

Impacts of Subsidized Childcare on Obesity in the Long-run

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Abstract:

In this paper I estimate the causal effect of exposure to subsidized childcare on rates of childhood obesity in the long-run. I use the Quebec Family Policy, which implemented \$5 a day universal childcare in 1997, as a natural experiment. Using data from the Canadian Community Health Survey, I analyze whether exposure to this policy affected BMI. My results show that exposure to subsidized childcare does not have a statistically significant effect on BMI in the long-run. I corroborate this result by performing a series of robustness checks, including examining the impacts of exposure to the policy on subsets of the sample, such as males and children from single-parent families. I also perform unconditional quantile regression analysis to examine changes to the distribution of BMI. These specification checks confirm that exposure to subsidized childcare does not have a statistically significant impact on BMI.

Keywords: childcare, obesity

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I. Introduction:

In this paper, I estimate the causal effect of subsidized childcare on obesity in the long-run. It is important to understand this relationship because rates of childhood obesity are increasing. In the last 30 years, obesity rates amongst Canadian children have nearly tripled. Childhood obesity is proven to cause an increased risk of developing adult obesity as well as an increased risk of developing conditions such as Type-II diabetes and hypertension (Must and Strauss, 1999). Given this link between childhood and adult obesity, it is important to measure determinants of childhood obesity in order to mitigate them.

The Quebec Family Policy, which was implemented in 1997, introduced \$5 a day subsidized childcare to children in Quebec and provides an opportunity to analyze how subsidized childcare affects child obesity. It is important to understand the impacts of the Quebec Family Policy because similar subsidized childcare programs are under consideration in other jurisdictions both inside and outside of Canada. In 2018, BC implemented the Affordable Child Care Benefit and the Child Care Fee Reduction Initiative which reduced the cost of childcare in the province (Saltman, 2019), and in 2017 the federal government pledged to spend \$7.5 billion on childcare spaces over the next decade (Smith, 2017). Similar policies have been proposed in the United States such as Senator Elizabeth Warren's proposed Universal Child Care and Early Learning Act which would provide subsidized childcare to low-income families (Astor, 2019).

I analyze how exposure to subsidized childcare provided by the 1997 Quebec Family Policy impacts rates of obesity in the long-run. I use data from the Canadian Community Health Survey to compare changes in Body Mass Index (BMI) of children who were exposed to the policy with changes in BMI of children who were not. I compare the BMIs of 12 to 14 year-olds in Quebec who would have been exposed to the policy after its implementation, to 12 to 14 year-

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olds in other provinces who were not exposed to the policy. I also compare changes in the BMIs of 12 to 14 year-olds to the changes in BMIs of 20 to 24 year-olds because 20 to 24 year-olds would never have been exposed to the policy. By comparing these two different age groups, one which was exposed to the policy after its implementation and one which was not, I can control for any other Quebec-specific shocks which might have affected the BMIs of people in the province during this time regardless of exposure to the Quebec Family Policy.

My results show that exposure to the Quebec Family Policy does not have a statistically significant impact on BMI. I check this result for robustness by separating the data into subsamples, and examining the effect of the policy on each subsample to see how various demographic groups are affected by the policy. I create subsamples of the data based on gender, income level, and family type. The results from this analysis further corroborate the conclusion that exposure to subsidized childcare does not have a statistically significant impact on BMI. To further check the robustness of my results I undertake Unconditional Quantile Regression Analysis to see how people at different BMI percentiles are affected by exposure to the policy. The results show that exposure to the Quebec Family Policy does not have a statistically significant effect on people at any BMI percentile, further supporting my result of non-significance. The final check for robustness that I perform is to analyze rates of smoking for people who were exposed to the policy because smoking can have an effect on BMI (Heart and Stroke Foundation, 2018). I use the same triple difference-in-differences approach with smoking as the dependent variable and find that people exposed to the Quebec Family Policy are statistically significantly less likely to have ever smoked one cigarette, but the effects of exposure are not statistically significant for being a daily smoker, an occasional smoker, or for having smoked more than 100 cigarettes.

II. Literature Review:

There is an extensive body of research examining determinants of childhood obesity, including studies examining the relationship between subsidized childcare and child obesity and maternal labour supply and child obesity. Research on the Quebec Family Policy demonstrates that the policy's implementation has had causal effects on use of childcare and maternal labour supply in Quebec, as well as causal impacts on child well-being. I also examine studies which research the effects of subsidized childcare on child obesity in the United States. I assess these papers to examine the relationship that other researchers have found between subsidized childcare and child obesity, as well as the impacts of the Quebec Family Policy, before further investigating these issues with my own research.

Baker, Gruber, and Milligan (2008) use the National Longitudinal Survey of Children and Youth to perform a difference-in-differences analysis comparing mother and child outcomes in Quebec before and after the Quebec Family Policy was implemented. They find that after the policy's implementation, the employment of women in two-parent families rose by 7.7 percentage points, and the odds that a child was in care rose by 14.6 percentage points, relative to the reference group. The authors find a significant shift from children receiving informal care, in the form of relatives or unlicensed non-relatives, to using licensed childcare centres. Baker *et al.* (2008) also find that children exposed to the policy demonstrated higher levels of anxiety, aggressiveness, hyperactivity, and a lower chance of being in excellent health.

These findings are confirmed by Kottelenberg and Lehrer (2013), who extend the Baker *et al.* (2008) study by using two additional cycles of the survey as well as an instrumental variables estimator to ascertain the causal effect of using childcare. Their results confirm that

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Quebec's subsidized childcare led to worse child outcomes, and suggest that the negative results were not indicative of short-term effects resulting from the policy's implementation.

The Baker *et al.* (2008) findings that the policy was associated with increased rates of maternal labor supply are corroborated by Lefebvre and Merrigan (2008), who use data from the Survey of Labour and Income Dynamics to perform a difference-in-differences analysis comparing mothers with young children in Quebec to the same group in other provinces. They find strong, positive, and statistically significant evidence that the labour supply, participation, hours worked, and annual earnings of mothers with children between the ages of 1 and 5 were affected by the policy.

These findings are significant because they indicate that the policy has had negative effects on children and that subsidized childcare has induced increased childcare usage and maternal employment. Other research examines the relationship between maternal employment and child obesity, finding mixed results. Chia (2008) examines whether a mother's work intensity is related to a child's risk of becoming overweight or obese. The author finds that increased maternal work intensity before a child starts school is associated with a child's increased risk of becoming overweight or obese later in childhood, decreased probability of a child participating in organized sports, and increased probability of a child watching three or more hours of television a day. Chia (2008) hypothesizes that increased maternal employment decreases a mother's ability to monitor a child's diet and activities. Ruhm (2008) finds that maternal employment when children are younger than three is associated with lower cognitive scores, though levels of obesity are not affected, and he finds that children from advantaged families are more negatively impacted by their mothers working than children from disadvantaged families. Ruhm (2008) theorizes that these negative outcomes from maternal

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employment could be attributed to children being removed from nurturing environments, such as the home, which is especially detrimental for advantaged children.

Other studies examine the relationship between subsidized childcare and obesity. Herbst and Tekin (2011) use American data from the Early Childhood Longitudinal Study to examine how using subsidized childcare prior to entering kindergarten affects children's weight. They find that using subsidized childcare before starting kindergarten is associated with a greater likelihood of a child becoming overweight or obese, and that children with the highest BMIs saw large, positive effects on their BMIs from utilizing subsidized childcare, whereas children with initial lower or "middle" range BMIs experienced fewer impacts. Herbst and Tekin (2016) further research this issue, and use travel distance as an instrumental variable to determine causality. The authors find that as distance to the agencies where the subsidy is administered increases, fewer parents utilize subsidized childcare. They use this as an instrumental variable. Herbst and Tekin (2016) perform the same analysis as Herbst and Tekin (2011), and find causal evidence that children who used subsidized childcare were 11.9 percentage points more likely to be overweight and 4.8 percentage points more likely to be obese than children who did not use subsidized childcare. The authors theorize that childcare subsidies might cause children to move from being cared for in their homes to attending low-quality childcare centres, resulting in negative health effects on the child.

By contrast, Frisvold (2006) examines impacts that the Head Start program, a government-funded pre-school program in the United States, has had on levels of childhood obesity. The results from this study show that participation in the Head Start program causes a significantly decreased probability that children will become overweight or obese later in childhood, particularly because of the nutritional education provided by the program. The Head

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Start program differs from many other childcare programs because it was specifically designed to instill healthy habits in the children using the program. It does this by encouraging children to try a large variety of healthy foods, by providing children with healthy meals, and by providing nutritional information for children and for parents (Frisvold, 2006). These efforts might explain why the Head Start program lowers the risk of a child becoming overweight or obese later in childhood.

An unpublished study by Kottelenberg (2014) examines the causal impact of the Quebec Family Policy on child BMIs. Kottelenberg (2014) uses data from the National Longitudinal Survey of Children and Youth to perform a difference-in-differences analysis to examine the impact of access to subsidized childcare while controlling for household fixed effects.

Kottelenberg (2014) finds that exposure to subsidized childcare has a negative impact on BMI for boys from two-parent families, and that the effects last until the children are aged 8-9.

Kottelenberg (2014) also examines the unconditional distribution of BMI, and finds that the policy had no impact on children at the highest BMI levels. The author theorizes that increased hyperactivity among boys, which he finds to be associated with exposure to the policy, could contribute to their decreased BMI levels.

My research adds to the existing literature by examining the relationship between subsidized childcare and obesity within the context of the Quebec Family Policy for an age group, 12 to 14 year-olds, which has not been previously studied. Additionally, I examine whether effects on this age group persist into adulthood. By studying the impact of universal subsidized childcare, I can measure effects on children from both single-parent and two-parent families and from middle-class families. This is in contrast to much of the existing literature which examines subsidies only available to low-income or single-parent families.

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III. Quebec Family Policy:

In 1997, the Quebec government introduced a set of policy initiatives known as the Quebec Family Policy designed to improve family welfare. Several policy initiatives were introduced at the same time, including voluntary full-time kindergarten, afterschool care for children aged 5-12, and subsidized \$5 a day childcare for children aged 59 months or younger.¹ The subsidized \$5 a day childcare was implemented on a rolling basis, and when it was first introduced in 1997 it was only available for 4-year-olds. The following year the policy expanded to include 3-year-olds, the next year included 2-year-olds, and by 2000 subsidized childcare was available to all children aged 59 months or younger in Quebec. All children living in Quebec are eligible for subsidized childcare, and parents are not required to be employed.

Subsidized childcare for children aged 0 to 4 in Quebec is available in two main forms. The first is Centres de la petite enfance, commonly referred to as CPEs. These are non-profit, private corporations, and provide childcare for up to 80 children. The second type of subsidized childcare is in the form of family-based caregivers. This type of care is generally administered from the caregiver's home, and usually consists of groups of six children per centre. People also have the option of using private, for-profit childcare centres that charge higher fees.

When the \$5 a day childcare policy was first introduced, there was excess demand for the program, resulting in queues. Quebec responded to this excess demand by increasing the number of childcare spaces available, and between 1997 and 2005 the number of subsidized childcare spaces in Quebec more than doubled. The Quebec Family Policy also introduced new standards and regulations for both CPEs and family-based care centres. New regulations included

¹ In 2007 the price increased from \$5/day to \$7/day, though this does not affect the groups that I am examining.

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increased training and professional development and requiring that at least two-thirds of the staff at subsidized childcare centres must hold a university degree or college diploma in Early Childhood Education. The government also implemented regulations for the childcare centres such as space requirements, limiting the amount of time children could spend watching television, and requiring childcare providers to adhere to Canada's Food Guide.²

IV. Data:

I use data from the Canadian Community Health Survey (CCHS). The CCHS is a nationally-representative cross-sectional survey which collects information from people across Canada regarding health status, health care utilization, and health determinants. The CCHS was conducted biannually from 2001-2005, with approximately 130,000 observations in each wave, and has been conducted annually beginning in 2007 with approximately 65,000 observations in each wave. I use the 2001, 2003, 2014, 2015, and 2016 waves of the survey. The primary age group of interest are people aged 12-14. People in this age group would not have been exposed to Quebec's subsidized childcare policy in the 2001 and 2003 waves, but would have been fully exposed to the childcare policy in the 2014, 2015, and 2016 waves. I also examine people in the 20-24 age group because people in this age group would never have been exposed to the policy and so serve as a useful control group. By comparing the 12 to 14 year-olds who would have been exposed to the policy after its implementation to 20 to 24 year-olds who would never have been exposed to the policy, I can observe whether people in Quebec over this time period experienced changes in BMI regardless of whether they were exposed to the policy. If the 20-24 age group in Quebec experienced changes to their BMIs similar to changes experienced by the 12-14 age group that was exposed to the policy, then this might indicate that observed changes to

² For more information, see Baker *et al.* (2008) and Kottelenberg (2014).

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the treatment group are because of some Quebec-specific shock other than the Quebec Family Policy. I use variables for self-reported height and weight to calculate BMI, which is equal to weight (kilograms) divided by height squared (metres²). The data also include information on sociodemographic factors such as household income and living arrangements, and information on nutrition and physical activity. Table 1 includes descriptive statistics of the variables included in my analysis. I have restricted the data to only include people born in Canada.

V. Empirical Strategy:

I use a triple difference estimator, also known as a difference-in-difference-in-differences estimator, to estimate changes in BMI that occur in Quebec relative to the rest of Canada around the time of the Quebec Family Policy's implementation. The triple difference estimator includes three components of variation: time, location, and age. The time variable compares changes that occur between the time before the policy was implemented and the time after the policy was implemented. The location variable compares changes that occur in Quebec relative to the rest of Canada. The age variable compares the 12-14 age group, who were not exposed to the policy in the "pre" period, but who were exposed in the "post" period, to the 20-24 age group, who were not exposed in either the "pre" or the "post" period. I refer to the "pre" period as the CCHS waves from 2001 and 2003, and the "post" period as the CCHS waves from 2014, 2015 and 2016. My triple difference regression equation is as follows:

$$BMI_{apt} = \beta_1 PROV_p + \beta_2 POST_t + \beta_3 AGE_a + \beta_4 (PROV * POST)_{pt} + \beta_5 (AGE * POST)_{at} + \beta_6 (PROV * AGE)_{pa} + \beta_7 (PROV * POST * AGE)_{apt} + X_{apt}\lambda + \varepsilon_{apt}$$

where a indexes age, p indexes provinces, and t indexes year. I have included dummy variables for provinces, year, and age. The dummy variable $POST$ is equal to one for time periods after the policy's implementation, and the AGE dummy variable is equal to one for the 12 to 14 year-old age group, which is the group that is exposed to the policy. X_{apt} denotes a vector of covariates of

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characteristics that includes sex of the individual, number of siblings, household income level, whether an individual grew up in a single-parent household, presence of asthma, whether an individual's home is rented or owned, and whether someone regularly smokes in the individual's home. The variable of interest is the *PROV*POST*AGE* term, which is a dummy variable indicating eligibility for subsidized childcare in Quebec. This is equal to one for individuals in the 12-14 age group living in Quebec after the policy's implementation. I also include interaction terms between the variables. This empirical strategy estimates the intention-to-treat effects rather than the effects of using subsidized childcare in Quebec. This means that the results measure the effects on all children exposed to the policy, regardless of whether they actually used subsidized childcare or not.

I exclude the surveys conducted from 2005-2012 because they include years during which the Quebec Family Policy was being implemented. The excluded period—seven years—is longer than the implementation period, which took four years, because I am using data that groups participants into age intervals.

I perform robustness checks that include examining the impact of exposure to the policy on subsets of the sample, separating the sample by gender, income group, and family-structure. Additionally, I examine whether exposure to the policy influences people's smoking behaviour, as this might further influence weight. I also perform Unconditional Quantile Regression Analysis to examine how the distribution of BMI is affected by exposure to the policy, as the initial triple difference regressions only examine average BMI. The Unconditional Quantile Regression Analysis will identify whether certain parts of the distribution are more affected by the policy than others, providing a more robust analysis of the policy's impact.

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VI. Results:

Table 2 provides the regression results, which give the estimated effects of exposure to the Quebec Family Policy on BMI. The first column includes the control variable, and the second column includes the estimated coefficient for each variable with the standard errors in brackets beneath the coefficient. The first row in Table 2 shows the estimated impacts of exposure to Quebec's subsidized childcare on BMI using robust standard errors. Robust standard errors provide consistent standard errors in the presence of heteroskedasticity. Heteroskedasticity means that there is non-constant variance among the error terms, which can result in understated standard errors, overstated t-ratios, and incorrectly interpreted significance.

The coefficient for the triple difference variable is small, positive, and statistically insignificant. This indicates that exposure to Quebec's subsidized childcare policy did not have a statistically significant impact in children's BMIs.

While the coefficients of the other explanatory variables are not incorporated in the model a quasi-experimental way, they demonstrate how BMI is affected by factors other than exposure to childcare. The results indicate that being a male, having asthma, and having a household member regularly smoke in the house all have a positive, statistically significant effect on BMI. A family owning their own home has a negative, statistically significant impact on the child's BMI.

VII. Checks for Robustness:

I perform various specification checks to examine the robustness of these results. The results from these checks are given in Table 3. The first check for robustness is to exclude data from the 2015 and 2016 surveys. In my overall regression, which uses the full sample of data, I compare the 12-14 age group—which was not exposed to the policy in the 2001 and 2003

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surveys but was exposed in the 2014, 2015, and 2016 surveys—to an age group that was not exposed to the policy in any of the surveys, the 20-24 age group. However, because Statistics Canada combines the data from the 2015 and 2016 surveys, and groups age into age intervals, it is possible that a small portion of the individuals in the 20-24 age group in the 2015/2016 combined survey might have been exposed to the policy when they were younger. In order to confirm the validity of my previous results, I perform the same triple difference regression excluding data from the 2015/2016 survey. This ensures that participants in the 20-24 age group are fully unexposed to the policy. The results from this regression confirm that the policy had a statistically insignificant impact on BMI. The coefficient for the exposure term remains small, positive, and statistically insignificant.

I also perform a specification check using errors clustered by province as there could be province-specific characteristics which are correlated with BMI. By running the regression using robust standard errors clustered by province I can control for these province-specific characteristics. The results show that when clustering errors by province, the standard errors decrease in magnitude, and the p-value increases, although the effect of exposure to childcare on BMI remains statistically insignificant.

The next specification checks involve dividing the sample into subsamples and running the regression on each respective subsample to see how various demographic groups are impacted by the policy. It is possible that certain demographic groups are affected by the policy but that these impacts cancel each other out, indicating non-significance for the total sample. I first separate the data into male and female groups. The results indicate that for males, exposure to the policy has a small, positive, but statistically insignificant impact on BMI. The results for females indicate that exposure to the policy also has a statistically insignificant impact on BMI.

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I then divide the sample by income level. The results indicate that for individuals with household incomes less than or equal to \$29,999, the exposure to the policy has a small, positive, statistically insignificant impact on BMI. For individuals with household incomes between \$30,000 and \$79,999, the results show that exposure to the policy has a positive effect on BMI that is significant at the 20% significance level, but not at the 10% significance level. The results show that for individuals with household incomes greater or equal to \$80,000, exposure to the policy has a small, negative, statistically insignificant impact on BMI.

I also separate the data into single-parent families and two-parent families. The results show that for children from single-parent families, exposure to the policy has a small, negative, statistically insignificant impact on BMI. For children from two-parent families, exposure to the policy has a small, positive, statistically insignificant impact on BMI.

The last subsamples that I examine are males and females from single-parent and two-parent families, as this outcome is examined by Kottelenberg (2014) for a different age group. My results demonstrate that for both males and females from single-parent families, exposure to the policy results in a small, negative, statistically insignificant impact on BMI. Males and females from two-parent families experienced a small, positive impact on BMI from exposure to the policy. For males this impact is statistically significant at the 20% significance level, but not at the 10% significance level, and for females the result is statistically insignificant. These results differ from the Kottelenberg results, which found that 8 to 9 year-old boys from two-parent families experienced a statistically significant negative impact on BMI when exposed to the Quebec Family Policy.

The last robustness check I do is to consider how exposure to subsidized childcare affects smoking behaviour. There is a relationship between weight and tobacco because tobacco is an

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appetite suppressant and smokers are often observed to gain weight after quitting smoking (Heart and Stroke Foundation, 2018). If exposure to subsidized childcare causes an increase in smoking behaviour then this could affect my interpretation of the policy's effect on BMI. To examine the policy's impact on smoking I run the triple difference-in-differences regression again using smoking as the dependent variable instead of BMI. The results are given in Table 4.

The results show that exposure to the policy has a small, negative, but statistically significant effect on whether a person has ever smoked one cigarette. However, the results also show that exposure to the policy has small, statistically insignificant effects on whether a person has ever smoked at least 100 cigarettes, whether a person considers himself or herself to be a daily smoker, and whether a person considers himself or herself to be an occasional smoker. These results demonstrate that exposure to the Quebec Family Policy does not statistically change a person's probability of developing a smoking habit. This suggests that my findings that exposure to the policy has a statistically insignificant impact on weight cannot be attributed to the policy changing smoking behaviour.

VIII. Quantile Analysis:

I undertake Unconditional Quantile Regression Analysis to further examine how exposure to the Quebec Family Policy affects BMI. The analysis conducted so far has examined how exposure to universal subsidized childcare has affected average BMI and the results have shown that exposure to the policy does not have a statistically significant impact on average BMI. However, it is possible that exposure to subsidized childcare impacts BMI differently at different percentiles, and that these changes cancel each other out resulting in a statistically insignificant change in average BMI.

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I examine the effect of exposure to universal subsidized childcare on percentiles by performing Unconditional Quantile Regression Analysis. This method was developed by Firpo, Fortin, and Lemeiux (2009) and examines how changes to the distributions of explanatory variables affect the distribution of the dependent variable. In the context of my analysis, Unconditional Quantile Regression Analysis will show how the BMI distribution is affected by the changing distribution of the variable of interest, the triple difference-in-differences interaction term denoting exposure to the Quebec Family Policy.

The method of computing the quantiles is done in Stata. I used the `rifreg` command, in place of `reg`, and estimate the same triple difference-in-differences equation as for my other regressions. I run this regression for percentiles from 1% to 99%, and graph the coefficient for the variable of interest, which denotes exposure to the Quebec Family Policy. I graph these coefficients along with a 95% confidence interval. I perform this quantile analysis for three demographic groups: the whole sample of data, males only, and females only.

Figure 1 graphically shows how the estimated coefficient for the variable of interest, exposure to the policy, changes over different percentiles when using the full sample of data. The coefficients for estimated marginal impacts of the policy on BMI fluctuate around zero. The upper bound of the 95% confidence interval is located above zero for all percentiles except for the 10th percentile and the lower bound of the 95% confidence interval is located below zero for all percentiles indicating statistical insignificance. For the 10th percentile, the marginal effects of the policy are seen to be slightly statistically significant, as both bounds of the confidence interval are below zero. However, the policy is seen to be statistically insignificant for the percentiles above and below the 10th percentile, which might indicate that this statistical significance is due to sampling variance. Although people above the the 80th percentiles for BMI

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appear to be more influenced by exposure to the policy, the confidence intervals still encompass zero and so it cannot be said that these effects are statistically significant.

The percentile analysis for males is located in Figure 2. For males, the effects of the policy are still seen to be statistically insignificant, as the confidence intervals contain zero for all percentiles. Males above the 80th percentile appear to be negatively affected by exposure to the policy, but the confidence intervals still encompass zero and so it cannot be said that these effects are statistically significant.

The graph containing the estimated marginal effects of the policy on BMI for females is given in Figure 3. The policy's estimated marginal effect on BMI is approximately zero and statistically insignificant for all percentiles up to the 95th percentile, where the the marginal effects increase and become slightly statistically significant. The estimated effects for percentiles above the 95th percentile become statistically insignificant again, which might indicate that the observed statistical significance could be due to sampling variance.

These results are corroborated by histograms of the BMI distributions in Quebec and the rest of Canada for children aged 12-14 before and after the policy's implementation. Figure 4 shows the distribution of BMIs in Quebec before the policy's implementation, and Figure 5 shows the distribution of BMIs in Quebec after the policy's implementation. Although there is a slightly higher concentration of BMIs in the mid-twenties area after the policy's implementation, this shift is small, and does not indicate a significant change in BMIs in Quebec relative to the rest of Canada over this time period.

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IX. Discussion:

The results from the triple difference regression indicate that exposure to subsidized childcare does not have a statistically significant effect on BMI. This result is confirmed when separating the data into subsections based on gender, household income, and family type.

My results are consistent with the existing literature, which finds that subsidized childcare has an ambiguous effect on BMI. Herbst and Tekin (2016) find that exposure to subsidized childcare causes an increase in risk of overweight and obesity, and attribute their results to the fact that subsidizing childcare might result in children moving from homecare to low-quality childcare, thereby possibly receiving lower quality care than children who do not receive subsidized childcare. Frisvold (2006) examines the Head Start program in the United States and finds that the government-funded preschool program causes a decreased probability that children will become overweight or obese later in childhood. Frisvold (2006) attributes these findings to the nutritional education provided by the program. These results demonstrate that a child's BMI can be impacted differently depending on what type of childcare they receive. Additionally, both of these studies examine childcare programs that are targeted towards low-income families, and the researchers often only include single-parent families in their studies. My research examines single-parent and two-parent families, and people of all income-levels, as it is a universal childcare program.

Kottelenberg (2014) examines the Quebec Family Policy's impact on boys from two-parent families and finds that the policy causes a negative, statistically significant impact on BMI. Kottelenberg (2014) examines the BMI for this group during pre-school ages and finds that the effects persist until ages 8-9. When I examine boys from two-parent families at ages 12-14, I find that the impact of exposure to subsidized childcare is small, positive, and statistically

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significant but only at the 20% significance level. These results differ from the Kottelenberg (2014) finding of a negative impact which he attributes to increased hyperactivity of boys exposed to childcare. Kottelenberg (2014) also notes that the reduction in BMI mostly occurs in boys with initial BMIs in the “normal” range, and that those with initially high BMIs are not affected. The results from my regression could demonstrate that boys who experience decreased BMIs at ages 8-9 because of exposure to subsidized childcare (Kottelenberg, 2014) do not see these effects persist into their teenage years. This might be attributed to decreased hyperactivity as boys get older, or to changing food and activity choices as boys become teenagers.

It should be noted that because I use public-use data to perform my economic analysis, there are certain inconsistencies and assumptions that I make about the data. One assumption that I make is that the province individuals live in during the survey period is the same province they lived in when they were young enough to receive childcare. The survey does not ask about city or province of birth, but it does ask about country of birth, so I have filtered the data to only include people born in Canada. However, I cannot control for movement throughout the country. Additionally, Statistics Canada has implemented certain privacy controls on their public-use data, such as recording the ages of individuals as multi-year ranges. This means that I am limited to comparing full exposure to no exposure and cannot exploit other variation in the years of exposure to subsidized childcare.

Although my results show that exposure to subsidized childcare does not have statistically significant impacts on BMI, I can still recommend policy changes to improve the program, particularly regarding the quality of childcare centres. When the Quebec Family Policy was first introduced, the Quebec government implemented stricter regulations for the subsidized childcare centres. However, many centres have not met these increased standards, resulting in

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lower-quality care being provided for some children. Japel *et al.* (2005) find that 37% of centre-based CPEs and 31% of family-based caregivers scored a rating of “good” for quality of space, meaning that there was spacious room for play inside and outside the care centre. Additionally, 33% of centre-based CPEs and 20% of family-based caregivers scored a rating of “good” for their personal care routines, which means that the childcare centre is kept clean, the children practice good hygiene, and that the meals provided for the children are nutritious. Japel *et al.* (2005) also find that 21% of centre-based CPEs and 36% of family-based caregivers scored a rating of “good” for activities, meaning that children had access to sand and water play for an hour each day and were provided with activities that promote learning. Baker *et al.* (2008) find that the subsidized childcare centres in Quebec were higher quality than the non-subsidized childcare centres in Quebec, but that only 61% of the subsidized childcare centres met the criteria for minimum quality. However, Baker *et al.* (2008) also find evidence that childcare in Quebec was not falling relative to the rest of Canada.

Given these findings, there are potential policy recommendations that could be made in regards to the quality and standards of the subsidized childcare centres in Quebec. While one of the main changes could be ensuring that subsidized childcare centres are meeting the minimum quality requirements set by the government, there could be further changes made regarding food and physical activity to help children develop healthy habits later in life. Frisvold (2006) shows that in the Head Start program, nutritional education in pre-school has a causal effect in reducing a child’s risk of becoming overweight or obese. Although current regulations for Quebec childcare centres include regulations that food provided for children must comply with Canada’s Food Guide, additional health training could be added to improve nutritional knowledge and to instill healthy habits.

X. Conclusion:

In this paper, I examine the causal impact of exposure to subsidized childcare on childhood obesity in the long-run. I examine this topic in the context of the Quebec Family Policy, and use data from the Canadian Community Health Survey. I employ a triple difference estimator and find that exposure to the Quebec Family Policy does not have a statistically significant effect on BMI in the long-run. I further verify these findings by performing a series of checks for robustness, including examining the effect of the policy on subsamples of the population, such as various income levels and single-parent families, and by examining the policy's impact on specific percentiles of BMI. The results from my empirical analysis of these subsamples of data corroborate the result that exposure to subsidized childcare does not have a causal impact on BMI in the long-run. Additionally, I corroborate my findings by performing quantile analysis and by examining changes in smoking behaviour which both further support the finding that exposure to the policy does not have a statistically significant impact on BMI. The results from my research imply that any impacts that exposure to subsidized childcare might have on BMI in the short-run will not last into a child's teenage years or into adulthood. These results complement a body of research which examines the impacts that subsidized childcare has on child outcomes at a time when subsidized childcare is a contentious and growing issue in policy debates.

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References

- Astor, M. (2019, February 19). Elizabeth Warren proposes universal child care. *New York Times*. Retrieved from <https://www.nytimes.com/2019/02/19/us/politics/elizabeth-warren-child-care.html>
- Baker, M., Gruber, J., & Milligan, K. (2008, August). Universal child care, maternal labor supply, and family well-being. *Journal of Political Economy*, 116(4), 709-745.
- Chia, Y. (2008, February). Maternal labour supply and childhood obesity in Canada: Evidence from the NLSCY. *Canadian Journal of Economics*, 41(1), 217-242.
- Childhood Obesity (2016, September 26). In *Government of Canada*. Retrieved September 27, 2018, from <https://www.canada.ca/en/public-health/services/childhood-obesity/childhood-obesity.html>
- Firpo, S., Fortin, N. M., & Lemieux, T. (2009, May). Unconditional quantile regressions. *Econometrica*, 77(3), 953-973.
- Frisvold, D. (2006, February). Head start participation and childhood obesity. Vanderbilt University Working Paper No. 06-WG01.
- Herbst, C. M., & Tekin, E. (2011, September). Child care subsidies and childhood obesity. *Review of Economics of the Household*, 9(3), 349-378.
- Herbst, C. M., & Tekin, E. (2016, Winter). The Impact of child-care subsidies on child development: Evidence from geographic variation in the distance to social service agencies. *Journal of Policy Analysis and Management*, 35(1), 94-116.
- Japel, C., Tremblay, R. E., & Cote, S. (2005, December). Quality counts: Assessing the quality of daycare services based on the Quebec longitudinal study of child development. *IRPP Choices*, 11(5), 1-42.
- Kottelenberg, M. J., & Lehrer, S. F. (2013, June). New evidence on the impacts of access to and attending universal child-care in Canada. *Canadian Public Policy*, 39(2), 263-286.
- Kottelenberg, M. (2014, October). Universal child care, child obesity, and the BMI distribution. Job Market Paper, Queen's University.
- Lefebvre, P., & Merrigan, P. (2008, July). Child-care policy and the labor supply of mothers with young children: A natural experiment from Canada. *Journal of Labor Economics*, 26(3), 519-548.
- Must, A., & Strauss, R.S. (1999). Risks and consequences of childhood and adolescent obesity. *International Journal of Obesity*, 23(2), S2-S11.

SUBSIDIZED CHILDCARE AND OBESITY

Ruhm, C. J. (2008, October). Maternal employment and adolescent development. *Labour Economics*, 15(5), 958-983.

Saltman, J. (2019, February 19). B.C. Budget 2019: Increase to child-care funding, new child bandit introduced. *Vancouver Sun*. Retrieved from <https://vancouver.sun.com/news/local-news/b-c-budget-2019-minor-increase-to-child-care-funding-new-benefit-introduced>

Smith, J. (2017, June 12). Feds sign national child-care deal to get \$7 billion flowing to provinces. *CTV News*. Retrieved from <https://www.ctvnews.ca/politics/feds-sign-national-child-care-deal-to-get-7-billion-flowing-to-provinces-1.3454398>

Smoking and tobacco (2018). In *Heart and Stroke Foundation*. Retrieved from <https://www.heartandstroke.ca/heart/risk-and-prevention/lifestyle-risk-factors/smoking-and-tobacco>

Figure 1: Quantile Analysis – Full Sample

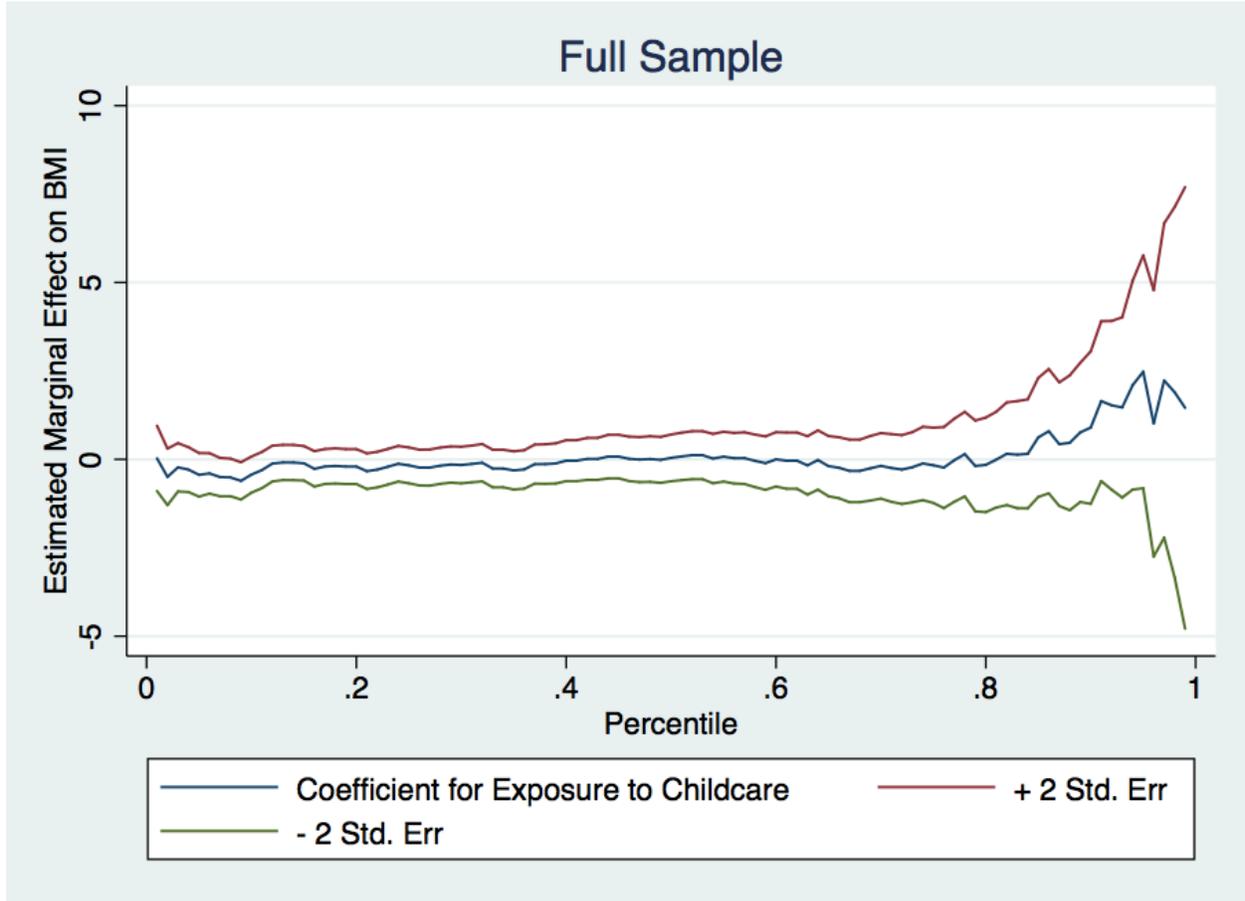


Figure 2: Quantile Analysis – Males Only

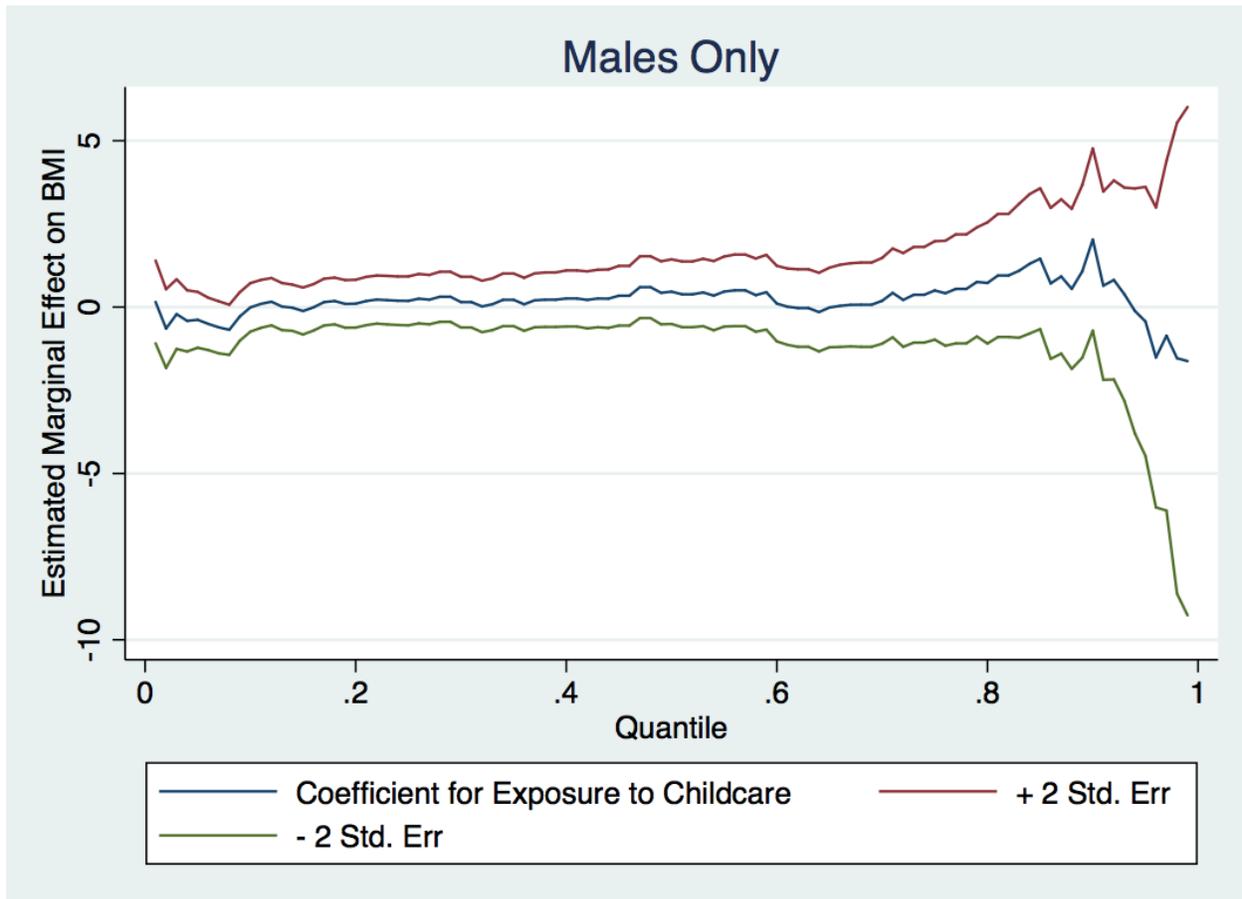


Figure 3: Quantile Analysis – Females Only

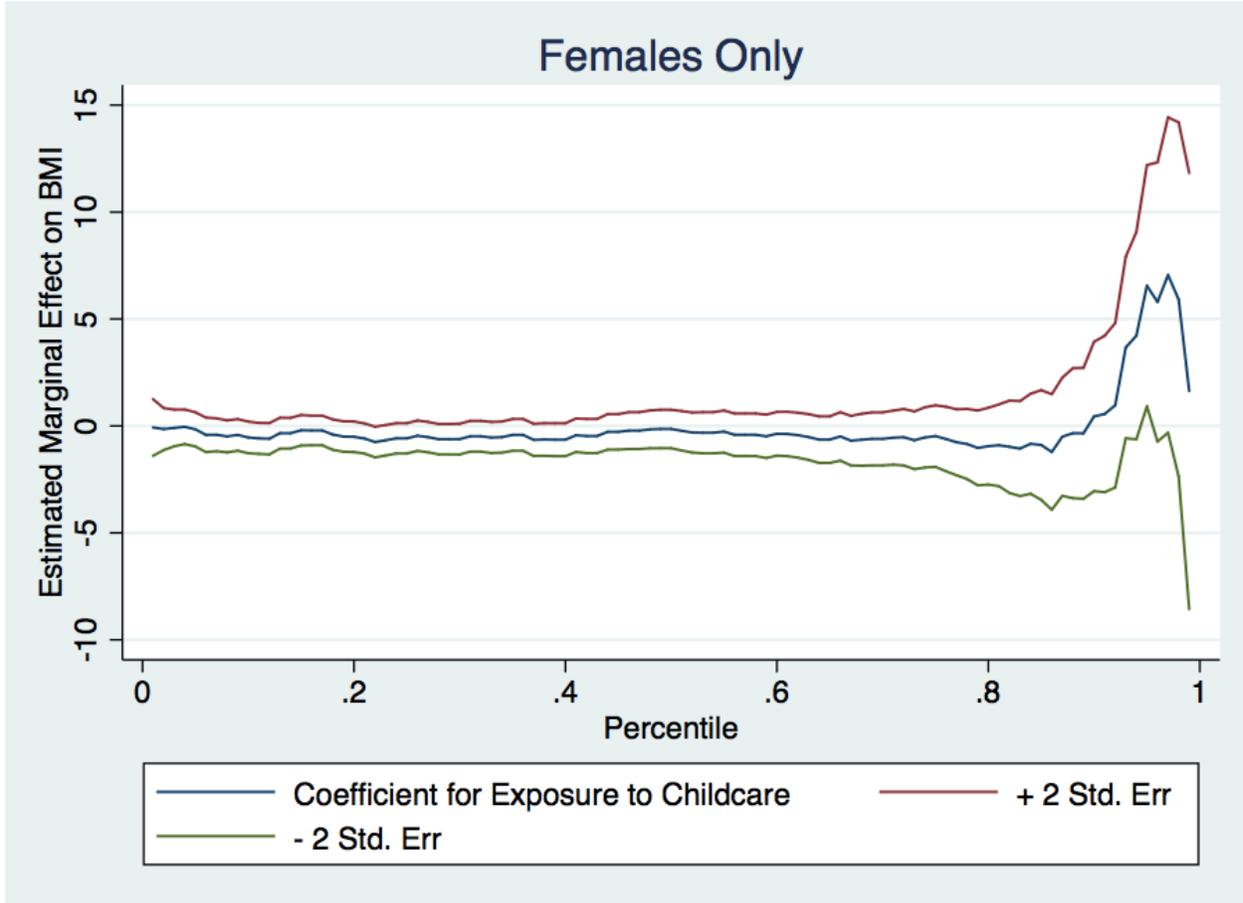


Figure 4: Pre-Policy Distribution of BMIs for 12 to 14 year-olds in Quebec

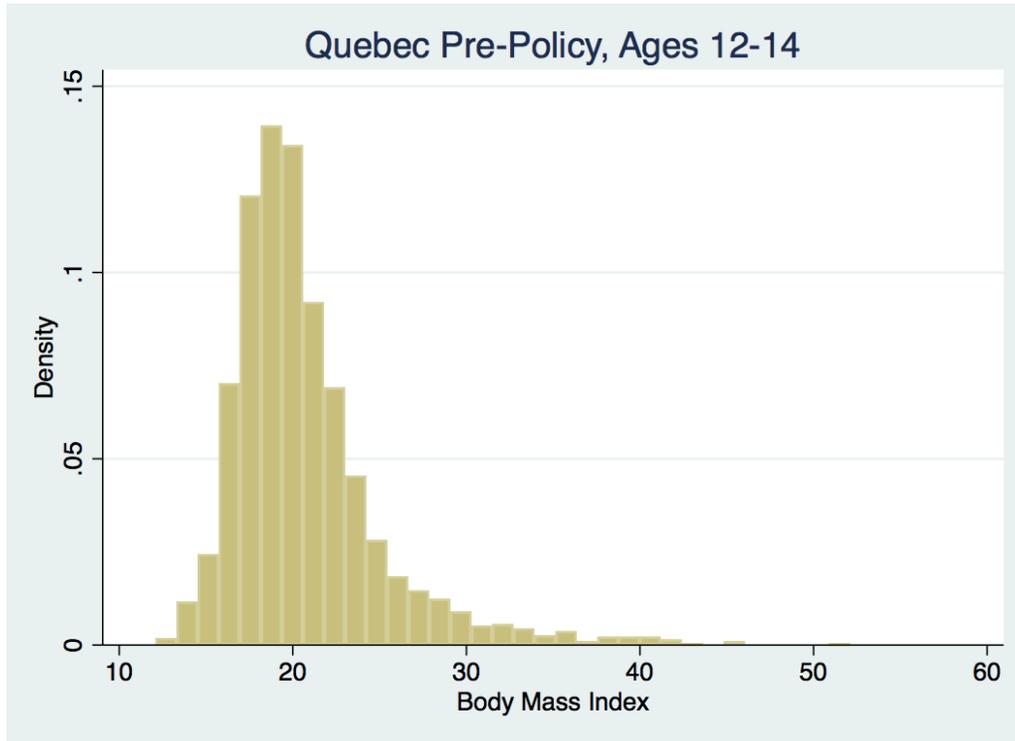


Figure 5: Post-Policy Distribution of BMIs for 12 to 14 year-olds in Quebec

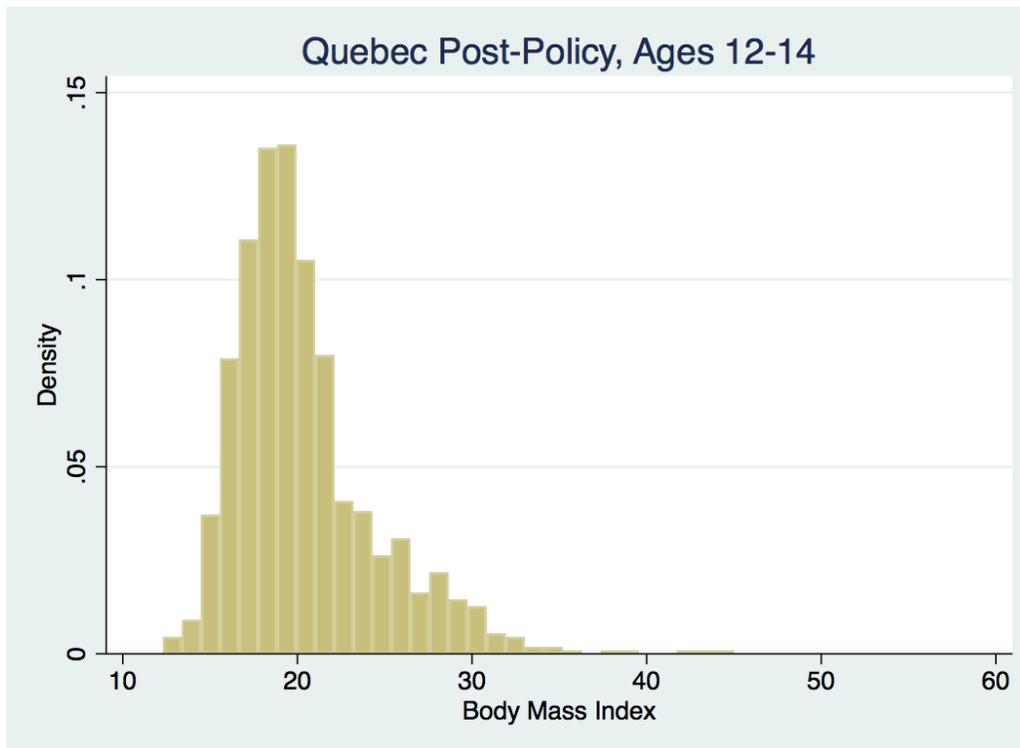


Figure 6: Pre-Policy Distribution of BMIs for 12 to 14 year-olds in the rest of Canada

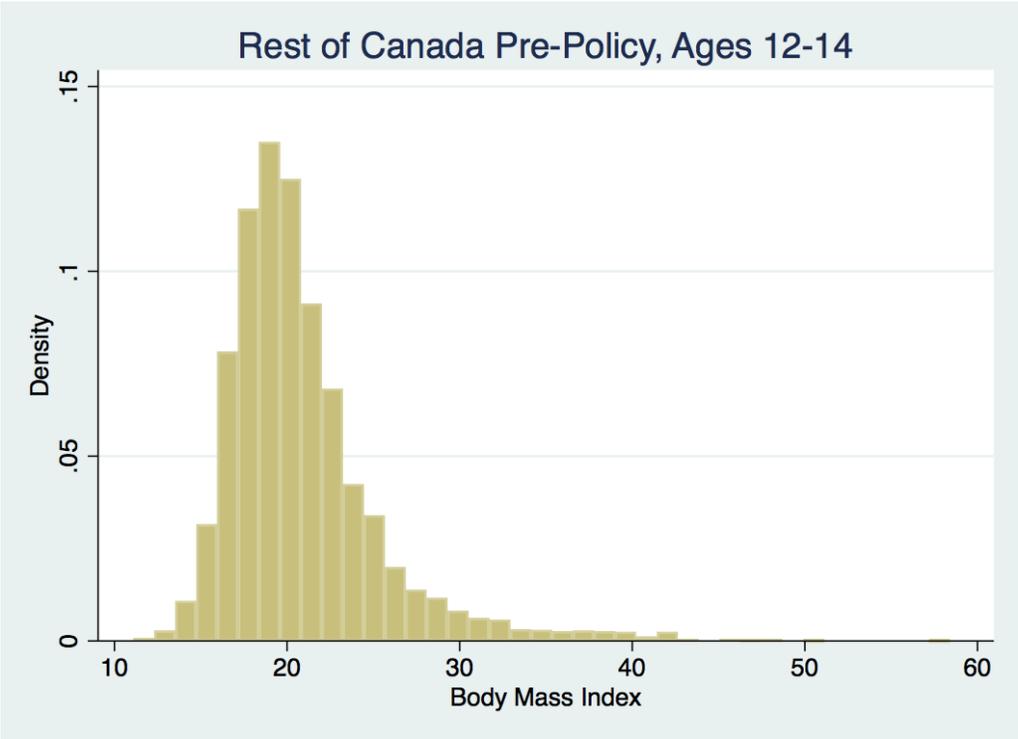
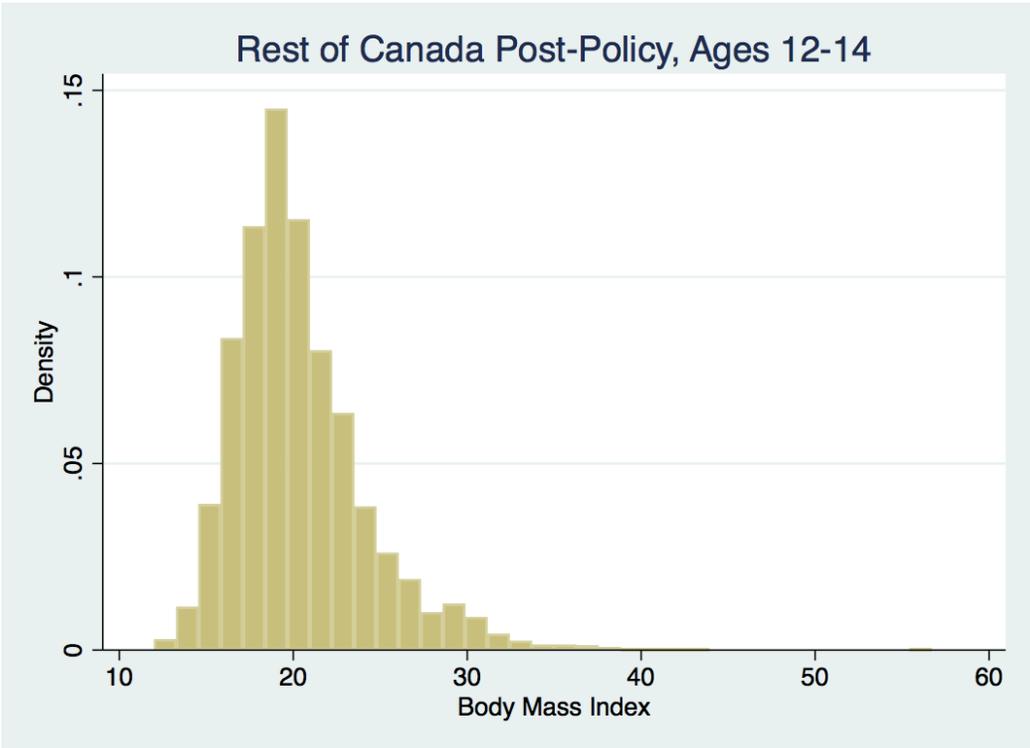


Figure 7: Post -Policy Distribution of BMIs for 12 to 14 year-olds in the rest of Canada



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Table 1: Descriptive Statistics

Demographic/ Control Variable	Quebec		Rest of Canada	
	2001,2003	2014,2016	2001,2003	2014,2016
Household Income	2.592 (1.242)	3.320 (1.439)	2.856 (1.285)	3.571 (1.413)
Children aged 6-11 in house	0.488 (0.500)	0.463 (0.500)	0.501 (0.500)	0.449 (0.497)
Children aged <5 in house	0.100 (0.296)	0.132 (0.338)	0.115 (0.319)	0.114 (0.318)
House owned by family	0.776 (0.417)	0.815 (0.389)	0.814 (0.389)	0.822 (0.382)
Single-Parent Family	0.224 (0.417)	0.195 (0.397)	0.175 (0.380)	0.187 (0.390)
Child has asthma	0.123 (0.329)	0.105 (0.306)	0.140 (0.347)	0.102 (0.302)
Child has diabetes	0.002 (0.040)	0.003 (0.055)	0.002 (0.049)	0.006 (0.079)
Someone smokes regularly in house	0.412 (0.492)	0.138 (0.345)	0.281 (0.449)	0.088 (0.283)

1. Each number represents the average for each variable. The standard deviation is below in brackets.
2. With the exception of household income, each variable is a dummy variable.
3. Household income refers to household income ranges.
 - 1: Household income: < \$15,000
 - 2: Household income: \$15,000-\$29,999
 - 3: Household income: \$30,000-\$49,999
 - 4: Household income: \$50,000-\$79,999
 - 5: Household income: >=\$80,000

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Table 2: Estimates of Triple Difference Model of BMI

Control Variable	Coefficient (Standard Error)
Group exposed to the universal childcare	0.101 (0.333)
Post-implementation dummy variable	0.321 (0.131)**
Age-exposure dummy variable	-3.429 (0.110)***
Dummy variable for being in Quebec	-1.277 (0.311)***
Interaction term between year and age	-0.510 (0.154)***
Interaction term between year and province	0.162 (0.271)
Interaction term between age and province	0.538 (0.220)**
Male	0.618 (0.062)***
Household Income: \$15,000-\$29,999	-0.159 (0.201)
Household Income: \$30,000-\$49,999	-0.066 (0.188)
Household Income: \$50,000-\$79,999	-0.339 (0.183)**
Household Income: >= \$80,000	-0.457 (0.181)**
Own their own home	-0.309 (0.107)***
Single-Parent Family	0.125 (0.091)

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Has a sibling aged<12	0.015 (0.266)
Someone in household smokes regularly	0.602 (0.084)***
Has asthma	0.615 (0.104)***
Constant	24.681 (0.295)

- * Statistically significant at the 10% significance level
- ** Statistically significant at the 5% significance level
- *** Statistically significant at the 1% significance level

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Table 3: Triple Difference Estimates for Various Subsamples

Group	Coefficient (Standard Error)	Observations	Range of BMI	Mean BMI
Males	0.400 (0.429)	11,036	11.1-58.4	20.689
Females	-0.012 (0.484)	9,842	11.4-58.4	20.740
Household Income: <\$30,000	0.278 (0.373)	3,152	11.4-56.2	20.756
Household Income: \$30,000-\$79,999	0.857 (0.539)	8,590	11.1-52.1	20.592
Household Income: >=\$80,000	-0.357 (0.468)	9,136	11.4-50.2	20.366
Single-Parent Family	-0.507 (0.667)	4,109	11.4-58.4	20.856
Two-Parent Family	0.467 (0.371)	16,769	11.1-58.4	20.600
Without 2015-2016	0.519 (0.473)	29,327	11.1-58.4	22.762
Clustered Errors	0.101 (0.192)	36,441	11.1-58.4	22.769
Male, Single-Parent Family	-0.204 (0.902)	2,196	11.4-56.7	20.949
Male, Two-Parent Family	0.666 (0.495)	8,840	11.1-58.4	20.539
Female, Single-Parent Family	-0.780 (1.003)	1,913	11.8-58.4	20.773
Female, Two-Parent Family	0.227 (0.553)	7,929	12-52.1	20.663

* Statistically significant at the 10% significance level
 ** Statistically significant at the 5% significance level
 *** Statistically significant at the 1% significance level

Table 4: Effect of Quebec Family Policy on Smoking Behaviour

Dependent Variable	Coefficient (Standard Error)	Observations
Ever smoked 1 cigarette	-0.107 (-3.21)***	18496
Ever smoked ≥ 100 cigarettes (approx. 5 packs)	-0.007 (-0.26)	20982
Daily Smoker	0.003 (0.12)	20988
Occasional Smoker	0.227 (0.553)	20988

* Statistically significant at the 10% significance level

** Statistically significant at the 5% significance level

*** Statistically significant at the 1% significance level

Note: Each coefficient estimate is from a different triple difference-in-difference regression using the listed dependent variable.