Commonwealth of Kentucky
Department for Medicaid Services
Division of Program Quality and Outcomes

Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity Among the Kentucky Medicaid Managed Care Population
Clinical Focus Study 2015

FINAL REPORT

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EXECUTIVE SUMMARY

Introduction

Childhood obesity is a serious public health problem in the United States that is associated with immediate and long term health risks and costs. Childhood obesity rates in Kentucky exceed national rates, and it is particularly prevalent among publicly insured children in Kentucky. Reducing the prevalence of child and adolescent obesity is a priority for Kentucky, yet the Healthcare Effectiveness Data and Information Set (HEDIS®) data on performance measures (PMs) for weight assessment and counseling for nutrition and physical activity for children and adolescents indicate the need to improve care for children enrolled in Kentucky Medicaid managed care (MMC). The American Medical Association (AMA), Health Resources and Services Administration (HRSA) and the Centers for Disease Control and Prevention (CDC)'s Expert Committee issued "Recommendations on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity" in 2007.[1] This focused study assessed the implementation of recommendations for the prevention, identification, assessment, and treatment of pediatric obesity among the Kentucky MMC population in accordance with the Expert Committee Recommendations. The primary goal was to detect specific gaps in care and highlight opportunities for improvement.

Methodology

The eligible population for this study included all Kentucky MMC enrollees who turned 2–18 years old from November 1, 2013 to October 31, 2014, were continuously enrolled in MMC with no more than one gap in continuous enrollment of up to 45 days, and who had at least one outpatient visit that was associated with a primary care provider (PCP). A random sample of 900 MMC members was selected from the eligible population, stratified by managed care organization (MCO; Anthem Blue Cross and Blue Shield Medicaid, CoventryCares of Kentucky, Humana-CareSource, Passport Health Plan and WellCare of Kentucky) and age group (preschool children: 2–5 years old; school-aged children: 6–11 years old; and adolescents: 12–18 years old). A retrospective medical record review (MRR) of all PCP outpatient visits during the measurement year (MY; November 1, 2013 to October 31, 2014) among members in the study sample was conducted. All records were abstracted by Island Peer Review Organization (IPRO) nurse reviewers using an electronic tool that included all study indicators, and inter-rater reliability (IRR) was conducted to evaluate the performance of the nurse reviewers at the outset and at regular intervals during the review. All nurse abstractor reviewers maintained a performance of at least 95% accuracy throughout the oversight process.

Of the total of 900 charts requested, 702 charts were received and 34 were excluded. This resulted in a final study sample of 668 members: 217 preschool children, 225 school-aged children, and 226 adolescents.

Key Findings

Study results revealed prevalent overweight and obesity and multiple apparent gaps in the process of prevention, identification, risk assessment and management of these conditions. At least 29% of the sample could be identified as at-risk for cardiovascular and other obesity-related conditions, but it is possible that there were other at-risk children who could not be identified due to a lack of uniform screening for obesity-related risk.

- Obesity was noted to be particularly prevalent in the adolescent age group (30%), but 17% of preschool children were also noted to be obese.

[1] Barlow SE and the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatrics 2007; 120:S164

- While Body Mass Index (BMI) value or percentile was appropriately documented for older adolescents, BMI percentile documentation was documented for only 49% of younger children.
- Risk assessment was lacking in medical record documentation, with only 57% of records including family history and 29% including plotting of BMI on a growth chart. Most records of overweight and obese children did not include appropriate laboratory testing for obesity-related conditions, and risk behavior assessment was not universally documented.

Prevention and management also offered opportunity for improvement.

- Less than half of the members in the study sample had nutritional counseling (47%) or physical activity counseling (41%), and most counseling was not specific to risk behaviors.
- Most of the medical records of at-risk overweight and obese children and adolescents did not include assessment of risk behaviors or behavioral or weight goals; only 5% included a scheduled follow-up of weight status in three to six months, and only 2% included any structured, higher intensity interventions for their weight status.

Since at-risk children were identified even among preschool children, with increasing rates of obesity in older age groups, it is important to ensure early identification and intervention, as advocated by the Institute of Medicine (IOM).[2] Most apparently at-risk children and adolescents did not have documentation of acknowledgement of their weight status by their providers. Since most at-risk children and adolescents did not receive identification of target goals, reassessment of goals or close monitoring and follow-up, it was not possible to evaluate whether more intensive, tailored interventions were appropriately implemented for those most at risk who did not make progress.

Implementation of coordinated efforts to improve universal prevention interventions and identification, risk assessment and management of overweight and obese children is recommended to address this public health problem and reach Healthy Kentuckians 2020 goals:

- MCOs should promote BMI percentile screening and universal prevention interventions for all MMC-enrolled children beginning in early childhood.
- Since pediatricians with better access to community and adjunct resources have been reported to better screen for overweight and obesity, MCOs should ensure that resources for nutrition, physical activity and weight management are disseminated to their network providers.
- MCOs should ensure appropriate risk assessment, management and monitoring of overweight and obese members among network providers, and investigate and address provider-reported barriers to appropriate care.
- Improvement efforts should focus on addressing obesity with a chronic care model, since successful models have been those incorporating motivational interviewing, family involvement, and engaging all office staff in the care of at-risk children and adolescents.
- MCOs should ensure member and family awareness of the cardiovascular and other health risks associated with overweight and obesity to facilitate motivation to change.
- Because of the prevalence of obesity in preschool children noted in this study and other reports, MCOs and the State should collaborate on antenatal interventions such as appropriate maternal gestation weight gain and promotion of breastfeeding.
- Demographic and regional disparities in care for at-risk children and adolescents should be further explored.

[2] Institute of Medicine. Early childhood obesity prevention policies. Report Brief June 2011. National Academy of Sciences, Washington, D.C.

INTRODUCTION

Background

The state of Kentucky ranks 40th in the nation for the percent of preschool children (children between the ages of two and five years) who were obese, at 15.5%, compared to the states that rank in the top ten least obese with rates ranging from 12.7% of young children who were obese in Minnesota to 9.0% in Utah.[3] Among high school students in Kentucky, 18% were obese, a rate above the U.S. median of 12.4% (range = 6.4%, 18.0%).[4] Moreover, disparities exist between publicly and privately insured children in Kentucky; data from the 2011/12 National Survey of Children's Health (NSCH) show that a significantly greater percentage of publicly insured children, aged 10–17 years, in Kentucky are obese (28.9%; 95% confidence interval [CI] = 21.3%, 36.5%) compared to privately insured children (13.3%; 95% CI = 9.1, 17.5%).[5]

In recognition of the adverse health effects of childhood obesity throughout human life, the Kentucky Task Force on Childhood Obesity was established in 2011 to reduce the prevalence of obesity among children and adolescents in Kentucky, and set a goal to rank Kentucky in the top 10 states with the lowest levels of childhood obesity.[6] Unhealthy lifestyles pose barriers to attaining this goal. For example, 15.2% of Kentucky adolescents drank soda/pop 3 or more times per day (95% CI = 12.3%, 18.8%); this proportion was well above the U.S. median of 7.2% (range = 4.0%, 18.7%).[7] Furthermore, 19.9% of Kentucky adolescents lacked appropriate levels of physical activity (i.e., participation in at least 60 minutes of physical activity per day on five or more days per week; 95% CI: 17.5%, 22.6%); this proportion was also above the U.S. median of 15% (range = 10.0%, 22.8%). The IOM's early childhood obesity prevention policies recommend monitoring BMI and counseling for nutrition and physical activity, yet HEDIS® data on PMs for weight assessment and counseling for nutrition and physical activity for children and adolescents indicate the need to improve care for children enrolled in Kentucky MMC.[8] Specifically:

- all four Medicaid MCOs reported 2013 HEDIS® rates (MY 2012) for BMI percentile documentation that were significantly lower than the national Medicaid health maintenance organization (HMO) 90th percentile for children aged 3–11 (80.93%) and adolescents aged 12–17 years (80.26%), and three of the four MCOs reported rates significantly lower than the national Medicaid HMO average rate for children (51.48%) and adolescents (52.31%);
- all four MCOs reported 2013 HEDIS® rates for counseling for nutrition that were significantly lower than the national Medicaid HMO 90th percentile for children (76.63%) and adolescents (72.73%), and three of the four MCOs reported rates significantly lower than the national Medicaid HMO average rate for children (56.68%) and adolescents (51.34%); and
- all four MCOs reported 2013 HEDIS® rates for counseling for physical activity that were significantly lower than the national Medicaid HMO 90th percentile (65.75%) and average (42.81%) rates for

[3] Centers for Disease Control and Prevention (CDC). 2011 Pediatric Nutrition Surveillance. http://www.cdc.gov/pednss/pednss_tables/pdf/national_table6.pdf [October 9, 2014]
[4] Morbidity Mortality Weekly Report (MMWR). Youth Risk Behavior Survey, 2013. June 13, 2013. No. 4. http://www.cdc.gov/mmwr/pdf/ss/ss6304.pdf [October 9, 2014]
[5] National Survey of Children's Health (NSCH). NSCH 2011/12. Data query from the Child and Adolescent Health Measurement Initiative. Data Resource Center for Child and Adolescent Health website. www.childhealthdata.org [October 9, 2014]
[6] Legislative Research Commission (LRC). Report of the Co-Chairs of the Task Force on Childhood Obesity. 2011 House Concurrent Resolution 13. Research Memorandum No. 509, September 2012
[7] Morbidity Mortality Weekly Report (MMWR). Youth Risk Behavior Survey, 2013. June 13, 2013. No. 4. http://www.cdc.gov/mmwr/pdf/ss/ss6304.pdf [October 9, 2014]
[8] Institute of Medicine (IOM). Early Childhood Obesity Prevention Policies, Goals, Recommendations, and Potential Actions. The Institute of Medicine of the National Academies. June 2011.

children aged 3–11 years, and two of the four MCOs reported rates significantly below the national Medicaid HMO average for adolescents (47.3%).

The AMA, HRSA and the CDC's Expert Committee issued "Recommendations on the Assessment, Prevention and Treatment of Child and Adolescent Overweight and Obesity."[9] Recent research findings, however, indicate that the expert recommendations and guidelines have not resulted in changes in clinical practice, and the authors advised that further research is needed to identify approaches to improve performance.[10]

Objectives

This focused study assessed the implementation of recommendations for the prevention, identification, assessment, and treatment of pediatric obesity among the Kentucky MMC population in accordance with the Expert Committee Recommendations. The primary goal was to detect specific gaps in care and highlight opportunities for improvement.

[9] Barlow SE and the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatrics 2007; 120:S164

[10] Sharifi M, Rifas-Shiman SL, Marshall R, Simon SR, Gillman MW, Finkelstein JA, Taveras EM. Evaluating the implementation of expert committee recommendation for obesity assessment. Clinical Pediatrics 2013; 52(2); 131-138

METHODOLOGY

Eligible Population

The eligible population for this study included all Kentucky MMC enrollees who turned 2–18 years old during the MY from November 1, 2013 to October 31, 2014, who were continuously enrolled in MMC with no more than one gap in continuous enrollment in MMC of up to 45 days, and who had at least one claim for an outpatient visit that was associated with a PCP with the following Current Procedural Terminology (CPT) encounter codes during the MY: 99201–99205; 99211–99215; 99241–99245; 99341–99345; 99347–99381; 99382–99385; 99391–99395; 99401–99404; 99411–99412; 99420; 99429; or the Healthcare Common Procedure Coding System (HCPCS) codes G0438–G0439. Members who turned 2through 18 years old during the MY without an outpatient visit were excluded.

Scope of Review

A random sample of 900 MMC members were selected from the eligible population stratified by MCO and age group. The eligible population was stratified into three age groups: preschool children who were 2–5 years old; school-aged children who were 6–11 years old; and adolescents who were 12–18 years old. In some cases, the adolescent age group was divided into two subgroups: younger adolescents of 12–15 years of age and older adolescents of 16–18 years of age. The samples for each of the five MCOs, therefore, consisted of 180 enrollees; 60 enrollees per age group, including an oversample of 10 enrollees per age group. This sampling strategy provided for subgroups that were large enough to allow for statistical comparison of the differing subgroups within the study sample.

Data Collection

A retrospective MRR of all PCP outpatient visits during the MY among members in the study sample was conducted. Medical records of all PCP visits during the MY were requested from the following MCOs: Anthem Blue Cross and Blue Shield Medicaid, CoventryCares of Kentucky, Humana-CareSource, Passport Health Plan and WellCare of Kentucky. The review was not limited to well-child visits; all PCP visits in the MY were reviewed to evaluate every opportunity the provider had to assess the member's weight status. All records were abstracted by IPRO nurse reviewers using an electronic tool that included all study indicators.

Medical records were excluded if:

- there was no documentation for the MY;
- the member was younger than 2 years of age or older than 18 years of age during the entire MY, or did not have an outpatient visit while they were of eligible age during the MY; and/or
- the chart was illegible.

Demographic information for each member in the study sample was collected from the data warehouse (administrative data) and pre-populated into the electronic review tool.

Medical Record Review

IPRO developed a medical record abstraction tool for the study in collaboration with the Kentucky Department for Medicaid Services (DMS). To help standardize the abstraction process, a record review tool and detailed instructions for each element, including requirements for indicator compliance, clear definitions for elements and likely location of the elements in the medical records were developed for the review. An electronic tool was created in Microsoft Access, with training provided for IPRO nurse reviewers. Each nurse reviewer achieved greater than 95% accuracy on test charts prior to beginning chart abstractions. IRR was conducted to evaluate the performance of the nurse reviewers at the outset, and regular oversight was conducted

throughout the review process through weekly over-reads of a minimum of 5% of reviewed charts. All nurse abstractor reviewers maintained a performance of at least 95% accuracy throughout the oversight process. The cumulative abstraction accuracy rate for the over-read was 99%.

Statistical Analysis

SAS version 9.3 (SAS Institute, North Carolina) was used to analyze the data. The *chi*-square test was used to test the difference in proportions between two or more groups, i.e., region (urban vs. rural). To test the difference in proportions between three or more groups, i.e., among the three age groups (preschool children vs. school-aged children vs. adolescents), the *chi*-square test was used to determine an association between age group and the dependent variables, followed by logistic regression for any significant associations observed to determine the direction of the difference.

The chance of a spurious statistically significant result increases when a large number of statistical tests are conducted. Thus, to limit the likelihood of reporting significance when it did not exist, the Bonferroni correction for multiple analyses was applied, resulting in an adjusted significance level of $P < 0.001$.

Medical Record Disposition

Table 1 shows the overall disposition of records. Of the total of 900 charts requested, 702 charts were received. The final chart retrieval rate (77%) includes 668 valid charts that were reviewed and 34 charts that were excluded: 17 charts were excluded due to the member's age during the MY; 16 charts were excluded because no documentation was found for the MY and one illegible chart was also excluded. Among the final study sample of 668 members, for whom the medical record was reviewed, 217 members were preschool children, 225 members were school-aged children, and 226 members were adolescents.

Table 1: Overall Disposition of Records

MCO	Charts Requested	Valid Charts Received				Charts Excluded	Reason for Exclusion			Chart Retrieval Rate[1]
		Preschool Children (2–5 Years)	School-Aged Children (6–11 Years)	Adolescents (12–18 Years)	Final Study Sample		Age Exclusion	No Record for MY	Other	
Anthem Blue Cross and Blue Shield Medicaid	180	31	26	26	83	2	1	1	0	47%
CoventryCares of Kentucky	180	30	40	39	109	8	1	7	0	63%
Humana-CareSource	180	53	60	59	172	8	7	1	0	100%
Passport Health Plan	180	56	59	59	174	3	3	0	0	98%
WellCare of Kentucky	180	47	40	43	130	13	5	7	1	78%
TOTAL	**900**	**217**	**225**	**226**	**668**	**34**	**17**	**16**	**1**	**77%**

[1]Chart retrieval rate = number of valid charts received / (number of charts requested - number of charts excluded).

RESULTS

Member Characteristics

The age of the member represented in results is the age of the member in years at the time of the first outpatient visit associated with a PCP during the measurement year. For example, a child that is 3 years and 8 months old on the date of the relevant visit was included in the 3-yearold group since they did not reach their 4th birthday. Overall, one-third of the children in the study sample were in each of the study age groups: 32% were preschool children; 34% were school-aged children, and 34% were adolescents (**Table A1**). Older adolescents made up a third of the adolescent age group and 11% of the study sample.

The members' gender, race and residence were also obtained from administrative data. Overall, 50% of the children in the sample were male or female, with more (52%) male children among the preschool children than among the school-aged children (48%). For the majority (80%) of members, race could not to be determined from the administrative data; for 74% of members "other race" was reported and race was "not provided" for 6% of the members. Among the 20% of children with race information obtained from the administrative data, 15% were white and 5% were black (**Table A1**).

Urban counties in Kentucky included Boone, Bourbon, Boyd, Bracken, Bullitt, Campbell, Christian, Clark, Daviess, Edmonson, Fayette, Gallatin, Grant, Greenup, Hancock, Hardin, Henderson, Henry, Jefferson, Jessamine, Kenton, Larue, McLean, Meade, Nelson, Oldham, Pendleton, Scott, Shelby, Simpson, Spencer, Trigg, Trimble, Warren, Webster and Woodford Counties, while the remaining ones were considered rural (DMS, personal communication, 2013; **Table A1**).About three-fifths (63%) of the members in the study sample resided in an urban area, ranging from 56% for adolescents to 65 and 67% for school-aged and preschool children, respectively; while approximately two-fifths of the members resided in a rural area, with 33, 35 and 44% of preschool children, school-aged children and adolescents, respectively, residing in rural areas (**Table A1**).

Documentation Characteristics

A large majority of the medical records (87%) in the study sample were electronic medical records (EMRs). (**Table A1**).

Domain 1: Identification

A. Documented Weight Status

The Expert Committee recommends that BMI, which measures weight relative to height, be calculated as the initial screen for weight status at each well-child visit. The Expert Committee Recommendations note that although BMI does not directly measure body fat, it is a simple, non-invasive calculation that has been shown to correlate with body fat, as well as with health risks, especially for cardiovascular condition risks. Weight varies by muscle mass as well as by fat, i.e., athletes might have a higher weight relative to height while being healthy. Therefore, BMI is a starting point for providers to assess and classify health risks related to being overweight. Also, as children grow, their body fat composition changes, and there are gender-normal ranges. Unlike adults, for whom BMI values can be used to assess weight status, children under the age of 16 years should have their BMI and weight status assessed as a percentile relative to their gender and age. Weight status for older adolescents (16 years and older) can be assessed using either the BMI value or percentile. The

BMI percentile categories are as follows: < 5th percentile: underweight; 5th to 84th percentile: healthy weight; > 85th to 94th percentile: overweight; and > 95th percentile: obese.[11]

The medical records of the study sample were reviewed for documentation of height and weight at the same visit during the MY, as well as documentation of BMI or BMI percentile. For members with height and weight at the same visit, but without BMI or BMI percentile documented, the CDC BMI algorithm[12] was used to calculate the BMI and BMI percentile (**Table 2**).

A large majority of children (93%) had both height and weight documented at the same visit during the MY. In addition, the majority also had at least one BMI documented in their medical record during the MY (87%). Fewer children in total (43%) had BMI percentile documented than had BMI value documented (**Table 2**). In fact, 48% of preschool children had a BMI percentile documented, as well as 43% of school-aged children and 37% of adolescents. There was documentation of BMI percentile for 36% of younger adolescents. The Expert Committee recommends that a BMI value or percentile be reported for older adolescents; 91% of older adolescents had a BMI value documented, while 39% had a BMI percentile documented. Overall, 43% (256/593) of children younger than 16 years of age had BMI percentile documented (data not shown). Nearly half (48%) of preschool children had both a BMI value and a BMI percentile documented; fewer school-aged children (43%) and adolescents (37%) had documentation of both a BMI value and a percentile (**Table 2**).

Overall, 12% of children did not have documentation of either a BMI value or a BMI percentile. BMI value was computed using the CDC BMI algorithm for 35 of these 82 children (43%), who had a documented height and weight during the same visit in the MY (**Table 2**). For the remaining 47 children, a BMI value or percentile could not be calculated or computed because they did not have height and weight documented during the same visit in the MY. As a result, BMI value or percentile was documented or calculated for 93% (621/668) of the children.

There was no statistical difference between the younger and older adolescents with regard to the rates of documentation of height, weight and BMI values (**Table 2**).

[11] Barlow SE and the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatrics 2007; 120:S164

[12] A SAS Program for the 2000 CDC Growth Charts (ages 0 to <20 years): http://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm

Table 2: Documentation of Height, Weight and BMI

Documentation of Height, Weight and BMI[1]	Age Group: Preschool Children (2–5 Years) (N = 217)		Age Group: School-Aged Children (6–11 Years) (N = 225)		Age Group: Adolescents (12–18 Years) (N = 226)		Total (N = 668)		Adolescent Subset: Younger Adolescents (12–15 Years) (N = 151)		Adolescent Subset: Older Adolescents (16–18 Years) (N = 75)	
Height and weight documented at the same visit	201	93%	211	94%	208	92%	620	93%	135	89%	73	97%
BMI value documented	192	88%	198	88%	194	86%	584	87%	126	83%	68	91%
BMI percentile documented	105	48%	97	43%	83	37%	285	43%	54	36%	29	39%
BMI value and percentile documented	104	48%	96	43%	83	37%	283	42%	54	36%	29	39%
BMI value or percentile documented	193	89%	199	88%	194	86%	586	88%	126	83%	68	91%
Neither BMI value nor percentile documented	24	11%	26	12%	32	14%	82	12%	25	17%	7	9%
of whom had:	n = 24		n = 26		n = 32		n = 82		n = 25		n = 7	
Height and weight documented[2]	8	33%	13	50%	14	44%	35	43%	9	36%	5	71%
No height and weight documented[3]	16	67%	13	50%	18	56%	47	57%	16	64%	2	29%
BMI value or percentile (documented or computed)	201	93%	212	94%	208	92%	621	93%	135	89%	73	97%

[1]Documentation could occur at any time during the measurement year.
[2]Body mass index (BMI) values/percentiles were computed using the CDC algorithm, which is based on height and weight at same visit, in addition to age and gender.
[3]BMI value/percentile could not be computed using the CDC algorithm, because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

B. Weight Category and BMI Percentile Category

In total, 8% of the children had a weight category documented during the MY (**Table 3**). A higher percentage (49%) of children and adolescents had a BMI percentile category documented than the percentage with a documented weight category, and preschool children were significantly more likely than adolescents to have a BMI percentile category documented ($P < 0.001$). Although the difference was statistically significant between preschool children who had a rate of 58% documentation of BMI percentile category and adolescents who had a rate of 38% BMI percentile category documentation, it should be noted that BMI percentile measurement is not indicated for older adolescents. Just over half the children and adolescents (51%) had either a weight category or a BMI percentile category documented during the MY, with 59% and 54% of preschool and school-aged children, respectively, and 42% of adolescents having documentation of either category. About half (48%) of the older adolescents (16–18 years of age) had either a weight category or a BMI percentile category documented during the MY (**Table 3**).

The majority of children without a weight category or a BMI percentile category documented had height and weight documented during the same visit in the MY so that their weight or percentile categories could be computed. In total, 93% of the children and adolescents had weight category or BMI category documented or computed (**Table 3**).

There was no statistical difference between the younger and older adolescents with regard to the rates of documentation of weight and BMI percentile categories (**Table 3**).

Table 3: Documentation of Weight and BMI Percentile Categories

Documentation of Weight and BMI Percentile Categories[1]	Age Group						Total (N = 668)		Adolescent Subset: Younger Adolescents (12–15 Years) (N = 151)		Adolescent Subset: Older Adolescents (16–18 Years) (N = 75)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)							
Weight category documented	9	4%	22	10%	24	11%	55	8%	13	9%	9	12%
BMI percentile category documented	125	58%[2]	113	50%	87	38%[2]	325	49%	55	36%	32	43%
Weight category or BMI percentile category documented	127	59%	121	54%	96	42%	344	51%	60	40%	36	48%
Neither weight category nor BMI percentile category documented	90	41%	104	46%	130	58%	324	49%	91	60%	39	52%
of whom had:	n = 90		n = 104		n = 130		n = 324		n = 91		n = 39	
Height and weight documented[3]	74	82%	91	88%	112	86%	277	85%	75	82%	37	95%
No height and weight documented[4]	16	18%	13	13%	18	14%	47	15%	16	18%	2	5%
Weight category or BMI percentile category (documented or computed)	201	93%	212	94%	208	92%	621	93%	135	89%	73	97%

[1]Documentation could occur at any time during the measurement year. Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]Body mass index (BMI) category was documented in a significantly higher proportion of preschool children than the proportion of adolescents (green shade); $P < 0.001$.
[3]BMI values/percentiles were computed using the CDC algorithm, which is based on height and weight at same visit, in addition to age and gender.
[4]BMI value/percentile could not be computed using the CDC algorithm, because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

As shown in **Table 4**, about half (49%) of the children were in the "healthy" weight category, corresponding to the BMI 5th–84th percentile category (preschool children: 55%, school-aged children: 48%, and adolescents: 45%). Nearly one-quarter (24%) of the children were in the "obese" weight category, corresponding to the BMI ≥ 95th percentile category. Thirty percent of adolescents as a whole, 32% of younger adolescents, and 27% of older adolescents were in the obese category, while 23% of school-aged children and 17% of preschool children were categorized as obese (**Table 4**).

Overall, 16% of the children were in the "overweight" weight category, corresponding to the BMI 85th–94th percentile category (preschool children: 14%, school-aged children: 18%, adolescents: 15%, and older adolescents: 16%) and 5% of the children were in the "underweight" category corresponding to the BMI < 5th percentile category (preschool children: 7%, school-aged children: 5%, adolescents: 2%, and younger adolescents: 3%; **Table 4**). Only one child (1%) in the older adolescent age subset was underweight. BMI percentile or weight category was not documented or could not be computed for 7% of the children in the study.

All obese children are considered to be at risk for cardiovascular disease (CVD) and other morbidity, whereas overweight children should be assessed for the presence of additional factors that place them at risk, including: a diagnosis of diabetes (type 1 diabetes mellitus (DM), type 2 DM, or pre-diabetes); hypertension; non-alcoholic fatty liver disease (NAFLD) or hyperlipidemia/hypercholesteremia; and a positive family history of obesity, cardiovascular/coronary artery disease (CVD/CAD), or diabetes, or an abnormally high fasting glucose, fasting lipid panel, or AST/ALT laboratory result. About one in four (24%, 157/668) children were obese and one in six (16%, 104/668) children were overweight in the study sample. A total of 6% of all children in the study sample were overweight with documentation of additional risk factors including risk for CVD. In total, 29% of the children in the study were at risk for CVD and other morbidity, and a significantly higher percentage of adolescents (36%) were at risk than the percentage of preschool children (20%) at risk ($P < 0.001$; **Table 4**).

BMI should be plotted on a curve on a growth chart to show the child's weight trajectory and BMI percentile over time. Overall, only 29% of children had BMI plotted on a growth chart in their medical record (**Table 4**). Because many electronic records automatically calculate and record BMI if height and weight are entered during a visit, MRR included abstraction of documentation of the provider's explicit acknowledgement of the child's weight status or BMI during the MY. Overall, 18% of the children had documentation of the provider's acknowledgement of weight status/BMI: 19% of school-aged children and adolescents as well as 16% of older adolescents had provider acknowledgement documented, while 15% of preschool children had provider acknowledgement documented. For 9% of the children in the sample, the provider explicitly documented that the child's BMI or weight category was a problem; this included 12% of adolescents and older adolescents, 11% of school-aged children and 4% of preschool children. For 4% of the children, the provider indicated that the child's BMI or weight status was not an issue (**Table 4**).

There was no statistical difference between the younger and older adolescents with regard to the rates of documentation of these elements (**Table 4**).

Table 4: Weight/BMI Category and Cardiovascular Disease Risk

Weight Category, BMI Percentile Category, and Cardiovascular Disease (CVD) Risk[1]	Age Group											
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)		Total (N = 668)		Adolescent Subset: Younger Adolescents (12–15 Years) (N = 151)		Adolescent Subset: Older Adolescents (16–18 Years) (N = 75)	
Documented/Computed BMI value/percentile	201	93%	212	94%	208	92%	621	93%	135	89%	73	97%
Overall BMI percentile category												
< 5th percentile	15	7%	11	5%	5	2%	31	5%	4	3%	1	1%
5th–84th percentile	119	55%	109	48%	101	45%	329	49%	61	40%	40	53%
85th–94th percentile	30	14%	40	18%	34	15%	104	16%	22	15%	12	16%
≥ 95th percentile	37	17%	52	23%	68	30%	157	24%	48	32%	20	27%
Not documented	16	7%	13	6%	18	8%	47	7%	16	11%	2	3%
Overall weight category												
Underweight	15	7%	11	5%	5	2%	31	5%	4	3%	1	1%
Healthy	119	55%	109	48%	101	45%	329	49%	61	40%	40	53%
Overweight	30	14%	40	18%	34	15%	104	16%	22	15%	12	16%
Obese	37	17%	52	23%	68	30%	157	24%	48	32%	20	27%
Not documented	16	7%	13	6%	18	8%	47	7%	16	11%	2	3%
Overall CVD risk stratum												
Underweight	15	7%	11	5%	5	2%	31	5%	4	3%	1	1%
Healthy	119	55%	109	48%	101	45%	329	49%	61	40%	40	53%
Overweight	23	11%	23	10%	21	9%	67	10%	13	9%	8	11%
Overweight + risk factors[2]	7	3%	17	8%	13	6%	37	6%	9	6%	4	5%
Obese	37	17%	52	23%	68	30%	157	24%	48	32%	20	27%
At risk for CVD (overweight + risk factors, obese)[3]	**44**	**20%[4]**	**69**	**31%**	**81**	**36%[4]**	**194**	**29%**	**57**	**38%**	**24**	**32%**
BMI plotted on growth chart	68	31%	72	32%	56	25%	196	29%	36	24%	20	27%
Weight status/BMI acknowledged by provider	32	15%	43	19%	44	19%	119	18%	32	21%	12	16%
Provider explicitly acknowledged BMI/weight category as a problem	9	4%	25	11%	26	12%	60	9%	17	11%	9	12%
Provider indicated BMI/weight was not an issue	6	3%	11	5%	8	4%	25	4%	5	3%	3	4%

[1]Documentation or provider acknowledgement could occur at any time during the measurement year. Due to rounding, some subgroup percentages may not add up exactly to 100%.

[2]Risk factors include type 2 diabetes; type 1 diabetes mellitus, pre-diabetes; diabetes mellitus unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease/coronary artery disease (CVD/CAD), positive family history of diabetes, abnormally high lab test result(s).
[3]The rate of children at risk for cardiovascular disease (CVD) was calculated by identifying the overweight children with the above noted risk factors, in addition to obese children (boldface).
[4]The proportion of preschool children who were at risk for CVD was significantly lower than the proportion of adolescents who were at risk of CVD (green shade); $P < 0.001$.

C. Identification of Pre-Existing or Newly Diagnosed Comorbid Conditions

The Expert Committee recommends the evaluation of all children for comorbid, weight-related conditions. **Table 5** shows that 20% of the children had at least one comorbid condition documented in their medical record, including 30% of adolescents, 18% of school-aged children and 11% of preschool children.

Among the preschool children, 21 (10%) had a diagnosis of asthma documented; two (1%) children had an anxiety diagnosis, and one child had hyperlipidemia documented (**Table 5**). None of the children in this age group had a DM diagnosis documented. Among the school-aged children, 37 (16%) had an asthma diagnosis documented; two (1%) had a documented diagnosis of DM unspecified; two (1%) had depression documented; two (1%) had an anxiety diagnosis documented; and one child had hyperlipidemia documented. Among the adolescents, 45 (20%) had an asthma diagnosis documented; 14 (6%) had an anxiety diagnosis documented; eight (4%) had a positive tobacco use or screen documented; three (1%) had hyperlipidemia documented; and two (1%) had hypertension documented. One adolescent had pre-diabetes and one adolescent had type 2 DM documented (**Table 5**). None of the children in the study sample had a diagnosis of type 1 DM, NAFLD, obstructive sleep apnea, or gallbladder disease/gallstones documented.

A significantly higher percentage of adolescents had at least one comorbid diagnosis documented than the percentage of preschool children with documentation of at least one comorbid diagnosis ($P < 0.001$; **Table 5**). Importantly, as noted above, a higher percentage of these older children were at risk for CVD (**Table 4**).

Table 5: Identification of Comorbid Conditions

Identification of Comorbid Conditions[1]	Age Group									
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)		Total (N = 668)		Adolescent Subset: Older Adolescents (16–18 Years) (N = 75)	
Diabetes Mellitus (DM) documented										
Type 2 DM	0	0%	0	0%	1	0%	1	0%	0	0%
Type 1 DM	0	0%	0	0%	0	0%	0	0%	0	0%
Pre-Diabetes	0	0%	0	0%	1	0%	1	0%	1	1%
DM unspecified	0	0%	2	1%	0	0%	2	0%	0	0%
Diabetes diagnosis not documented	217	100%	223	99%	224	99%	664	99%	74	99%
Other diagnoses documented										
Hypertension	0	0%	0	0%	2	1%	2	0%	0	0%
Depression	0	0%	2	1%	9	4%	11	2%	6	8%
Asthma	21	10%	37	16%	45	20%	103	15%	11	15%
Hyperlipidemia/Hypercholesterolemia	1	0%	1	0%	3	1%	5	1%	1	1%
Anxiety	2	1%	2	1%	14	6%	18	3%	5	7%
Positive tobacco use or screen	0	0%	0	0%	8	4%	8	1%	5	7%
At least one diagnosis documented[2]	**24**	**11%[3]**	**41**	**18%**	**67**	**30%[3]**	**132**	**20%**	**22**	**29%**
At least one diagnosis documented + diabetes[2]	**24**	**11%[4]**	**43**	**19%**	**69**	**31%[4]**	**136**	**20%**	**22**	**29%**

[1]Documentation could occur at any time during the measurement year. Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]The proportion of children with at least one of the other diagnoses documented was calculated from the medical record review abstraction of comorbid conditions (boldface); $P < 0.001$.
[3]A significantly higher proportion of adolescents than preschool children had at least one other diagnosis documented (green shade); $P < 0.001$.
[4]A significantly higher proportion of adolescents than preschool children had at least one other diagnosis and diabetes documented (green shade); $P < 0.001$.

Domain 2: Assessment of Medical and Behavioral Risk

The Expert Committee recommends that all children have a complete review of systems, family history, physical exam and methods to assess behavioral risks related to diet and physical activity as an inexpensive means of screening children for current weight-related conditions and for future risks (**Table 6**). When these non-invasive services show that an overweight child is at risk for CVD, laboratory tests should be done to diagnose potential weight-related conditions (**Table 7**).

A. Assessment of Medical Risk: Relevant History

A complete review of systems should be performed during a well-child visit, and particularly among children who are overweight or obese to elicit patient report of symptoms that may reflect obesity-related conditions. A complete review of systems includes an assessment of all the major body systems, at a minimum the cardiovascular, respiratory, head, ears, eyes, nose and throat (HEENT) and gastrointestinal systems. A provider might perform a focused review of systems that is targeted to a particular complaint during a visit for an acute condition. More than half (51%) of the children and adolescents had documentation of a complete review of systems that included queries regarding symptoms related to each body system during the MY and over one-third (37%) of all the children had a focused review of systems targeted to a specific body system only documented during the MY (**Table 6**).

The Expert Committee Recommendations note that parental obesity is a strong indicator of a child's likelihood of being obese as an adult, and that many obesity-related conditions are familial, including diabetes, CVD and hyperlipidemia/hypertension. More than half (57%) of the children had a review of family history documented; 58% of school-aged children and 56% of preschool children, as well as 56% of adolescents had a documented family history (**Table 6**).

Among the 379 children with a documented family history, 41% had a positive family history of CVD/CAD documented with a higher percentage of adolescents (50%) than of preschool children (38%) or school-aged children (34%) with this risk documented; however, these differences were not statistically significant (**Table 6**). Among children with a documented family history, positive family history of diabetes was documented in one-third of the records; 45% of adolescents, 31% of school-aged children and 23% of preschool children had documented positive history of diabetes. A positive family history of obesity was documented for only 2% of the children with a documented family history. Importantly, the documentation of positive family history of diabetes was significantly higher for adolescents than for preschool children ($P < 0.001$; **Table 6**).

Among the children with a documented family history, more than half (51%) had documentation of at least one risk factor (i.e., obesity, CVD/CAD or diabetes); 64% of adolescents, 46% of school-aged children and 43% of preschool children had at least one of these risk factors documented (**Table 6**).

B. Assessment of Medical Risk: Physical Exam

A complete physical exam should be performed during a well-child visit and includes an examination of the entire body, minimally the cardiovascular, respiratory, HEENT and gastrointestinal systems. As noted earlier, a provider might perform a focused review of systems as well as a focused physical exam targeted to a specific chief complaint for an acute condition and only examine relevant body systems. Overall, 85% of the children in the study had a complete physical exam documented during the MY (preschool children: 89%, school-aged children: 81%, and adolescents: 85%), while only a focused physical exam was documented during the MY for just under one-third (31%) of all children (preschool children: 28%, school-aged children: 32% and adolescents:

34%); some children had both. A blood pressure reading, which is an important indicator of cardiovascular risk, and is indicated for children older than three years of age, was documented for 80% of the children. A significantly higher percentage of adolescents than percentage of preschool children had a blood pressure reading documented (93% vs. 64%, respectively). However, it should be noted that blood pressure reading is not indicated for children under three years of age, and 18 of the 217 children in the preschool age group were less than three years of age during their PCP visits, although 5 of the 18 did have a documented blood pressure (data not shown). Findings for documentation during the MY of a complete review of systems, present for 51% of the children, or of a complete physical exam, present for 85% of the children, are presented in **Table 6** as a proxy for having at least one comprehensive well-child visit during the MY.

Table 6: Assessment of Medical Risk: Family History and Physical Exam

Assessment of Medical Risk: Family History and Physical Exam[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Relevant history documentation								
Complete review of systems	107	49%	111	49%	125	55%	343	51%
Focused review of systems	89	41%	88	39%	72	32%	249	37%
Family history documented	122	56%	130	58%	127	56%	379	57%
of whom had documentation of:	n = 122		n = 130		n = 127		n = 379	
Positive family history of obesity	3	2%	3	2%	2	2%	8	2%
Positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD)	46	38%	44	34%	64	50%	154	41%
Positive family history of diabetes	28	23%[2]	40	31%	57	45%[2]	125	33%
At least one element documented[3]	**52**	**43%**	**60**	**46%**	**81**	**64%**	**193**	**51%**
Physical exam documentation								
Complete physical exam	193	89%	183	81%	191	85%	567	85%
Focused physical exam	61	28%	72	32%	77	34%	210	31%
Blood pressure taken	139	64%[4]	188	84%	210	93%[4]	537	80%
At least one well-child visit[5]	**199**	**92%**	**196**	**87%**	**200**	**88%**	**595**	**89%**

[1]Documentation could occur at any time during the measurement year.
[2]A significantly lower proportion of preschool children than adolescents had their family history documented, which included documentation of positive family history of diabetes (green shade); $P < 0.001$.
[3]The proportion of children with at least one family history element documented was calculated from the medical record review abstraction of documentation of individual family history elements (boldface).
[4]A significantly lower proportion of preschool children than adolescents had documentation for "blood pressure taken" during a physical exam (green shade); $P < 0.001$.
[5]The proportion of children who had at least one well-child visit was calculated from the number of children who had a complete review of systems or a complete physical exam documented during the outpatient visit (boldface).

C. Assessment of Medical Risk: Laboratory Evaluation Appropriate to Age and to Risk Category

A review of history and physical examination cannot detect some of the most common obesity-related conditions, including hyperlipidemia, diabetes, and NAFLD; therefore, the Expert Committee recommends laboratory tests to diagnose these conditions. It is recommended that beginning at age 10, all overweight children (including those without additional risk factors) and all obese children have a fasting lipid profile, which includes both total triglycerides and a break out of "good" (high-density lipoprotein [HDL]) vs. "bad"

(low-density lipoprotein [LDL]) cholesterol levels. Overweight children with additional risk factors (i.e., a positive family history of obesity, CVD or diabetes) and all obese children should have a fasting glucose test to screen for diabetes, as well as an aspartate transaminase (AST)/alanine transaminase (ALT) ratio test to screen for NAFLD.

Abnormal lipid values are among the most common obesity-related medical conditions and, because of the high prevalence, it is recommend that all overweight children, beginning at age 10, be screened, even if they do not have additional risk factors.

Among the 131 children in the study who were overweight or obese, 97% did not have documentation of a fasting LDL test being ordered or of having test results reported; none of these children had documentation of an abnormally high fasting LDL test result; one overweight and one obese child had normal test results documented and 2 obese children had documentation of the test being ordered, but the results were not documented in the medical record (**Table 7**). In total, 97% of at-risk and overweight children did not have documentation of a fasting triglyceride test; none had documentation of an abnormally high fasting triglycerides test result. Two obese children had documentation of the test being ordered, but results were not documented in their medical records; and one overweight and one obese child had documentation of a normal fasting triglyceride test result.

Laboratory tests that were not documented as fasting were assumed to be non-fasting during abstraction (**Table 7**). Abnormally high non-fasting LDL or non-fasting triglyceride results warrant repeat fasting lab tests for diagnosis. In total, 87% and 88% of the overweight and obese children, respectively, did not have documentation of non-fasting LDL or triglyceride tests being ordered nor did they have documented results in their medical records. Two obese children had documentation of an abnormally high non-fasting LDL; and one overweight child with risks, as well as one obese child, had an abnormally high non-fasting triglyceride test result documented. A total of seven children, two overweight with risks and five obese children, had normal non-fasting LDL results documented; one overweight child with risks and six obese children had normal non-fasting triglyceride test results documented. In total, 6% (8/131) of overweight and obese children had documentation of a non-fasting LDL test being ordered, but lacked documentation of the results, and 5% (7/131) had documentation of a non-fasting triglyceride test being ordered, but lacked documentation of the results (**Table 7**).

The Expert Committee Recommendations note that type 2 DM is one of the most serious complications of childhood obesity, and, in accordance with recommendations from the American Diabetes Association (ADA), suggest a fasting glucose test to screen children beginning at age 10 who are obese, as well as children who are overweight with additional risk factors. Among the 101 children in the study who were obese or overweight with an additional risk factor, 97% did not have documentation of a fasting glucose test being ordered or results documented in the medical record (**Table 7**). None of the 101 children had an abnormal fasting glucose documented; one obese child had a normal test result documented; and two obese children had documentation of a fasting glucose test being ordered, but the results were not documented in their medical records. Among the children who are obese and overweight with additional risk factors, 77% did not have documentation of a non-fasting glucose test being ordered or results documented in the medical record. Three of these children had an abnormally high non-fasting glucose test result documented (i.e., two overweight children and one obese child); 13 children had a normal test result reported (i.e., four overweight and nine obese children), and 7 children (i.e., three overweight and four obese children) had documentation of a non-fasting glucose test being ordered, but the results were not documented in the medical records (**Table 7**).

Obesity and diabetes are significant risk factors for NAFLD, and because of the increasing prevalence of both, the Expert Committee recommends ALT and AST screening for at-risk children. Among the 101 children in the study who were obese or overweight with an additional risk factor, 86% and 87%, did not have documentation of ALT or AST tests, respectively, being ordered or results documented in the medical record during the MY. None of the overweight children had an abnormally high ALT or AST result documented; two (2%) obese children had an abnormally high ALT test result and one (1%) obese child had an abnormally high AST test result documented. In total, nine (9%) at-risk children had a normal ALT test result documented and 10 (10%) had a normal AST test result documented. Overall, three (3%) at-risk children had documentation that an ALT test was ordered, but the result was not documented. Two obese children had documentation of an AST test being ordered without any documented results.

Table 7: Assessment of Medical Risk: Laboratory Evaluation

Assessment of Medical Risk: Laboratory Evaluation[1] (Members > 10 years old)	Risk Category						Total (N = 131)	
	Overweight Children (N = 30)		Overweight Children with Risk Factors[2] (N = 17)		Obese Children (N = 84)			
Fasting LDL test documentation								
Abnormally high	0	0%	0	0%	0	0%	0	0%
Normal (or low)	1	3%	0	0%	1	1%	2	2%
Ordered, results not documented	0	0%	0	0%	2	2%	2	2%
Not ordered, not documented	29	97%	17	100%	81	96%	127	97%
Non-fasting LDL test documentation								
Abnormally high	0	0%	0	0%	2	2%	2	2%
Normal (or low)	0	0%	2	12%	5	6%	7	5%
Ordered, results not documented	1	3%	1	6%	6	7%	8	6%
Not ordered, not documented	29	97%	14	82%	71	85%	114	87%
Fasting triglyceride test documentation								
Abnormally high	0	0%	0	0%	0	0%	0	0%
Normal (or low)	1	3%	0	0%	1	1%	2	2%
Ordered, results not documented	0	0%	0	0%	2	2%	2	2%
Not ordered, not documented	29	97%	17	100%	81	96%	127	97%
Non-fasting triglyceride test documentation								
Abnormally high	0	0%	1	6%	1	1%	2	2%
Normal (or low)	0	0%	1	6%	6	7%	7	5%
Ordered, results not documented	2	7%	0	0%	5	6%	7	5%
Not ordered, not documented	28	93%	15	88%	72	86%	115	88%
Fasting glucose test documentation[3]			n = 17		n = 84		n = 101	
Abnormally high			0	0%	0	0%	0	0%
Normal (or low)			0	0%	1	1%	1	1%
Ordered, results not documented			0	0%	2	2%	2	2%
Not ordered, not documented			17	100%	81	96%	98	97%
Non-fasting glucose test documentation[3]			n = 17		n = 84		n = 101	
Abnormally high			2	12%	1	1%	3	3%
Normal (or low)			4	24%	9	11%	13	13%
Ordered, results not documented			3	18%	4	5%	7	7%
Not ordered, not documented			8	47%	70	83%	78	77%
ALT test documentation[3]			n = 17		n = 84		n = 101	

Assessment of Medical Risk: Laboratory Evaluation[1] (Members > 10 years old)	Risk Category						Total (N = 131)	
	Overweight Children (N = 30)		Overweight Children with Risk Factors[2] (N = 17)		Obese Children (N = 84)			
Abnormally high			0	0%	2	2%	2	2%
Normal (or low)			5	29%	4	5%	9	9%
Ordered, results not documented			1	6%	2	2%	3	3%
Not ordered, not documented			11	65%	76	90%	87	86%
AST test documentation[3]			n = 17		n = 84		n = 101	
Abnormally high			0	0%	1	1%	1	1%
Normal (or low)			5	29%	5	6%	10	10%
Ordered, results not documented			0	0%	2	2%	2	2%
Not ordered, not documented			12	71%	76	90%	88	87%

[1]Assessment could occur at any time during the measurement year. Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).
[3]Testing recommended by the Expert Committee and the American Diabetes Association for children and adolescents over the age of 10 who are overweight with risk factors or obese.

D. Assessment of Behavioral Risk

Assessment of a child's nutritional status and level of physical activity, especially relative to sedentary behaviors, such as screen time, are important indicators of risk for weight-related conditions. Just over half (51%) of all the children in the study had an assessment of nutritional behavior documented in their medical record (preschool children: 65%, school-aged children: 45% and adolescents: 45%). A lower percentage of children, 33% overall, had documentation of an assessment of physical activity during the MY (preschool children: 34%, school-aged children: 25%, and adolescents: 40%; **Table 8**).

Table 8: Assessment of Behavioral Risk by Age Group

Assessment of Behavioral Risk[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Assessment of nutritional behavior	140	65%	102	45%	102	45%	344	51%
Assessment of physical activity	74	34%	56	25%	91	40%	221	33%

[1]Assessment could occur at any time during the measurement year.

Over half (55%) of the children at risk for CVD had an assessment of nutritional behavior documented in their medical record (overweight children: 58%, overweight children with risk factors: 51%, and obese children: 54%; **Table 9**). A lower percentage of at risk children, 32% overall, had documentation of an assessment of physical activity during the MY (overweight children: 34%, overweight children with risk factors: 35%, and obese children: 31%).

Table 9: Assessment of Behavioral Risk by Weight Risk Category

Assessment of Behavioral Risk[1]	Risk Category						Total (N = 261)	
	Overweight Children (N = 67)		Overweight Children with Risk Factors[2] (N = 37)		Obese (N = 157)			
Assessment of nutritional behavior	39	58%	19	51%	85	54%	143	55%
Assessment of physical activity	23	34%	13	35%	48	31%	84	32%

[1]Assessment could occur at any time during the measurement year.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).

Domain 3: Prevention Counseling

The Expert Committee notes that in addition to screening all children for obesity, PCPs can best have an impact on the obesity epidemic by providing all children with anticipatory guidance on healthy behaviors related to nutrition and physical activity that are specific to the quality of each child's nutrition and physical behaviors and that can be targeted for counseling, using behavior modification to help prevent weight-related conditions. The medical record review included abstraction of general nutrition counseling, as well as common, specific healthy nutrition and physical activity behaviors that can be encouraged or targeted to help create goals for healthy behaviors.

Overall, less than half (47%) of the children had documentation of general nutrition counseling in their medical records; 58% of preschool children, 44% of school-aged children and 38% of adolescents had documentation of general nutrition counseling (**Table 10**). The rate of documentation of general nutrition counseling was significantly lower for adolescents than for preschool children ($P < 0.001$).

Among those with documented nutrition counseling, the majority of children received general nutrition information (84%), while 37% received specific instructions (reported in **Table 10** as "other"), such as to switch to low-fat or non-fat milk and dairy products, or to select whole grains. Additional nutritional guidance topics recommended by the Expert Committee documented during the MY included: having at least five servings of fruit and vegetables per day (21%); avoidance of sugar-sweetened beverages (15%); having regular family meals (12%); eating breakfast every day (11%); limiting eating out, especially fast food (9%); and limiting portion sizes (3%).

A lower percentage of children, 41% overall, had documentation of general physical activity counseling (preschool children: 48%, school-aged children: 39% and adolescents: 35%). Among those with documented physical activity counseling, the majority of children, 77% overall, had general physical activity counseling documented, such as "regular exercise," while only 5% had counseling of a frequency/amount that differs from the Expert Committee recommendations (reported in **Table 10** as "other"), such as "30 minutes of exercise at least three times per week" documented in the medical records. Additional physical activity guidance topics recommended by the Expert Committee documented during the MY included: limiting screen time to no more than two hours per day (48%); having moderate to vigorous physical activity for at least 60 minutes per day (21%); and removing television from the child's bedroom (2%).

With regard to the provision of nutritional or physical activity education/counseling, the rate of documentation decreased as the age of the child increased (**Table 10**). According to the American Academy of Pediatrics (AAP), preschool children (2–5 years old) account for a higher percentage of all well-child visits, on average, than school-aged children (6–11 years old) or adolescents (12–18 years old), which provides more opportunity for the provider to document guidance during a MY, and might have been one factor contributing to the higher rate of documented anticipatory guidance found in this study.[13]

[13]"Profile of Pediatric Visits", American Academy of Pediatrics, April, 2010. Downloaded on June, 4, 2015 from: https://www.aap.org/en-us/professional-resources/practice-support/financing-and-payment/Billing-and-Payment/Documents/Profile_Pediatric_Visits.pdf.

Table 10: Prevention Counseling

Prevention Counseling[1]	Age Group: Preschool Children (2–5 Years) (N = 217)		Age Group: School-Aged Children (6–11 Years) (N = 225)		Age Group: Adolescents (12–18 Years) (N = 226)		Total (N = 668)	
General nutrition education/counseling	126	58%[2]	100	44%	85	38%[2]	311	47%
Nutritional education/counseling topics:	n = 126		n = 100		n = 85		n = 311	
General nutrition information	105	83%	82	82%	73	86%	260	84%
Avoidance of sugar-sweetened beverages	22	17%	16	16%	9	11%	47	15%
Have at least five servings of fruit and vegetables/day	24	19%	25	25%	17	20%	66	21%
Limit eating out, especially fast food	7	6%	10	10%	11	13%	28	9%
Have regular family meals	13	10%	16	16%	9	11%	38	12%
Limit portion sizes	1	1%	5	5%	4	5%	10	3%
Eat breakfast every day	12	10%	13	13%	10	12%	35	11%
Other nutritional topics	50	40%	32	32%	33	39%	115	37%
General physical activity education/counseling	105	48%	88	39%	80	35%	273	41%
Physical activity education/counseling topics:	n = 105		n = 88		n = 80		n = 273	
General info on physical activity	74	70%	69	78%	68	85%	211	77%
Moderate to vigorous physical activity for at least 60 minutes/day	21	20%	21	24%	15	19%	57	21%
Limit screen time to no more than two hours/day	62	59%	35	40%	33	41%	130	48%
Remove television from children's bedroom	4	4%	1	1%	1	1%	6	2%
Other physical activity topics	7	7%	3	3%	4	5%	14	5%

[1]Documentation could occur at any time during the measurement year.
[2]The proportion of children with documentation of general nutrition education/counseling was significantly higher than the proportion of adolescents with documentation of general nutrition education/counseling (green shade); $P < 0.001$.

Domain 4: Treatment for At-Risk Children

The Expert Committee recommends treating children identified as at risk for CVD with a four-stage approach. Children are defined as "at risk" if they are obese, or if they are overweight with any of the following risk factors: type 2 DM; type 1 DM; pre-diabetes; DM unspecified; hypertension; NAFLD; hyperlipidemia/hypercholesterolemia; positive family history of obesity; positive family history of CVD/CAD; positive family history of diabetes; abnormally high laboratory test result(s) for fasting glucose, fasting lipid panel or AST/ALT.

A. Treatment Stage 1: Prevention Plus

First stage of treatment begins with an assessment of the quality of nutritional and physical activity behaviors for identification of child-specific counseling and behavioral goal-setting targets that can be provided in the primary care office, or by a nutritionist to whom the child can be referred. Among the 194 at-risk children, 58 (30%) had at least one nutritional goal documented. Among the obese children, 32% had at least one nutritional goal documented (**Table 11**). In addition, seven of the 37 overweight children with risks (19%) had at least one nutritional goal documented. Documented nutritional goals included: to avoid sugar-sweetened beverages (8%); to consume at least five fruits and vegetables per day (7%); to limit eating out (3%); to eat breakfast every day (3%); to limit portion sizes (2%); and to eat more meals as a family (1%). In total, an additional 24% of at-risk children had a more specific nutritional goal documented and reported as "other" in **Table 11**. Other nutritional goals documented included switching to low-fat or fat-free milk and dairy products, reducing or limiting milk and dairy products, and limiting sugary and high-sodium foods, especially candy and salty snacks.

Among the 194 at-risk children, 23% had at least one physical activity goal documented, with a higher percentage of obese children (24%) than overweight children (19%) having at least one physical activity goal documented (**Table 11**). Documented physical activity goals included: limiting screen time to no more than two hours per day (9%); doing moderate to vigorous physical activity for at least 60 minutes per day (4%); and doing moderate to vigorous physical activity for at least 30 minutes for at least three times per week (2%). None of the children had documentation of the goal to remove television from the child's room, while a total of 44 children (23%) had other physical activity goals set. In total, an additional 15% (30) of at-risk children had a more specific physical activity goal documented categorized as "other" in **Table 11**. Other physical activity goals documented included dancing and taking the stairs.

Recommended weight goals can be for general weight loss or maintenance over a specified period of time, or can be for a specified gradual weight loss amount over time, ranging from up to one pound per month for preschool children with a very high BMI to two pounds per week for children of six years of age and older, depending on the age and excess weight status of the child. The Expert Committee notes that providers should monitor excessive weight loss for children six years of age and older for high-risk behaviors that might be contributing to the weight loss. Goals can also be set to maintain weight velocity or trajectory over a specified time period. A large majority (81%) of the at-risk children were obese, and only 8% of the obese children had documentation of at least one weight goal being set in the medical record during the MY; 10 of the obese children had an unspecified weight loss goal, two obese children had weight maintenance goals and one child had a specific weight and BMI target set documented as a goal in the medical record (**Table 11**). None of the overweight children with positive risk factors had documentation of any weight goals being set during the MY. Based on the child's age and weight and/or BMI trajectory, after six months of Stage-1 treatment, Stages 2–4, which require additional resources, might be warranted.

Table 11: Treatment of At-Risk Children: Stage 1 – Behavioral and Weight Goals

Behavioral and Weight Goals Documented[1]	Weight Category					
	Overweight Children with Risk Factors[2] (N = 37)		Obese Children (N = 157)		Total (N = 194)	
Behavioral goals						
Nutritional goals						
Avoid sugar-sweetened beverages	1	3%	14	9%	15	8%
Consume at least five servings of fruit and vegetables/day	4	11%	10	6%	14	7%
Limit eating out, especially fast food	1	3%	5	3%	6	3%
Prepare more meals at home as family (5–6 times/week)	1	3%	0	0%	1	1%
Limit portion sizes	0	0%	4	3%	4	2%
Eat a healthy breakfast every day	1	3%	5	3%	6	3%
Other nutritional topics	4	11%	43	27%	47	24%
At least one nutritional goal set [3]	**7**	**19%**	**51**	**32%**	**58**	**30%**
Physical activity goals						
Moderate to vigorous physical activity for at least 30 minutes, at least three times/week	3	8%	1	1%	4	2%
Moderate to vigorous physical activity for at least 60 minutes/day	1	3%	6	4%	7	4%
Remove television from child's bedroom	0	0%	0	0%	0	0%
Limit screen time to no more than two hours/day	4	11%	14	9%	18	9%
Other physical activity topics	2	5%	28	18%	30	15%
At least one physical activity goal set[3]	**7**	**19%**	**37**	**24%**	**44**	**23%**
Weight loss/gain goals						
Weight loss (not specified or general provider statement)	0	0%	10	6%	10	5%
Weight velocity (weight trajectory) maintenance	0	0%	0	0%	0	0%
Weight maintenance	0	0%	2	1%	2	1%
Slow weight gain	0	0%	0	0%	0	0%
Gradual weight loss of up to 1 lb/month or 0.5 kg/month	0	0%	0	0%	0	0%
Weight loss > 1 lb/month or average up to 2 lb/week	0	0%	0	0%	0	0%
Other weight goal set	0	0%	1	1%	1	1%
At least one weight goal set[3]	**0**	**0%**	**13**	**8%**	**13**	**7%**

[1]Documentation could occur at any time during the measurement year.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).
[3]The proportion of children with at least one goal set was calculated from the number of children with goals set within each category abstracted from medical records (boldface).

B. Treatment Stages 2–4

Stage 2, Structured Weight Management, is recommended for at-risk children who have not had improvement in their weight or BMI trajectory after 3–6 months of Stage 1 – Prevention Plus treatment. Stage 2 requires more clinical support than might be available in the primary care setting, such as a dietitian or nutritionist, and monthly follow-up office visits are suggested. For Stage 2, the child should be engaged in a structured and supervised nutrition and exercise program, or in a structured weight management protocol that includes both nutritional and physical activity supervision, with increased specificity of timing and quantification of weight and behavior goals. For example, Stage 2 includes a planned diet with specified meals and snacks developed by a nutritionist or clinician with nutrition training; the child should track eating in a log so that targeted behaviors can be reinforced. Only 4 of the 194 at-risk children (2%) had documentation of a referral to structured nutrition classes (**Table 12**). None of the at-risk children had documentation of a referral to a structured exercise program or of a referral to a structured weight management protocol.

Stage 3, Comprehensive Multidisciplinary Intervention, involves frequent visits, with weekly visits for 8–12 weeks appearing to be most efficacious, and the inclusion of additional specialty providers, such as social workers and mental healthcare workers, to increase the support required for more intensive behavioral change. Although it would be difficult to provide intensive services at this level at any one primary care office, the Expert Committee suggests that offices could organize their specialists to provide the multidisciplinary care necessary. None of the 194 at-risk children had documentation of more intensive multidisciplinary interventions recommended for Stage 3, including engaging the family in behavior modifications, with a set number of weekly visits to monitor weight over 8–12 weeks, or of the intensive treatment included in Stage 4, Tertiary Care Interventions (**Table 12**). The Expert Committee Recommendations note that failure to progress in earlier stages alone does not necessarily mean a child should move on to Stage 4, since the child's level of maturity and commitment to weight loss and healthy behaviors, their understanding of the risks involved in some of these advanced treatments, including medications and very low calorie diets, as well as their geographic location relative to the availability of the pediatric weight management centers at which this level of care should be provided, need to be taken into consideration when managing care.

Table 12: Treatment of At-Risk Children: Stages 2–4

Referral to Stage 2–4[1]	Weight Category				Total (N = 194)	
	Overweight Children with Risk Factors[2] (N = 37)		Obese Children (N = 157)			
Referral to Stage 2 – Structured Weight Management (SWM)						
Referral to, or attendance at structured nutrition class/session	0	0%	4	3%	4	2%
Referral to, or attendance at structured exercise program	0	0%	0	0%	0	0%
Documentation of member referral to or participation in SWM	0	0%	0	0%	0	0%
Referral to Stage 3 – Comprehensive Multidisciplinary Intervention (CMI)						
Documentation of member referral to or participation in CMI	0	0%	0	0%	0	0%
Continued SWM	0	0%	0	0%	0	0%
Planned negative energy balance	0	0%	0	0%	0	0%
Structured Behavioral Modification Program	0	0%	0	0%	0	0%
Primary caregivers/family involved in behavior modification for children younger than 12 years of age	0	0%	0	0%	0	0%
Home Environment Improvement Training	0	0%	0	0%	0	0%
Weekly visits for 8–12 weeks	0	0%	0	0%	0	0%
Stage 4 – Referral to tertiary care interventions						
Medication: sibutramine	0	0%	0	0%	0	0%
Medication: orlistat	0	0%	0	0%	0	0%
Very low calorie diet	0	0%	0	0%	0	0%
Meal replacement	0	0%	0	0%	0	0%
Weight control surgery	0	0%	0	0%	0	0%
None of the above	0	0%	0	0%	0	0%

[1]Documentation could occur at any time during the measurement year.

[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).

Domain 5: Monitoring for At-Risk Children

A total of 10 at-risk children (5%), 9 obese and 1 overweight, had documentation of the provider planning a follow-up visit to reassess weight status or weight goals; follow-up visits were planned within three months for all the obese children and within four to six months for the overweight child (**Table 13**). In total, 2% of the at-risk children had documentation of weight goals being reassessed at a later date: two obese children had weight goals reassessed within three months, one obese child had goals reassessed within four to six months and one obese child had goals reassessed after six months.

Table 13: Follow-up and Reassessment of Weight Goals

Follow-up and Reassessment of Weight Goals[1]	Weight Category				Total (N = 194)	
	Overweight Children with Risk Factors[2] (N = 37)		Obese Children (N = 157)			
Documentation of provider planning follow-up visit to reassess weight status or weight goals	1	3%	9	6%	10	5%
Documented time interval of follow-up visit						
Within three months	0	0%	9	6%	9	5%
Within four to six months	1	3%	0	0%	1	1%
After six months	0	0%	0	0%	0	0%
No follow-up visits planned or occurred	36	97%	148	94%	184	95%
Weight goals reassessed at a later date						
Yes, within three months	0	0%	2	1%	2	1%
Yes, within four to six months	0	0%	1	1%	1	1%
Yes, after six months	0	0%	1	1%	1	1%
No	37	100%	153	97%	190	98%

[1]Documentation could occur at any time during the measurement year. Due to rounding, some subgroup percentages may not add up exactly to 100%.

[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).

Only 1% (2) of the at-risk children had documentation of a weight goal being met, and both children were obese; one met an unspecified weight loss goal and the other met a gradual weight loss goal of up to one pound per month (**Table 14**).

Table 14: Weight Goals Met

Weight Goals Met[1]	Weight Category					
	Overweight Children with Risk Factors[2] (N = 37)		Obese Children (N = 157)		Total (N = 194)	
Children with at least one weight goal set[3]	0	0%	13	8%	13	7%
Weight goals met[4]			n = 13		n = 13	
Provider statement that goal(s) met			0	0%	0	0%
Weight loss (not specified, or general provider statement)			1	8%	1	8%
Weight velocity (weight trajectory) maintenance			0	0%	0	0%
Weight maintenance			0	0%	0	0%
Slow weight gain			0	0%	0	0%
Gradual weight loss of up to 1 lb/month or 0.5 kg/month			1	8%	1	8%
Weight loss > 1 lb/month or average up to 2 lb/week			0	0%	0	0%
Other weight goal met			0	0%	0	0%
At least one weight goal met[5]			**2**	**15%**	**2**	**15%**
Weight goal was not assessed at any subsequent visits			11	85%	11	85%

[1]Documentation could occur at any time during the measurement year.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).
[3]See **Table 11**.
[4]Only 13 obese children had at least one weight goal set (**Table 11**), and hence were included in this analysis.
[5]The proportion of children with at least one goal met was calculated from the number of children with goals met abstracted from medical records (boldface).

None of the overweight children with risk factors had documentation of barriers to meeting weight loss goals, as none had any goals set (**Table 15**). Five obese children had barriers documented in the medical record: one obese child had lack of family readiness to change nutritional habits, one child had lack of member readiness to change physical activity habits, one child had medications that increase risk for weight gain, and two children categorized in "other" had mental health diagnoses noted by the provider (attention deficit hyperactivity disorder (ADHD) and autism) that created barriers to behavior modification.

Table 15: Barriers to Meeting Weight Goals

Barriers to Meeting Weight Loss Goals[1]	Weight Category				Total (N = 194)	
	Overweight Children with Risk Factors[2] (N = 37)		Obese Children (N = 157)			
Barriers to meeting weight loss goal						
Family expressed lack of readiness to change nutrition habits	0	0%	1	1%	1	1%
Family expressed lack of readiness to change physical activity habits	0	0%	0	0%	0	0%
Member expressed lack of readiness to change nutrition habits	0	0%	0	0%	0	0%
Member expressed lack of readiness to change physical activity habits	0	0%	1	1%	1	1%
Lack of access to safe places to exercise	0	0%	0	0%	0	0%
Lack of time for exercise or for supervision of exercise	0	0%	0	0%	0	0%
Lack of access to affordable nutritious food	0	0%	0	0%	0	0%
Medications (that increase risk for weight gain)	0	0%	1	1%	1	1%
Other	0	0%	2	1%	2	1%
At least one barrier identified[3]	**0**	**0%**	**5**	**3%**	**5**	**3%**

[1]Documentation could occur at any time during the measurement year.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM; pre-diabetes, DM unspecified, hypertension, nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity, positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD), positive family history of diabetes, abnormally high lab test result(s).
[3]The proportion of children with at least one barrier identified was calculated from the number of children with identified barriers that were abstracted from medical records (boldface).

Subgroup Analysis

Table 16: Subgroup Analysis by Cardiovascular Disease Risk

Cardiovascular Disease (CVD) Risk[1]	Description of Findings
Domain 1: Identification	
Documented weight status	No significant differences were observed between at-risk children and children who were not at risk (**Table B1**).
Weight category and body mass index (BMI) percentile category	○ One-fifth (20%) of children who were at risk had weight category documented at any time during the MY compared to 4% of children who were not at risk (**Table B2**). ○ A significantly higher proportion of children who were at risk than the proportion of children who were not at risk had documentation of the provider's explicit acknowledgement of the child's weight status or BMI (29% vs. 14%; **Table B3**). ○ A significantly higher proportion of children who were at risk than the proportion of children who were not at-risk had documentation that the provider explicitly acknowledged that the child's BMI or weight category was a problem (23% vs. 4%; **Table B3**).
Identification of comorbid conditions	○ A significantly higher proportion of children who were at risk than the proportion of children who were not at risk had documentation of at least one comorbid condition (29% vs. 16%; **Table B4**).
Domain 2: Assessment of Risk	
Medical risk: relevant history	○ Two-thirds (67%) of children who were at risk had family history documented compared to 54% children who were not at risk (**Table B5**). ○ Of the children who had family history documented, 64% of at-risk children had positive family history of obesity, CVD/coronary artery disease (CAD) and/or diabetes (**Table B5**).
Medical risk: physical exam	No significant differences were observed between at-risk children and children who were not at risk (**Table B5**).
Medical risk: laboratory evaluation	No significant differences were observed between at-risk children and children who were not at risk (**Table B6**).
Behavioral risk assessment	No significant differences were observed between at-risk children and children who were not at risk (**Table B7**).
Domain 3: Prevention Counseling	
Prevention counseling	No significant differences were observed between at-risk children and children who were not at risk (**Table B8**).

[1]See also **Tables B1–B8**.

Table 17: Subgroup Analysis by Region

Region (Urban vs. Rural)[1]	Description of Findings
Domain 1: Identification	
Documented weight status	No significant differences were observed between children who reside in urban and rural areas (**Table C1**).
Weight category and body mass index (BMI) percentile category	○ Over half (54%) of children from urban areas had BMI percentile category documented at any time during the MY compared to two-fifths (40%) of children from rural areas. Similarly, children from urban areas had a higher rate of documentation of weight category or BMI percentile category at any time during the MY than children from rural areas (57% vs. 42%; **Table C2**).
Identification of comorbid conditions	No significant differences were observed between children who reside in urban and rural areas (**Table C4**).
Domain 2: Assessment of Risk	
Medical risk: relevant history	No significant differences were observed between children who reside in urban and rural areas (**Table C5**).
Medical risk: physical exam	No significant differences were observed between children who reside in urban and rural areas (**Table C5**).
Medical risk: laboratory evaluation	No significant differences were observed between children who reside in urban and rural areas (**Table C6**).
Behavioral risk assessment	○ Children from urban areas had a significantly higher rate of assessment of nutritional behavior assessment and/or physical activity assessment than children from rural areas (nutritional assessment: 58% vs. 40%; physical activity assessment: 37% vs. 27%; **Table C7**).
Domain 3: Prevention Counseling	
Prevention counseling	○ A significantly higher proportion of children from urban areas had education/counseling for general nutrition documented than children from rural areas (52% vs. 37%; **Table C8**). ○ A significantly higher proportion of children from urban areas had general physical activity education/counseling documented than children from rural areas (47% vs. 31%; **Table C8**).

[1]See also **Tables C1–C8**.

DISCUSSION

Pediatric obesity is a recognized public health priority due to its associated medical and psychosocial complications and impact on current and future healthcare costs.[14] Obesity remains prevalent among children and adolescents in Kentucky, particularly among children and adolescents who are publicly insured.[15] Overweight and obesity in childhood place children at risk for lifelong problems, including adult obesity, diabetes, hypertension, and CVD.[16] Reducing the prevalence of obesity among young children and decreasing obesity to prevent and/or improve management of chronic disease are prominent among Healthy Kentuckians 2020 goals.

This retrospective review of medical records of children and adolescents enrolled in Kentucky MMC was undertaken to evaluate the implementation of Expert Committee recommendations for the prevention, identification, assessment, and treatment of childhood obesity among Kentucky MMC-enrolled children and adolescents. Study findings revealed high prevalence of overweight and obesity among the study population, and opportunities for improvement in the identification of overweight and obesity, assessment of risk and management of children at risk for obesity-related health conditions.

Pediatric care providers play an integral role in the prevention of chronic conditions such as obesity.[17] As for other chronic conditions, early recognition of obesity risk and early intervention are crucial for optimal outcomes. The AAP and the Expert Committee recommend universal assessment of obesity risk, including routine documentation of BMI, at each well-child visit for children aged 2 years and older.[18] Visual assessment is not optimal for early recognition, as it may not accurately identify excess body fat, which is associated with increased health risks. However, BMI is a useful way to assess Barlow body fat. BMI is correlated with more direct measures of body fat that are less feasible to implement in primary care, and elevated BMI is correlated with cardiovascular risk and future morbidity and mortality.[19]

Since normative BMI levels vary by age and gender among children and young adolescents, BMI is evaluated relative to other children of the same age and sex for children less than 16 years old. Age- and sex-specific BMI percentiles, not BMI values, define overweight and obesity in this age group, although BMI values can define overweight and obesity in adolescents of age 16 years and older. Surveys of pediatricians have revealed that BMI percentile screening can be limited by lack of time and resources, as well as a belief that there is no effective treatment for child obesity.[20] Our study revealed that BMI percentile screening was lacking, because BMI percentile was documented in less than half of the reviewed records of children aged 2–15 years. Interestingly, over 80% of the records of these younger children had BMI values recorded, which may reflect the prevalence of EMRs that often auto-calculate BMI values from height and weight measurements. BMI values would be difficult to interpret in terms of health risk in children aged 15 years and younger, and

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[14] Daniels SR, Hassink SG, Committee on Nutrition. The role of the pediatrician in primary prevention of obesity. Pediatrics 2015; 136(1): e275.

[15] National Survey of Children's Health (NSCH). NSCH 2011/12. Data query from the Child and Adolescent Health Measurement Initiative. Data Resource Center for Child and Adolescent Health website. www.childhealthdata.org [July 15, 2015]

[16] Freedman DS, Khan LK, Dietz WH, Srinivasan SA, Berenson GS. Relationship of childhood obesity to coronary heart disease risk factors in adulthood: the Bogalusa Heart Study. *Pediatrics* 2001;108:712–718.

[17] Daniels SR, Hassink SG, Committee on Nutrition. The role of the pediatrician in primary prevention of obesity. Pediatrics 2015; 136(1): e275.

[18] SE and the Expert Committee. Expert Committee recommendations regarding the prevention, assessment and treatment of child and adolescent overweight and obesity: summary report. Pediatrics 2007; 120:S164.

[19] Barlow SE and the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatrics 2007; 120:S164

[20] Klein JD, Sesselberg TS, Johnson MS *et al*. Adoption of Body Mass Index guidelines for screening and counseling in pediatric practice. Pediatrics 2010; 125(2): 265-272.

therefore, recognition of at-risk children in this younger age group could be suboptimal. An assessment of barriers to appropriate BMI percentile screening among Kentucky MMC providers and interventions to improve screening should be a focus of improvement efforts, since it is a critical first step in identifying children at risk.

Since BMI reflects body fat levels and associated risks that are continuous, the Expert Committee identified cut points to define BMI percentile ranges that signify varying degrees of health risk due to body fat levels. A BMI percentile < 85% is associated with body fat levels that confer little health risk, BMI ≥ 95% reflects obesity and is associated with body fat levels that are high risk, and BMI ≥ 85%, but < 95% indicates overweight status and body fat levels that confer a variable degree of health risk depending on the presence of other risk factors. In order to appropriately assess health risk in overweight children, evaluation of current cardiovascular risk factors, family history of cardiovascular risk factors, parental obesity, and BMI trajectory must be evaluated. Among children and adolescents for whom BMI percentile was documented or could be calculated, overweight and obesity were prevalent, with 16% in the overweight category and 24% obese. Obesity, which is associated with known health risks, was particularly high among adolescents (30%); however, it is important to note that even among the preschool children the obesity rate was 17%, highlighting the need for prevention, identification and intervention long before children enter school, as advocated by the IOM.[21]

Only 6% of children and adolescents were documented to have overweight status plus at least one of the factors that increase health risk. Few children and adolescents in the study sample were reported to have medical conditions that increase cardiovascular risk, i.e., diabetes, hypertension or dyslipidemia, and abnormal laboratory tests for diabetes, liver enzymes or dyslipidemia were rarely reported. However, among members with family history documented (57% of study sample members), over half were noted to have a positive family history of obesity, cardiovascular disease or diabetes. The high prevalence of positive findings among those with family history documented may reflect documentation practices or EMR reporting formats, with only positive findings noted or displayed.

Overweight members with risk factors and members with obese weight status comprised 29% of the study sample, and are at risk for adverse health outcomes due to body fat levels and associated risk factors. Because assessment for some risk factors was not universal, such as documentation of family history and laboratory testing, it is possible that some children and adolescents who were at risk were not identified, and rates of at-risk members in the study sample may be even higher. Among adolescents, the at-risk population comprised fully 36% of sample members. However, despite this prevalence, providers did not acknowledge weight status and attendant health risk as a problem or concern for most of the at-risk children and adolescents. This finding could have been influenced by many factors, including documentation practices, lack of BMI percentile calculation, or reported provider barriers such as belief that no effective treatment is available for obese youth, as well as lack of training.[22]

The Expert Committee recommends that providers have procedures in place to assess health risks in overweight and obese children. Assessment of health risks associated with obesity is not confined to a static BMI measurement, but should also be based on determination of weight category, monitoring of the trajectory of BMI and an assessment of associated medical and behavioral risks. Our study revealed opportunity for improvement in the assessment of at-risk children and adolescents for rate of weight gain, comorbidity and behavioral risks.

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[21] Institute of Medicine. Early childhood obesity prevention policies. Report Brief June 2011. National Academy of Sciences, Washington, D.C.

[22] Klein JD, Sesselberg TS, Johnson MS *et al*. Adoption of Body Mass Index guidelines for screening and counseling in pediatric practice. Pediatrics 2010; 125(2): 265-272.

To evaluate BMI trajectory, measurements should be plotted on growth charts and monitored over time to assess the rate of weight gain and facilitate the early identification of children and adolescents at risk for obesity.[23] However, evidence of monitoring of BMI trajectory was documented in only 29% of records of at-risk children and adolescents.

An assessment of obesity-related medical conditions that are associated with increased cardiovascular risk is also part of the evaluation of at-risk children and adolescents, and should include a review of systems, laboratory testing and physical examination, including blood pressure measurement. Metabolic abnormalities have been shown to increase with excess fat, and overweight and obese children and adolescents are much more likely than their healthy-weight peers to develop hypertension, dyslipidemia and diabetes as young adults.[24]

Although only 1–3% of at-risk children and adolescents in our study sample were reported to have dyslipidemia or other medical conditions or laboratory abnormalities that confer cardiovascular risk, much higher prevalence of these cardiovascular risk factors among overweight and obese youth have been identified in other studies.[25] It is possible that incomplete evaluation contributed to the low rates of comorbid conditions reported for at-risk members. Not all records of at-risk children and adolescents included a blood pressure reading during the MY, and most at-risk children and adolescents did not have indicated laboratory evaluation for dyslipidemia and diabetes. Since dyslipidemia is among the most commonly reported obesity-related conditions, and type 2 DM is one of the most serious complications, screening for these obesity-associated conditions should be a focus of improvement initiatives. Of note, 2% of the at-risk members were identified as smokers, and screening for heightened cardiovascular risk due to tobacco use is also important for overweight and obese youth.

While there were few at-risk children and adolescents who had documented medical conditions that confer increased cardiovascular risk, there were other conditions documented in the members' medical records that may be associated with or exacerbated by obesity. Higher BMI has been associated with increased asthma risk, and obesity has been associated with increased asthma severity, exacerbation and emergency department utilization.[26] A total of 21% of at-risk members had asthma, and these members may require special counseling regarding management to facilitate physical activity to address overweight and obesity. Psychosocial problems have also been associated with obesity, and depression is an important comorbidity that may precede or result from obesity and manifest as anxiety symptoms. Among at-risk members, 3% were documented to have depression and 5%, anxiety. For these respiratory and psychosocial conditions, under-identification may also have affected reported rates, since a review of systems that may have exposed related symptoms was documented in only 49% of records of at-risk children and adolescents. Similarly, the lack of testing for NAFLD, for which obesity is a risk factor, among most at-risk children and adolescents may have resulted in missed diagnoses, since the condition is most often asymptomatic.[27]

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[23] Institute of Medicine. Early childhood obesity prevention policies. Report Brief June 2011. National Academy of Sciences, Washington, D.C.

[24] Weiss, R., Dziura, J., Burgert, T. S., *et al* (2004) Obesity and the metabolic syndrome in children and adolescents. N Engl J Med.350: 2362–2374.

[25] Daniels SR, Arnett DK, Eckel RH, *et al*. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation* 2005;111;1999–2002.

[26] Black MH, Zhou H, Takayanagi M *et al*. Increased asthma risk and asthma-related healthcare complications associated with childhood obesity. Am J Epidemiol 2013;178(7):1120-1128.

[27] Barlow SE and the Expert Committee. Expert Committee Recommendations Regarding the Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity: Summary Report. Pediatrics 2007; 120:S164.

Preventive interventions for all children and adolescents, and management and follow-up of those at-risk, offer additional opportunities for improvement. Lower-risk children and adolescents should have preventive counseling to establish or maintain a healthy lifestyle, while higher-risk children and adolescents, i.e., those that are overweight with other risk factors or obese, should have more intensive intervention as per Expert Committee recommendations.

Primary prevention is considered key to curbing the obesity epidemic.[28] All children should receive prevention interventions, including anticipatory guidance regarding healthy behaviors to minimize obesity risk. Like all chronic diseases, prevention and early intervention for obesity is preferable to delaying intervention until children already have risks that are challenging to address. Less than half of the members overall had medical record evidence of any nutritional counseling, with higher rates documented for younger children than adolescents, and physical activity counseling was documented in only 41% of records.

There is consistent evidence that adoption of specific behaviors is associated with obesity risk or energy balance, and may help prevent excessive weight gain. These behaviors include limiting sugar-sweetened beverages, screen time, portion size and eating out at restaurants, as well as eating breakfast and having family meals. The Youth Risk Behavior Surveillance System (YRBSS) 2013 results revealed that youth in Kentucky had some adverse health behaviors, such as consumption of sugar-sweetened beverages, which were reported at significantly higher rates than national rates.[29] Among all members in our study sample, nutritional and physical activity counseling consisted of general information in most cases, with low rates of counseling for specific behaviors associated with obesity risk. The Expert Committee recommends a focused assessment of these modifiable behavioral risks for overweight and obese children. However, important risk behaviors were not universally assessed, with nutritional behaviors assessed in only 54% of at-risk children and adolescents and physical activity in only 31%.

Expert Committee recommendations stress that providers should have procedures in place to not only assess risk in overweight and obese children and adolescents, but also to implement interventions to effect lasting changes in lifestyle habits. The first stage of management of at-risk children and adolescents (Prevention Plus) focuses on healthy lifestyle habits and frequent monitoring to improve BMI status. Overweight children and adolescents with risk factors and obese children and adolescents should have more intensive interventions than other children, but they received nutritional and physical activity counseling at the same rate as other members in the study sample. Most at-risk members received only general counseling rather than counseling targeted to evidence-based behavior change. Counseling to consume at least five fruits and vegetables, for which there is mixed evidence, was the most commonly documented risk behavior counseling for at-risk children and adolescents (22%), while 19% or less of the members received counseling on the specific nutritional topics with a stronger evidence base. Limitation of screen time was the most commonly documented physical activity behavior discussed, with 44% of at-risk members receiving this counseling. Not surprisingly, since potential target behaviors were not routinely assessed or discussed with at-risk children and adolescents, documentation of goal setting for behaviors was also lacking, although it is central to Expert Committee recommendations for management of overweight and obesity. Among at-risk children and adolescents, only 30% had at least one nutritional goal set and only 23% had at least one physical activity goal. Weight goals, such as weight maintenance to improve BMI status in the face of linear growth, were particularly poorly documented. Only 7% of at-risk children had any weight goal documented, and these goals were mostly general statements about weight loss for obese children rather than quantifiable goals such as those advocated by the Expert Committee.

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[28] Daniels SR, Hassink SG, Committee on Nutrition. The role of the pediatrician in primary prevention of obesity. Pediatrics 2015; 136(1): e275.

[29] Youth Risk Behavior Surveillance System available at https://nccd.cdc.gov/youthonline/App/Results, query July 15, 2015.

While brief office-based intervention may benefit the greatest number of overweight and obese children, the Expert Committee recommendations advocate escalation to a more intensive stage of management, as appropriate for age and degree of excess weight, if target behavior goals are not reached in three to six months. Although the higher stages of management require more resources, the most evidence based interventions for at-risk children and adolescents involve a comprehensive behavioral approach with medium to high intensity interventions consistent with these more intensive stages of management.[30]

Adherence to this staged approach to the management of overweight and obesity would require goal setting and follow-up to assess whether target goals were met and to evaluate weight status. As noted, less than one-third of at-risk children and adolescents had nutritional goals set, and less than one-fourth had physical activity goals set. Furthermore, documentation of follow-up of at-risk members was noted in few records; only 5% had a scheduled weight status follow-up within three to six months, and only 2% had weight goals reassessed at a later date. Because of the lack of goal setting and follow-up, it is difficult to evaluate which at-risk children may have been eligible for more structured support to attain goals, but only 2% were documented to have structured nutritional interventions and no children or adolescents were noted to have received any other interventions beyond Stage 1: Prevention Plus. There was little documentation of barriers to meeting goals, with family readiness to change noted in only one record, but this assessment would be central to formulating new or modified interventions for at-risk members. It is possible that this finding represents a lack of appropriate management for those children and adolescents most at risk, and this aspect of management should be further explored.

Some racial and ethnic groups bear disproportionate burdens of child and adolescent obesity, and cultural issues must be considered in prevention and management. Race and ethnicity were poorly reported in administrative data, and therefore racial/ethnic disparities could not be evaluated and could be considered for future study. However, there were some regional disparities noted, with fewer members residing in rural areas documented to have weight categorized, behavioral risks assessed and prevention counseling than members residing in urban areas. While this finding could be influenced by several factors, including types of providers in the two settings, providers serving members in rural areas could potentially be targeted for improvement interventions.

Limitations

This medical record review study was limited to information documented in medical records, and it is possible that assessments and interventions were conducted that were not included in medical record documentation. Since the study was limited to children and adolescents with primary care visits, children and adolescents enrolled in MMC who did not seek care were not included in the study sample, and their level of risk could not be evaluated. It was not possible to fully evaluate management of at-risk members, since risk assessment was incomplete. Finally, fasting lipid and glucose testing may have been performed, but not labeled as fasting tests; these rates may, therefore, be under-reported.

Conclusion

This medical record review study of Kentucky MMC-enrolled children and adolescents revealed multiple apparent gaps in the process of prevention, identification, risk assessment and management of overweight and obesity. At least 29% of the sample was at-risk for cardiovascular and other obesity-related conditions, but other at-risk children may not have been identified due to a lack of uniform screening for obesity-related

[30] Whitlock EP, O'Connor EA, Williams SB, Beil TL, Lutz KW. Effectiveness of Primary Care Interventions for Weight Management in Children and Adolescents: An Updated, Targeted Systematic Review for the USPSTF. Evidence Synthesis No.76. AHRQ Publication No. 10-05144-EF-1. Rockville, Maryland: Agency for Healthcare Research and Quality, January 2010.

conditions and contributory family history. Since at-risk children were identified even among preschool children, with increasing rates of obesity in older age groups, it is important to ensure early identification and intervention, as advocated by the IOM.[31] Most apparently at-risk children and adolescents did not have documentation of acknowledgement of their weight status by their providers, and assessment of health behaviors, goal setting and reassessment of goals for these children and adolescents are also opportunities for improvement. Finally, close monitoring and follow-up of at-risk children and adolescents was rarely documented, and therefore, it was not possible to evaluate whether more intensive, tailored interventions were appropriately implemented for those at most risk who did not make progress.

Recommendations

Implementation of coordinated efforts to improve universal prevention interventions and identification, risk assessment and management of overweight and obese children should be undertaken to address this public health problem and reach Healthy Kentuckians 2020 goals:

- MCOs should promote BMI percentile screening and universal prevention interventions for all MMC-enrolled children beginning in early childhood.
- Since pediatricians with better access to community and adjunct resources have been reported to better screen for overweight and obesity, MCOs should ensure that resources for nutrition, physical activity and weight management are disseminated to their network providers.
- MCOs should ensure appropriate risk assessment, management and monitoring of overweight and obese members among network providers, and investigate and address provider-reported barriers to appropriate care.
- Improvement efforts should focus on addressing obesity with a chronic care model, since successful models have been those incorporating motivational interviewing, family involvement, and engaging all office staff in the care of at-risk children and adolescents.
- MCOs should ensure member and family awareness of the cardiovascular and other health risks associated with overweight and obesity to facilitate motivation to change.
- Because of the prevalence of obesity in preschool children noted in this study and other reports, MCOs and the state of Kentucky should collaborate on antenatal interventions, such as appropriate maternal gestation weight gain and promotion of breastfeeding.
- Demographic and regional disparities in care for at-risk children and adolescents should be further explored.

[31] Institute of Medicine. Early childhood obesity prevention policies. Report Brief June 2011. National Academy of Sciences, Washington, D.C.

APPENDIX A: FREQUENCY TABLES

Table A1: Member Characteristics

Member Characteristics[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Race/Ethnicity								
Native American	1	0%	0	0%	0	0%	1	0%
Asian or Pacific Islander	1	0%	0	0%	0	0%	1	0%
Black	11	5%	10	4%	10	4%	31	5%
White	32	15%	37	16%	32	14%	101	15%
Other race or ethnicity	165	76%	163	72%	169	75%	497	74%
Not provided	7	3%	15	7%	15	7%	37	6%
Gender								
Female	105	48%	117	52%	111	49%	333	50%
Male	112	52%	108	48%	115	51%	335	50%
Region[2]								
Urban	145	67%	147	65%	126	56%	418	63%
Rural	72	33%	78	35%	100	44%	250	37%
Record type								
Electronic	193	89%	203	90%	188	83%	584	87%
Paper	24	11%	22	10%	38	17%	84	13%

[1]Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]Urban counties include: Boone, Bourbon, Boyd, Bracken, Bullitt, Campbell, Christian, Clark, Daviess, Edmonson, Fayette, Gallatin, Grant, Greenup, Hancock, Hardin, Henderson, Henry, Jefferson, Jessamine, Kenton, Larue, McLean, Meade, Nelson, Oldham, Pendleton, Scott, Shelby, Simpson, Spencer, Trigg, Trimble, Warren, Webster, and Woodford Counties. All other counties were designated as rural. Source: DMS, personal communication, 2013.

Table A2: Weight, Height and BMI Assessment

Weight, Height, and BMI Assessment[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
B1. Members with both height and weight documented at the same visit any time during measurement year								
Yes	201	93%	211	94%	208	92%	620	93%
No	16	7%	14	6%	18	8%	48	7%
B3-B4. Abstracted height at earliest visit (inches)	n = 201		n = 211		n = 208		n = 620	
Lower quartile (median of the lower half of the data)	36.00		47.50		61.00		42.18	
Median	39.00		51.00		64.00		51.81	
Upper quartile (median of the upper half of the data)	42.10		56.00		67.00		62.00	
B5-B6. Abstracted weight at earliest visit (pounds)	n = 201		n = 211		n = 208		n = 620	
Lower quartile	31.00		52.50		116.15		41.40	
Median	35.80		65.00		137.25		67.30	
Upper quartile	42.00		89.95		170.00		122.55	
B7. BMI value or percentile documented at the same earliest visit in which height and weight were documented								
Yes	186	86%	191	85%	190	84%	567	85%
No	31	14%	34	15%	36	16%	101	15%
B8a. Members with BMI value documented at the same earliest visit in which height and weight were documented	186	86%	190	84%	190	84%	566	85%
Abstracted BMI value at earliest visit	n = 186		n = 190		n = 190		n = 566	
Lower quartile	15.30		15.50		20.20		15.89	
Median	16.34		17.30		23.30		18.14	
Upper quartile	17.90		20.60		29.07		22.87	
B8b. Members with BMI percentile documented at the same earliest visit in which height and weight were documented	85	39%	82	36%	67	30%	234	35%
Abstracted BMI percentile at earliest visit	n = 85		n = 82		n = 67		n = 234	
Lower quartile	39.00		47.00		72.96		51.00	
Median	72.00		79.00		84.24		80.17	
Upper quartile	93.50		93.92		98.00		95.00	
Members with both BMI value and percentile documented at the same earliest visit in which height and weight were documented[2]	**84**	**39%**	**81**	**36%**	**67**	**30%**	**232**	**35%**

Weight, Height, and BMI Assessment[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Members who did NOT have either BMI value or percentile documented at the same earliest visit but had height and weight documented[2]	**15**	**7%**	**21**	**9%**	**18**	**8%**	**54**	**8%**
Computed BMI value at earliest visit	n = 15		n = 21		n = 18		n = 54	
Lower quartile	15.38		15.87		20.03		16.71	
Median	16.73		17.57		23.46		19.41	
Upper quartile	18.99		21.35		27.12		23.74	
Computed BMI percentile at earliest visit	n = 15		n = 21		n = 18		n = 54	
Lower quartile	45.41		59.78		57.92		57.92	
Median	79.25		84.85		83.75		82.12	
Upper quartile	96.29		98.43		96.49		97.24	
B9. Weight category documented at earliest visit with both height and weight documented								
Underweight	0	0%	3	1%	2	1%	5	1%
Healthy weight	5	2%	5	2%	0	0%	10	1%
Overweight	1	0%	5	2%	3	1%	9	1%
Obese	0	0%	7	3%	12	5%	19	3%
Not documented	211	97%	205	91%	209	92%	625	94%
B10. BMI percentile category documented at earliest visit with both height and weight documented								
< 5th percentile	4	2%	5	2%	3	1%	12	2%
5th–84th percentile	65	30%	55	24%	44	19%	164	25%
85th–94th percentile	19	9%	15	7%	7	3%	41	6%
≥ 95th percentile	17	8%	23	10%	16	7%	56	8%
Not documented	112	52%	127	56%	156	69%	395	59%
Members with weight category or BMI percentile category documented at earliest visit with both height and weight documented[2]	**107**	**49%**	**104**	**46%**	**80**	**35%**	**291**	**44%**
B11. BMI was plotted on a growth chart at a visit during the measurement year	68	31%	72	32%	56	25%	196	29%
B12.Weight status/BMI was acknowledged by the provider at a visit during the measurement year	32	15%	43	19%	44	19%	119	18%

Weight, Height, and BMI Assessment[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
B13. The provider explicitly acknowledged that BMI or weight category was a problem at a visit	9	4%	25	11%	26	12%	60	9%
B15. The provider indicated that BMI/weight was NOT an issue	6	3%	11	5%	8	4%	25	4%
B16a. BMI value or percentile was documented at more than one visit or date during the measurement year								
BMI value documented	102	47%	110	49%	112	50%	324	49%
BMI percentile documented	53	24%	49	22%	41	18%	143	21%
B16b. BMI value or percentile was documented at a visit or date during the measurement year other than the earliest visit								
BMI value documented	106	49%	112	50%	112	50%	330	49%
BMI percentile documented	66	30%	54	24%	51	23%	171	26%
B18a. Abstracted BMI value at latest visit	n = 106		n = 112		n = 112		n = 330	
Lower quartile	15.11		15.83		20.19		16.08	
Median	16.27		17.77		24.16		18.37	
Upper quartile	17.17		21.14		29.75		23.30	
B18b. Abstracted BMI percentile at latest visit	n = 59		n = 47		n = 44		n = 150	
Lower quartile	35.61		43.97		61.00		48.00	
Median	70.00		68.38		84.89		74.00	
Upper quartile	87.54		93.33		98.12		94.14	
B19. Weight category documented at latest visit in the measurement year at which a BMI value or percentile is documented or at a visit other than the earliest visit with both height and weight documented:	n = 107		n = 113		n = 112		n = 332	
Underweight	0	0%	4	4%	1	1%	5	2%
Healthy weight	1	1%	2	2%	0	0%	3	1%
Overweight	0	0%	1	1%	5	4%	6	2%
Obese	3	3%	3	3%	8	7%	14	4%
Not documented	103	96%	103	91%	98	88%	304	91%
B20. BMI percentile category documented at latest visit in the measurement year at which BMI value or percentile is documented or at a visit other than the earliest visit with both height and weight documented:	n = 107		n = 113		n = 112		n = 332	

Weight, Height, and BMI Assessment[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
< 5th percentile	6	6%	1	1%	0	0%	7	2%
5th–84th percentile	36	33%	23	20%	17	15%	76	23%
85th–94th percentile	6	6%	8	7%	5	4%	19	6%
≥ 95th percentile	13	12%	9	8%	14	13%	36	11%
Not documented	46	43%	72	64%	76	68%	194	58%
Members with weight category or BMI percentile category documented at latest visit in the measurement year[2]	**61**	**57%**	**46**	**41%**	**43**	**38%**	**150**	**45%**
B21. Weight goals set								
Weight loss (not specified, or general provider statement)	2	1%	3	1%	6	3%	11	2%
Weight velocity (weight trajectory) maintenance	0	0%	1	0%	0	0%	1	0%
Weight maintenance	0	0%	0	0%	5	2%	5	1%
Slow weight gain	1	0%	0	0%	0	0%	1	0%
Gradual weight loss of up to 1 lb/month or 0.5 kg/month	0	0%	0	0%	0	0%	0	0%
Weight loss > 1 lb/month or average up to 2 lb/week	0	0%	0	0%	0	0%	0	0%
Other weight goal set	0	0%	1	0%	1	0%	2	0%
At least one weight goal set[2]	**3**	**1%**	**5**	**2%**	**12**	**5%**	**20**	**3%**
B24a. Documentation of the provider planning a follow-up visit to reassess weight status or weight goals	4	2%	7	3%	10	4%	21	3%
B24b. Documented time interval planned by provider for follow-up visit to reassess weight status or weight goals								
Within three months	3	1%	4	2%	7	3%	14	2%
Within four to six months	0	0%	2	1%	0	0%	2	0%
After six months	0	0%	1	0%	0	0%	1	0%
No follow-up visits planned or occurred	214	99%	218	97%	219	97%	651	97%
B25.Weight goals reassessed at a later date								
Yes, within three months	0	0%	0	0%	2	1%	2	0%
Yes, within four to six months	2	1%	0	0%	0	0%	2	0%
Yes, after six months	0	0%	0	0%	1	0%	1	0%
No	215	99%	225	100%	223	99%	663	99%
B26. Weight goals met								

Weight, Height, and BMI Assessment[1]	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Provider statement that goal(s) met	0	0%	0	0%	0	0%	0	0%
Weight loss (not specified, or general provider statement)	0	0%	0	0%	1	0%	1	0%
Weight velocity (weight trajectory) maintenance	0	0%	0	0%	0	0%	0	0%
Weight maintenance	0	0%	0	0%	0	0%	0	0%
Slow weight gain	1	0%	0	0%	0	0%	1	0%
Gradual weight loss of up to 1 lb/month or 0.5 kg/month	0	0%	0	0%	1	0%	1	0%
Weight loss > 1 lb/month or average up to 2 lb/week	0	0%	0	0%	0	0%	0	0%
Other weight goal met	0	0%	0	0%	0	0%	0	0%
At least one weight goal met[2]	**1**	**0%**	**0**	**0%**	**2**	**1%**	**3**	**0%**
Weight goal was not assessed at any subsequent visits	1	0%	3	1%	8	4%	12	2%
B28. Barriers to meeting weight loss goal								
Family expressed lack of readiness to change nutrition habits	2	1%	0	0%	0	0%	2	0%
Family expressed lack of readiness to change physical activity habits	0	0%	0	0%	0	0%	0	0%
Member expressed lack of readiness to change nutrition habits	0	0%	0	0%	0	0%	0	0%
Member expressed lack of readiness to change physical activity habits	0	0%	0	0%	1	0%	1	0%
Lack of access to safe places to exercise	0	0%	0	0%	0	0%	0	0%
Lack of time for exercise or for supervision of exercise	0	0%	0	0%	0	0%	0	0%
Lack of access to affordable nutritious food	0	0%	0	0%	0	0%	0	0%
Medications (that increase risk for weight gain)	0	0%	0	0%	1	0%	1	0%
Other	0	0%	1	0%	2	1%	3	0%
At least one barrier identified[2]	**2**	**1%**	**1**	**0%**	**4**	**2%**	**7**	**1%**

[1]Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]The number and proportion of children was calculated from abstracted elements (boldface).

Table A3: Anticipatory Guidance, Assessment and Goal Setting for Nutrition

Anticipatory Guidance, Assessment and Goal Setting for Nutrition	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
C1. Assessment of nutritional behavior was conducted	140	65%	102	45%	102	45%	344	51%
C2. Education/counseling for general nutrition was documented	126	58%	100	44%	85	38%	311	47%
C3. Nutritional education/counseling topics covered	n = 126		n = 100		n = 85		n = 311	
General nutrition information	105	83%	82	82%	73	86%	260	84%
Avoidance of sugar-sweetened beverages	22	17%	16	16%	9	11%	47	15%
Have at least five servings of fruit and vegetables/day	24	19%	25	25%	17	20%	66	21%
Limit eating out, especially fast food	7	6%	10	10%	11	13%	28	9%
Have regular family meals	13	10%	16	16%	9	11%	38	12%
Limit portion sizes	1	1%	5	5%	4	5%	10	3%
Eat breakfast every day	12	10%	13	13%	10	12%	35	11%
Other nutritional topics	50	40%	32	32%	33	39%	115	37%
At least one nutritional topic covered[1]	**126**	**100%**	**100**	**100%**	**85**	**100%**	**311**	**100%**
C5. Nutritional goals set								
Avoid sugar-sweetened beverages	17	8%	8	4%	8	4%	33	5%
Consume at least five servings of fruit and vegetables/day	15	7%	16	7%	5	2%	36	5%
Limit eating out, especially fast food	3	1%	5	2%	4	2%	12	2%
Prepare more meals at home as family (5–6 times/week)	0	0%	1	0%	1	0%	2	0%
Limit portion sizes	1	0%	2	1%	2	1%	5	1%
Eat a healthy breakfast every day	7	3%	6	3%	5	2%	18	3%
Other nutritional topics	52	24%	35	16%	37	16%	124	19%
At least one nutritional goal set[1]	**59**	**27%**	**45**	**20%**	**41**	**18%**	**145**	**22%**

[1]The number and proportion of children was calculated from abstracted elements (boldface).

Table A4: Anticipatory Guidance, Assessment and Goal Setting for Physical Activity

Anticipatory Guidance, Assessment and Goal Setting for Physical Activity	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
D1. Assessment of physical activity was conducted	74	34%	56	25%	91	40%	221	33%
D2. General physical activity education/counseling was documented	105	48%	88	39%	80	35%	273	41%
D3. Physical activity education/counseling topics covered	n = 105		n = 88		n = 80		n = 273	
General information on physical activity	74	70%	69	78%	68	85%	211	77%
Moderate to vigorous physical activity for at least 60 min/day	21	20%	21	24%	15	19%	57	21%
Limit screen time to no more than two hours/day	62	59%	35	40%	33	41%	130	48%
Remove television from children's bedroom	4	4%	1	1%	1	1%	6	2%
Other physical activity topics	7	7%	3	3%	4	5%	14	5%
At least one physical activity topic covered[1]	**105**	**100%**	**88**	**100%**	**80**	**100%**	**273**	**100%**
D5. Physical activity goals set								
Moderate to vigorous physical activity for at least 30 minutes, at least three times/week	5	2%	3	1%	4	2%	12	2%
Moderate to vigorous physical activity for at least 60 minutes/day	12	6%	10	4%	7	3%	29	4%
Remove television from children's bedroom	3	1%	0	0%	0	0%	3	0%
Limit screen time to no more than two hours/day	30	14%	20	9%	13	6%	63	9%
Other physical activity topics	13	6%	17	8%	21	9%	51	8%
At least one physical activity goal set[1]	**44**	**20%**	**35**	**16%**	**34**	**15%**	**113**	**17%**

[1]The number and proportion of children was calculated from abstracted elements (boldface).

Table A5: Physical Exam and Other Diagnoses

Physical Exam and Other Diagnoses	Age Group						Total	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)		(N = 668)	
E1. Elements of the medical exam that were documented during the measurement year								
Blood pressure taken	139	64%	188	84%	210	93%	537	80%
Complete review of systems	107	49%	111	49%	125	55%	343	51%
Focused review of systems	89	41%	88	39%	72	32%	249	37%
Complete physical exam	193	89%	183	81%	191	85%	567	85%
Focused physical exam	61	28%	72	32%	77	34%	210	31%
At least one element documented[1]	**214**	**99%**	**221**	**98%**	**224**	**99%**	**659**	**99%**
Members with at least one well-child visit (member had a complete review of systems or a complete physical exam documented during the outpatient visit)[1]	**199**	**92%**	**196**	**87%**	**200**	**88%**	**595**	**89%**
E2. Members diagnosed with diabetes mellitus (DM)								
Type 2 DM	0	0%	0	0%	1	0%	1	0%
Type 1 DM	0	0%	0	0%	0	0%	0	0%
Pre-Diabetes	0	0%	0	0%	1	0%	1	0%
DM unspecified	0	0%	2	1%	0	0%	2	0%
Diabetes diagnosis not documented	217	100%	223	99%	224	99%	664	99%
E3. Diagnoses documented during the measurement year								
Hypertension	0	0%	0	0%	2	1%	2	0%
Depression	0	0%	2	1%	9	4%	11	2%
Asthma	21	10%	37	16%	45	20%	103	15%
Non-alcoholic fatty liver disease (NAFLD)	0	0%	0	0%	0	0%	0	0%
Hyperlipidemia/Hypercholesterolemia	1	0%	1	0%	3	1%	5	1%
Obstructive sleep apnea (OSA)	0	0%	0	0%	0	0%	0	0%
Gallbladder disease/gallstones	0	0%	0	0%	0	0%	0	0%
Anxiety	2	1%	2	1%	14	6%	18	3%
Positive tobacco use or screen	0	0%	0	0%	8	4%	8	1%
At least one diagnosis documented[1]	**24**	**11%**	**41**	**18%**	**67**	**30%**	**132**	**20%**
At least one diagnosis documented + diabetes[1]	**24**	**11%**	**43**	**19%**	**69**	**31%**	**136**	**20%**

[1]The number and proportion of children was calculated from abstracted elements (boldface).

Table A6: Family History

Family History	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
F1. Family history documented anywhere in the medical record	122	56%	130	58%	127	56%	379	57%
F2. Family history elements that were documented during the measurement year	n = 122		n = 130		n = 127		n = 379	
Positive family history of obesity	3	2%	3	2%	2	2%	8	2%
Positive family history of Cardiovascular Disease (CVD)/Coronary Artery Disease (CAD)	46	38%	44	34%	64	50%	154	41%
Positive family history of Diabetes	28	23%	40	31%	57	45%	125	33%
At least one element documented[1]	**52**	**43%**	**60**	**46%**	**81**	**64%**	**193**	**51%**

[1]The number and proportion of children was calculated from abstracted elements (boldface).

Table A7: Laboratory Tests

Laboratory Tests	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
G1. Fasting glucose								
Abnormally high	1	0%	0	0%	0	0%	1	0%
Normal (or low)	2	1%	1	0%	3	1%	6	1%
Ordered, but results not documented	1	0%	3	1%	3	1%	7	1%
Not ordered and not reported	213	98%	221	98%	220	97%	654	98%
G2. Non-fasting glucose								
Abnormally high	1	0%	5	2%	4	2%	10	1%
Normal (or low)	3	1%	15	7%	22	10%	40	6%
Ordered, but results not documented	8	4%	16	7%	16	7%	40	6%
Not ordered and not reported	205	94%	189	84%	184	81%	578	87%
G3. Fasting LDL								
Abnormally high	0	0%	0	0%	0	0%	0	0%
Normal (or low)	1	0%	1	0%	2	1%	4	1%
Ordered, but results not documented	0	0%	1	0%	3	1%	4	1%
Not ordered and not reported	216	100%	223	99%	221	98%	660	99%
G4. Non-fasting LDL								
Abnormally high	0	0%	1	0%	2	1%	3	0%
Normal (or low)	0	0%	5	2%	11	5%	16	2%
Ordered, but results not documented	4	2%	3	1%	15	7%	22	3%
Not ordered and not reported	213	98%	216	96%	198	88%	627	94%
G5. Fasting triglycerides								
Abnormally high	0	0%	0	0%	0	0%	0	0%
Normal (or low)	1	0%	2	1%	2	1%	5	1%
Ordered, but results not documented	0	0%	0	0%	3	1%	3	0%
Not ordered and not reported	216	100%	223	99%	221	98%	660	99%
G6. Non-fasting triglycerides								
Abnormally high	0	0%	2	1%	2	1%	4	1%

Laboratory Tests	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
Normal (or low)	1	0%	3	1%	12	5%	16	2%
Ordered, but results not documented	2	1%	5	2%	10	4%	17	3%
Not ordered and not reported	214	99%	215	96%	202	89%	631	94%
G7. ALT								
Abnormally high	1	0%	1	0%	3	1%	5	1%
Normal (or low)	2	1%	7	3%	19	8%	28	4%
Ordered, but results not documented	3	1%	0	0%	5	2%	8	1%
Not ordered and not reported	211	97%	217	96%	199	88%	627	94%
G8. AST								
Abnormally high	1	0%	1	0%	1	0%	3	0%
Normal (or low)	2	1%	7	3%	21	9%	30	4%
Ordered, but results not documented	4	2%	0	0%	3	1%	7	1%
Not ordered and not reported	210	97%	217	96%	201	89%	628	94%

Table A8: Referral to a Structure Weight Management Program

Referral to a Structured Weight Management (SWM) Program	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
H1. Referral to or attendance at structured nutrition class/session	5	2%	2	1%	2	1%	9	1%
H2. Referral to or attendance at structured exercise program	1	0%	1	0%	0	0%	2	0%
H3. Documentation of member referral to or participation in SWM protocol[1]	1	0%	0	0%	0	0%	1	0%

[1]One underweight child was enrolled in a weight management protocol.

Table A9: Referral to a Comprehensive Multidisciplinary Intervention or Program

Referral to a Comprehensive Multidisciplinary Intervention (CMI) or Program	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
I1. Documentation of member referral to or participation in a CMI	0	0%	0	0%	0	0%	0	0%
I2. Continued SWM	0	0%	0	0%	0	0%	0	0%
I3. Planned negative energy balance	0	0%	0	0%	0	0%	0	0%
I4. Structured Behavioral Modification Program	0	0%	0	0%	0	0%	0	0%
I5. Primary caregivers/family involved in behavior modification for children younger than 12 years of age	1	0%	1	0%	1	0%	3	0%
I6. Home Environment Improvement Training	0	0%	2	1%	1	0%	3	0%
I7. Weekly visits for 8–12 weeks	1	0%	1	0%	0	0%	2	0%

Table A10: Referral to Tertiary Care Interventions

Referral to Tertiary Care Interventions	Age Group						Total (N = 668)	
	Preschool Children (2–5 Years) (N = 217)		School-Aged Children (6–11 Years) (N = 225)		Adolescents (12–18 Years) (N = 226)			
J1. Documentation of referral to any of the following tertiary care interventions								
Medication: sibutramine	0	0%	0	0%	0	0%	0	0%
Medication: orlistat	0	0%	0	0%	0	0%	0	0%
Very low calorie diet	0	0%	0	0%	0	0%	0	0%
Meal replacement	0	0%	0	0%	0	0%	0	0%
Weight control surgery	0	0%	0	0%	0	0%	0	0%
None of the above	217	100%	225	100%	226	100%	668	100%

APPENDIX B: CROSS-TABULATION BY CARDIOVASCULAR DISEASE RISK

Domain 1: Identification

Table B1: Height, Weight and BMI by Cardiovascular Disease Risk

Documentation of Height, Weight and Body Mass Index (BMI)	Cardiovascular Disease Risk					
	Children Not At Risk (N = 427)		At-Risk Children (N = 194)		Total (N = 621)	
Members with both height and weight documented at the same visit any time during measurement year	427	100%	193	99%	620	100%
Members with a BMI value documented at any time during the measurement year	404	95%	180	93%	584	94%
Members with a BMI percentile documented at any time during the measurement year	196	46%	89	46%	285	46%
Members with BMI value and percentile documented at any time during the measurement year	195	46%	88	45%	283	46%
Members with BMI value or percentile documented at any time during the measurement year	405	95%	181	93%	586	94%
Members with neither BMI value and percentile documented at any time during the measurement year	22	5%	13	7%	35	6%
of whom had:	n = 22		n = 13		n = 35	
Height and weight documented[1]	22	100%	13	100%	35	100%
No height and weight documented[2]	0	0%	0	0%	0	0%
Members with a BMI value or percentile (documented or computed)	427	100%	194	100%	621	100%

[1]BMI values/percentiles were computed using the Centers for Disease Control and Prevention (CDC) algorithm, which is based on height and weight at same visit, in addition to age and gender.
[2]BMI value/percentile could not be computed using the CDC algorithm because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

Table B2: Documentation of Weight or BMI Percentile Categories by Cardiovascular Disease Risk

Documentation of Weight Category or Body Mass Index (BMI) Percentile Category	Cardiovascular Disease Risk				Total (N = 621)	
	Children Not At Risk (N = 427)		At-Risk Children (N = 194)			
Members with weight category documented at any time during the measurement year	17	4%[1]	38	20%[1]	55	9%
Members with BMI percentile category documented at any time during the measurement year	222	52%	103	53%	325	52%
Members with weight category or BMI percentile category documented at any time during the measurement year	227	53%	117	60%	344	55%
Members with neither weight category or BMI percentile category documented at any time during the measurement year	200	47%	77	40%	277	45%
of whom had:	n = 200		n = 77		n = 277	
Height and weight documented[2]	200	100%	77	100%	277	100%
No height and weight documented[3]	0	0%	0	0%	0	0%
Members with weight category or BMI percentile category (documented or computed)	427	100%	194	100%	621	100%

[1]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[2]BMI values/percentiles were computed using the Centers for Disease Control and Prevention (CDC) algorithm, which is based on height and weight at same visit, in addition to age and gender.
[3]BMI value/percentile could not be computed using the CDC algorithm because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

Table B3: Documented or Computed Weight or BMI Percentile Categories by Cardiovascular Disease Risk

Overall Weight Category and Body Mass Index (BMI) Percentile Category (Documented or Computed)	Cardiovascular Disease Risk				Total (N = 621)	
	Children Not At Risk (N = 427)		At-Risk Children (N = 194)			
BMI was plotted on a growth chart at a visit during the measurement year	138	32%	56	29%	194	31%
Weight status/BMI was acknowledged by the provider at a visit during the measurement year	61	14%[1]	56	29%[1]	117	19%
The provider explicitly acknowledged that BMI or weight category was a problem at a visit	15	4%[2]	44	23%[2]	59	10%
The provider indicated that BMI/weight was NOT an issue	21	5%	4	2%	25	4%

[1]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[2]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).

Table B4: Identification of Comorbid Conditions by Cardiovascular Disease Risk

Identification of Comorbid Conditions	Cardiovascular Disease Risk: Children Not At Risk (N = 427)		Cardiovascular Disease Risk: At-Risk Children (N = 194)		Total (N = 621)	
Members diagnosed with diabetes mellitus (DM)						
Type 2 DM	0	0%	1	1%	1	0%
Type 1 DM	0	0%	0	0%	0	0%
Pre-Diabetes	0	0%	1	1%	1	0%
DM unspecified	1	0%	0	0%	1	0%
Diabetes diagnosis not documented	426	100%	192	99%	618	100%
Other diagnoses documented during the measurement year						
Hypertension	0	0%	2	1%	2	0%
Depression	5	1%	5	3%	10	2%
Asthma	58	14%	40	21%	98	16%
Hyperlipidemia/Hypercholesterolemia	0	0%	5	3%	5	1%
Anxiety	8	2%	9	5%	17	3%
Positive tobacco use or screen	5	1%	3	2%	8	1%
At least one diagnosis documented[1]	**70**	**16%[2]**	**56**	**29%[2]**	**126**	**20%**
At least one diagnosis documented + diabetes[1]	**72**	**17%[3]**	**57**	**29%[3]**	**129**	**21%**

[1]The number and proportion of children was calculated from abstracted elements (boldface).
[2]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[3]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).

Domain 2: Assessment of Risk

Table B5: Assessment of Risk by Cardiovascular Disease Risk

Assessment of Risk	Cardiovascular Disease Risk: Children Not At Risk (N = 427)		Cardiovascular Disease Risk: At-Risk Children (N = 194)		Total (N = 621)	
Relevant history						
Complete review of systems	231	54%	95	49%	326	52%
Focused review of systems	169	40%	59	30%	228	37%
Family history documented	230	54%[1]	130	67%[1]	360	58%
of whom had documentation of:	n = 230		n = 130		n = 360	
Positive family history of obesity	6	3%	2	2%	8	2%
Positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD)	82	36%	65	50%	147	41%
Positive family history of diabetes	62	27%[2]	58	45%[2]	120	33%
At least one element documented[3]	**103**	**45%[4]**	**83**	**64%[4]**	**186**	**52%**
Physical exam						
Complete physical exam	374	88%	163	84%	537	86%
Focused physical exam	132	31%	61	31%	193	31%
Blood pressure taken	348	81%	169	87%	517	83%
Members with at least one well-child visit[5]	**389**	**91%**	**170**	**88%**	**559**	**90%**

[1]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[2]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[3]The number and proportion of children was calculated from the abstracted elements (boldface).
[4]Proportion for children who were not at risk was significantly lower than the proportion for at-risk children (green shade; $P < 0.001$).
[5]Members had a complete review of systems or a complete physical exam documented in an outpatient visit during the measurement year (boldface).

Table B6: Laboratory Evaluation by Cardiovascular Disease Risk

Laboratory Evaluation as Appropriate for Risk Category (Members > 10 years of age)[1]	Cardiovascular Disease Risk: Children Not At Risk (N = 166)		Cardiovascular Disease Risk: At-Risk Children (N = 101)		Total (N = 267)	
Fasting low-density lipoprotein (LDL)						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	2	1%	1	1%	3	1%
Ordered, but results not documented	1	1%	2	2%	3	1%
Not ordered and not reported	163	98%	98	97%	261	98%
Non-fasting LDL						
Abnormally high	0	0%	2	2%	2	1%
Normal (or low)	6	4%	7	7%	13	5%
Ordered, but results not documented	9	5%	7	7%	16	6%
Not ordered and not reported	151	91%	85	84%	236	88%

Laboratory Evaluation as Appropriate for Risk Category (Members > 10 years of age)[1]	Cardiovascular Disease Risk				Total (N = 267)	
	Children Not At Risk (N = 166)		At-Risk Children (N = 101)			
Fasting triglycerides						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	3	2%	1	1%	4	1%
Ordered, but results not documented	1	1%	2	2%	3	1%
Not ordered and not reported	162	98%	98	97%	260	97%
Non-fasting triglycerides						
Abnormally high	1	1%	2	2%	3	1%
Normal (or low)	6	4%	7	7%	13	5%
Ordered, but results not documented	6	4%	5	5%	11	4%
Not ordered and not reported	153	92%	87	86%	240	90%
Fasting glucose						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	3	2%	1	1%	4	1%
Ordered, but results not documented	2	1%	2	2%	4	1%
Not ordered and not reported	161	97%	98	97%	259	97%
Non-fasting glucose						
Abnormally high	2	1%	3	3%	5	2%
Normal (or low)	12	7%	13	13%	25	9%
Ordered, but results not documented	12	7%	7	7%	19	7%
Not ordered and not reported	140	84%	78	77%	218	82%
Alanine transaminase (ALT)						
Abnormally high	2	1%	2	2%	4	1%
Normal (or low)	12	7%	9	9%	21	8%
Ordered, but results not documented	2	1%	3	3%	5	2%
Not ordered and not reported	150	90%	87	86%	237	89%
Aspartate transaminase (AST)						
Abnormally high	1	1%	1	1%	2	1%
Normal (or low)	13	8%	10	10%	23	9%
Ordered, but results not documented	1	1%	2	2%	3	1%
Not ordered and not reported	151	91%	88	87%	239	90%

[1]Due to rounding, some subgroup percentages may not add up exactly to 100%.

Table B7: Assessment of Behavioral Risk by Cardiovascular Disease Risk

Assessment of Behavioral Risk	Cardiovascular Disease Risk				Total (N = 621)	
	Children Not At Risk (N = 427)		At-Risk Children (N = 194)			
Assessment of nutritional behavior was conducted	237	56%	104	54%	341	55%
Assessment of physical activity was conducted	154	36%	61	31%	215	35%

Domain 3: Prevention Counseling

Table B8: Prevention Counseling by Cardiovascular Disease Risk

Prevention Counseling	Cardiovascular Disease Risk				Total (N = 621)	
	Children Not At Risk (N = 427)		At-Risk Children (N = 194)			
Education/Counseling for general nutrition was documented	203	48%	102	53%	305	49%
Nutritional education/counseling topics covered:	n = 203		n = 102		n = 305	
General nutrition information	165	81%	90	88%	255	84%
Avoidance of sugar-sweetened beverages	27	13%	19	19%	46	15%
Have at least five servings of fruit and vegetables/day	43	21%	22	22%	65	21%
Limit eating out, especially fast food	18	9%	10	10%	28	9%
Have regular family meals	23	11%	15	15%	38	12%
Limit portion sizes	3	1%	7	7%	10	3%
Eat breakfast every day	24	12%	11	11%	35	11%
Other nutritional topics	76	37%	36	35%	112	37%
General physical activity education/counseling was documented	182	43%	87	45%	269	43%
Physical activity education/counseling topics covered:	n = 182		n = 87		n = 269	
General information on physical activity	136	75%	71	82%	207	77%
Moderate to vigorous physical activity for at least 60 min/day	40	22%	16	18%	56	21%
Limit screen time to no more than two hours/day	89	49%	38	44%	127	47%
Remove television from children's bedroom	5	3%	1	1%	6	2%
Other physical activity topics	10	5%	4	5%	14	5%

APPENDIX C: CROSS-TABULATION BY REGION

Domain 1: Identification

Table C1: Documentation of Height, Weight, and BMI by Region

Documentation of Height, Weight and Body Mass Index (BMI)	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Members with both height and weight documented at the same visit any time during measurement year	224	90%	396	95%	620	93%
Members with a BMI value documented at any time during the measurement year	211	84%	373	89%	584	87%
Members with a BMI percentile documented at any time during the measurement year	89	36%	196	47%	285	43%
Members with BMI value and percentile documented at any time during the measurement year	88	35%	195	47%	283	42%
Members with BMI value or percentile documented at any time during the measurement year	212	85%	374	89%	586	88%
Members with neither BMI value and percentile documented at any time during the measurement year	38	15%	44	11%	82	12%
of whom had:	n = 38		n = 44		n = 82	
Height and weight documented[1]	13	34%	22	50%	35	43%
No height and weight documented[2]	25	66%	22	50%	47	57%
Members with a BMI value or percentile (documented or computed)	225	90%	396	95%	621	93%

[1]BMI values/percentiles were computed using the Centers for Disease Control and Prevention (CDC) algorithm, which is based on height and weight at same visit, in addition to age and gender.
[2]BMI value/percentile could not be computed using the CDC algorithm because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

Table C2: Documentation of Weight or BMI Percentile Category by Region

Documentation of Weight Category or Body Mass Index (BMI) Percentile Category	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Members with weight category documented at any time during the measurement year	14	6%	41	10%	55	8%
Members with BMI percentile category documented at any time during the measurement year	99	40%[1]	226	54%[1]	325	49%
Members with weight category or BMI percentile category documented at any time during the measurement year	105	42%[2]	239	57%[2]	344	51%
Members with neither weight category or BMI percentile category documented at any time during the measurement year	145	58%	179	43%	324	49%
of whom had:	n = 145		n = 179		n = 324	
Height and weight documented[3]	120	83%	157	88%	277	85%
No height and weight documented[4]	25	17%	22	12%	47	15%
Members with weight category or BMI percentile category (documented or computed)	225	90%	396	95%	621	93%

[1]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).
[2]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).
[3]BMI values/percentiles were computed using the Centers for Disease Control and Prevention (CDC) algorithm, which is based on height and weight at same visit, in addition to age and gender.
[4]BMI value/percentile could not be computed using the CDC algorithm because height and weight were not documented, except for one school-aged member who had only a BMI value documented.

Table C3: Documented or Computed Weight or BMI Percentile Categories by Region

Overall Weight Category and Body Mass Index (BMI) Percentile Category (Documented or Computed)[1]	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Members with a BMI value or percentile (documented or computed)	225	90%	396	95%	621	93%
Overall BMI percentile category						
< 5th percentile	9	4%	22	5%	31	5%
5th–84th percentile	121	48%	208	50%	329	49%
85th–94th percentile	33	13%	71	17%	104	16%
≥ 95th percentile	62	25%	95	23%	157	24%
Not documented	25	10%	22	5%	47	7%
Overall weight category						
Underweight	9	4%	22	5%	31	5%
Healthy	121	48%	208	50%	329	49%
Overweight	33	13%	71	17%	104	16%
Obese	62	25%	95	23%	157	24%
Not documented	25	10%	22	5%	47	7%
Overall cardiovascular disease (CVD) risk stratum						
Underweight	9	4%	22	5%	31	5%
Healthy	121	48%	208	50%	329	49%
Overweight	20	8%	47	11%	67	10%
Overweight + risk factors[2]	13	5%	24	6%	37	6%
Obese	62	25%	95	23%	157	24%
Not documented	25	10%	22	5%	47	7%
At risk for CVD (overweight + risk factors, obese)[3]	**75**	**30%**	**119**	**28%**	**194**	**29%**
BMI was plotted on a growth chart at a visit during the measurement year	56	22%	140	33%	196	29%
Weight status/BMI was acknowledged by the provider at a visit during the measurement year	31	12%	88	21%	119	18%
The provider explicitly acknowledged that BMI or weight category was a problem at a visit	15	6%	45	11%	60	9%
The provider indicated that BMI/weight was NOT an issue	6	2%	19	5%	25	4%

[1]Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]Risk factors include type 2 diabetes mellitus (DM), type 1 DM, pre-diabetes, DM unspecified, hypertension; nonalcoholic fatty liver disease (NAFLD), hyperlipidemia/hypercholesterolemia, positive family history of obesity; positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD); positive family history of diabetes; abnormally high lab test result(s).
[3]The rate of children at risk for cardiovascular disease (CVD) was calculated by identifying the overweight children with the above noted risk factors, in addition to obese children (boldface).

Table C4: Identification of Comorbid Conditions by Region

Identification of Comorbid Conditions[1]	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Members diagnosed with diabetes mellitus (DM)						
Type 2 DM	0	0%	1	0%	1	0%
Type 1 DM	0	0%	0	0%	0	0%
Pre-Diabetes	0	0%	1	0%	1	0%
DM unspecified	1	0%	1	0%	2	0%
Diabetes diagnosis not documented	249	100%	415	99%	664	99%
Other diagnoses documented during the measurement year						
Hypertension	2	1%	0	0%	2	0%
Depression	2	1%	3	1%	5	1%
Asthma	34	14%	69	17%	103	15%
Hyperlipidemia/Hypercholesterolemia	2	1%	3	1%	5	1%
Anxiety	4	2%	14	3%	18	3%
Positive tobacco use or screen	4	2%	4	1%	8	1%
At least one diagnosis documented[2]	**43**	**17%**	**89**	**21%**	**132**	**20%**
At least one diagnosis documented + diabetes[2]	**45**	**18%**	**91**	**22%**	**136**	**20%**

[1]Due to rounding, some subgroup percentages may not add up exactly to 100%.
[2]The number and proportion of children was calculated from the abstracted elements (boldface).

Domain 2: Assessment of Risk

Table C5: Assessment of Risk by Region

Assessment of Risk	Region				Total	
	Rural (N = 250)		Urban (N = 418)		(N = 668)	
Relevant history						
Complete review of systems	117	47%	226	54%	343	51%
Focused review of systems	105	42%	144	34%	249	37%
Family history documented	137	55%	242	58%	379	57%
of whom had documentation of:	n = 137		n = 242		n = 379	
Positive family history of obesity	2	1%	6	2%	8	2%
Positive family history of cardiovascular disease (CVD)/coronary artery disease (CAD)	60	44%	94	39%	154	41%
Positive family history of diabetes	44	32%	81	33%	125	33%
At least one element documented[1]	**71**	**52%**	**122**	**50%**	**193**	**51%**
Physical exam						
Complete physical exam	204	82%	363	87%	567	85%
Focused physical exam	83	33%	127	30%	210	31%
Blood pressure taken	195	78%	342	82%	537	80%
Members with at least one well-child visit[2]	**218**	**87%**	**377**	**90%**	**595**	**89%**

[1]The number and proportion of children was calculated from the abstracted elements (boldface).
[2]The number and proportion of children with at least one well-child visit was calculated from the number of children who had a complete review of systems or a complete physical exam documented in an outpatient visit during the measurement year (boldface).

Table C6: Laboratory Evaluation by Region

Laboratory Evaluation (Members > 10 years of age[1,2])	Region				Total	
	Rural (N = 124)		Urban (N = 162)		(N = 286)	
Fasting low-density lipoprotein (LDL)						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	1	1%	2	1%	3	1%
Ordered, but results not documented	1	1%	2	1%	3	1%
Not ordered and not reported	122	98%	158	98%	280	98%
Non-fasting LDL						
Abnormally high	1	1%	1	1%	2	1%
Normal (or low)	3	2%	10	6%	13	5%
Ordered, but results not documented	6	5%	10	6%	16	6%
Not ordered and not reported	114	92%	141	87%	255	89%
Fasting triglycerides						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	1	1%	3	2%	4	1%
Ordered, but results not documented	1	1%	2	1%	3	1%
Not ordered and not reported	122	98%	157	97%	279	98%

Laboratory Evaluation (Members > 10 years of age[1,2])	Region				Total (N = 286)	
	Rural (N = 124)		Urban (N = 162)			
Non-fasting triglycerides						
Abnormally high	0	0%	3	2%	3	1%
Normal (or low)	4	3%	9	6%	13	5%
Ordered, but results not documented	6	5%	5	3%	11	4%
Not ordered and not reported	114	92%	145	90%	259	91%
Fasting glucose						
Abnormally high	0	0%	0	0%	0	0%
Normal (or low)	2	2%	2	1%	4	1%
Ordered, but results not documented	1	1%	3	2%	4	1%
Not ordered and not reported	121	98%	157	97%	278	97%
Non-fasting glucose						
Abnormally high	2	2%	3	2%	5	2%
Normal (or low)	9	7%	17	10%	26	9%
Ordered, but results not documented	4	3%	15	9%	19	7%
Not ordered and not reported	109	88%	127	78%	236	83%
Alanine transaminase (ALT)						
Abnormally high	2	2%	2	1%	4	1%
Normal (or low)	11	9%	11	7%	22	8%
Ordered, but results not documented	2	2%	3	2%	5	2%
Not ordered and not reported	109	88%	146	90%	255	89%
Aspartate transaminase (AST)						
Abnormally high	0	0%	2	1%	2	1%
Normal (or low)	13	10%	11	7%	24	8%
Ordered, but results not documented	1	1%	2	1%	3	1%
Not ordered and not reported	110	89%	147	91%	257	90%

[1]Includes 19 members who are older than 10 years of age and who had unknown cardiovascular disease risk due to lack of height and weight documentation in their medical records.
[2]Due to rounding, some subgroup percentages may not add up exactly to 100%.

Table C7: Assessment of Behavioral Risk by Region

Assessment of Behavioral Risk	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Assessment of nutritional behavior was conducted	101	40%[1]	243	58%[1]	344	51%
Assessment of physical activity was conducted	68	27%[2]	153	37%[2]	221	33%

[1]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).
[2]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).

Domain 3: Prevention Counseling

Table C8: Prevention Counseling by Region

Prevention Counseling	Region				Total (N = 668)	
	Rural (N = 250)		Urban (N = 418)			
Education/Counseling for general nutrition was documented	92	37%[1]	219	52%[1]	311	47%
Nutritional education/counseling topics covered:	n = 92		n = 219		n = 311	
General nutrition information	77	84%	183	84%	260	84%
Avoidance of sugar-sweetened beverages	14	15%	33	15%	47	15%
Have at least five servings of fruit and vegetables/day	20	22%	46	21%	66	21%
Limit eating out, especially fast food	5	5%	23	11%	28	9%
Have regular family meals	11	12%	27	12%	38	12%
Limit portion sizes	1	1%	9	4%	10	3%
Eat breakfast every day	11	12%	24	11%	35	11%
Other nutritional topics	38	41%	77	35%	115	37%
General physical activity education/counseling was documented	78	31%[2]	195	47%[2]	273	41%
Physical activity education/counseling topics covered:	n = 78		n = 195		n = 273	
General information on physical activity	62	79%	149	76%	211	77%
Moderate to vigorous physical activity for at least 60 min/day	18	23%	39	20%	57	21%
Limit screen time to no more than two hours/day	38	49%	92	47%	130	48%
Remove television from children's bedroom	1	1%	5	3%	6	2%
Other physical activity topics	1	1%	13	7%	14	5%

[1]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).
[2]Proportion for children living in rural regions was significantly lower than the proportion for children living in urban regions (green shade; $P < 0.001$).