinated X overweight          | -                              | -                     | -0.32                   | -0.31                 |
| Coordinated X at risk             | -                              | -                     | 0.30                    | 0.33                  |
| <b>Compassionate</b>              | -                              | -                     | 0.13                    | 0.09                  |
| Compassionate X overweight        | -                              | -                     | -0.28                   | -0.24                 |
| Compassionate X at risk           | -                              | -                     | 0.15                    | 0.27                  |
| <b>Culturally effective</b>       | -                              | -                     | 1.39**                  | 1.07**                |
| Culturally effective X overweight | -                              | -                     | -0.40                   | -0.39                 |
| Culturally effective X at risk    | -                              | -                     | 1.79*                   | 1.90*                 |
| Constant                          | 3.72                           | 3.84                  | 2.55                    | 2.90                  |
| <b>Emergency Room (N=790)</b>     |                                |                       |                         |                       |
| <b>Overweight</b>                 | 0.06                           | 0.07                  | -0.03                   | -0.05                 |
| <b>At risk for overweight</b>     | 0.01                           | 0.02                  | -0.07                   | -0.06                 |
| <b>Medical home</b>               | -0.09                          | -0.08                 | -                       | -                     |
| Medical home X overweight         | 0.21                           | 0.21                  | -                       | -                     |
| Medical home X at risk            | 0.07                           | 0.06                  | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | -0.44**                 | -0.48**               |
| USC X overweight                  | -                              | -                     | 1.22**                  | 1.34**                |
| USC X at risk                     | -                              | -                     | -0.27                   | -0.26                 |
| <b>Accessible</b>                 | -                              | -                     | -0.05                   | -0.05                 |
| Accessible X overweight           | -                              | -                     | 0.15                    | 0.14                  |
| Accessible X at risk              | -                              | -                     | 0.21                    | 0.23                  |
| <b>Family-centered</b>            | -                              | -                     | -0.06                   | -0.07                 |
| Family-centered X overweight      | -                              | -                     | -0.13                   | -0.14                 |
| Family-centered X at risk         | -                              | -                     | -0.24                   | -0.24                 |
| <b>Comprehensive</b>              | -                              | -                     | 0.22**                  | 0.20**                |
| Comprehensive X overweight        | -                              | -                     | 0.22                    | 0.13                  |
| Comprehensive X at risk           | -                              | -                     | 0.15                    | 0.15                  |
| <b>Coordinated</b>                | -                              | -                     | 0.08                    | 0.10                  |
| Coordinated X overweight          | -                              | -                     | 0.12                    | 0.08                  |
| Coordinated X at risk             | -                              | -                     | -0.32                   | -0.32                 |
| <b>Compassionate</b>              | -                              | -                     | 0.03                    | 0.04                  |
| Compassionate X overweight        | -                              | -                     | -0.04                   | -0.02                 |
| Compassionate X at risk           | -                              | -                     | 0.19                    | 0.20                  |
| <b>Culturally effective</b>       | -                              | -                     | 0.15                    | 0.20**                |
| Culturally effective X overweight | -                              | -                     | -1.34**                 | -1.32                 |
| Culturally effective X at risk    | -                              | -                     | 0.45                    | 0.42                  |
| Constant                          | 1.20                           | 1.19                  | 1.25                    | 1.25                  |
| <b>Inpatient (N=135)</b>          |                                |                       |                         |                       |
| <b>Overweight</b>                 | -0.18*                         | -0.18*                | -0.18                   | -0.07                 |
| <b>At risk for overweight</b>     | 0.28                           | 0.26                  | -0.18                   | 0.13                  |
| <b>Medical home</b>               | 0.58                           | 0.59                  | -                       | -                     |
| Medical home X overweight         | 0.40                           | 0.11                  | -                       | -                     |
| Medical home X at risk            | -1.06                          | -1.16                 | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | -                       | -0.77                 |
| USC X overweight                  | -                              | -                     | 0.31                    | 0.31                  |
| USC X at risk                     | -                              | -                     | 0.61                    | -                     |
| <b>Accessible</b>                 | -                              | -                     | 0.07                    | 0.10                  |
| Accessible X overweight           | -                              | -                     | -0.05                   | -0.01                 |
| Accessible X at risk              | -                              | -                     | -0.44                   | -0.29                 |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Family-centered</b>            | -                           | -                     | 0.07                    | 0.13                  |
| Family-centered X overweight      | -                           | -                     | -0.01                   | -0.18                 |
| Family-centered X at risk         | -                           | -                     | -0.31                   | -0.43                 |
| <b>Comprehensive</b>              | -                           | -                     | 0.34*                   | 0.72                  |
| Comprehensive X overweight        | -                           | -                     | -0.18                   | -0.25                 |
| Comprehensive X at risk           | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                           | -                     | 0.19*                   | 0.15                  |
| Coordinated X overweight          | -                           | -                     | -0.05                   | 0.01                  |
| Coordinated X at risk             | -                           | -                     | 1.67                    | 1.76                  |
| <b>Compassionate</b>              | -                           | -                     | 0.16                    | 0.10                  |
| Compassionate X overweight        | -                           | -                     | -0.08                   | -0.07                 |
| Compassionate X at risk           | -                           | -                     | -1.71*                  | -1.62                 |
| <b>Culturally effective</b>       | -                           | -                     | -0.59                   | -                     |
| Culturally effective X overweight | -                           | -                     | -                       | -                     |
| Culturally effective X at risk    | -                           | -                     | -                       | 0.08                  |
| Constant                          | 1.20                        | 1.06                  | 1.18                    | 0.86                  |

<sup>a</sup>Adjusted for missing weight only; <sup>b</sup>Adjusted for age, sex, race, poverty status, insurance type, and missing weight. <sup>c</sup>Dropped because perfectly predicts failure or success. <sup>d</sup>Dropped due to collinearity  
\*p<0.05, \*\*p<0.01

A similar set of analyses examined the effect of a medical home on expenditures. Using the single medical home variable, the presence of a medical home increased the likelihood of having any expenditure for a physician's office, any outpatient care, and any health care, before and after adjusting for socioeconomic factors (Table D.3). Examining the individual domains reveals that accessibility is most strongly related to the likelihood of having any expenditure, with significant effects for physician's office expenditures, total outpatient expenditures, and total health care expenditures. Those reporting compassionate care were less likely to have any emergency room expenditure. Overweight children are less likely to have any health care expenditure even when controlling for having a medical home, using either the single medical home variable (OR=0.70) or the individual domains (OR=0.73), differences that are no longer significant after adjusting for socioeconomic factors.

**Table D.3. Effect of weight and medical home domains on likelihood of any expenditure (N=7301).**

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Physician's office</i>         |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.87                        | 1.03                  | 1.08                    | 1.24                  |
| <b>At risk for overweight</b>     | 0.95                        | 1.03                  | 0.84                    | 0.82                  |
| <b>Medical home</b>               | 1.71**                      | 1.66**                | -                       | -                     |
| Medical home X overweight         | 1.24                        | 1.21                  | -                       | -                     |
| Medical home X at risk            | 0.66                        | 0.65                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 1.75                    | 1.84                  |
| USC X overweight                  | -                           | -                     | 0.52                    | 0.46                  |
| USC X at risk                     | -                           | -                     | 0.55                    | 0.53                  |
| <b>Accessible</b>                 | -                           | -                     | 1.36**                  | 1.27**                |
| Accessible X overweight           | -                           | -                     | 0.87                    | 0.86                  |
| Accessible X at risk              | -                           | -                     | 1.09                    | 1.06                  |
| <b>Family-centered</b>            | -                           | -                     | 1.15                    | 1.10                  |
| Family-centered X overweight      | -                           | -                     | 0.97                    | 0.89                  |
| Family-centered X at risk         | -                           | -                     | 1.05                    | 1.06                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.43                    | 1.34                  |
| Comprehensive X overweight        | -                           | -                     | 1.43                    | 1.47                  |
| Comprehensive X at risk           | -                           | -                     | 0.81                    | 0.80                  |
| <b>Coordinated</b>                | -                           | -                     | 1.01                    | 1.05                  |
| Coordinated X overweight          | -                           | -                     | 1.28                    | 1.35                  |
| Coordinated X at risk             | -                           | -                     | 0.85                    | 0.87                  |
| <b>Compassionate</b>              | -                           | -                     | 1.02                    | 1.03                  |
| Compassionate X overweight        | -                           | -                     | 1.14                    | 1.12                  |
| Compassionate X at risk           | -                           | -                     | 0.89                    | 0.90                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.23                    | 1.06                  |
| Culturally effective X overweight | -                           | -                     | 0.93                    | 1.07                  |
| Culturally effective X at risk    | -                           | -                     | 3.13                    | 3.51                  |
| <i>Nurse practitioner</i>         |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.78                        | 0.93                  | 0.18*                   | 0.21                  |
| <b>At risk for overweight</b>     | 0.94                        | 1.03                  | 0.72                    | 0.73                  |
| <b>Medical home</b>               | 0.78                        | 0.73                  | -                       | -                     |
| Medical home X overweight         | 1.41                        | 1.39                  | -                       | -                     |
| Medical home X at risk            | 2.59                        | 2.48                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 0.00                    | 0.00                  |
| USC X overweight                  | -                           | -                     | 6.01                    | 6.12                  |
| USC X at risk                     | -                           | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>                 | -                           | -                     | 0.70*                   | 0.66*                 |
| Accessible X overweight           | -                           | -                     | 1.15                    | 1.08                  |
| Accessible X at risk              | -                           | -                     | 2.27                    | 2.15                  |
| <b>Family-centered</b>            | -                           | -                     | 0.92                    | 0.88                  |
| Family-centered X overweight      | -                           | -                     | 1.62                    | 1.53                  |
| Family-centered X at risk         | -                           | -                     | 1.88                    | 1.85                  |
| <b>Comprehensive</b>              | -                           | -                     | 1.89                    | 1.70                  |
| Comprehensive X overweight        | -                           | -                     | 0.76                    | 0.85                  |
| Comprehensive X at risk           | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                           | -                     | 1.13                    | 1.19                  |
| Coordinated X overweight          | -                           | -                     | 1.01                    | 1.06                  |
| Coordinated X at risk             | -                           | -                     | 0.87                    | 0.92                  |
| <b>Compassionate</b>              | -                           | -                     | 1.15                    | 1.16                  |
| Compassionate X overweight        | -                           | -                     | 0.56                    | 0.55                  |

|                                      | Complete medical home<br>score |                       | Individual domains      |                       |
|--------------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                      | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Compassionate X at risk              | -                              | -                     | 0.85                    | 0.84                  |
| <b>Culturally effective</b>          | -                              | -                     | -                       | -                     |
| Culturally effective X overweight    | -                              | -                     | 1.20                    | 1.16                  |
| Culturally effective X at risk       | -                              | -                     | 1.11                    | 1.08                  |
| <i>Physician's assistant</i>         |                                |                       |                         |                       |
| <b>Overweight</b>                    | 0.54                           | 0.72                  | 0.83                    | 1.17                  |
| <b>At risk for overweight</b>        | 1.15                           | 1.31                  | 1.26                    | 1.23                  |
| <b>Medical home</b>                  | 0.88                           | 0.82                  | -                       | -                     |
| Medical home X overweight            | 5.22*                          | 5.05*                 | -                       | -                     |
| Medical home X at risk               | 0.97                           | 0.92                  | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | 0.00                    | 0.00                  |
| USC X overweight                     | -                              | -                     | 0.00                    | 0.00                  |
| USC X at risk                        | -                              | -                     | 16.39                   | 18.66                 |
| <b>Accessible</b>                    | -                              | -                     | 1.00                    | 0.89                  |
| Accessible X overweight              | -                              | -                     | 2.50                    | 2.30                  |
| Accessible X at risk                 | -                              | -                     | 1.12                    | 1.02                  |
| <b>Family-centered</b>               | -                              | -                     | 0.63                    | 0.58                  |
| Family-centered X overweight         | -                              | -                     | 5.88*                   | 5.49*                 |
| Family-centered X at risk            | -                              | -                     | 0.44                    | 0.42                  |
| <b>Comprehensive</b>                 | -                              | -                     | 1.83                    | 1.53                  |
| Comprehensive X overweight           | -                              | -                     | -                       | -                     |
| Comprehensive X at risk              | -                              | -                     | 0.04*                   | 0.04*                 |
| <b>Coordinated</b>                   | -                              | -                     | 0.91                    | 0.98                  |
| Coordinated X overweight             | -                              | -                     | 3.18                    | 3.55                  |
| Coordinated X at risk                | -                              | -                     | 2.10                    | 2.23                  |
| <b>Compassionate</b>                 | -                              | -                     | 1.66                    | 1.70                  |
| Compassionate X overweight           | -                              | -                     | 0.25                    | 0.25                  |
| Compassionate X at risk              | -                              | -                     | 0.47                    | 0.44                  |
| <b>Culturally effective</b>          | -                              | -                     | -                       | -                     |
| Culturally effective X overweight    | -                              | -                     | 0.37                    | 0.42                  |
| Culturally effective X at risk       | -                              | -                     | 2.09                    | 2.36                  |
| <i>Physical/Occupational Therapy</i> |                                |                       |                         |                       |
| <b>Overweight</b>                    | 0.76                           | 0.81                  | 1.31                    | 1.34                  |
| <b>At risk for overweight</b>        | 0.54                           | 0.57                  | 0.00                    | 0.00                  |
| <b>Medical home</b>                  | 0.65                           | 0.63                  | -                       | -                     |
| Medical home X overweight            | -                              | -                     | -                       | -                     |
| Medical home X at risk               | -                              | -                     | -                       | -                     |
| <b>Usual source of care</b>          | -                              | -                     | 0.00                    | 0.00                  |
| USC X overweight                     | -                              | -                     | 0.00                    | 0.00                  |
| USC X at risk                        | -                              | -                     | 7.38                    | 12.37                 |
| <b>Accessible</b>                    | -                              | -                     | 1.16                    | 1.03                  |
| Accessible X overweight              | -                              | -                     | 0.79                    | 0.86                  |
| Accessible X at risk                 | -                              | -                     | 0.15                    | 0.15                  |
| <b>Family-centered</b>               | -                              | -                     | 0.69                    | 0.68                  |
| Family-centered X overweight         | -                              | -                     | -                       | -                     |
| Family-centered X at risk            | -                              | -                     | 0.19                    | 0.18                  |
| <b>Comprehensive</b>                 | -                              | -                     | -                       | -                     |
| Comprehensive X overweight           | -                              | -                     | 2.59                    | 0.45                  |
| Comprehensive X at risk              | -                              | -                     | 1.54                    | 0.54                  |
| <b>Coordinated</b>                   | -                              | -                     | 0.45*                   | 0.48*                 |
| Coordinated X overweight             | -                              | -                     | 0.69                    | 0.77                  |
| Coordinated X at risk                | -                              | -                     | 2.93                    | 3.01                  |
| <b>Compassionate</b>                 | -                              | -                     | 1.78                    | 1.69                  |

|                                   | Complete medical home<br>score |                       | Individual domains      |                       |
|-----------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Compassionate X overweight        | -                              | -                     | -                       | -                     |
| Compassionate X at risk           | -                              | -                     | -                       | -                     |
| <b>Culturally effective</b>       | -                              | -                     | -                       | -                     |
| Culturally effective X overweight | -                              | -                     | 0.23                    | 0.99                  |
| Culturally effective X at risk    | -                              | -                     | 1.12                    | 2.15                  |
| <i>Hospital Outpatient</i>        |                                |                       |                         |                       |
| <b>Overweight</b>                 | 1.18                           | 1.28                  | 1.51                    | 1.63                  |
| <b>At risk for overweight</b>     | 0.80                           | 0.85                  | 0.79                    | 0.76                  |
| <b>Medical home</b>               | 1.03                           | 1.00                  | -                       | -                     |
| Medical home X overweight         | 1.56                           | 1.52                  | -                       | -                     |
| Medical home X at risk            | 2.69                           | 2.73*                 | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | 1.44                    | 1.58                  |
| USC X overweight                  | -                              | -                     | 3.36                    | 3.53                  |
| USC X at risk                     | -                              | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>                 | -                              | -                     | 1.17                    | 1.11                  |
| Accessible X overweight           | -                              | -                     | 1.10                    | 1.08                  |
| Accessible X at risk              | -                              | -                     | 0.96                    | 0.96                  |
| <b>Family-centered</b>            | -                              | -                     | 1.11                    | 1.06                  |
| Family-centered X overweight      | -                              | -                     | 1.81                    | 1.75                  |
| Family-centered X at risk         | -                              | -                     | 0.65                    | 0.65                  |
| <b>Comprehensive</b>              | -                              | -                     | 0.89                    | 0.83                  |
| Comprehensive X overweight        | -                              | -                     | 0.27                    | 0.29                  |
| Comprehensive X at risk           | -                              | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                              | -                     | 1.00                    | 1.05                  |
| Coordinated X overweight          | -                              | -                     | 1.15                    | 1.17                  |
| Coordinated X at risk             | -                              | -                     | 1.23                    | 1.28                  |
| <b>Compassionate</b>              | -                              | -                     | 0.79                    | 0.80                  |
| Compassionate X overweight        | -                              | -                     | 0.88                    | 0.84                  |
| Compassionate X at risk           | -                              | -                     | 1.15                    | 1.17                  |
| <b>Culturally effective</b>       | -                              | -                     | 1.54                    | 1.25                  |
| Culturally effective X overweight | -                              | -                     | 0.52                    | 0.48                  |
| Culturally effective X at risk    | -                              | -                     | -                       | -                     |
| <i>All Outpatient</i>             |                                |                       |                         |                       |
| <b>Overweight</b>                 | 0.85*                          | 1.02                  | 1.00                    | 1.15                  |
| <b>At risk for overweight</b>     | 0.95                           | 1.04                  | 0.85                    | 0.83                  |
| <b>Medical home</b>               | 1.64**                         | 1.57**                | -                       | -                     |
| Medical home X overweight         | 1.18                           | 1.15                  | -                       | -                     |
| Medical home X at risk            | 0.83                           | 0.82                  | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | 1.65                    | 1.74                  |
| USC X overweight                  | -                              | -                     | 0.49                    | 0.43                  |
| USC X at risk                     | -                              | -                     | 0.45                    | 0.44                  |
| <b>Accessible</b>                 | -                              | -                     | 1.36**                  | 1.27**                |
| Accessible X overweight           | -                              | -                     | 0.87                    | 0.85                  |
| Accessible X at risk              | -                              | -                     | 1.15                    | 1.11                  |
| <b>Family-centered</b>            | -                              | -                     | 1.12                    | 1.07                  |
| Family-centered X overweight      | -                              | -                     | 1.04                    | 0.95                  |
| Family-centered X at risk         | -                              | -                     | 0.95                    | 0.95                  |
| <b>Comprehensive</b>              | -                              | -                     | 1.32                    | 1.23                  |
| Comprehensive X overweight        | -                              | -                     | 1.72                    | 1.81                  |
| Comprehensive X at risk           | -                              | -                     | 0.85                    | 0.85                  |
| <b>Coordinated</b>                | -                              | -                     | 1.03                    | 1.09                  |
| Coordinated X overweight          | -                              | -                     | 1.23                    | 1.31                  |
| Coordinated X at risk             | -                              | -                     | 0.95                    | 0.98                  |

|                                   | Complete medical home<br>score |                       | Individual domains      |                       |
|-----------------------------------|--------------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>        | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Compassionate</b>              | -                              | -                     | 0.98                    | 0.99                  |
| Compassionate X overweight        | -                              | -                     | 1.06                    | 1.03                  |
| Compassionate X at risk           | -                              | -                     | 1.02                    | 1.03                  |
| <b>Culturally effective</b>       | -                              | -                     | 1.36                    | 1.17                  |
| Culturally effective X overweight | -                              | -                     | 0.91                    | 1.04                  |
| Culturally effective X at risk    | -                              | -                     | 3.27                    | 3.66                  |
| <i>Emergency Room</i>             |                                |                       |                         |                       |
| <b>Overweight</b>                 | 1.26                           | 1.27                  | 1.61                    | 1.56                  |
| <b>At risk for overweight</b>     | 1.15                           | 1.20                  | 1.80*                   | 1.77                  |
| <b>Medical home</b>               | 1.14                           | 1.11                  | -                       | -                     |
| Medical home X overweight         | 0.72                           | 0.69                  | -                       | -                     |
| Medical home X at risk            | 1.14                           | 1.11                  | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | 0.71                    | 0.75                  |
| USC X overweight                  | -                              | -                     | 0.18                    | 0.20                  |
| USC X at risk                     | -                              | -                     | 1.91                    | 2.15                  |
| <b>Accessible</b>                 | -                              | -                     | 1.12                    | 1.11                  |
| Accessible X overweight           | -                              | -                     | 0.80                    | 0.80                  |
| Accessible X at risk              | -                              | -                     | 0.74                    | 0.73                  |
| <b>Family-centered</b>            | -                              | -                     | 1.23                    | 1.24                  |
| Family-centered X overweight      | -                              | -                     | 0.75                    | 0.74                  |
| Family-centered X at risk         | -                              | -                     | 0.88                    | 0.85                  |
| <b>Comprehensive</b>              | -                              | -                     | 0.69                    | 0.69                  |
| Comprehensive X overweight        | -                              | -                     | 3.41                    | 3.55                  |
| Comprehensive X at risk           | -                              | -                     | 3.12                    | 2.91                  |
| <b>Coordinated</b>                | -                              | -                     | 0.80                    | 0.81                  |
| Coordinated X overweight          | -                              | -                     | 1.42                    | 1.42                  |
| Coordinated X at risk             | -                              | -                     | 1.25                    | 1.26                  |
| <b>Compassionate</b>              | -                              | -                     | 0.84                    | 0.81                  |
| Compassionate X overweight        | -                              | -                     | 0.88                    | 0.83                  |
| Compassionate X at risk           | -                              | -                     | 0.68                    | 0.72                  |
| <b>Culturally effective</b>       | -                              | -                     | 3.76                    | 3.10                  |
| Culturally effective X overweight | -                              | -                     | 1.43                    | 1.30                  |
| Culturally effective X at risk    | -                              | -                     | 0.16                    | 0.16                  |
| <i>Inpatient</i>                  |                                |                       |                         |                       |
| <b>Overweight</b>                 | 1.80*                          | 1.85*                 | 0.00                    | 0.00                  |
| <b>At risk for overweight</b>     | 0.80                           | 0.84                  | 1.40                    | 1.41                  |
| <b>Medical home</b>               | 0.81                           | 0.77                  | -                       | -                     |
| Medical home X overweight         | 0.40                           | 0.40                  | -                       | -                     |
| Medical home X at risk            | 2.41                           | 2.25                  | -                       | -                     |
| <b>Usual source of care</b>       | -                              | -                     | 0.00                    | 0.00                  |
| USC X overweight                  | -                              | -                     | -                       | -                     |
| USC X at risk                     | -                              | -                     | 0.00                    | 0.00                  |
| <b>Accessible</b>                 | -                              | -                     | 0.90                    | 0.88                  |
| Accessible X overweight           | -                              | -                     | 1.16                    | 1.18                  |
| Accessible X at risk              | -                              | -                     | 1.11                    | 1.23                  |
| <b>Family-centered</b>            | -                              | -                     | 1.94                    | 1.90                  |
| Family-centered X overweight      | -                              | -                     | 0.50                    | 0.50                  |
| Family-centered X at risk         | -                              | -                     | 1.17                    | 1.24                  |
| <b>Comprehensive</b>              | -                              | -                     | 1.21                    | 1.15                  |
| Comprehensive X overweight        | -                              | -                     | 0.07                    | 0.10                  |
| Comprehensive X at risk           | -                              | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                              | -                     | 1.19                    | 1.15                  |
| Coordinated X overweight          | -                              | -                     | 0.50                    | 0.53                  |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Coordinated X at risk             | -                           | -                     | 0.73                    | 0.75                  |
| <b>Compassionate</b>              | -                           | -                     | 0.58                    | 0.57                  |
| Compassionate X overweight        | -                           | -                     | 6.17                    | 6.22                  |
| Compassionate X at risk           | -                           | -                     | 0.37                    | 0.37                  |
| <b>Culturally effective</b>       | -                           | -                     | -                       | -                     |
| Culturally effective X overweight | -                           | -                     | 0.93                    | 1.13                  |
| Culturally effective X at risk    | -                           | -                     | 0.91                    | 1.42                  |
| <b>Total</b>                      |                             |                       |                         |                       |
| <b>Overweight</b>                 | 0.70**                      | 0.92                  | 0.90                    | 1.11                  |
| <b>At risk for overweight</b>     | 0.98                        | 1.14                  | 1.09                    | 1.08                  |
| <b>Medical home</b>               | 1.95**                      | 1.77**                | -                       | -                     |
| Medical home X overweight         | 0.95                        | 0.93                  | -                       | -                     |
| Medical home X at risk            | 0.65                        | 0.60                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 2.34                    | 2.55                  |
| USC X overweight                  | -                           | -                     | 0.39                    | 0.35                  |
| USC X at risk                     | -                           | -                     | 3.29                    | 3.09                  |
| <b>Accessible</b>                 | -                           | -                     | 1.37**                  | 1.20                  |
| Accessible X overweight           | -                           | -                     | 0.80                    | 0.76                  |
| Accessible X at risk              | -                           | -                     | 1.42                    | 1.34                  |
| <b>Family-centered</b>            | -                           | -                     | 1.20                    | 1.10                  |
| Family-centered X overweight      | -                           | -                     | 1.05                    | 0.92                  |
| Family-centered X at risk         | -                           | -                     | 0.95                    | 0.95                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.81                    | 0.73                  |
| Comprehensive X overweight        | -                           | -                     | 1.93                    | 2.06                  |
| Comprehensive X at risk           | -                           | -                     | 0.18                    | 0.19                  |
| <b>Coordinated</b>                | -                           | -                     | 1.03                    | 1.14                  |
| Coordinated X overweight          | -                           | -                     | 0.97                    | 1.03                  |
| Coordinated X at risk             | -                           | -                     | 0.67                    | 0.67                  |
| <b>Compassionate</b>              | -                           | -                     | 0.98                    | 0.99                  |
| Compassionate X overweight        | -                           | -                     | 1.33                    | 1.30                  |
| Compassionate X at risk           | -                           | -                     | 1.26                    | 1.31                  |
| <b>Culturally effective</b>       | -                           | -                     | 1.95**                  | 1.50                  |
| Culturally effective X overweight | -                           | -                     | 0.88                    | 1.05                  |
| Culturally effective X at risk    | -                           | -                     | 1.53                    | 1.77                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

When using logged dollars, having a medical home has no significant effect on expenditures for care from a physician's office, nurse practitioner, physician assistant, physical or occupational therapist, hospital outpatient department, any outpatient provider, emergency room, inpatient unit, or any health care provider (Table D.4). When analyzing the individual domains, the only aspect of the medical home with a consistent relationship to expenditures is cultural effectiveness, which is related to increased expenditures for physician's office care, all outpatient care, and

all health care. Controlling for the presence of a medical home, overweight or at risk for overweight children have no differences in expenditures, compared to healthy weight children.

**Table D.4. Effect of weight and medical home domains on logged expenditures, among those with any expenditure.**

|                                    | Complete medical home score |                       | Individual domains      |                       |
|------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                    | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <i>Physician's office (N=4160)</i> |                             |                       |                         |                       |
| <b>Overweight</b>                  | 0.08                        | 0.11                  | -0.23                   | -0.25                 |
| <b>At risk for overweight</b>      | -0.14*                      | -0.11                 | -0.34*                  | -0.39*                |
| <b>Medical home</b>                | 0.07                        | 0.07                  | -                       | -                     |
| Medical home X overweight          | -0.16                       | -0.16                 | -                       | -                     |
| Medical home X at risk             | 0.17                        | 0.17                  | -                       | -                     |
| <b>Usual source of care</b>        | -                           | -                     | -0.33                   | -0.37                 |
| USC X overweight                   | -                           | -                     | 0.98                    | 0.89                  |
| USC X at risk                      | -                           | -                     | -0.64                   | -0.66                 |
| <b>Accessible</b>                  | -                           | -                     | 0.05                    | 0.02                  |
| Accessible X overweight            | -                           | -                     | -0.02                   | -0.01                 |
| Accessible X at risk               | -                           | -                     | -0.04                   | -0.04                 |
| <b>Family-centered</b>             | -                           | -                     | 0.12*                   | 0.11*                 |
| Family-centered X overweight       | -                           | -                     | 0.28*                   | 0.25*                 |
| Family-centered X at risk          | -                           | -                     | -0.44**                 | -0.44**               |
| <b>Comprehensive</b>               | -                           | -                     | 0.01                    | -0.01                 |
| Comprehensive X overweight         | -                           | -                     | -0.56                   | -0.43                 |
| Comprehensive X at risk            | -                           | -                     | 0.35                    | 0.34                  |
| <b>Coordinated</b>                 | -                           | -                     | 0.00                    | 0.02                  |
| Coordinated X overweight           | -                           | -                     | 0.01                    | 0.00                  |
| Coordinated X at risk              | -                           | -                     | 0.17                    | 0.18                  |
| <b>Compassionate</b>               | -                           | -                     | 0.03                    | 0.02                  |
| Compassionate X overweight         | -                           | -                     | -0.15                   | -0.13                 |
| Compassionate X at risk            | -                           | -                     | 0.00                    | 0.03                  |
| <b>Culturally effective</b>        | -                           | -                     | 0.39*                   | 0.37*                 |
| Culturally effective X overweight  | -                           | -                     | -0.19                   | -0.19                 |
| Culturally effective X at risk     | -                           | -                     | 0.80**                  | 0.87**                |
| Constant                           | 5.02                        | 5.06                  | 4.81                    | 4.96                  |
| <i>Nurse practitioner (N=349)</i>  |                             |                       |                         |                       |
| <b>Overweight</b>                  | 0.09                        | 0.07                  | 1.73**                  | 1.82**                |
| <b>At risk for overweight</b>      | -0.11                       | -0.12                 | 0.34                    | 0.44                  |
| <b>Medical home</b>                | -0.07                       | -0.05                 | -                       | -                     |
| Medical home X overweight          | 1.06                        | 0.93                  | -                       | -                     |
| Medical home X at risk             | -0.21                       | -0.20                 | -                       | -                     |
| <b>Usual source of care</b>        | -                           | -                     | -                       | 0.52                  |
| USC X overweight                   | -                           | -                     | -                       | -2.01                 |
| USC X at risk                      | -                           | -                     | -1.05                   | -                     |
| <b>Accessible</b>                  | -                           | -                     | -0.31                   | -0.32                 |
| Accessible X overweight            | -                           | -                     | 0.78                    | 0.72                  |
| Accessible X at risk               | -                           | -                     | 0.70                    | 0.72                  |
| <b>Family-centered</b>             | -                           | -                     | -0.03                   | -0.06                 |
| Family-centered X overweight       | -                           | -                     | 0.58                    | 0.50                  |
| Family-centered X at risk          | -                           | -                     | -0.60                   | -0.68                 |
| <b>Comprehensive</b>               | -                           | -                     | 0.88                    | 0.79*                 |

|                                             | Complete medical home score |                       | Individual domains      |                       |
|---------------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                             | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Comprehensive X overweight                  | -                           | -                     | -0.75                   | -0.22                 |
| Comprehensive X at risk                     | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                          | -                           | -                     | -0.07                   | -0.03                 |
| Coordinated X overweight                    | -                           | -                     | -0.58                   | -0.49                 |
| Coordinated X at risk                       | -                           | -                     | 0.50                    | 0.46                  |
| <b>Compassionate</b>                        | -                           | -                     | -0.09                   | -0.11                 |
| Compassionate X overweight                  | -                           | -                     | -0.24                   | 0.03                  |
| Compassionate X at risk                     | -                           | -                     | 0.30                    | 0.34                  |
| <b>Culturally effective</b>                 | -                           | -                     | 0.37                    | -                     |
| Culturally effective X overweight           | -                           | -                     | -1.20                   | -                     |
| Culturally effective X at risk              | -                           | -                     | -                       | -1.09                 |
| Constant                                    | 4.13                        | 4.13                  | 3.25                    | 3.21                  |
| <i>Physician's assistant (N=100)</i>        |                             |                       |                         |                       |
| <b>Overweight</b>                           | 0.49                        | 0.37                  | 0.12                    | 0.05                  |
| <b>At risk for overweight</b>               | -0.34                       | -0.40*                | -0.75*                  | -0.51                 |
| <b>Medical home</b>                         | -0.14                       | -0.14                 | -                       | -                     |
| Medical home X overweight                   | 0.99                        | 1.10                  | -                       | -                     |
| Medical home X at risk                      | 0.07                        | 0.08                  | -                       | -                     |
| <b>Usual source of care</b>                 | -                           | -                     | -0.70                   | -1.28                 |
| USC X overweight                            | -                           | -                     | -                       | -0.74                 |
| USC X at risk                               | -                           | -                     | 1.06                    | 1.37                  |
| <b>Accessible</b>                           | -                           | -                     | -0.05                   | -0.08                 |
| Accessible X overweight                     | -                           | -                     | 1.17                    | 1.53                  |
| Accessible X at risk                        | -                           | -                     | 0.16                    | 0.39                  |
| <b>Family-centered</b>                      | -                           | -                     | 0.08                    | 0.00                  |
| Family-centered X overweight                | -                           | -                     | -0.68                   | 0.03                  |
| Family-centered X at risk                   | -                           | -                     | -0.39                   | -0.43                 |
| <b>Comprehensive</b>                        | -                           | -                     | 0.41                    | 0.91                  |
| Comprehensive X overweight                  | -                           | -                     | -                       | -                     |
| Comprehensive X at risk                     | -                           | -                     | -0.38                   | -0.96                 |
| <b>Coordinated</b>                          | -                           | -                     | 0.12                    | 0.25                  |
| Coordinated X overweight                    | -                           | -                     | -0.82                   | -0.99                 |
| Coordinated X at risk                       | -                           | -                     | -0.40                   | -0.55                 |
| <b>Compassionate</b>                        | -                           | -                     | -0.05*                  | 0.01                  |
| Compassionate X overweight                  | -                           | -                     | 1.30                    | 1.47                  |
| Compassionate X at risk                     | -                           | -                     | 0.36                    | 0.24                  |
| <b>Culturally effective</b>                 | -                           | -                     | -                       | -                     |
| Culturally effective X overweight           | -                           | -                     | 0.18                    | -                     |
| Culturally effective X at risk              | -                           | -                     | -                       | -                     |
| Constant                                    | 4.08                        | 4.18                  | 4.28                    | 4.40                  |
| <i>Physical/Occupational Therapy (N=53)</i> |                             |                       |                         |                       |
| <b>Overweight</b>                           | 0.09                        | -0.17                 | 0.20                    | -2.21                 |
| <b>At risk for overweight</b>               | 0.66                        | 0.71                  | 0.86                    | 0.13                  |
| <b>Medical home</b>                         | 0.30                        | -0.27                 | -                       | -                     |
| Medical home X overweight                   | -                           | -                     | -                       | -                     |
| Medical home X at risk                      | -                           | -                     | -                       | -                     |
| <b>Usual source of care</b>                 | -                           | -                     | -                       | -                     |
| USC X overweight                            | -                           | -                     | -                       | -                     |
| USC X at risk                               | -                           | -                     | -                       | -                     |
| <b>Accessible</b>                           | -                           | -                     | -0.31                   | -1.32                 |
| Accessible X overweight                     | -                           | -                     | 0.04                    | 2.48                  |

|                                    | Complete medical home score |                       | Individual domains      |                       |
|------------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                    | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Accessible X at risk               | -                           | -                     | -0.35                   | 0.67                  |
| <b>Family-centered</b>             | -                           | -                     | -0.28                   | 0.32                  |
| Family-centered X overweight       | -                           | -                     | -                       | -                     |
| Family-centered X at risk          | -                           | -                     | 2.36**                  | 1.75                  |
| <b>Comprehensive</b>               | -                           | -                     | -                       | -                     |
| Comprehensive X overweight         | -                           | -                     | -                       | -                     |
| Comprehensive X at risk            | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                 | -                           | -                     | -0.58                   | -1.96                 |
| Coordinated X overweight           | -                           | -                     | -0.32                   | 1.92                  |
| Coordinated X at risk              | -                           | -                     | -1.21*                  | 0.18                  |
| <b>Compassionate</b>               | -                           | -                     | -0.89                   | -0.61                 |
| Compassionate X overweight         | -                           | -                     | 0.09                    | -0.42                 |
| Compassionate X at risk            | -                           | -                     | -                       | -                     |
| <b>Culturally effective</b>        | -                           | -                     | 1.62                    | 2.05                  |
| Culturally effective X overweight  | -                           | -                     | -                       | -                     |
| Culturally effective X at risk     | -                           | -                     | -                       | -                     |
| Constant                           | 5.32                        | 5.74                  | 5.25                    | 6.03                  |
| <i>Hospital Outpatient (N=378)</i> |                             |                       |                         |                       |
| <b>Overweight</b>                  | 0.26                        | 0.21                  | 1.37*                   | 1.41*                 |
| <b>At risk for overweight</b>      | 0.42                        | 0.36                  | -0.33                   | -0.35                 |
| <b>Medical home</b>                | -0.23                       | -0.21                 | -                       | -                     |
| Medical home X overweight          | 0.27                        | 0.20                  | -                       | -                     |
| Medical home X at risk             | -0.69                       | -0.62                 | -                       | -                     |
| <b>Usual source of care</b>        | -                           | -                     | 1.98*                   | 1.37                  |
| USC X overweight                   | -                           | -                     | -5.27**                 | -5.40**               |
| USC X at risk                      | -                           | -                     | -                       | -                     |
| <b>Accessible</b>                  | -                           | -                     | -0.19                   | -0.24                 |
| Accessible X overweight            | -                           | -                     | 0.22                    | 0.41                  |
| Accessible X at risk               | -                           | -                     | -0.11                   | -0.05                 |
| <b>Family-centered</b>             | -                           | -                     | -0.33                   | -0.29                 |
| Family-centered X overweight       | -                           | -                     | 0.02                    | 0.13                  |
| Family-centered X at risk          | -                           | -                     | 1.12*                   | 1.04*                 |
| <b>Comprehensive</b>               | -                           | -                     | 0.03                    | 0.22                  |
| Comprehensive X overweight         | -                           | -                     | 0.77                    | 0.60                  |
| Comprehensive X at risk            | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                 | -                           | -                     | -0.16                   | -0.16                 |
| Coordinated X overweight           | -                           | -                     | 0.30                    | 0.20                  |
| Coordinated X at risk              | -                           | -                     | 0.77                    | 0.71                  |
| <b>Compassionate</b>               | -                           | -                     | 0.00                    | -0.09                 |
| Compassionate X overweight         | -                           | -                     | 0.61                    | 0.66                  |
| Compassionate X at risk            | -                           | -                     | -0.73                   | -0.61                 |
| <b>Culturally effective</b>        | -                           | -                     | -0.73                   | -0.20                 |
| Culturally effective X overweight  | -                           | -                     | 2.52**                  | 2.51**                |
| Culturally effective X at risk     | -                           | -                     | -0.30                   | -0.38                 |
| Constant                           | 5.67                        | 5.63                  | 4.85                    | 4.78                  |
| <i>All Outpatient (N=4371)</i>     |                             |                       |                         |                       |
| <b>Overweight</b>                  | 0.11                        | 0.13                  | 0.09                    | 0.08                  |
| <b>At risk for overweight</b>      | -0.15*                      | -0.13                 | -0.33                   | -0.36                 |
| <b>Medical home</b>                | 0.07                        | 0.06                  | -                       | -                     |
| Medical home X overweight          | -0.03                       | -0.03                 | -                       | -                     |
| Medical home X at risk             | 0.05                        | 0.03                  | -                       | -                     |
| <b>Usual source of care</b>        | -                           | -                     | -0.20                   | -0.22                 |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| USC X overweight                  | -                           | -                     | 0.56                    | 0.45                  |
| USC X at risk                     | -                           | -                     | -0.35                   | -0.36                 |
| <b>Accessible</b>                 | -                           | -                     | 0.02                    | 0.00                  |
| Accessible X overweight           | -                           | -                     | 0.00                    | 0.01                  |
| Accessible X at risk              | -                           | -                     | -0.03                   | -0.03                 |
| <b>Family-centered</b>            | -                           | -                     | 0.09                    | 0.08                  |
| Family-centered X overweight      | -                           | -                     | 0.34*                   | 0.32*                 |
| Family-centered X at risk         | -                           | -                     | -0.34                   | -0.34*                |
| <b>Comprehensive</b>              | -                           | -                     | 0.11                    | 0.08                  |
| Comprehensive X overweight        | -                           | -                     | -0.64                   | -0.50                 |
| Comprehensive X at risk           | -                           | -                     | 0.00                    | -0.03                 |
| <b>Coordinated</b>                | -                           | -                     | -0.01                   | 0.01                  |
| Coordinated X overweight          | -                           | -                     | -0.01                   | -0.01                 |
| Coordinated X at risk             | -                           | -                     | 0.11                    | 0.11                  |
| <b>Compassionate</b>              | -                           | -                     | 0.03                    | 0.02                  |
| Compassionate X overweight        | -                           | -                     | -0.10                   | -0.08                 |
| Compassionate X at risk           | -                           | -                     | -0.09                   | -0.07                 |
| <b>Culturally effective</b>       | -                           | -                     | 0.39*                   | 0.35                  |
| Culturally effective X overweight | -                           | -                     | -0.09                   | -0.08                 |
| Culturally effective X at risk    | -                           | -                     | 0.86**                  | 0.93**                |
| Constant                          | 5.11                        | 5.16                  | 4.76                    | 4.89                  |
| <i>Emergency Room (N=790)</i>     |                             |                       |                         |                       |
| <b>Overweight</b>                 | -0.15                       | -0.07                 | -0.09                   | -0.11                 |
| <b>At risk for overweight</b>     | -0.12                       | -0.06                 | -0.35                   | -0.33                 |
| <b>Medical home</b>               | 0.14                        | 0.00                  | -                       | -                     |
| Medical home X overweight         | -0.01                       | 0.11                  | -                       | -                     |
| Medical home X at risk            | -0.03                       | 0.04                  | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | -0.48                   | -0.64                 |
| USC X overweight                  | -                           | -                     | 1.85*                   | 2.61**                |
| USC X at risk                     | -                           | -                     | 1.19                    | 1.51                  |
| <b>Accessible</b>                 | -                           | -                     | 0.24*                   | 0.16                  |
| Accessible X overweight           | -                           | -                     | -0.05                   | -0.05                 |
| Accessible X at risk              | -                           | -                     | -0.08                   | -0.13                 |
| <b>Family-centered</b>            | -                           | -                     | 0.20                    | 0.10                  |
| Family-centered X overweight      | -                           | -                     | 0.07                    | 0.01                  |
| Family-centered X at risk         | -                           | -                     | 0.12                    | 0.27                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.03                    | 0.09                  |
| Comprehensive X overweight        | -                           | -                     | 0.81*                   | 1.08**                |
| Comprehensive X at risk           | -                           | -                     | 0.10                    | -0.30                 |
| <b>Coordinated</b>                | -                           | -                     | -0.11                   | -0.09                 |
| Coordinated X overweight          | -                           | -                     | 0.41                    | 0.45                  |
| Coordinated X at risk             | -                           | -                     | -0.18                   | -0.15                 |
| <b>Compassionate</b>              | -                           | -                     | -0.08                   | -0.03                 |
| Compassionate X overweight        | -                           | -                     | -0.05                   | 0.09                  |
| Compassionate X at risk           | -                           | -                     | -0.03                   | -0.03                 |
| <b>Culturally effective</b>       | -                           | -                     | 0.44                    | 0.47                  |
| Culturally effective X overweight | -                           | -                     | -2.97**                 | -3.98**               |
| Culturally effective X at risk    | -                           | -                     | -0.86                   | -0.85                 |
| Constant                          | 5.54                        | 5.82                  | 5.42                    | 5.82                  |
| <i>Inpatient (N=135)</i>          |                             |                       |                         |                       |
| <b>Overweight</b>                 | -0.11                       | -0.24                 | 0.33                    | -0.56                 |
| <b>At risk for overweight</b>     | 0.79                        | 0.81                  | 1.72*                   | 1.57*                 |

|                                   | Complete medical home score |                       | Individual domains      |                       |
|-----------------------------------|-----------------------------|-----------------------|-------------------------|-----------------------|
|                                   | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| <b>Medical home</b>               | 0.51                        | 0.60                  | -                       | -                     |
| Medical home X overweight         | 0.81                        | 1.01                  | -                       | -                     |
| Medical home X at risk            | -0.10                       | -0.20                 | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | 0.65                    | -                     |
| USC X overweight                  | -                           | -                     | -                       | -                     |
| USC X at risk                     | -                           | -                     | -2.66*                  | -2.81**               |
| <b>Accessible</b>                 | -                           | -                     | -0.21                   | -0.24                 |
| Accessible X overweight           | -                           | -                     | 0.34                    | 0.18                  |
| Accessible X at risk              | -                           | -                     | 0.89                    | 1.15*                 |
| <b>Family-centered</b>            | -                           | -                     | -0.13                   | -0.30                 |
| Family-centered X overweight      | -                           | -                     | -0.37                   | -0.29                 |
| Family-centered X at risk         | -                           | -                     | 0.31                    | 0.09                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.08                    | -0.14                 |
| Comprehensive X overweight        | -                           | -                     | -0.97*                  | -0.42                 |
| Comprehensive X at risk           | -                           | -                     | -                       | -                     |
| <b>Coordinated</b>                | -                           | -                     | -0.07                   | -0.33                 |
| Coordinated X overweight          | -                           | -                     | -0.32                   | 0.23                  |
| Coordinated X at risk             | -                           | -                     | 1.76*                   | 2.46*                 |
| <b>Compassionate</b>              | -                           | -                     | 0.13                    | 0.41                  |
| Compassionate X overweight        | -                           | -                     | 0.73                    | 0.53                  |
| Compassionate X at risk           | -                           | -                     | -0.96                   | -1.13                 |
| <b>Culturally effective</b>       | -                           | -                     | -                       | 0.93                  |
| Culturally effective X overweight | -                           | -                     | -                       | -                     |
| Culturally effective X at risk    | -                           | -                     | -                       | -                     |
| Constant                          | 8.01                        | 8.44                  | 7.54                    | 7.91                  |
| <b>Total (N=5335)</b>             |                             |                       |                         |                       |
| <b>Overweight</b>                 | -0.11                       | -0.01                 | -0.19                   | -0.12                 |
| <b>At risk for overweight</b>     | -0.16*                      | -0.08                 | -0.08                   | -0.08                 |
| <b>Medical home</b>               | 0.06                        | 0.05                  | -                       | -                     |
| Medical home X overweight         | -0.04                       | -0.07                 | -                       | -                     |
| Medical home X at risk            | 0.49*                       | 0.47*                 | -                       | -                     |
| <b>Usual source of care</b>       | -                           | -                     | -0.09                   | 0.01                  |
| USC X overweight                  | -                           | -                     | 0.63                    | 0.70                  |
| USC X at risk                     | -                           | -                     | -0.39                   | -0.51                 |
| <b>Accessible</b>                 | -                           | -                     | 0.07                    | 0.01                  |
| Accessible X overweight           | -                           | -                     | 0.07                    | 0.06                  |
| Accessible X at risk              | -                           | -                     | 0.05                    | 0.02                  |
| <b>Family-centered</b>            | -                           | -                     | 0.09                    | 0.05                  |
| Family-centered X overweight      | -                           | -                     | 0.08                    | 0.02                  |
| Family-centered X at risk         | -                           | -                     | 0.06                    | 0.07                  |
| <b>Comprehensive</b>              | -                           | -                     | 0.17                    | 0.08                  |
| Comprehensive X overweight        | -                           | -                     | -0.72                   | -0.68                 |
| Comprehensive X at risk           | -                           | -                     | 0.21                    | 0.26                  |
| <b>Coordinated</b>                | -                           | -                     | -0.06                   | 0.00                  |
| Coordinated X overweight          | -                           | -                     | -0.01                   | 0.02                  |
| Coordinated X at risk             | -                           | -                     | 0.05                    | 0.07                  |
| <b>Compassionate</b>              | -                           | -                     | 0.04                    | 0.04                  |
| Compassionate X overweight        | -                           | -                     | -0.02                   | -0.01                 |
| Compassionate X at risk           | -                           | -                     | -0.19                   | -0.18                 |
| <b>Culturally effective</b>       | -                           | -                     | 0.43**                  | 0.28                  |
| Culturally effective X overweight | -                           | -                     | 0.08                    | 0.02                  |
| Culturally effective X at risk    | -                           | -                     | 0.26                    | 0.38                  |

|          | Complete medical home score |                       | Individual domains      |                       |
|----------|-----------------------------|-----------------------|-------------------------|-----------------------|
|          | Unadjusted <sup>a</sup>     | Adjusted <sup>b</sup> | Unadjusted <sup>a</sup> | Adjusted <sup>b</sup> |
| Constant | 6.16                        | 6.33                  | 5.60                    | 5.93                  |

<sup>a</sup> Adjusted for missing weight only; <sup>b</sup> Adjusted for age, sex, race, poverty status, insurance type, and missing weight. \*p<0.05, \*\*p<0.01

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