THE ATLANTIC BULGE:

THE ROLE OF LOW-INCOME STATUS IN EXPLAINING REGIONAL VARIATION OF ADOLESCENT WEIGHT IN CANADA

by

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To my wife Kimberley, for all the motivation, love and support she provides.

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Abstract

Childhood obesity has become an increasingly important public health concern in Canada. This paper provides an econometric analysis of the role of income and other explanatory factors on adolescent overweight and obese statuses within Canada using data from the 2009/2010 Canadian Community Health Survey. Results reveal the importance of low-income status on adolescent body weight. The effect of low income is particularly pronounced after accounting for household size. However, it does not account for much of the additional incidence of overweight and obesity in the Atlantic region of Canada.

List of Abbreviations Used

BMI – Body Mass Index

CCHS – Canadian Community Health Survey

CDC – United States Center for Disease Control

IOTF – International Obesity Task Force

OLS – Ordinary least squares

PUMF – Public use microdata file

WHO – World Health Organization

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Chapter 1 – Introduction

Over recent years, the prevalence of overweight status and obesity has dramatically increased in Canada and our expanding waistlines have become a costly health care burden. Estimates have shown adult obesity rates to have more than doubled since 1970 (Luo et al., 2007) and the Canadian government has described obesity to be at epidemic level (Starky, 2005). Most alarming is the growth rate of overweight and obesity in Canadian children where between 1978 and 2004 the proportion of 12-17 year old adolescents who were overweight more than doubled while obesity rates tripled (Shields, 2006).

The health and financial implications are profound. Excess weight predisposes individuals to many health risks including increased rates for diabetes, hypertension, stroke, heart failure and certain cancers (Sassi, 2010). Obesity has also been correlated with higher likelihoods of depression and other mood disorders in both adults and children (Rofey et al., 2009).

Financially, the direct and indirect Canadian health care costs of obesity were estimated at $3.9 billion and $3.2 billion respectively in 2006 (Janssen, 2013). Although already high, these estimates are likely to increase for future years as the frequency of obesity and its comorbidities rise while the price of medical technology, pharmaceuticals and public health care in Canada continue their projected climb at a pace that currently far exceeds growth of real GDP per capita (Di Matteo & Di Matteo, 2012).

Research has indicated a higher prevalence of overweight and obesity in the Atlantic region of Canada (Canning, Courage, Frizzell, & Seifert, 2007; Dutton & McLaren, 2011; Pouliou & Elliot, 2009, St John et al., 2008). The Atlantic is also home

to the four poorest provinces in the country (Statistics Canada, 2012). The goal of this study is to investigate the correlation described above and provide a closer look at the causes of overweight and obese children in hopes of determining better strategies to reduce a future public health burden. With the unnecessary costs and suffering associated with these avoidable conditions, the prevention of overweight, obesity and related health care illnesses should become a priority for Canada.

Chapter 2 – Literature Review

Physiologically, overweight and obese statuses develop from an energy imbalance that arises when a person consumes more calories than they utilize (Wolin & Petrelli, 2009). While the problem is quite simple from a biological standpoint, a variety of more complex factors have been shown as determinants of weight gain. In fact, recent research estimates that diet and exercise (direct contributors to the energy imbalance) play a relatively minor role in weight gain compared to other explanatory and potentially unobservable factors (Ng, Norton, Guilkey, & Popkin, 2012). Factors such as relative income (Burton & Phipps, 2010; Levine, 2011; Phipps, Burton, Osberg, & Lethbridge, 2006), parental education (Lamerz et al., 2005), food prices (Lakdawalla & Philipson, 2002), geography and food access (He et al., 2012; Levine, 2011; Veugelers, Sithole, Zhang, & Muhajarine, 2008), and a changing landscape of food convenience and marketing (Andreyeva, Kelly, & Harris, 2011) have all been shown to contribute to a developed world with difficulty managing body weight. Of these factors, the complex link between low household income and weight gain has some of the strongest evidence in the literature. Estimating the effect of income on body weight in children for different regions of Canada will be the focus of this paper.

For all research involving childhood body weight, it is important to note that the measurement of overweight and obese children is more complicated than in adults. There are three major guidelines for estimating elevated levels of childhood body fat including standards from the U.S. Center for Disease Control (CDC), the World Health Organization (WHO) and the International Obesity Task Force (IOTF). Each guideline has its own set of cut-off points for overweight and obese children leading to estimates

that can significantly vary between age groups and guidelines. With respect to the age range measured in the present study (12-17 year old adolescents), Shields and Tremblay (2010) compared estimates of weight status for the same group of adolescents using all three guidelines. They found that overall the IOTF guidelines were the most conservative of the three, with the most prominent differences occurring in the measurement of obesity (obesity rates were significantly lower when measured with IOTF guidelines compared to CDC and WHO guidelines). The IOTF guidelines are also the guidelines used for measurement in the present study.

There is a large body of literature that focuses on the complex relationship between income and weight status. Economic models show how income can either increase or decrease body weight. Higher incomes may facilitate an individual's ability to consume more calories through more purchasing power. Higher incomes may also increase body weight by raising the opportunity cost of physical activity and unpaid leisure time, in turn reducing time spent on exercise (Sturm, 2004). In contrast, increased income could decrease body weight by facilitating a better capability to participate in exercise and burn calories (St John et al., 2008; Tarasuk, Fitzpatrick, & Ward, 2010). Higher incomes can also enable an individual to afford healthier and more expensive food options such as fruits and vegetables (Tarasuk et al., 2010).

The complexity of this interaction is evident throughout the literature. Gregory and Ruhm (2009) found that American women's wages peaked at a lower body-mass index (BMI) while men's wages actually peaked in the overweight range. This scenario inherently demonstrates the complex nature of the relationship between body weight and

income and how other elements such as social norms, gender and discrimination can influence the dynamic.

Levine (2011) describes a paradoxical observation between income and weight gain: high income countries have the greatest rates of obesity, yet it is the poor areas within these countries that are most affected. The poorest regions in the United States had obesity rates 145 percent greater than wealthier areas. Levine lists a variety of factors that contribute to this phenomenon including limited access to fresh foods and a higher proportion of sedentary lifestyles in poorer regions. Another reason low-income contributes to obesity may be that high calorie foods have simply become less expensive. Lakdawalla and Philipson (2002) contend that agricultural innovation and the resulting decreases in food price explain up to 40 percent of weight growth. Despite a complex relationship, the literature overwhelmingly points to a negative correlation between income and body weight in the developed world.

For children in Canada, there is also strong evidence of a negative correlation between BMI and household income. Burton and Phipps (2010) found that adolescent girls from the lowest income families in Canada were significantly more likely to be overweight than those from higher income families, and more than three times as likely to be obese. While a similar trend was somewhat evident in adolescent boys, the results were less significant and may point to a gender gap in this relationship for children. Phipps, Burton, Osberg and Lethbridge (2006) examined child poverty and obesity across the U.S., Canada and Norway and found evidence that within these countries childhood poverty rates and childhood obesity rates seemed to mimic each other – more evidence that low-income status is a driving force in adolescent obesity.

In a specific look at Nova Scotia, the most populated province of the Atlantic region, St John et al. (2008) found a significant relationship between overweight children and the lowest household incomes. The authors found that income plays an important role in Nova Scotia youth obesity rates by influencing both physical activity habits and diet. Corroborating these results, Tarasuk et al. (2010) found that income has a significant and positive correlation with healthy dietary intake and physical activity of adults and children across Canada.

There is evidence that excess body weight has even begun to affect children as young as three years old in Canada. Twells and Newhook (2011) tested overweight and obesity in preschool children using all three major guidelines (CDC, IOTF, WHO) and found that approximately one in three preschool children were either overweight or obese in Canada.

Childhood overweight and obesity is not a problem that is easily resolved with age, as the link between overweight children and overweight and obese adults appears strong. In a longitudinal study, Freedman, Khan, Serdula, Dietz and Srinivasa (2005) followed a group of overweight children between 2 and 17 years of age and found consistent trends towards obesity later in life. In fact, overweight children were at least four times as likely to become obese adults and the likelihood became stronger with the older overweight children.

Although the dynamics between income and obesity are complicated, the evidence is strong of a positive correlation between low-incomes and obesity – especially in developed countries. What is not complicated is the detrimental relationship between childhood obesity and later life health outcomes.

Chapter 3: Data

3.1 Canadian Community Health Survey

The primary data source for this analysis is the 2009/2010 Canadian Community Health Survey (CCHS) two year public use microdata file (PUMF) – the most recent two year file at the time of this writing. The survey is cross-sectional and collects information about Canadians related to their health status and health care utilization, as well as information on potential health determinants.

The CCHS was chosen as the database for this analysis because of its large sample of Canadian adolescents and the information on their BMI and BMI determinants such as exercise, diet, household income and household education.

3.2 Sample Selection

The 2009/2010 two year CCHS PUMF contains interviews of 10,985 adolescents from ages 12- to 17-years-old. Of this group, 9649 responded to the height and weight questions needed to derive BMI. Those with missing data for BMI, or any variable analysed in this study were dropped from the sample. The most noteworthy reductions came from parents who did not respond to household income (2164) or household education (706) questions, leaving the final sample count at 6326 adolescents – 3268 boys and 3058 girls.

3.3 Dependent Variables

Three dependent variables were used in this study to represent adolescent weight status: a continuous variable for BMI, and binary classifications for both overweight and obese statuses. For the purpose of this study, overweight specifications will also include obesity.

It is important to note that BMI is not a perfect measure of adiposity (body fat) and can be subject to both measurement error (Ode, Pivarnik, Reeves, & Knous, 2007) and biases inherent in self-reporting (Sherry, Jefferds, & Grummer-Strawn, 2007). Nevertheless, BMI has become a standard measurement tool for determining adiposity and related health conditions and is widely used in clinical settings (Daniels, 2009). BMI is also a very convenient measurement tool since only body weight and height are required to establish a coefficient from the simple formula: BMI = (body weight in kilograms)/(height in metres)^2.

Overweight and obese cut-off points for adolescents are defined in the CCHS PUMF according to the Cole Classification system recommended for use by the IOTF. As discussed in the literature review, the measurement of overweight and obese adolescents is far more complicated than for adults because adolescent body mass is not representative of adult body mass and can change substantially with age and between genders. The IOTF system was created by Cole, Bellizzi, Flegal and Dietz (2000) and links childhood body mass to representative adult overweight and obese cut-offs dependent on both age and gender. IOTF cut-off points increase as children age and are generally higher for girls than for boys, especially at younger ages. The full IOTF classification system for adolescents used in the CCHS PUMF is found in Table 3.1. As discussed in the literature review, this IOTF classification system generally yields the most conservative estimates of the three major guidelines, especially when it comes to obesity.

Table 3.1 – CCHS Adolescent Weight Classifications				
	Overweight Thresholds (BMI ≥)		**Obese Thresholds** (BMI ≥)	
Age (years)	Boys	Girls	Boys	Girls
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18	25.00	25.00	30.00	30.00
Source: Statistics Canada (2011a)				

A comparison of means for all dependent variables is found in Table 3.2, and is separated by gender and region. The two regions included are the "Atlantic provinces" and the non-Atlantic or "other provinces". The Atlantic provinces in Canada consist of Newfoundland and Labrador in addition to the three Maritime provinces: Nova Scotia, New Brunswick, and Prince Edward Island. The remaining six ("other provinces") include Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. The Canadian Territories were excluded from this analysis.

As visible in Table 3.2, measures of adiposity are generally higher in boys than in girls, with the exception of mean BMI for the Atlantic provinces where BMI in girls is

slightly higher than in boys. However, with cut-off points higher for girls throughout the IOTF classification system, the general trend remains that Canadian boys are more prone to excess body weight.

In comparing regions, residents of the Atlantic provinces are heavier than those of other Canadian provinces in all measures of adiposity. Differences are most noticeable in childhood obesity where Atlantic children are 80 percent more likely to be obese than children from other provinces. In addition, Atlantic children are 24 percent more likely to be overweight. Although girls are less likely to be overweight or obese in both regions, Atlantic girls are nearly twice as likely to be obese and 44 percent more likely to be overweight than girls from other provinces. While some differences might be expected when comparing regions that differ in culture, demographics and geography, the striking differences between Atlantic Canada and the other provinces warrant a closer examination using econometric analysis. This study will attempt to account for the differences between regions by isolating the impact of variables such as income, education, minority status, fruit and vegetable intake and activity levels.

Table 3.2 – Mean Adolescent Weight Status by Region and Gender

	Atlantic Provinces			Other Provinces		
	All	Boys	Girls	All	Boys	Girls
Mean BMI	21.78	21.75	21.80	21.16	21.47	20.82
	(0.154)	(0.210)	(0.226)	(0.052)	(0.074)	(0.072)
Percent overweight	25.50	27.42	23.38	20.61	24.71	16.24
	(0.015)	(0.022)	(0.022)	(0.005)	(0.008)	(0.007)
Percent obese	8.54	10.17	6.75	4.73	5.98	3.40
	(0.010)	(0.015)	(0.013)	(0.003)	(0.004)	(0.004)
Observations	808	423	385	5518	2845	2673

Notes: Author's calculations. 2009/20010 CCHS. Standard errors are reported in parentheses.

3.4 Explanatory Variables

The explanatory variables analysed in this study include region, gender, age, household income, household education, physical activity levels, minority status and fruit and vegetable intake. Income and education questions were answered by parents or guardians from the household while other questions about explanatory variables were answered by the children themselves.

As discussed in the literature review, the effect of income on adiposity is well established. However income can be measured in a variety of ways and its relationship with adiposity may not be linear. In fact, research suggests the impact of income is likely strongest for low-income households (Burton & Phipps, 2010). As a result, three different variables were incorporated to analyse income: "low-income", "equivalent income" and "low equivalent income". The low-income variable was created simply by isolating the bottom three deciles of the household income distribution directly from the CCHS PUMF, making 27.41 percent of the adolescent sample classified as low-income.

The equivalent income measures were incorporated to account for the impact of family size on available resources within a household. However, the creation of equivalent income and low equivalent income variables required some data manipulation. The CCHS PUMF categorizes total household income in ranges of $20,000 until a maximum range of ≥ $80,000. Within each income range, incomes were adjusted by selecting the middle value (ie. $0 – $19,999 = $10,000), until the highest range where it was simply set to $80,000. From these adjusted income values, equivalent income[1] was measured by dividing income by the square root of family size. As a result, equivalent

[1] Equivalent income = Total Household Income/(√Family Size)

income is generally lower for the larger families. The low equivalent income variable was created from the equivalent income range and includes children from households with ≤ $25,000 equivalent income, classifying 26.83 percent of the sample as low equivalent income.

Mean values for the three income variables are listed in Table 3.3 and separated by gender and region. Overall, it can be seen that Atlantic children come from households with far less income. Average equivalent income for families of Atlantic children is $2191 less than for children of other provinces. Atlantic children are also 6.5 percent more likely to come from low-income households and 37.3 percent more likely to come from low equivalent income households.

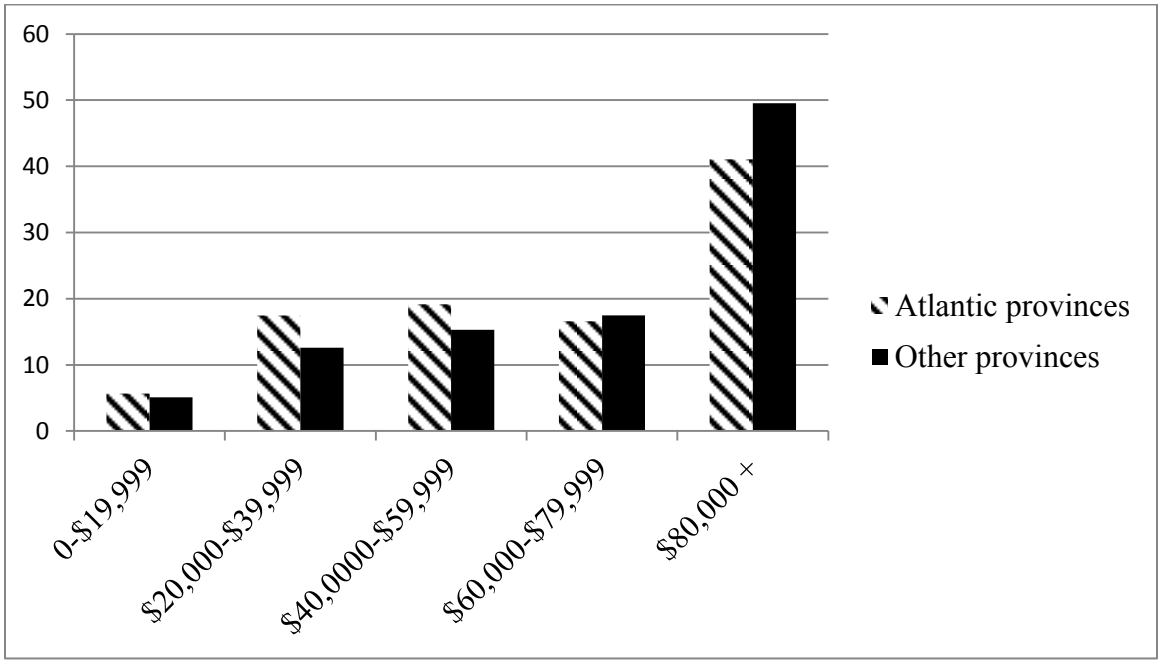
Table 3.3. Mean Values for Income by Region and Gender

	Atlantic Provinces			Other Provinces		
	All	Boys	Girls	All	Boys	Girls
Equivalent income	$31,001	$31,087	$30,906	$33,192	$33,552	$32,851
	(401)	(536)	(603)	(149)	(204)	(217)
Low-income	28.96%	27.42%	30.65%	27.18	26.15%	28.28%
	(0.0160)	(0.022)	(0.024)	(0.006)	(0.008)	(0.009)
Low equivalent income	35.15%	33.57%	36.88%	25.61%	$24.39%	26.90%
	(0.017)	(0.023)	(0.025)	(0.006)	(0.008)	(0.009)
Observations	808	423	385	5518	2845	2673

Notes: Author's calculations. 2009/20010 CCHS. Standard errors are reported in parentheses.

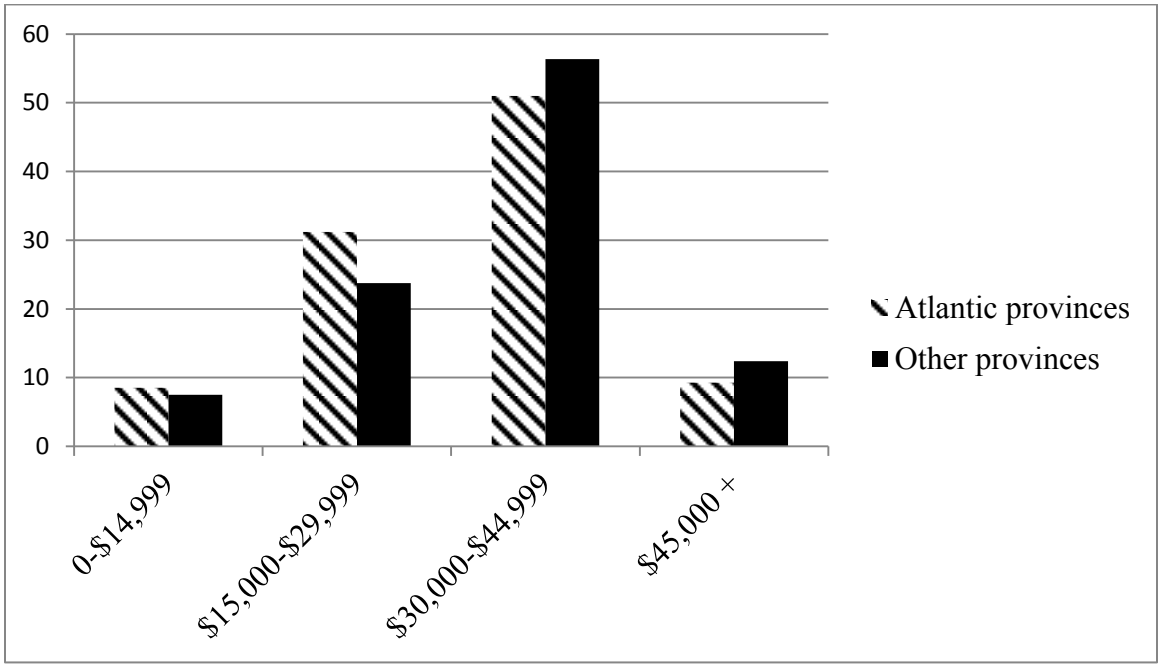
The income distribution of households in the sample is demonstrated in Figures 3.1 & 3.2, for total household income and equivalent income respectively. In both figures it is evident that Atlantic children are clearly worse off financially.

Figure 3.1 - Total Household Income by Region (Percent)



Notes: Author's calculations. 2009/20010 CCHS.

Figure 3.2 - Equivalent Income by Region (Percent)



Notes: Author's calculations. 2009/20010 CCHS.

Household education was the next explanatory variable incorporated into the analysis. The CCHS PUMF separates highest level of education into four main categories: less than secondary school graduation, secondary school graduation, some post-secondary school and post-secondary school graduation. For this study, categories for secondary school graduation and some post-secondary school were amalgamated. Dummy variables were created for the categories with the least observations (less than secondary school graduation and secondary school graduation/some post-secondary) and incorporated into econometric specifications as controls.

Another variable that directly influences adiposity is physical activity levels. The CCHS PUMF constructed a physical activity variable from a variety of questions related to energy expenditure. This derived variable classified activity levels into one of three categories: active, moderately active and inactive. Again, dummy variables were created for the categories with the least observations (inactive and moderately active) and incorporated into econometric specifications as controls.

Age was listed in categories by the CCHS PUMF, with 12-14 year olds grouped together and 15-17 year olds grouped together (12-14 year olds were treated as the base). The final two independent variables included for analysis were a dummy for visible minority status and a dummy for low fruit and vegetable intake. Low fruit and vegetable intake was defined in this study as less than five servings per day, a level below the minimum suggested servings for adolescents in Canada's Food Guide (Health Canada, 2011).

Mean values for other explanatory variables are listed in Table 3.4. The first three rows of the table describe education and show that overall household education levels are

very high in this sample. The non-Atlantic provinces had the highest household education in the sample with over 80 percent of households with a post-secondary education. However, the Atlantic households were not too far behind with 78.3 percent of households with a post-secondary education.

Activity rates were also quite similar across regions with the majority of children being classified as active, and the remainder of children almost equally split between inactive and moderately active categories. The most noticeable differences in activity were gender specific with boys displaying higher rates of activity than girls. These gender differences were most pronounced in the Atlantic region, where boys were 53 percent more likely to be considered active than girls, while girls were 86 percent more likely to be considered inactive compared to boys. In other provinces, boys were 30 percent more likely to be active than girls, while girls were 47 percent more likely to be inactive than boys.

Age groups were also similar across region and gender and split quite evenly between the two age categories. In contrast, regional differences in visible minorities were very strong. Atlantic children were less than half as likely to consider themselves as visible minorities compared to non-Atlantic children. The final row of Table 3.4 shows Atlantic children were 18.8 percent more likely to have a diet below the recommended servings of fruits and vegetables.

Table 3.4 – Mean Values for Other Explanatory Variables by Region and Gender						
	Atlantic Provinces			Other Provinces		
	All	Boys	Girls	All	Boys	Girls
Less than secondary	3.96%	3.78%	4.16%	3.35%	3.55%	3.14%
	(0.007)	(0.009)	(0.010)	(0.002)	(0.003)	(0.003)
Secondary graduate	17.70%	17.26%	18.18%	15.88%	16.17%	15.56%
	(0.013)	(0.018)	(0.020)	(0.005)	(0.007)	(0.007)
Post-secondary graduate	78.34%	78.96%	77.66%	80.77%	80.28%	81.29%
	(0.015)	(0.020)	(0.021)	(0.005)	(0.007)	(0.008)
Inactive	24.63%	17.49%	32.47%	24.65%	20.07%	29.52%
	(0.015)	(0.018)	(0.024)	(0.006)	(0.008)	(0.009)
Moderately active	23.89%	20.80%	27.27%	23.05%	21.09%	25.14%
	(0.015)	(0.020)	(0.023)	(0.006)	(0.008)	(0.008)
Active	51.49%	61.70%	40.26%	52.30%	58.84%	45.34%
	(0.018)	(0.024)	(0.025)	(0.007)	(0.009)	(0.010)
Age 12-14	50.87%	51.78%	49.87%	51.79%	50.79%	52.86%
	(0.018)	(0.024)	(0.026)	(0.007)	(0.009)	(0.010)
Age 15-17	49.13%	48.23%	50.13%	48.21%	49.21%	47.14%
	(0.018)	(0.024)	(0.026)	(0.007)	(0.009)	(0.010)
Visible minority	9.03%	10.40%	7.53%	20.37%	20.70%	20.01%
	(0.010)	(0.015)	(0.013)	(0.005)	(0.008)	(0.008)
Less than 5 fruit and veg per day	58.17%	57.45%	58.96%	48.93%	50.83%	46.91%
	(0.017)	(0.024)	(0.025)	(0.007)	(0.009)	(0.010)
Observations	808	423	385	5518	2845	2673

Notes: Author's calculations. 2009/20010 CCHS. Standard errors are reported in parentheses.

Chapter 4: Methodology

To estimate the correlation between explanatory variables and adolescent adiposity, ordinary least squares (OLS) regressions were performed according to the following basic equation:

$$Adiposity_i = \beta_0 + \beta_1 Atlantic_i + \beta_2 Female_i + \beta_3 Age15\text{-}17_i + \beta_4 Y_i + \beta_5 C_i + \mu_i$$

The basic equation was separated into three models to evaluate how each explanatory variable affects adiposity. The first model analyzes adolescent BMI as a continuous variable, using a natural log transformation, ln(BMI), as the measure of adiposity. The second and third models are linear probability models estimated with binary coefficients for overweight and obese statuses.

The β_1 coefficient is a regional dummy that explains the "Atlantic effect" on adiposity. The Atlantic effect represents the difference in adiposity between regions that is unexplained by income and other variables in the model. The β_2 coefficient is a dummy that captures female gender effects and the β_3 coefficient captures the effect of older adolescent age on level of adiposity.

The β_4 coefficient, Y_i, represents the model's measure of income. As discussed in Chapter 3, income may have non-linear effects on adiposity. As a result, separate specifications for "low-income", "equivalent income" and "low equivalent income" were incorporated into models to comprehensively evaluate the role of income. As done with BMI measures, equivalent income was transformed into ln(equivalent income) to recognize that increases in income are likely more important at lower income levels.

The β_5 coefficient, C_i, represents a vector for the remaining control variables which includes dummies for household education, activity levels, minority status and fruit and vegetable intake.

In addition to the models for the varying levels of adiposity, and specifications for different measures of income, separate models were also estimated for all children, boys and girls for a total of 27 different regression specifications.

A Blinder-Oaxaca decomposition was the final analytical technique employed in this study to measure how much the Atlantic gap of overweight adolescents is explained by the explanatory variables. The decomposition is a means based estimation that decomposes the Atlantic effect on overweight children by assigning weights to each independent variable. Decompositions were also performed for all children, boy and girls.

All regressions and decompositions were run in the statistical software program STATA and incorporate the sample weight recommended by the CCHS user guide (Statistics Canada, 2011b).

Chapter 5: Results

A large collection of results were generated from the variety of econometric specifications analysed in this study. For the complete set of regression results refer to Tables A.1-A.27 in the appendix section. This chapter will discuss the most prominent findings from the analysis. In general, strong regional coefficients stood out with significant and positive "Atlantic effects" for measures of adolescent adiposity. Income was also an important predictor of adolescent adiposity, but results varied between measures of income analysed. Other important findings include a strong negative relationship between female gender on adolescent weight status; and positive relationships for inactivity and visible minority status.

Sections 5.1, 5.2 and 5.3 of this chapter will focus primarily on specifications that include low-income as the only measure of income (Tables A.1-A.9) in order to simplify the discussion of non-income explanatory variables. Subsequently, section 5.4 describes key findings for the relationship between income and adolescent adiposity by summarizing the remainder of the econometric specifications (Tables A.10-A.27).

5.1 The "Atlantic Effect"

The Atlantic coefficient for regional differences was strong in each specification of adiposity pertaining to all children (Tables A.1-A.3). This shows a large disparity in adolescent BMI, overweight and obese statuses between Atlantic Canada and the other provinces, even after accounting for differences in other explanatory variables.

Column 1 of Table A.1 shows a large positive coefficient for "the Atlantic effect" on BMI that is significant at the 1 percent level. After controlling for other explanatory variables this effect not only holds, but the coefficient increases while maintaining high

statistical significance. After the final set of controls, a 0.0274 coefficient for Atlantic ln(BMI) remains, which represents slightly more than a full point difference (1.03) in BMI for Atlantic children.

Table A.2 is a binary specification for overweight status and has an Atlantic coefficient of 0.0564 after all control variables. This indicates that the probability of a child being overweight is increased by 5.64 percentage points for the Atlantic region. The final column of Table A.3 shows the probability of being obese is increased by 3.65 percentage points for Atlantic children. With mean values of 21.23 percent and 5.22 percent for overweight and obese respectively (see Table 3.1), the percentage increases from the Atlantic effect are quite substantial and all significant to the 1 percent level.

Tables A.4, A.5 and A.6 are a sequence of specifications separated for adolescent girls, while tables A.7, A.8 and A.9 were run separately for adolescent boys. In the estimations for adolescent girls the Atlantic effect is pronounced for all measures of adiposity and significant to a minimum 5 percent level through the addition of all controls. The last column of Table A.5 explains that girls are 7.9 percentage points more likely to be overweight in the Atlantic region. Table A.6 shows their chance of being obese is nearly 4 percentage points higher. In contrast, the estimations for boys has "Atlantic effects" that are lower in both significance and the scale of its coefficients. As seen in Table A.7 and Table A.8, the boy's specifications for BMI and overweight were not significant for the Atlantic coefficient. The only specification with a significant Atlantic coefficient in boys was for obese status (Table A.9).

Table 5.1 summarizes the Blinder-Oaxaca pooled decomposition performed for the overweight specification. It shows that the cumulative effect of all explanatory

variables results in more left to explain for the Atlantic gap, corroborating results from regression specifications where the Atlantic coefficient increased through the inclusion of controls. As a result, the decomposition reveals -2.8 percent of the Atlantic gap is explained by the sum of explanatory variables. While most variables were insignificant in influencing the Atlantic gap, minority status and low equivalent income had the strongest and most significant effects. Since minorities were more likely to be overweight in the overall sample, controlling for the low proportion of minorities in the Atlantic (see Table 3.3) increased the overweight gap by 12.86 percent. In contrast, the high rates of low equivalent income in the Atlantic explain 5.9 percent of the gap. This says that by decreasing the rate of children living in low-equivalent income households to match other provinces, the Atlantic overweight gap would decrease 5.9 percent. In the gender specific Blinder-Oaxaca overweight decompositions (Tables A.28 & A.29), it can be seen that low equivalent income was the only significant variable in explaining the Atlantic gap for girls, while the boys' decomposition had no significant explanatory variables explaining the gap.

The lack of a full explanation for the Atlantic gap revealed in this study indicates that there may be important omitted variables that could explain some of the regional differences. Factors such as climate, food access, food prices, population density, ethnicity and local cultures are examples of other factors that may differ in the Atlantic region and could contribute to the overweight and obese gaps. Future research would do well do include a broader set of controls for factors that differ between regions if attempting to explain the regional disparity in Canadian adolescent adiposity.

Table 5.1 – Blinder-Oaxaca Decomposition of the Atlantic Overweight Gap

	Number	Percent
Atlantic overweight gap	0.0505**	100.00**
	(0.0202)	
Portion explained by:		
Female	0.0017	3.29
	(0.0021)	
Age 15-17	0.0001	0.25
	(0.0005)	
Low equivalent income	0.0030*	5.90*
	(0.0016)	
Below High School	0.0003	0.54
	(0.0008)	
High School	0.0001	0.18
	(0.0006)	
Inactive	-0.0007	-1.33
	(0.0009)	
Moderately Active	-0.0002	-0.46
	(0.0005)	
Minority	-0.0065*	-12.86*
	(0.0036)	
Low Fruit & Veg	0.0009	1.81
	(0.0014)	
Total portion explained	-0.0014	-2.67
	(0.0050)	
Portion unexplained	0.0518**	102.67**
	(0.0203)	

Notes: All decompositions have been pooled with the sample weight included. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

5.2 The Role of Gender

All nine specifications with a female dummy (Tables A.1-A.3, A.10-A.12 and A.19-A.21) had negative coefficients that were significant to the 1 percent level. This demonstrates a strong negative relationship between female gender and adolescent adiposity that persists despite controlling for potential determinants.

Factors that were statistically important in the female only specifications included inactivity, older age, Atlantic region and low measures of income. In contrast, the adolescent male specifications showed less effect from most determinants. Low equivalent income status was the only consistently significant determinant of boy's adiposity while other income variables showed little to no significance.

5.3 Other Explanatory Variables

In analysing other explanatory variables for adolescent adiposity, most results were in line with expected assumptions. Inactivity was a significant determinant of overweight and obese children. However, inactivity was insignificant in determining BMI after controls. Moderate activity had both positive and negative relationships depending on specification, but was rarely significant.

The dummy for older children (age 15-17) had a positive coefficient in all but one adiposity specification (girl's likelihood of overweight, Table A.5) with the strongest significance levels found in BMI estimations. The direction of older age effects is hardly surprising though, as one would expect excess weight more likely to build up as children age.

The coefficient for minority status was positive in every specification, but results were only significant for the overweight status of all children. Low fruit and vegetable intake was insignificant for most specifications with the exception of a positive coefficient for adolescent boy BMI.

Highest household education produced the most unexpected results in this analysis. One might expect better household education to have negative effects on childhood adiposity levels (Lamerz et al., 2005). However, most estimations in this study

were insignificant for household education measures and a unexpected finding was a significant negative coefficient for the lowest household education on adolescent girl obese status (Table A.6). Of note however, the average household education in this study was highly skewed with more than 80 percent of households having at least one post-secondary education. In contrast, households with less than a secondary education were under 4 percent of the sample.

5.4 The Role of Income

As discussed in Chapter 4, three different measures of income were employed in this analysis including low-income status, equivalent income and low equivalent income. As expected, the two binary low-income measures had a positive relationship with adiposity and equivalent income had a negative relationship. However, the levels of significance and impact of coefficients varied between income measures.

After controlling for explanatory variables, low-income status was significant for overweight children at the 5 percent level with a coefficient of 0.0348 (Table A.2). This indicates that coming from a low-income household increased a child's probability of being overweight by 3.48 percentage points. After controls, low-income was significant at the 10 percent level for obesity with a coefficient of 0.0167 (Table A.3), but was not significant for the BMI specification (Table A.1). In separate boy and girl specifications, low-income was significant at the 5 percent level for female overweight status (Table A.5) and at the 10 percent level for male obese status (Table A.9), but insignificant in other boy/girl specifications.

To better estimate available income per child, Tables A.10-A.12 analyse adiposity with the equivalent income variable. The coefficient for equivalent income was an

important factor in the BMI estimation (Table A.10) where low-income had been insignificant, and was equally significant as low-income in the overweight (Table A.11) and obese (Table A.12) estimations. In the boy/girl specifications, equivalent income was significant at the 10 percent level for girl overweight status, boy BMI and boy obese status. Overall it seems equivalent income was a slightly better predicator of adiposity than low-income status.

After the relationship between equivalent income and adolescent adiposity was established, low equivalent income was analysed to check for a non-linear income relationship. By far, the variable for low equivalent income was the best predictor of adolescent adiposity with significantly stronger coefficients than the low-income series of estimations. Through the addition of explanatory controls, the coefficient for low equivalent income was significant to the 1 percent level in all three measure of adiposity for all children (Tables A19-21). It also displayed coefficients that exceeded those from the low-income specifications. The final columns of childhood adiposity specifications for low-income and low equivalent income are summarized in Table 5.2 to compare the difference between measures of low-income.

Table 5.2 – Comparison of Low-Income Measures after Controls

Specification	Low-Income	Low Equivalent Income
ln(BMI)	0.0066	0.0206***
Overweight	0.0348**	0.0542***
Obese	0.0167*	0.0257***

Source: Tables A.1-A.3 and Tables A.19-A.21 of appendix.
Notes: *, **, *** represent 10%, 5% and 1% significance levels respectively.

Low equivalent income was also the best predictor of gender specific adiposity as it was significant to the 5 percent level in determining girl overweight status (Table A.23), as well as in all measures of boy adiposity (Tables A.25-A.27). The significance for boys is particularly noteworthy as the low-income variable had been mostly insignificant in the analysis of adiposity in boys (Tables A.7-A.9).

Although the analysis of different measures of income reveal important insights into the relationship between lower incomes and adolescent adiposity, it should be noted that all measures of income analysed were subject to the imprecise income ranges from the CCHS PUMF (as discussed in Chapter 3), and was a limitation to the results of this study.

Chapter 6 – Discussion and Concluding Remarks

The two strongest determinants of adolescent adiposity in this study were Atlantic region and income – most specifically low equivalent income. It was surprising to see the Atlantic effect persist through the combination of controls incorporated. Previous research by Veugelers et al. (2008) had found that fruit and vegetable intake was a significant determinant of overweight and obesity in Nova Scotia; however this was generally not true for this study. As defined in the Blinder-Oaxaca decomposition the Atlantic region's lower average equivalent income accounts for a significant portion of the region's higher rate of overweight children, yet a lot is left unexplained.

It is important to note that the Atlantic effect measured in this study may suffer from omitted variable bias, such as the lack of controls for population density (urban, rural and remote), screen-time (television, computers and video games), or other variables. Unfortunately, a control for population density was not available for this analysis, and the variables for screen-time would have eliminated the majority of the adolescent sample size. Nevertheless, other factors that are difficult to control for (such as culture) may also impact childhood adiposity in the Atlantic region.

Although previous research from St. John et al. (2008) and Veugelers et al. (2008) had already found a higher prevalence of adolescent adiposity in parts of the Atlantic, neither study systematically analysed the Atlantic region compared to the remainder of Canada while controlling for other determinants. As a result, the significance of the Atlantic gap found in this study is quite remarkable, especially after the inclusion of control variables, and warrants further research to better understand this dramatic regional disparity.

The overall importance of low-income was the other major finding of this analysis. While all measures of income showed significance at times, the strongest and most consistent determinant of childhood adiposity was living in a low equivalent income household. This highlights the impact of low-income in Canada's childhood outcomes and demonstrates the importance of evaluating different measures when analysing this relationship, especially the impact of family size.

Another important finding for income was gender specific differences. Although low-income was a significant factor for girls, it was mostly insignificant in estimating adiposity in boys, corroborating findings from Burton and Phipps (2010). In contrast, low equivalent income was a significant predictor of all measures of adiposity in boys, introducing the possibility that resource splitting within larger families may have a more detrimental impact on boys compared to girls when it comes to healthy body weights.

Although the complete spectrum of determinants for healthy body weight in children is complex, this study provides further evidence of the strong link between low-income and adolescent overweight and obesity rates. Overall, the results highlight both a need and a potential route for public policy to address this epidemic. Public policy aimed at raising income for the lowest income families, especially those from larger households, could result in significant improvements in childhood body weight, increased adolescent well-being, and establish a better course for our children into adulthood. With the economic burden of obesity and its comorbidities, policy change also makes financial sense as the costs of implementation may be outweighed by future healthcare savings.

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Appendix A – Additional Tables

Table A.1 – The Atlantic Effect on Adolescent BMI, Low-Income Specification

	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0259***	0.0265***	0.0262***	0.0264***	0.0284***	0.0274***
	(0.0082)	(0.0082)	(0.0081)	(0.0081)	(0.0081)	(0.0081)
Female	-0.0281***	-0.0283***	-0.0281***	-0.0299***	-0.0295***	-0.0289***
	(0.0061)	(0.0061)	(0.0061)	(0.0062)	(0.0061)	(0.0062)
Age 15-17	0.0784***	0.0789***	0.0789***	0.0786***	0.0792***	0.0790***
	(0.0061)	(0.0061)	(0.0060)	(0.0060)	(0.0060)	(0.0060)
Low-income		0.0144*	0.0115	0.0105	0.0071	0.0066
		(0.0073)	(0.0074)	(0.0075)	(0.0073)	(0.0073)
Below high school			0.0359	0.0341	0.0339	0.0337
			(0.0249)	(0.0245)	(0.0244)	(0.0248)
High school			0.0015	0.0015	0.0014	0.0011
			(0.0084)	(0.0084)	(0.0084)	(0.0084)
Inactive				0.0146*	0.0144*	0.126
				(0.0077)	(0.0077)	(0.0079)
Moderately active				0.0024	0.0023	0.0013
				(0.0077)	(0.0077)	(0.0077)
Minority					0.0121	0.0118
					(0.0081)	(0.0082)
Low fruit & veg						0.0099
						(0.0063)
Constant	3.0046***	2.9998***	2.9993***	2.9963***	2.9937***	2.9897***
	(0.0055)	(0.0055)	(0.0056)	(0.0058)	(0.0058)	(0.0064)
Observations	6325	6325	6325	6325	6325	6325
R^2	0.0643	0.0658	0.0672	0.0685	0.0694	0.0702
F	62.36	49.26	35.30	27.29	25.20	22.94

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.2 – The Atlantic Effect on Adolescent Overweight Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0488**	0.0509**	0.0502**	0.0509**	0.0575***	0.0564***
	(0.0206)	(0.0205)	(0.0204)	(0.0204)	(0.0204)	(0.0205)
Female	-0.0770***	-0.0775***	-0.0770***	-0.0828***	-0.0815***	-0.0810***
	(0.0146)	(0.0145)	(0.0145)	(0.0145)	(0.0144)	(0.0144)
Age 15-17	0.0023	0.0042	0.0042	0.0031	0.050	0.048
	(0.0146)	(0.0174)	(0.0145)	(0.0145)	(0.0145)	(0.0144)
Low-income		0.0575***	0.0496***	0.0466***	0.0353**	0.0348**
		(0.0174)	(0.0174)	(0.0174)	(0.0173)	(0.0173)
Below high school			0.0965	0.0915	0.0906	0.0905
			(0.0623)	(0.0617)	(0.0618)	(0.0620)
High school			0.0055	0.0056	0.0073	0.0065
			(0.0212)	(0.0212)	(0.0212)	(0.0212)
Inactive				0.0426**	0.0421**	0.0401**
				(0.0178)	(0.0178)	(0.0183)
Moderately active				0.0223	0.0221	0.0209
				(0.0184)	(0.0184)	(0.0185)
Minority					0.0396**	0.0393**
					(0.0199)	(0.0200)
Low fruit & veg						0.0109
						(0.0151)
Constant	0.2249***	0.2057***	0.2041***	0.1920***	0.1836***	0.1794***
	(0.0135)	(0.0137)	(0.0138)	(0.0145)	(0.0145)	(0.0156)
Observations	6325	6325	6325	6325	6325	6325
R^2	0.0106	0.0153	0.0170	0.0190	0.0207	0.0209
F	11.40	12.10	8.63	7.57	6.87	6.34

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.3 – The Atlantic Effect on Adolescent Obese Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0340***	0.0347***	0.0351***	0.0356***	0.0373***	0.0365***
	(0.0112)	(0.0112)	(0.0112)	(0.0111)	(0.0111)	(0.0112)
Female	-0.0213***	-0.0215***	-0.0216***	-0.0250***	-0.0247***	-0.0242***
	(0.0068)	(0.0068)	(0.0068)	(0.0070)	(0.0070)	(0.0070)
Age 15-17	0.0086	0.0092	0.0093	0.0086	0.0091	0.0089
	(0.0069)	(0.0069)	(0.0069)	(0.0070)	(0.0070)	(0.0069)
Low-income		0.0192**	0.0219**	0.0201**	0.0171*	0.0167*
		(0.0086)	(0.0094)	(0.0096)	(0.0092)	(0.0091)
Below high school			-0.0232*	-0.0261	-0.0263	-0.0264
			(0.0123)	(0.0126)	(0.0127)	(0.0126)
High school			-0.0068	-0.0067	-0.0063	-0.0069
			(0.0088)	(0.0088)	(0.0087)	(0.0088)
Inactive				0.0247***	0.0246***	0.0230**
				(0.0091)	(0.0091)	(0.0096)
Moderately active				0.0150*	0.0149*	0.0140
				(0.0091)	(0.0091)	(0.0093)
Minority					0.0104	0.0102
					(0.0099)	(0.0099)
Low fruit & veg						0.0084
						(0.0073)
Constant	0.0447***	0.0383***	0.0392***	0.0318***	0.0296***	0.0263***
	(0.0063)	(0.0060)	(0.0063)	(0.0057)	(0.0053)	(0.0062)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0054	0.0074	0.0079	0.0107	0.0112	0.0116
F	7.57	6.42	4.47	4.99	4.50	4.31

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.4 – The Atlantic Effect on Adolescent Girl BMI, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0464***	0.0466***	0.0458***	0.0460***	0.0484***	0.0488***
	(0.0115)	(0.0115)	(0.0115)	(0.0115)	(0.0114)	(0.0115)
Age 15-17	0.0698***	0.0702***	0.0705***	0.0700***	0.0702***	0.0703***
	(0.0087)	(0.0087)	(0.0085)	(0.0085)	(0.0085)	(0.0085)
Low-income		0.0187*	0.0142	0.0118	0.0080	0.0081
		(0.0104)	(0.0100)	(0.0101)	(0.0096)	(0.0096)
Below high school			0.0581	0.0551	0.0550	0.0549
			(0.0455)	(0.0442)	(0.0439)	(0.0437)
High school			0.0038	0.0024	0.0032	0.0034
			(0.0123)	(0.0122)	(0.0122)	(0.0123)
Inactive				0.0295***	0.0290***	0.0294***
				(0.0103)	(0.0102)	(0.0106)
Moderately active				0.0130	0.0127	0.0130
				(0.0105)	(0.0105)	(0.0105)
Minority					0.0128	0.0130
					(0.0115)	(0.0115)
Low fruit & veg						-0.0023
						(0.0091)
Constant	2.9792***	2.9729***	2.9719***	2.9604***	2.9585***	2.9592***
	(0.0071)	(0.0070)	(0.0071)	(0.0081)	(0.0115)	(0.0086)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0499	0.0527	0.0562	0.0618	0.0628	0.0628
F	37.13	28.20	18.11	14.44	12.73	11.32

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.5 – The Atlantic Effect on Adolescent Girl Overweight Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0733***	0.0741***	0.0721***	0.0722***	0.0782***	0.0790***
	(0.0269)	(0.0194)	(0.0271)	(0.0271)	(0.0271)	(0.0272)
Age 15-17	-0.0086	-0.0071	-0.0063	-0.0077	-0.0071	-0.0069
	(0.0195)	(0.0194)	(0.0189)	(0.0189)	(0.0189)	(0.0189)
Low-income		0.0769***	0.0662***	0.0599***	0.0499**	0.0501**
		(0.0237)	(0.0225)	(0.0225)	(0.0217)	(0.0218)
Below high school			0.1314	0.1244	0.1206	0.1239
			(0.1062)	(0.1034)	(0.1025)	(0.1021)
High school			0.0126	0.0098	0.0121	0.0125
			(0.0261)	(0.0261)	(0.0261)	(0.0260)
Inactive				0.0676***	0.0664***	0.0673***
				(0.0222)	(0.0222)	(0.0237)
Moderately active				0.0493**	0.0485**	0.0490**
				(0.0239)	(0.0239)	(0.0244)
Minority					0.0334	0.0339
					(0.0261)	(0.0262)
Low fruit & veg						-0.0049
						(0.0208)
Constant	0.1515***	0.1257***	0.1230***	0.0918***	0.0867***	0.0883***
	(0.0150)	(0.0145)	(0.0148)	(0.0158)	(0.0163)	(0.0164)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0027	0.0128	0.0166	0.0235	0.0249	0.0249
F	3.89	6.78	4.19	4.69	4.15	3.92

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.6 – The Atlantic Effect on Adolescent Girl Obese Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0380**	0.0381**	0.0377**	0.0379**	0.0407***	0.0398**
	(0.0156)	(0.0156)	(0.0156)	(0.0156)	(0.0155)	(0.0155)
Age 15-17	0.0031	0.0033	0.0030	0.0027	0.0030	0.0029
	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)
Low-income		0.0092	0.0087	0.0074	0.0029	0.0027
		(0.0085)	(0.0090)	(0.0092)	(0.0083)	(0.0082)
Below high school			-0.0185*	-0.0203*	-0.0205*	-0.0204**
			(0.0112)	(0.0113)	(0.0116)	(0.0115)
High school			0.0122	0.0112	0.0122	0.0118
			(0.0110)	(0.0108)	(0.0109)	(0.0112)
Inactive				0.0177**	0.0171**	0.0160*
				(0.0091)	(0.0092)	(0.0094)
Moderately active				0.0032	0.0028	0.0022
				(0.0096)	(0.0096)	(0.0096)
Minority					0.0153	0.0148
					(0.0106)	(0.0105)
Low fruit & veg						0.0057
						(0.0077)
Constant	0.0258***	0.0227***	0.0218***	0.0160***	0.0137**	0.0118*
	(0.0059)	(0.0058)	(0.0061)	(0.0060)	(0.0060)	(0.0067)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0033	0.0039	0.0050	0.0070	0.0083	0.0086
F	2.99	2.68	2.34	2.44	2.23	2.00

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.7 – The Atlantic Effect on Adolescent Boy BMI, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0083	0.0089	0.0089	0.0086	0.0104	0.0092
	(0.0115)	(0.0114)	(0.0113)	(0.0113)	(0.0113)	(0.0113)
Age 15-17	0.0863***	0.0867***	0.0867***	0.0870***	0.0879***	0.0877***
	(0.0084)	(0.0084)	(0.0085)	(0.0085)	(0.0084)	(0.0083)
Low-income		0.0102	0.090	0.0091	0.0060	0.0048
		(0.0103)	(0.0110)	(0.0110)	(0.0108)	(0.0108)
Below high school			0.0164	0.0165	0.0161	0.0151
			(0.0216)	(0.0215)	(0.0217)	(0.0217)
High school			-0.0013	-0.0016	-0.0013	-0.0029
			(0.0117)	(0.0118)	(0.0117)	(0.0117)
Inactive				-0.0014	-0.0012	-0.0049
				(0.0115)	(0.0115)	(0.0117)
Moderately active				-0.0073	-0.0072	-0.0096
				(0.0111)	(0.0111)	(0.0111)
Minority					0.0115	0.0121
					(0.0113)	(0.0113)
Low fruit & veg						0.0209***
						(0.0086)
Constant	3.0020***	2.9985***	2.9985***	3.0003***	2.9976***	2.9890***
	(0.0065)	(0.0066)	(0.0067)	(0.0069)	(0.0068)	(0.0077)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0654	0.0662	0.0665	0.0668	0.0676	0.0713
F	52.64	35.44	21.48	15.45	15.02	13.68

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.8 – The Atlantic Effect on Adolescent Boy Overweight Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0278	0.0301	0.0300	0.0300	0.0368	0.0354
	(0.0307)	(0.0305)	(0.0303)	(0.0303)	(0.0302)	(0.0304)
Age 15-17	0.0124	0.0390	0.0139	0.0138	0.0171	0.0169
	(0.0215)	(0.0252)	(0.0216)	(0.0218)	(0.0217)	(0.0216)
Low-income		0.0390	0.0339	0.0328	0.0208	0.0195
		(0.0252)	(0.0262)	(0.0263)	(0.0262)	(0.0262)
Below high school			0.0674	0.0650	0.0635	0.0626
			(0.0651)	(0.0652)	(0.0668)	(0.0661)
High school			-0.0021	-0.0018	-0.0007	-0.0026
			(0.0329)	(0.0330)	(0.0328)	(0.0328)
Inactive				0.0171	0.0177	0.0132
				(0.0280)	(0.0280)	(0.0282)
Moderately active				-0.0036	-0.0033	-0.0062
				(0.0277)	(0.0276)	(0.0275)
Minority					0.0443	0.0450
					(0.0291)	(0.0291)
Low fruit & veg						0.0254
						(0.0215)
Constant	0.2215***	0.2081***	0.2078***	0.2056***	0.1952***	0.1848***
	(0.0160)	(0.0167)	(0.0167)	(0.0180)	(0.0181)	(0.0208)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0005	0.0024	0.0032	0.0035	0.0054	0.0063
F	0.58	1.30	0.97	0.74	0.92	0.97

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.9 – The Atlantic Effect on Adolescent Boy Obese Status, Low-Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0307*	0.0324**	0.0330**	0.0343**	0.0355**	0.0349**
	(0.0160)	(0.0159)	(0.0159)	(0.0159)	(0.0158)	(0.0158)
Age 15-17	0.0136	0.0148	0.0157	0.0143	0.0149	0.0148
	(0.0113)	(0.0115)	(0.0115)	(0.0117)	(0.0116)	(0.0116)
Low-income		0.0289**	0.0343**	0.0326**	0.0305*	0.0299*
		(0.0147)	(0.0162)	(0.0163)	(0.0158)	(0.0157)
Below high school			-0.0287	-0.0326	-0.0328	-0.0332
			(0.0211)	(0.0218)	(0.0220)	(0.0220)
High school			-0.0239*	-0.0222*	-0.0220*	-0.02277*
			(0.0134)	(0.0136)	(0.0134)	(0.0135)
Inactive				0.0298*	0.0300*	0.0281
				(0.0164)	(0.0164)	(0.0173)
Moderately active				0.0256*	0.0257*	0.0245
				(0.0151)	(0.0151)	(0.0155)
Minority					0.0080	0.0083
					(0.0159)	(0.0159)
Low fruit & veg						0.0106
						(0.0119)
Constant	0.0424***	0.0326***	0.0351***	0.0242***	0.0223***	0.0180**
	(0.0073)	(0.0082)	(0.0083)	(0.0071)	(0.0066)	(0.0083)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0023	0.0059	0.0078	0.0116	0.0118	0.0124
F	2.91	3.30	2.57	3.88	3.40	3.21

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.10 – The Atlantic Effect on Adolescent BMI, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0259***	0.0252***	0.0252***	0.0255***	0.0274***	0.0264***
	(0.0082)	(0.0082)	(0.0082)	(0.0082)	(0.0081)	(0.0082)
Female	-0.0281***	-0.0286***	-0.0284***	-0.0302***	-0.0298***	-0.0293***
	(0.0061)	(0.0061)	(0.0061)	(0.0062)	(0.0061)	(0.0062)
Age 15-17	0.0784***	0.0789***	0.0790***	0.0787***	0.0793***	0.0791***
	(0.0061)	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0060)
Equivalent income		-0.0191***	-0.0170**	-0.0164**	-0.0143**	-0.0139**
		(0.0068)	(0.0070)	(0.0069)	(0.0068)	(0.0069)
Below high school			0.0309	0.0290	0.0286	0.0285
			(0.0255)	(0.0250)	(0.0249)	(0.0252)
High school			-0.0009	-0.0011	-0.0007	-0.0014
			(0.0084)	(0.0084)	(0.0084)	(0.0084)
Inactive				0.0145*	0.0143*	0.0125
				(0.0076)	(0.0076)	(0.0078)
Moderately active				0.0025	0.0023	0.0013
				(0.0076)	(0.0076)	(0.0077)
Minority					0.0103	0.0100
					(0.0082)	(0.0082)
Low fruit & veg						0.0096
						(0.0063)
Constant	3.0046***	3.2005***	3.1782***	3.1693***	3.1443***	3.1358***
	(0.0055)	(0.0706)	(0.0733)	(0.0729)	(0.0715)	(0.0723)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0643	0.0678	0.0688	0.0701	0.0707	0.0715
F	62.36	50.71	36.35	27.97	25.48	23.17

Notes: All regressions are weighted against the estimation sample weight using CCHS 2009/2010 survey data. BMI and equivalent income have been transformed by natural logarithm. Standard errors are reported below coefficients in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.11 – The Atlantic Effect on Adolescent Overweight Status, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0488**	0.0466**	0.0465**	0.0475**	0.0547***	0.0538***
	(0.0205)	(0.0205)	(0.0205)	(0.0205)	(0.0204)	(0.0205)
Female	-0.0770***	-0.0783***	-0.0778***	-0.0837***	-0.0823***	-0.0817***
	(0.0146)	(0.0145)	(0.0145)	(0.0145)	(0.0144)	(0.0144)
Age 15-17	0.0023	0.0038	0.0039	0.0029	0.0049	0.0047
	(0.0146)	(0.0145)	(0.0145)	(0.0145)	(0.0145)	(0.0144)
Equivalent income		-0.0559***	-0.0490***	-0.0473***	-0.0391**	-0.0386**
		(0.0166)	(0.0171)	(0.0171)	(0.0170)	(0.0171)
Below high school			0.0913	0.0855	0.0839	0.0839
			(0.0634)	(0.0627)	(0.0627)	(0.0630)
High school			0.0029	0.0027	0.0042	0.0034
			(0.0214)	(0.0214)	(0.0213)	(0.0213)
Inactive				0.0438**	0.0428**	0.0409**
				(0.0176)	(0.0176)	(0.0182)
Moderately active				0.0232	0.0227	0.0216
				(0.0185)	(0.0185)	(0.0186)
Minority					0.0397**	0.0394**
					(0.0198)	(0.0198)
Low fruit & veg						0.0104
						(0.0151)
Constant	0.2249***	0.7988***	0.7244***	0.6932***	0.5972***	0.5880***
	(0.0135)	(0.1731)	(0.1792)	(0.1786)	(0.1773)	(0.1793)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0106	0.0161	0.0177	0.0198	0.0215	0.0217
F	11.40	12.44	9.07	7.91	7.21	6.66

Notes: All regressions are weighted against the estimation sample weight using CCHS 2009/2010 survey data. Equivalent income has been transformed by natural logarithm. Standard errors are reported below coefficients in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.12 – The Atlantic Effect on Adolescent Obesity, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0340***	0.0333***	0.0336***	0.0342***	0.0362***	0.0354***
	(0.0112)	(0.0113)	(0.0113)	(0.0113)	(0.0112)	(0.0112)
Female	-0.0213***	-0.0217***	-0.0219***	-0.0254***	-0.0250***	-0.0245***
	(0.0068)	(0.0068)	(0.0069)	(0.0070)	(0.0070)	(0.0070)
Age 15-17	0.0086	0.0090	0.0091	0.0084	0.0090	0.0089
	(0.0069)	(0.0069)	(0.0069)	(0.0069)	(0.0069)	(0.0069)
Equivalent income		-0.0171**	-0.0198**	-0.0188**	-0.0165*	-0.0161*
		(0.0084)	(0.0093)	(0.0092)	(0.0088)	(0.0089)
Below high school			-0.0243*	-0.0277**	-0.0281**	-0.0282**
			(0.0127)	(0.0131)	(0.0132)	(0.0132)
High school			-0.0075	-0.0075	-0.0071	-0.0071
			(0.0092)	(0.0092)	(0.0092)	(0.0092)
Inactive				0.0253***	0.0250***	0.0235**
				(0.0088)	(0.0088)	(0.0093)
Moderately active				0.0154*	0.0153*	0.0143
				(0.0090)	(0.0090)	(0.0092)
Minority					0.0112	0.0109
					(0.0098)	(0.0098)
Low fruit & veg						0.0083
						(0.0074)
Constant	0.0447***	0.02203**	0.2504**	0.2317**	0.2048**	0.1975**
	(0.0063)	(0.0887)	(0.0997)	(0.0982)	(0.0938)	(0.0951)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0054	0.0074	0.0080	0.0109	0.0114	0.0118
F	7.57	6.52	4.55	4.60	4.27	4.22

Notes: All regressions are weighted against the estimation sample weight using CCHS 2009/2010 survey data. Equivalent income has been transformed by natural logarithm. Standard errors are reported below coefficients in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.13 – The Atlantic Effect on Adolescent Girl BMI, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0464***	0.0455***	0.0450***	0.0454***	0.0480***	0.0484***
	(0.0115)	(0.0116)	(0.0116)	(0.0115)	(0.0115)	(0.0115)
Age 15-17	0.0698***	0.0698***	0.0702***	0.0697***	0.0700***	0.0701***
	(0.0087)	(0.0087)	(0.0085)	(0.0085)	(0.0085)	(0.0085)
Equivalent income		-0.0161*	-0.0116	-0.0101	-0.0071	-0.0073
		(0.0089)	(0.0088)	(0.0088)	(0.0086)	(0.0086)
Below high school			0.0576	0.0543	0.0541	0.0540
			(0.0468)	(0.0453)	(0.0449)	(0.0447)
High school			0.0037	0.0021	0.0021	0.0032
			(0.0123)	(0.0122)	(0.0122)	(0.0123)
Inactive				0.0299***	0.0292***	0.0297***
				(0.0102)	(0.0102)	(0.0106)
Moderately active				0.0135	0.0130	0.0132
				(0.0106)	(0.0106)	(0.0106)
Minority					0.0132	0.0135
					(0.0117)	(0.0117)
Low fruit & veg						-0.0025
						(0.0091)
Constant	2.9792***	2.9792***	3.0956***	3.0683***	3.0342***	3.0363***
	(0.0071)	(0.0071)	(0.0923)	(0.0921)	(0.0900)	(0.0895)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0499	0.0526	0. 559	0. 617	0. 628	0. 628
F	37.13	26.99	17.90	14.33	12.69	11.29

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI and equivalent income have been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.14 – The Atlantic Effect on Adolescent Girl Overweight Status, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0733***	0.0696**	0.0684**	0.0688**	0.0758***	0.0767***
	(0.0269)	(0.0271)	(0.0273)	(0.0272)	(0.0272)	(0.0273)
Age 15-17	-0.0086	-0.0088	-0.0078	-0.0090	-0.0081	-0.0080
	(0.0195)	(0.0194)	(0.0189)	(0.0189)	(0.0189)	(0.0189)
Equivalent income		-0.0680***	-0.0575**	-0.0537**	-0.0456*	-0.0459*
		(0.0233)	(0.0240)	(0.0238)	(0.0236)	(0.0237)
Below high school			0.1264	0.1183	0.1178	0.1177
			(0.1107)	(0.1075)	(0.1062)	(0.1056)
High school			0.0112	0.0079	0.0101	0.0105
			(0.0274)	(0.0273)	(0.0273)	(0.0273)
Inactive				0.0695***	0.0678***	0.0688***
				(0.0221)	(0.0221)	(0.0236)
Moderately active				0.0514**	0.0502**	0.0508**
				(0.0239)	(0.0240)	(0.0244)
Minority					0.0358	0.0363
					(0.0262)	(0.0263)
Low fruit & veg						-0.0058
						(0.0209)
Constant	0.1515***	0.8491***	0.7360***	0.6629***	0.5709***	0.5758***
	(0.0150)	(0.2435)	(0.2508)	(0.2484)	(0.2469)	(0.2478)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0027	0.0127	0.0161	0.0235	0.0251	0.0252
F	3.89	6.06	3.85	4.47	4.00	3.77

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Equivalent income has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.15 – The Atlantic Effect on Adolescent Girl Obesity, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0380**	0.0375**	0.0371**	0.0375**	0.0404***	0.0395**
	(0.0156)	(0.0157)	(0.0157)	(0.0157)	(0.0156)	(0.0156)
Age 15-17	0.0031	0.0031	0.0028	0.0025	0.0029	0.0028
	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)
Equivalent income		-0.0091	-0.0089	-0.0081	-0.0047	-0.0045
		(0.0072)	(0.0079)	(0.0079)	(0.0072)	(0.0071)
Below high school			-0.0201*	-0.0220*	-0.0222*	-0.0221*
			(0.0117)	(0.0119)	(0.0122)	(0.0120)
High school			0.0116	0.0105	0.0114	0.0110
			(0.0112)	(0.0111)	(0.0111)	(0.0113)
Inactive				0.0178**	0.0171*	0.0161*
				(0.0089)	(0.0090)	(0.0093)
Moderately active				0.0034	0.0028	0.0023
				(0.0096)	(0.0096)	(0.0097)
Minority					0.0148	0.0143
					(0.0107)	(0.0105)
Low fruit & veg						0.0056
						(0.0077)
Constant	0.0258***	0.1191	0.1157	0.1016	0.0636	0.0588
	(0.0059)	(0.0757)	(0.0838)	(0.0841)	(0.0765)	(0.0746)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0033	0.0041	0.0051	0.0072	0.0085	0.0087
F	2.99	2.94	2.47	2.42	2.23	2.01

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Equivalent income has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.16 – The Atlantic Effect on Adolescent Boy BMI, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0083	0.0078	0.0078	0.0075	0.0090	0.0080
	(0.0115)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)
Age 15-17	0.0863***	0.0874***	0.0876***	0.0878***	0.0885***	0.0883***
	(0.0084)	(0.0084)	(0.0084)	(0.0085)	(0.0083)	(0.0083)
Equivalent income		-0.0222**	-0.0224**	-0.0224**	-0.0209**	-0.0200*
		(0.0101)	(0.0106)	(0.0106)	(0.0104)	(0.0106)
Below high school			0.0074	0.0076	0.0070	0.0063
			(0.0220)	(0.0220)	(0.0221)	(0.0223)
High school			-0.0056	-0.0059	-0.0058	-0.0073
			(0.0116)	(0.0111)	(0.0116)	(0.0116)
Inactive				-0.0018	-0.0017	-0.0054
				(0.0112)	(0.0112)	(0.0114)
Moderately active				-0.0072	-0.0072	-0.0095
				(0.0111)	(0.0110)	(0.0111)
Minority					0.0082	0.0087
					(0.0112)	(0.0111)
Low fruit & veg						0.0203
						(0.0086)
Constant	3.0020***	3.2297***	3.2320***	3.2338***	3.2157***	3.1986***
	(0.0065)	(0.1048)	(0.1112)	(0.1103)	(0.1085)	(0.1114)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0654	0.0700	0.0702	0.0705	0.0710	0.0744
F	52.64	38.20	23.08	16.70	15.41	14.02

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI and equivalent income have been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.17 – The Atlantic Effect on Adolescent Boy Overweight Status, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0278	0.0266	0.0269	0.0270	0.0344	0.0331
	(0.0307)	(0.0305)	(0.0304)	(0.0303)	(0.0303)	(0.0304)
Age 15-17	-0.0124	-0.0147	-0.0146	-0.0145	-0.0179	-0.0176
	(0.0215)	(0.0214)	(0.0216)	(0.0217)	(0.0216)	(0.0216)
Equivalent income		-0.0445*	-0.0408*	-0.0402*	-0.0324	-0.0314
		(0.0238)	(0.0246)	(0.0245)	(0.0242)	(0.0245)
Below high school			0.0606	0.0579	0.0551	0.0542
			(0.0642)	(0.0643)	(0.0662)	(0.0656)
High school			-0.0057	-0.0056	-0.0050	-0.0068
			(0.0326)	(0.0326)	(0.0324)	(0.0324)
Inactive				0.0178	0.0178	0.0133
				(0.0277)	(0.0288)	(0.0279)
Moderately active				-0.0033	-0.0031	-0.0060
				(0.0278)	(0.0288)	(0.0276)
Minority					0.0424	0.0430
					(0.0288)	(0.0288)
Low fruit & veg						0.0250
						0.0216
Constant	0.2215***	0.6779***	0.6393**	0.6301**	0.5362**	0.5152**
	(0.0160)	(0.2475)	(0.2567)	(0.2553)	(0.2521)	(0.2567)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0005	0.0035	0.0042	0.0045	0.0064	0.0072
F	0.58	1.67	1.21	0.91	1.05	1.09

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Equivalent income has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.18 – The Atlantic Effect on Adolescent Boy Obesity, Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0307*	0.0301*	0.0301*	0.0316**	0.0333**	0.0329**
	(0.0160)	(0.0161)	(0.0161)	(0.0161)	(0.0160)	(0.0160)
Age 15-17	0.0136	0.0149	0.0157	0.0144	0.0152	0.0151
	(0.0113)	(0.0113)	(0.0113)	(0.0115)	(0.0115)	(0.0114)
Equivalent income		-0.0251*	-0.0303*	-0.0295*	-0.0277*	-0.0272*
		(0.0148)	(0.0164)	(0.0160)	(0.0155)	(0.0157)
Below high school			-0.0287	-0.0331	-0.0338	-0.0342
			(0.0214)	(0.0223)	(0.0226)	(0.0226)
High school			-0.0245*	-0.0229*	-0.0227	-0.0236*
			(0.0142)	(0.0142)	(0.0142)	(0.0142)
Inactive				0.0310**	0.0311**	0.0291*
				(0.0159)	(0.0159)	(0.0168)
Moderately active				0.0259*	0.0260*	0.0248*
				(0.0151)	(0.0151)	(0.0154)
Minority					0.0100	0.0103
					(0.0157)	(0.0157)
Low fruit & veg						0.0108
						(0.0121)
Constant	0.0424***	0.3002*	0.3580**	0.3380**	0.3159*	0.3068*
	(0.0073)	(0.1552)	(0.1729)	(0.1685)	(0.1619)	(0.1650)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0023	0.0057	0.0076	0.0116	0.0120	0.0126
F	2.91	3.42	2.50	3.20	2.85	2.82

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Equivalent income has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.19 – The Atlantic Effect on Adolescent BMI, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0259***	0.0245***	0.0245***	0.0248***	0.0265***	0.0256***
	(0.0082)	(0.0082)	(0.0082)	(0.0082)	(0.0082)	(0.0082)
Female	-0.0281***	-0.0288***	-0.0286***	-0.0303***	-0.0300***	-0.0295***
	(0.0061)	(0.0061)	(0.0061)	(0.0061)	(0.0061)	(0.0062)
Age 15-17	0.0784***	0.0786***	0.0787***	0.0785***	0.0790***	0.0788***
	(0.0061)	(0.0076)	(0.0060)	(0.0060)	(0.0060)	(0.0059)
Low equivalent		0.0260***	0.0240***	0.0233***	0.0212***	0.0206***
		(0.0055)	(0.0076)	(0.0077)	(0.0075)	(0.0075)
Below high school			0.0298	0.0279	0.0275	0.0273
			(0.0247)	(0.0243)	(0.0242)	(0.0245)
High school			-0.0012	-0.0014	-0.0012	-0.0019
			(0.0084)	(0.0084)	(0.0083)	(0.0084)
Inactive				0.0140*	0.0139*	0.0121
				(0.0076)	(0.0076)	(0.0078)
Moderately active				0.0017	0.0017	0.0007
				(0.0076)	(0.0076)	(0.0077)
Minority					0.0089	0.0087
					(0.0081)	(0.0081)
Low fruit & veg						0.0093
						(0.0063)
Constant	3.0046***	2.9974***	2.9971***	2.9942***	2.9921***	2.9885***
	(0.0055)	(0.0055)	(0.0056)	(0.0058)	(0.0059)	(0.0064)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0643	0.0692	0.0701	0.0714	0.0718	0.0726
F	62.36	51.70	36.47	28.22	25.62	23.29

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.20 – The Atlantic Effect on Adolescent Overweight Status, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0488**	0.0447**	0.0447**	0.0458**	0.0527**	0.0518**
	(0.0206)	(0.0206)	(0.0205)	(0.0205)	(0.0205)	(0.0206)
Female	-0.0769***	-0.0788***	-0.0783***	-0.0840***	-0.0827***	-0.0821***
	(0.0146)	(0.0145)	(0.0145)	(0.0145)	(0.0144)	(0.0144)
Age 15-17	0.0023	0.0029	0.0031	0.0021	0.0041	0.0040
	(0.0146)	(0.0145)	(0.0145)	(0.0145)	(0.0144)	(0.144)
Low equivalent		0.0732***	0.0663***	0.0638***	0.0548***	0.0542***
		(0.0182)	(0.0181)	(0.0181)	(0.0178)	(0.0178)
Below high school			0.0895	0.0841	0.0823	0.0822
			(0.0613)	(0.0608)	(0.0610)	(0.0612)
High school			0.0026	0.0025	0.0036	0.0028
			(0.0210)	(0.0210)	(0.0210)	(0.0210)
Inactive				0.0426**	0.0418**	0.0400**
				(0.0177)	(0.0177)	(0.0182)
Moderately active				0.0213	0.0210	0.0200
				(0.0184)	(0.0184)	(0.0185)
Minority					0.0366*	0.0363*
					(0.0196)	(0.0197)
Low fruit & veg						0.0098
						(0.0151)
Constant	0.2249***	0.2048***	0.2031***	0.1910***	0.1824***	0.0179***
	(0.0135)	(0.0135)	(0.0137)	(0.0143)	(0.0144)	(0.0154)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0106	0.0177	0.0192	0.0212	0.0227	0.0228
F	11.40	13.69	9.61	8.26	7.44	6.83

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.21 – The Atlantic Effect on Adolescent Obesity, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0340***	0.0325***	0.0327***	0.0333***	0.0351***	0.0343***
	(0.0112)	(0.0114)	(0.0114)	(0.0113)	(0.0113)	(0.0113)
Female	-0.0213***	-0.0220***	-0.0222***	-0.0256***	-0.0252***	-0.0248***
	(0.0068)	(0.0068)	(0.0069)	(0.0071)	(0.0070)	(0.0070)
Age 15-17	0.0086	0.0088	0.0088	0.0082	0.0087	0.0086
	(0.0069)	(0.0069)	(0.0069)	(0.0069)	(0.0069)	(0.0069)
Low equivalent		0.0268***	0.0299***	0.0284***	0.0262***	0.0257***
		(0.0095)	(0.0104)	(0.0105)	(0.0100)	(0.0100)
Below high school			-0.0266**	-0.0297**	-0.0302**	-0.0303**
			(0.0125)	(0.0127)	(0.0129)	(0.0129)
High school			-0.0083	-0.0083	-0.0080	-0.0086
			(0.0090)	(0.0090)	(0.0090)	(0.0090)
Inactive				0.0246***	0.0244***	0.0230**
				(0.0090)	(0.0090)	(0.0095)
Moderately active				0.0145	0.0144	0.0136
				(0.0091)	(0.0091)	(0.0093)
Minority					0.0091	0.0089
					(0.0097)	(0.0097)
Low fruit & veg						0.0079
						(0.0073)
Constant	0.0447***	0.0373***	0.0386***	0.0312***	0.0290***	0.0259***
	(0.0063)	(0.0059)	(0.0062)	(0.0056)	(0.0053)	(0.0061)
Observations	6326	6326	6326	6326	6326	6326
R^2	0.0054	0.0091	0.0098	0.0125	0.0129	0.0133
F	7.57	7.27	5.01	5.44	4.86	4.59

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.22 – The Atlantic Effect on Adolescent Girl BMI, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0464***	0.0443***	0.0440***	0.0445***	0.0466***	0.0470***
	(0.0115)	(0.0116)	(0.0116)	(0.0116)	(0.0115)	(0.0115)
Age 15-17	0.0698***	0.0700***	0.0704***	0.0699***	0.0701***	0.0702***
	(0.0087)	(0.0087)	(0.0085)	(0.0085)	(0.0085)	(0.0085)
Low equivalent		0.0259**	0.0216**	0.0195*	0.0166*	0.0167*
		(0.0108)	(0.0104)	(0.0104)	(0.0099)	(0.0099)
Below high school			0.0533	0.0503	0.0502	0.0501
			(0.0454)	(0.0441)	(0.0439)	(0.0436)
High school			0.0020	0.0005	0.0012	0.0014
			(0.0123)	(0.0122)	(0.0122)	(0.0123)
Inactive				0.0164	0.0163	0.0165
				(0.0120)	(0.0120)	(0.0121)
Moderately active				-0.0126	-0.0123	-0.0126
				(0.0105)	(0.0105)	(0.0106)
Minority					0.0104	0.0106
					(0.0115)	(0.0115)
Low fruit & veg						-0.0027
						(0.0091)
Constant	2.9792***	2.9714***	2.9706***	2.9718***	2.9698***	2.9710***
	(0.0071)	(0.0069)	(0.0070)	(0.0099)	(0.0102)	(0.0107)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0499	0.0551	0.0580	0.0635	0.0641	0.0642
F	37.13	30.05	18.85	14.98	13.10	11.65

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.23 – The Atlantic Effect on Adolescent Girl Overweight Status, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0733***	0.0669**	0.0659**	0.0666**	0.0738***	0.0746***
	(0.0269)	(0.0272)	(0.0273)	(0.0272)	(0.0272)	(0.0272)
Age 15-17	-0.0086	-0.0080	-0.0071	-0.0084	-0.0076	-0.0075
	(0.0195)	(0.0194)	(0.0189)	(0.0189)	(0.0189)	(0.0189)
Low equivalent		0.0778***	0.0660***	0.0603***	0.0504**	0.0506**
		(0.0248)	(0.0232)	(0.0232)	(0.0222)	(0.0223)
Below high school			0.1291	0.1219	0.1215	0.1214
			(0.1062)	(0.1034)	(0.1025)	(0.1019)
High school			0.0135	0.0104	0.0125	0.0129
			(0.0259)	(0.0259)	(0.0259)	(0.0259)
Inactive				0.0685***	0.0670***	0.0680***
				(0.0221)	(0.0221)	(0.0236)
Moderately active				0.0500**	0.0491**	0.0496**
				(0.0239)	(0.0240)	(0.0244)
Minority					0.0348	0.0353
					(0.0259)	(0.0260)
Low fruit & veg						-0.054
						(0.0209)
Constant	0.1515***	0.1283***	0.1255***	0.0935***	0.0877***	0.0895***
	(0.0150)	(0.0141)	(0.0145)	(0.0156)	(0.0162)	(0.0164)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0027	0.0126	0.0162	0.0233	0.0248	0.0249
F	3.89	6.46	3.99	4.55	4.04	3.81

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.24 – The Atlantic Effect on Adolescent Girl Obesity, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0380**	0.0368**	0.0364**	0.0368**	0.0395**	0.0387**
	(0.0156)	(0.0158)	(0.0158)	(0.0157)	(0.0156)	(0.0157)
Age 15-17	0.0031	0.0032	0.0030	0.0026	0.0029	0.0028
	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)	(0.0075)
Low equivalent		0.0153	0.0155	0.0145	0.0108	0.0105
		(0.0094)	(0.0103)	(0.0104)	(0.0098)	(0.0097)
Below high school			-0.0228*	-0.0245**	-0.0247*	-0.0246*
			(0.0124)	(0.0125)	(0.0128)	(0.0126)
High school			0.0105	0.0095	0.0103	0.0099
			(0.0112)	(0.0111)	(0.0112)	(0.0114)
Inactive				0.0172*	0.0167*	0.0157*
				(0.0089)	(0.0090)	(0.0093)
Moderately active				0.0027	0.0024	0.0019
				(0.0096)	(0.0096)	(0.0096)
Minority					0.0130	0.0125
					(0.0107)	(0.0105)
Low fruit & veg						0.0054
						(0.0078)
Constant	0.0258***	0.0212***	0.0204***	0.0148**	0.0127**	0.0109*
	(0.0059)	(0.0054)	(0.0056)	(0.0058)	(0.0059)	(0.0065)
Observations	3058	3058	3058	3058	3058	3058
R^2	0.0033	0.0050	0.0061	0.0081	0.0090	0.0092
F	2.99	3.48	2.71	2.56	2.31	2.08

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.25 – The Atlantic Effect on Adolescent Boy BMI, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0083	0.0075	0.0076	0.0072	0.0087	0.0077
	(0.0115)	(0.0114)	(0.0114)	(0.0114)	(0.0114)	(0.0114)
Age 15-17	0.0863***	0.0865***	0.0866***	0.0869***	0.0876***	0.0875***
	(0.0084)	(0.0084)	(0.0084)	(0.0085)	(0.0083)	(0.0083)
Low equivalent		0.0259**	0.0257**	0.0259**	0.0242**	0.0230**
		(0.0106)	(0.0111)	(0.0111)	(0.0110)	(0.0110)
Below high school			0.0094	0.0095	0.0088	0.0081
			(0.0218)	(0.0217)	(0.0218)	(0.0219)
High school			-0.0045	-0.0049	-0.0049	-0.0064
			(0.0115)	(0.0115)	(0.0115)	(0.0115)
Inactive				-0.0018	-0.0018	-0.0054
				(0.0113)	(0.0113)	(0.0116)
Moderately active				-0.0079	-0.0078	-0.0087
				(0.0111)	(0.0111)	(0.0112)
Minority					0.0082	0.0087
					(0.0113)	(0.0112)
Low fruit & veg						0.0201**
						(0.0085)
Constant	3.0020***	2.9948***	2.9952***	2.9972***	2.9950***	2.9868***
	(0.0065)	(0.0067)	(0.0068)	(0.0070)	(0.0069)	(0.0077)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0654	0.0701	0.0703	0.0707	0.0711	0.0745
F	52.64	36.41	22.09	15.93	15.18	13.80

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. BMI has been transformed by natural logarithm. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.26 – The Atlantic Effect on Adolescent Boy Overweight Status, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0278	0.0255	0.0258	0.0259	0.0326	0.0314
	(0.0307)	(0.0306)	(0.0305)	(0.0304)	(0.0304)	(0.0305)
Age 15-17	0.0124	0.0128	0.0130	0.0130	0.0163	0.0161
	(0.0215)	(0.0214)	(0.0216)	(0.0218)	(0.0216)	(0.0216)
Low equivalent		0.0685**	0.0654**	0.0650**	0.0569**	0.0555**
		(0.0267)	(0.0275)	(0.0275)	(0.0271)	(0.0271)
Below high school			0.0557	0.0529	0.0497	0.0489
			(0.0635)	(0.0636)	(0.0653)	(0.0648)
High school			-0.0077	-0.0077	-0.0075	-0.0093
			(0.0326)	(0.0326)	(0.0324)	(0.0325)
Inactive				0.0168	0.0168	0.0126
				(0.0278)	(0.0279)	(0.0280)
Moderately active				-0.0052	-0.0047	-0.0075
				(0.0278)	(0.0277)	(0.0276)
Minority					0.0383	0.0390
					(0.0286)	(0.0285)
Low fruit & veg						0.0238
						(0.0215)
Constant	0.2215***	0.2025***	0.2025***	0.2005***	0.1904***	0.1806***
	(0.0160)	(0.0165)	(0.0166)	(0.0179)	(0.0180)	(0.0207)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0005	0.0058	0.0064	0.0068	0.0083	0.0091
F	0.58	2.73	1.81	1.34	1.33	1.29

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.27 – The Atlantic Effect on Adolescent Boy Obesity, Low Equivalent Income Specification						
	(1)	(2)	(3)	(4)	(5)	(6)
Atlantic	0.0307*	0.0295*	0.0295*	0.0310*	0.0324**	0.0319**
	(0.0160)	(0.0161)	(0.0162)	(0.0162)	(0.0161)	(0.0161)
Age 15-17	0.0136	0.0139	0.0145	0.0133	0.0140	0.0139
	(0.0113)	(0.0113)	(0.0113)	(0.0115)	(0.0114)	(0.0113)
Low equivalent		0.0380**	0.0433**	0.0419**	0.0402**	0.0396**
		(0.0162)	(0.0176)	(0.0178)	(0.0170)	(0.0169)
Below high school			-0.0298	-0.0341	-0.0348	-0.0351
			(0.0205)	(0.0211)	(0.0215)	(0.0216)
High school			-0.0249*	-0.0232*	-0.0232*	-0.0240*
			(0.0137)	(0.0138)	(0.0138)	(0.0139)
Inactive				0.0306*	0.0306*	0.0288*
				(0.0163)	(0.0163)	(0.0172)
Moderately active				0.0248	0.0249	0.0236
				(0.0153)	(0.0155)	(0.0156)
Minority					0.0083	0.0086
					(0.0064)	(0.0154)
Low fruit & veg						0.0101
						(0.0118)
Constant	0.0424***	0.0319***	0.0350***	0.0240***	0.0218***	0.0177**
	(0.0073)	(0.0079)	(0.0079)	(0.0069)	(0.0064)	(0.0081)
Observations	3268	3268	3268	3268	3268	3268
R^2	0.0023	0.0082	0.0102	0.0140	0.0143	0.0148
F	2.91	3.98	2.82	4.05	3.55	3.32

Notes: All regressions include the estimation sample weight. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.28 – Blinder-Oaxaca Decomposition of the Atlantic Overweight Gap for Adolescent Girls

	Number	Percent
Atlantic overweight gap	0.0729***	100.00***
	(0.0268)	
Portion explained by:		
Age 15-17	-0.0004	-0.49
	(0.0009)	
Low equivalent income	0.0042*	5.72*
	(0.0025)	
Below high school	0.0011	1.56
	(0.0019)	
High school	0.0007	0.94
	(0.0014)	
Inactive	-0.0010	-1.43
	(0.0022)	
Moderately active	0.0011	1.53
	(0.0017)	
Minority	-0.0067	-9.12
	(0.0049)	
Low fruit & veg	-0.0008	-1.04
	(0.0029)	
Total portion explained	-0.0017	-2.33
	(0.0073)	
Portion unexplained	0.0746***	102.33***
	(0.0271)	

Notes: All decompositions have been pooled with the sample weight included. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.

Table A.29 – Blinder-Oaxaca Decomposition of the Atlantic Overweight Gap for Adolescent Boys

	Number	Percent
Atlantic overweight gap	0.0280	100.00
	(0.0294)	
Portion explained by:		
Age 15-17	0.0003	0.99
	(0.0007)	
Low equivalent income	0.0018	6.37
	(0.0020)	
Below high school	-0.0001	-0.36
	(0.0007)	
High school	-0.0001	-0.41
	(0.0005)	
Inactive	-0.0002	-0.61
	(0.0005)	
Moderately active	0.0003	1.04
	(0.0011)	
Minority	-0.0067	-23.84
	(0.0050)	
Low fruit & veg	0.0012	4.35
	(0.0014)	
Total portion explained	-0.0035	-12.47
	(0.0059)	
Portion unexplained	0.0314	112.47
	(0.0294)	

Notes: All decompositions have been pooled with the sample weight included. 2009/20010 CCHS. Standard errors are reported in parentheses. See Chapter 3 for further description of variables.
*, **, *** represent 10%, 5% and 1% significance levels respectively.