An Inquiry into the Measurement of Child and Youth Obesity with Canadian Survey Data

James Chowhan[1]

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[1] McMaster University, 1280 Main St. W, Hamilton, Ontario, chowhan@mcmaster.ca

Abstract

This paper examines the impact that differences in the definition of child overweight and obesity have on describing the reference population. Two main definitions that describe child body mass index status will examined--an international definition (Cole et al 2004) and an American definition (from the Centers for Disease Control and Prevention). Further, the variation of self and proxy reports of weight and height across various Canadian data sources is investigated. Three main Statistics Canada data sets are used: the National Longitudinal Survey of Children and Youth (NLSCY), the National Population Health Survey (NPHS), and the Canadian Community Health Survey (CCHS). This study demonstrates that the definition of obesity is not immaterial and that different data sources can produces different population estimates of weight status.

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1. Introduction

The incidence of obesity in Canada is increasing not only for adults but also for children. For policy makers it is essential to monitor trends in child obesity since obesity is a risk factor for heart disease and other chronic diseases in later life.[2] However, these trends are sometimes difficult to measure with precision.

For this investigation, the measure used to categorize nutritional status is body mass index (BMI). This is an index of weight and height. The BMI is defined as body weight in kilograms divided by height in meters squared. Typically this measure is used to identify children and adolescents between the ages 2 to 20 (and adults) on the weight spectrum ranging from underweight or overweight.[3]

This paper examines the differing obesity prevalence outcomes that the two main definitions of child nutritional status indicators produce. The two measures are Cole et al's international measure (2004) and the American Centers for Disease Control and Prevention's (CDC) measure. The two main definitions that will be investigated use child weight and height to generate a body mass index that is then compared to centile curves and cut-off points to classify the child as: 1) not overweight, 2) overweight, or 3) obese. These indicators have different thresholds resulting in different incidence of children being categorized as overweight and obese.

Further, the variation of self and proxy reports of weight and height across various Canadian data sources is investigated. Three main Statistics Canada data sets are used: the 1998 National Longitudinal Survey of Children and Youth (NLSCY), the 1998 National Population Health Survey (NPHS), and the 2000-01 Canadian Community Health Survey (CCHS).

The paper is structured in the following manner: Section 2 briefly describes the two tools for identifying nutritional status, and Section 3 makes comparisons between the different measures. Section 4 defines the data used in this study, and it details the specific qualities and constraints of the data. Section 5 reports a comparison of nutritional status across the surveys. Finally, Section 5 consists of concluding remarks.

2. Literature Review

Two differing tools for identifying children's nutritional status are reviewed in this section. The percentile cut-off definition given by the United States Centers for Disease

[2] For policy makers it is essential to monitor trends in child obesity since obesity is a risk factor for common medical consequences such as Hyperlipidemia, Glucose intolerance, Hepatic steatosis, Cholelithiasis, and Early maturation (Dietz, 1998).

[3] Health professionals argue that the BMI is not a diagnostic tool that should be used in isolation, because it is only a proxy of body fatness and not a measure. Other measures, for example tricep skinfold measurements, can be used in addition to determine excess fat levels.

Control and Prevention (CDC) is described. Further, an international definition that benchmarks to adult risk levels, as outlined by Cole et al., is reviewed.

The CDC used a nationally representative sample from 5 U.S. national survey data sets on children and adolescents ages 2 to 20 years old. Data were obtained from the National Health Examination Survey (NHES) and the National Health and Nutrition Examination Survey (NHANES). Percentiles for age and sex were generated based on the distributions of BMI. Thus, nutritional status is determined by referring to BMI percentiles.

Barlow and Dietz (1998) suggest the cut-off points of 85th and 95th percentiles to classify children as "at risk-of-overweight" and "overweight". These cut-offs were chosen to minimize the risk of false positive results. In other words, they are designed so that the numbers of children that are not obese above the cut-off are minimized.[4]

The CDC prefers the use of the term "overweight" for children equal to or greater than the 95th percentile of body mass index for age and sex. Further, children in the 85th percentile are referred to as "at risk-of-overweight" (CDC, 2004). These terms are preferred to the nutritional status terminology of obese to identify children that may be at medical risk due to excess body weight. The CDC suggests that evaluating a child and classifying her/him should be done with more than one measure.

Research by Pietrobelli et al (1998) has tested the performance of the BMI for age and sex as a proxy of fatness against other fatness measures for reliability. Other measures, such as dual energy x-ray absorptometry (DXA)--a direct measure of adiposity, have positive significant correlations to the BMI proxy of fatness. These tests indicate the useful qualities of the BMI as a screening tool (Pietrobelli et al, 1998).

Even with this evidence continuing research has suggested that available data has not demonstrated the reliability of BMI as a predicator of individual body fat mass; specifically, caution is suggested when comparing the BMI of differing ages and groups of children (Widhalm and Schonegger, 1999).

Nonetheless, the BMI has been adopted as the standard nutritional status assessment proxy for both children and adults. Broad support for this measure exists internationally. Barlow and Dietz (1998) argue that BMI correlates well with both primary measures of adiposity (such as the total body fat (TBF) and percent of body weight as fat (PBF)) and secondary complications (such as hypertension and dyslipidemias).

The main objective of Cole et al's (2004) study was to produce less arbitrary and more internationally based age and sex specific cut-off points for child overweight and obesity outcomes. To achieve this, they used six national cross-sectional surveys (Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States) for a total of

[4] Percentiles indicate the rank of a measure in a group of 100. Thus, a child at the 95th percentile implies that there are 94 children below the 95th child of the same sex and age.

192,727 children of which 49.2% were female. The child's ages ranged from birth to 25 years.

The widely accepted adult cut-off points of 25 kg/m^2 and 30 kg/m^2 for overweight and obese, respectively, are used by Cole et al as a benchmark to calibrate each country's fitted centile curve. To calculate their aggregate obesity index, they allow each country's fitted curve to pass through the adult obesity of 30 kg/m^2 at age 18. From these fitted curves an average single smooth curve is calculated. This curve is independent of the individual country ranges of obesity.

Cole et al argue that it is not clear whether it is appropriate to use the 85th and 95th centiles of body mass index to identify the nutritional status of the child, as is done in the United States. Their main argument is that the United States data (reference population) may not be representative of international outcomes and that the cut-offs of 85th and 95th percentiles seem somewhat arbitrary.

3. Measurement Comparison

The CDC BMI for age percentiles and the Cole international BMI benchmarks are the two main measures for evaluating nutritional status with weight, height, age, and sex information. The choice of measure used for any investigation must be informed. This section compares some of the similarities and differences of the measures.

The shape of the CDC and Cole body mass indices for age and sex curves indicates that initially BMI declines with age until about ages 4 to 6 (for both the CDC 85th to 95th percentiles and the Cole overweight and obese curves). It then begins to increase over the remainder of the child/adolescent period to age 18 (see Appendix 1, Table A1.1 for a description of these indices).[5]

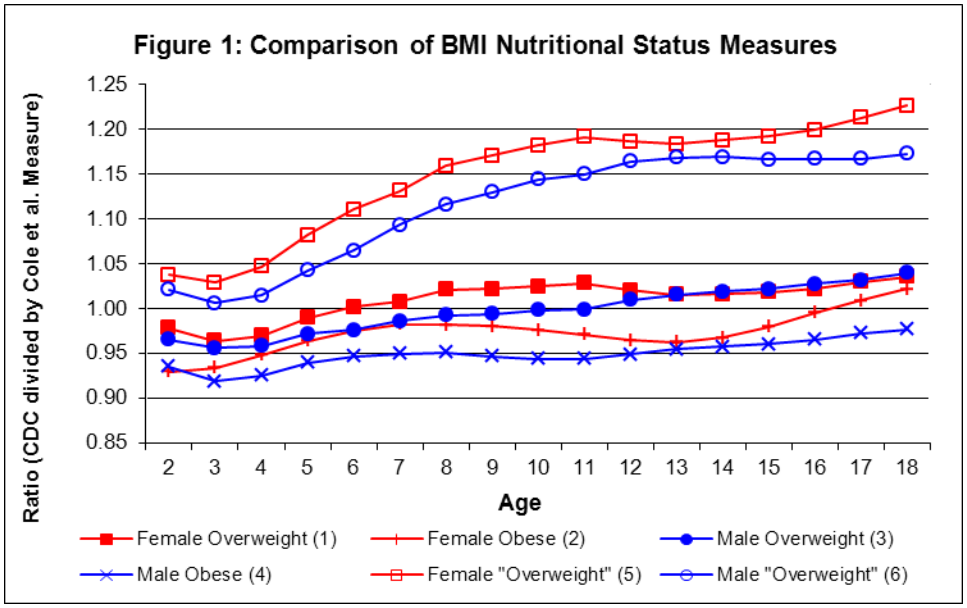
However, these two measures use substantially different reference populations to derive their indices. Further, the methodology to define cut-off points to classify nutritional status differs for each measure. As a result, these two measures produce different predictions for at risk-of-overweight, overweight, and obesity cut-offs. This is made clear by looking at the comparisons made in Figure 1 and Table 1.

[5] The ages after the 4 to 6 minimum BMI range is generally referred to as the "adiposity" rebound (CDC, 2004).

Table 1: Ratios of BMI Nutritional Status Measures

	Female		Male		CDC/Cole	
	CDC/Cole Overweight[1]	CDC/Cole Obese[2]	CDC/Cole Overweight[1]	CDC/Cole Obese[2]	Female Overweight[3]	Male Overweight[3]
Age	(1)	(2)	(3)	(4)	(5)	(6)
2	0.978	0.929	0.965	0.935	1.037	1.021
3	0.964	0.933	0.956	0.919	1.029	1.006
4	0.970	0.948	0.958	0.925	1.046	1.014
5	0.989	0.963	0.971	0.939	1.082	1.042
6	1.001	0.975	0.976	0.946	1.110	1.064
7	1.007	0.982	0.986	0.950	1.131	1.093
8	1.021	0.982	0.992	0.950	1.159	1.116
9	1.022	0.980	0.993	0.946	1.170	1.130
10	1.025	0.976	0.998	0.943	1.182	1.144
11	1.028	0.971	0.999	0.944	1.191	1.150
12	1.020	0.964	1.010	0.949	1.186	1.164
13	1.015	0.962	1.015	0.955	1.183	1.168
14	1.016	0.967	1.019	0.957	1.187	1.169
15	1.018	0.979	1.022	0.960	1.192	1.166
16	1.021	0.995	1.027	0.965	1.199	1.167
17	1.029	1.008	1.031	0.972	1.213	1.166
18	1.035	1.021	1.039	0.977	1.226	1.172

1. For comparative purposes, the CDC at risk-of-overweight cut-off is compared to the Cole et al overweight cut-off.
2. Again, for comparative purposes the CDC overweight cut-off is compared to the Cole et al obese cut-off.
3. For completeness, a comparison is made between both the CDC and Cole et al cut-offs.



The first comparisons of CDC "overweight" at the 95th percentile and Cole overweight (25 kg/m^2), lines 5 and 6, indicate that the CDC 95th percentile, described as "overweight", is always greater than the Cole index. The differences are greater for females than for males increasing from 3.7% to 22.6% for females and 2.1% to 17.2% for males from ages 2 to 18. The deviation between the two measures, for this comparison, is smaller for males than females. Thus, generally, when "overweight" indices are compared, the Cole measure will tend to predict more children as overweight, and specifically, females will tend to be predicted as overweight more frequently than with the CDC measure. However, this comparison was made to follow the CDC typology of the 95th percentile being called overweight as opposed to obese. It is not clear that this is the most informative comparison, because most researchers interpret the CDC 95th percentile cut-off as the level for obesity and the 85th percentile as the cut-off for overweight.

Notice that when the comparisons are made between the CDC 85th percentile (at risk-of-overweight) and the Cole overweight category, and the CDC 95th percentile (overweight) and the Cole obese category the deviations between the two measures are reduced. Lines 1 and 3 show that deviation between the two measures of overweight (CDC 85th percentile and Cole overweight) for females ranges from 0.14% to 3.6% and for males from 0.12% to 4.4%. Further, for females from ages 2 to 5 the Cole measure would predict more children as overweight and from ages 6 to 18 the CDC measure would predict more children as overweight. Similarly, for males the Cole measure predicts more children as overweight from ages 2 to 11, and the CDC predicts more from ages 12 to 18. For this comparison, the males will tend to be predicted as overweight more frequently with the Cole measure from ages 2 to 11. At about age 12 the female and male ratios of CDC by Cole begin to converge.

For the CDC 95th percentile cut-off comparison to the Cole obesity (30 kg/m^2) category lines 2 and 4 are of interest. Again, we see that, except for age 2, males will tend to be predicted as overweight more frequently with the Cole measure. This is due to males having a greater deviation between the measures than females. The male deviation ranges between 2.3% and 8.1%, whereas the female deviation is 0.85% to 7.1%. Generally, for both females and males the CDC measure will predict more children as being obese than will the Cole measure, except for females ages 17 and 18 when the Cole will predict more children with obesity.

In summary, when comparing the CDC 95th percentile cut-off as the level for obesity and the 85th percentile as the cut-off for overweight to the Cole measures, the CDC index will tend to predict children more frequently as overweight or obese than the Cole international measure. Thus, it is important to understand the tendencies of both measures. The choice of measure used should ultimately depend on the reference population being studied and its similarity to the United States or the international average population.

4. Data

There are three Statistics Canada surveys that are used for comparison in this study: the 1998 National Longitudinal Survey of Children and Youth (NLSCY), the 1998 National Population Health Survey (NPHS), and the 2000-01 Canadian Community Health Survey (CCHS).

The National Longitudinal Survey of Children and Youth (NLSCY) data are designed to measure child development and well-being as they grow over time.[6] There have been 5 cycles of data collected to date. This study focuses on the 1998 (cycle 3) NLSCY so that the data can be compared to the 1998 NPHS (cycle 3) children. From the NLSCY, cross-sectional estimates can be produced for ages 0 to 15 based on a total of 32, 223 children. However, the focus for this study is on ages 2 to 15, which includes 23, 835 children.

The NLSCY, like any survey data, does have respondents for which they were unable to collect information or for which there is missing information. For this analysis, children that have missing information for both weight and height questions are dropped, leaving a sample of 18,102 (see Appendix 2 for tables describing the frequency of missing BMI information).

During the interview for the NLSCY a person aged 15 or older who is most knowledgeable about the child that has been selected for the survey is asked to be the primary respondent for the household. In most cases the Person Most Knowledgeable (PMK) is the child's mother. For the variables of interest (age, sex, weight, and height), the PMK would have responded for all age groups of children.[7]

The National Population Health Survey (NPHS) Cycle 3 (1998-1999) cross-sectional sample is also used for this study. The NPHS collects information on the health and socio-demographic characteristics of the Canadian population. For households selected into the survey, all household members answer the general portion of the survey, and then a randomly selected person answers a more in-depth health component. For children less than 12 years old or unable to answer due to special circumstances a proxy was chosen to answer for them. In cycle 3, approximately 49,046 respondents (ages 0 to 65+) answered the general portion while 17,244 answered the detailed health portion.

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[6] The Labour Force Survey (LFS) sample was used as a screen (sample frame), by the NLSCY, to identify households with children. Thus, the LFS served as a basis for the NLSCY Main Component. As a result, the NLSCY data have the same population exclusions as the LFS; specifically, the LFS targets 98% of the Canadian population. The Northwest Territories and residents of Indian reserves and Crown lands are excluded from the survey. Inmates of institutions and full-time members of the Canadian Armed Forces are also excluded because they are considered to be outside of the labour market [Guide to Labour Force Survey, 2000]. Further, the NLSCY sample excluded children who lived in institutions for more than six months and Aboriginal children living on-reserve.

[7] The variables of interest weight and height are reported in metric. Weight is reported in kilograms and height is reported in centimetres. So there was no problem calculating the body mass index from the reported values.

Again the variables of interest for this study are weight and height, which are found in the health portion. Thus, the sample of interest is 17,244, but only children and youth ages 2 to 15 were examined resulting in a sample size of 2,417 (about 14% of the total).

The analysis depends on weight and height. The weight variable was reported in kilograms. The height variable is a scale that standardizes the metric and imperial systems. For height, a value of 50 on the scale is equivalent to 5'0" (60 inches) (151.1 to 153.6 cm), and an increase of one in the scale is equivalent to an inch. For this analysis, the imperial measure in inches was converted into centimeters to derive a height measure (a conversion rate of 1 inch to 2.54cm was used).

The Canadian Community Health Survey (CCHS) cycle 1.1 (2000-01) is also used for comparative purposes. The main objectives of this survey were to provide cross-sectional estimates of a Canadian reference population of health determinants, health status, and health system utilization. The survey focused on persons aged 12 and older, in ten provinces and the three territories.[8] For this survey the focus is on 8,699 (6.6% of sample) children ages 2 to 15. The CCHS reports weight in kilograms and height in meters, which makes for a straightforward calculation of the BMI.

The CCHS did permit proxy interviews (6.3%). This occurred when respondents were absent or incapable of completing the interview. A person in the household that was deemed knowledgeable completed the proxy interview.

5. Survey Comparisons

The main comparisons in this analysis will be between the health surveys (NPHS and CCHS) and the NLSCY. Recall, the BMI information collected in the NLSCY was by PMK. Similarly, in the NPHS, for children under 12 a person most knowledgeable reported their information. For the CCHS, child data was generally collected directly from the child respondent. Thus, differences between the surveys could be due to response error inherent to the proxy interview.

In Table 2, a comparison between the CCHS and the NPHS demonstrates that these two surveys have very similar predicted rates of overweight and obesity for ages 12 to 14, for age 15 the CCHS generally tends to have higher predictions. In both surveys, these measures are generally not proxy interviews.

[8] Components of the population that were excluded were persons living on Indian Reserves or Crown lands, clientele of institutions, full-time members of the Canadian Armed Forces and residents of certain remote regions.

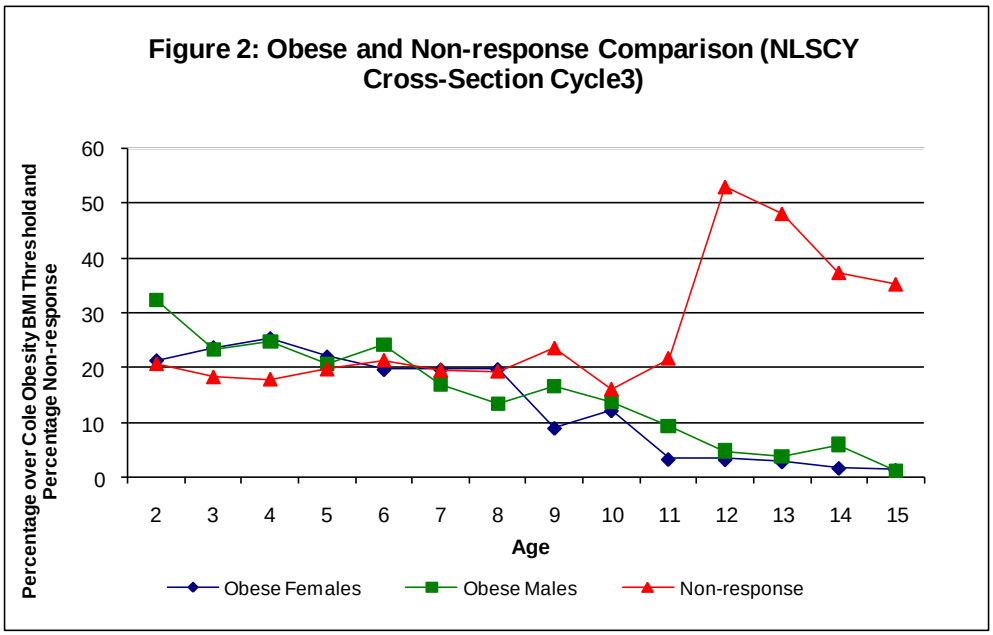
Table 2: Comparison of Health Surveys (NPHS and CCHS) to the NLSCY

	CDC Measures				Cole et al Measure of Obesity and Overweight			
	Risk of Overweight		Overweight		Overweight		Obese	
Ages	Males	Females	Males	Females	Males	Females	Males	Females
NPHS by NLSCY Ratio of BMI Frequencies								
2	1.22	1.28	1.27	1.39	1.21	1.19	1.30	1.76
3	1.33	1.20	1.39	1.41	1.39	1.40	1.75	1.50
4	0.98	1.19	1.04	1.38	0.99	1.35	1.37	1.24
5	1.08	0.88	1.31	0.94	1.15	0.91	1.45	0.84
6	1.11	0.90	0.90	1.32	0.85	0.91	0.76	0.90
7	1.05	1.25	1.13	0.97	1.13	1.24	1.30	0.93
8	1.17	0.89	1.21	0.83	1.36	0.95	1.50	0.92
9	0.69	1.46	0.74	1.35	0.59	1.52	0.91	1.40
10	1.12	0.78	0.63	0.75	1.13	0.77	0.37	0.67
11	1.17	1.02	0.88	0.76	1.17	1.11	0.54	0.99
12	1.22	1.62	1.78	2.53	1.29	1.36	1.54	2.10
13	1.20	0.96	1.37	2.19	1.13	0.94	1.95	1.44
14	0.99	1.68	0.68	1.95	1.00	1.65	0.93	2.27
15	0.96	0.64	1.66	1.05	1.05	0.59	4.58	1.64
CCHS by NLSCY Ratio of BMI Frequencies								
12	1.47	1.16	1.91	1.73	1.52	1.14	1.25	1.29
13	1.24	1.00	1.42	1.79	1.17	1.09	2.04	1.53
14	1.07	1.45	0.86	1.57	1.12	1.54	1.16	1.70
15	1.00	1.19	2.55	2.00	1.13	1.22	4.31	2.64
CCHS by NPHS Ratio of BMI Frequencies								
12	1.20	0.71	1.07	0.68	1.18	0.84	0.81	0.62
13	1.03	1.04	1.04	0.82	1.03	1.16	1.05	1.06
14	1.08	0.86	1.26	0.80	1.12	0.93	1.25	0.75
15	1.04	1.85	1.54	1.89	1.07	2.05	0.94	1.61

A comparison of the health surveys to the NLSCY reveals that the health surveys predict a higher frequency of children in the overweight or obese categories than the NLSCY, for ages 12 to 15, generally. Although, in the NPHS/NLSCY data comparisons there is somewhat more variability observed. Similarly, ages 2 to 4 tend to have higher predictions in the NPHS relative to the NLSCY. Ages 5 to 11 appear to be approximately even concerning the tendency of the relative prediction between the two surveys (NPHS/NLSCY).

The health surveys for both of their respective reference years have high response rates for the BMI variables. The response rate for the NPHS ranged from 89.1% to 98.3% (across ages 2 to 15 – see Appendix 2). The response rates for the CCHS are in a similar range from 93.6% to 97% (ages 12 to 15). The NLSCY generally has higher rates of missing information for the BMI variables with response rates ranging from 51.8% to 83.8%. However, as figure 2 shows the rate of missing responses increased substantially for ages 12 to 15. Even with this increase in missing responses, the rates of obesity

appear to continue their downward trend relatively smoothly, which is consistent with the results from both the CCHS and NPHS (see Appendix 3). Thus, it appears that the aggregate trend in nutritional status in the NLSCY is not substantially impacted by the missing responses.[9]



6. Concluding Remarks

The increasing trend in child obesity in Canada is difficult to measure with precision, given various data quality and measurement issues. This investigation compares the two main standards used in Canadian obesity research--Cole et al's international measure (2004) and the CDC measure. Three main Statistics Canada data sets are used: the 1998 National Longitudinal Survey of Children and Youth (NLSCY), the 1998 National Population Health Survey (NPHS), and the 2000-01 Canadian Community Health Survey (CCHS).

The two measures, Cole et al's international measure (2004) and the CDC measure, generate different incidence of child overweight and obese rates. These differences raise the question: which is the most appropriate threshold to be using to estimate Canadian prevalence rates? The observed differences suggest that a standard threshold for Canada may be appropriate to adopt. Perhaps it is time for the development of overweight and obesity thresholds based on the Canadian population of children and youth.

[9] Note this is an observation based on aggregate tabulations. Sub-groups may be substantially impacted by the missing responses resulting in bias if the missing responses are not randomly distributed across the possible sub-samples in the survey.

This study is not without limitations. Measurement data of weight and height (BMI) must be reported, obtained, and recorded accurately if they are to be useful as an identification tool. It is possible that measurement error could cause a change in classification. Even when measurement is accurate it is possible that due to age-related physiological variations it may be more difficult to distinguish at risk from normal weight range children.

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Appendix 1

Table A1.1: Comparison of International and U.S. Screening Tools for BMI Nutritional Status

	Females				Males			
	CDC BMI Thresholds		Cole et al BMI Threshold		CDC BMI Thresholds		Cole et al BMI Threshold	
Age	At risk-of-overweight[1]	Overweight[2]	Overweight[3]	Obese[4]	At risk-of-overweight	Overweight	Overweight	Obese
2	17.6	18.7	18.0	20.1	17.8	18.8	18.4	20.1
3	17.0	18.1	17.6	19.4	17.1	18.0	17.9	19.6
4	16.8	18.1	17.3	19.1	16.9	17.8	17.6	19.3
5	16.9	18.5	17.1	19.2	16.9	18.1	17.4	19.3
6	17.3	19.2	17.3	19.7	17.2	18.7	17.6	19.8
7	17.9	20.1	17.8	20.5	17.6	19.6	17.9	20.6
8	18.7	21.2	18.3	21.6	18.3	20.5	18.4	21.6
9	19.5	22.4	19.1	22.8	19.0	21.6	19.1	22.8
10	20.4	23.5	19.9	24.1	19.8	22.6	19.8	24.0
11	21.3	24.7	20.7	25.4	20.6	23.7	20.6	25.1
12	22.1	25.7	21.7	26.7	21.4	24.7	21.2	26.0
13	22.9	26.7	22.6	27.8	22.2	25.6	21.9	26.8
14	23.7	27.7	23.3	28.6	23.0	26.4	22.6	27.6
15	24.3	28.5	23.9	29.1	23.8	27.2	23.3	28.3
16	24.9	29.2	24.4	29.4	24.5	27.9	23.9	28.9
17	25.4	30.0	24.7	29.7	25.3	28.6	24.5	29.4
18	25.9	30.6	25.0	30.0	26.0	29.3	25.0	30.0

1. For the CDC measure children above the 85th and below the 95th percentile are at risk-of-overweight.
2. For the CDC measure, children above the 95th percentile are overweight.
3. For the Cole et al. the cut-off point for overweight at age 18 is described as a body mass index of 25 kg/m^2
4. For the Cole et al. the cut-off point for obesity at age 18 is described as a body mass index of 30 kg/m^2

Appendix 2

Table A2.1: Non-response Comparison for BMI (Percentage)

NLSCY Cycle 3 Cross-Section, 1998

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
No BMI	20.8	18.4	18.0	19.9	21.5	19.6	19.5	23.7	16.2	21.8	53.1	48.2	37.4	35.3	24.1
Positive BMI	79.2	81.6	82.0	80.2	78.5	80.4	80.5	76.3	83.8	78.2	46.9	51.8	62.6	64.7	76.0
Total	1,594	2,029	1,976	6,951	1,536	1,049	1,382	941	1,241	843	1,259	872	1,256	906	23,835

NPHS Cycle 3 Cross-Section, 1998

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
No BMI	10.98	9.64	10.9	9.59	6.37	12.73	8.81	3.91	5.49	6.49	3.39	3.26	2.91	1.69	6.87
Positive BMI	89.02	90.36	89.1	90.41	93.63	87.27	91.19	96.09	94.51	93.51	96.61	96.74	97.09	98.31	93.13
Total	246	166	156	146	157	165	159	128	164	185	177	184	206	178	2,417

CCHS Cycle 1.1 Cross-Section, 2000

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
No BMI	--	--	--	--	--	--	--	--	--	--	6.5	5.0	3.2	3.0	4.4
Positive BMI	--	--	--	--	--	--	--	--	--	--	93.6	95.1	96.8	97.0	95.6
Total	--	--	--	--	--	--	--	--	--	--	2,172	2,202	2,124	2,201	8,699

Appendix 3

Table A3.1: NHPS (1998) Cycle 3 Cross-Section Sample -- Percentage of Children

	CDC Measures				Cole et al Measure of Obesity and Overweight			
	Risk of Overweight		Overweight		Overweight		Obese	
Ages	Males	Females	Males	Females	Males	Females	Males	Females
2	65.6	57.6	57.1	46.7	58.1	49.7	42.1	37.5
3	69.1	54.3	56.7	47.8	60.2	50.5	41.1	35.5
4	48.9	55.5	39.8	40.5	39.8	55.5	34.1	31.5
5	45.2	36.6	38.7	25.6	44.4	36.6	30.1	18.4
6	45.1	36.6	25.1	29.3	32.6	36.9	18.3	17.6
7	38.7	44.2	23.7	19.5	38.7	44.8	22.3	18.2
8	46.1	35.0	23.6	18.1	45.4	39.2	20.3	18.1
9	27.9	32.9	15.7	13.4	23.3	38.8	15.2	12.7
10	39.7	22.4	11.4	9.9	39.7	23.5	5.2	8.1
11	32.0	17.9	14.1	3.4	32.0	22.8	5.0	3.4
12	21.8	25.0	11.0	9.1	24.0	26.0	7.4	7.0
13	25.7	15.0	10.3	7.3	27.5	15.0	7.3	4.2
14	21.4	18.3	7.3	5.1	23.8	19.3	5.5	4.0
15	19.5	7.2	5.5	2.3	23.2	7.6	5.4	2.3

Table A3.2: NLSCY (1998) Cycle 3 Cross-Section Sample -- Percentage of Children

	CDC Measures				Cole et al Measure of Obesity and Overweight			
	Risk of Overweight		Overweight		Overweight		Obese	
Ages	Males	Females	Males	Females	Males	Females	Males	Females
2	53.7	45.0	45.0	33.6	48.0	41.7	32.4	21.3
3	52.0	45.1	40.9	33.9	43.4	36.0	23.5	23.7
4	49.8	46.7	38.2	29.3	40.4	41.2	24.9	25.4
5	41.9	41.4	29.5	27.3	38.6	40.3	20.9	22.0
6	40.7	40.7	28.0	22.3	38.3	40.7	24.2	19.7
7	36.8	35.4	21.0	20.1	34.3	36.1	17.1	19.7
8	39.5	39.2	19.5	21.7	33.4	41.1	13.5	19.7
9	40.6	22.6	21.2	10.0	39.6	25.6	16.7	9.0
10	35.5	28.8	18.1	13.2	35.1	30.6	13.8	12.2
11	27.4	17.5	16.1	4.5	27.4	20.5	9.3	3.4
12	17.9	15.4	6.2	3.6	18.6	19.0	4.8	3.3
13	21.4	15.6	7.6	3.3	24.3	15.9	3.8	2.9
14	21.6	10.9	10.8	2.6	23.8	11.7	6.0	1.8
15	20.3	11.2	3.3	2.2	22.2	12.8	1.2	1.4

Table A3.3: CCHS (2000-01) cycle 1.1 Cross-Section Sample--Percentage of Children

	CDC Measures				Cole et al Measure of Obesity and Overweight			
	Risk of Overweight		Overweight		Overweight		Obese	
Ages	Males	Females	Males	Females	Males	Females	Males	Females
12	26.2	17.8	11.8	6.2	28.3	21.8	6.0	4.3
13	26.5	15.6	10.7	6.0	28.4	17.4	7.7	4.5
14	23.1	15.8	9.3	4.1	26.6	18.0	6.9	3.0
15	20.2	13.3	8.5	4.4	24.9	15.6	5.1	3.8