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A Simple Recipe: the Effect of a Prenatal Nutrition Program on Child Health at Birth

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A Simple Recipe: the Effect of a Prenatal Nutrition Program on Child Health at Birth

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Abstract

We study the impact of a Canadian prenatal nutrition program on child health at birth. The objective of the "*oeuf-lait-orange*" (eggs-milk-oranges) (OLO) program is to reduce the incidence of prematurity and low birth weight by providing a specific food basket and nutritional guidance to pregnant women in situations of poverty. Our identification strategy exploits exogenous variations in access to the program caused by the progressive implementation of the program. Using detailed administrative birth records for over 1.5 million newborns, we find that the program significantly increased the birth weight of treated children by 69.8 grams and reduced the probability of low birth weight by 3.6 percentage points. We also find that prematurity decreased by 2.2 percentage points and gestation increased by 1.5 days, but these effects are generally not significant. While the cost of the program is equivalent to the comparable United States Supplemental Nutrition Program for Women, Infants and Children (WIC), the food basket is simpler and the gains on birth weight are larger.

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Keywords: Child health at birth, Public program, Prenatal nutrition

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1 Introduction

Recent research suggests that investments made in utero may be less costly and more effective than interventions after birth, including those made in early childhood (Doyle et al., 2009). A number of recent studies have investigated the association between the United States Supplemental Nutrition Program for Women, Infants, and Children (WIC) and children's health at birth, but rarely document its cost effectiveness. Generally, studies on WIC suggest that children of mothers participating in the program have higher birth weight and reduced likelihood of low birth weight (LBW) compared to children of nonparticipating mothers. More specifically, the estimated impacts of WIC on birth weight ranges from 29 to 180 grams.[1]

This paper investigates the impact of the "oeuf-lait-orange" (eggs-milk-oranges) (OLO) program on child health at birth in Québec (Canada's second-largest province). This program shares important similarities with WIC, yet has a number of distinctive features. Both OLO and WIC emerged following the seminal work of Higgins (1976)[2] and offer both food packages and some nutrition counselling to disadvantaged pregnant women in order to reduce the incidence of prematurity and LBW among these mothers. While the costs of the programs are comparable (about \$49 per month, Bitler and Currie, 2005), the content of the food package is very different. OLO provides milk, orange juice, eggs and vitamin tablets in specific quantities to ensure that pregnant mothers consume essential nutrients for fetal development on a daily basis. WIC varies by state and allows mothers to choose from a wide variety of food items such as enriched cereals, cheese, soy-based beverages, fruits and vegetables (fresh, frozen, canned or dry). As such, the content of the food packages provided by WIC depends on both the mother's choice and her area of residence, while the content is uniquely defined under OLO since all mothers receive the same package. This study therefore estimates the impact of a unique, tightly defined, low-cost prenatal nutrition program on

[1] See for example Rossin-Slater, 2013; Hoynes, Page and Stevens, 2011; Gueorguieva, Morse, and Roth, 2008; Figlio, Hamersma and Roth, 2009; Bitler and Currie, 2005; Joyce, Gibson, and Colman, 2005; Kowaleski-Jones and Duncan, 2002; Joyce, Racine and Yunzal-Butler, 2008.

[2] Higgins et al. (1989) attributes the idea of supplemental food programs during pregnancy to Jeans et al. (1955).

infant health.

To our knowledge, this paper is the first to estimate the impact of in utero exposure to a nutrition program on birth outcomes outside the United States, using a quasi-experimental approach with multiple treatment groups.[3] With a long-standing, comprehensive, universal health care system and a large safety net for families (social assistance and child benefits), the Canadian context resembles that of many European countries but differs from the United States context. While WIC may serve as a gateway to Medicaid (Rossin-Slater, 2013) in the United States, participation in OLO has no impact on social assistance or access to health care services for mother or child in Canada.

The OLO program was deployed by public local community service centers (LCSCs). The mother's place of residence and poverty status strictly determines whether and when she is eligible for the program. We exploit the historical and geospatial progressive implementation of the program throughout the province to identify the overall impact. This approach is similar to that of Hoynes et al. (2011), who studied the impact of the WIC program by exploiting variations in WIC sites at the county level between 1974 and 1979.[4] Using county-level variation avoids the bias caused by non-random selection into treatment encountered in previous studies. Hoynes et al. (2011) found that the average birth weight of participating counties increased by 2.3 grams, but found no effects on the incidence of LBW. When they scaled their results by an estimated 8 percent participation rate for pregnant women in 1998, the average impact on the birth weight of children of treated mothers was 29 grams. When they focus on pregnant women who are the most likely eligible (low level of education), they find both an increase in birth weight and a decrease in the probability of LBW.

Compared to their study, we estimate the impact of the program not only on birth weight (in grams) and the probability of LBW (less than 2,500 grams), but also on gestation (in

[3]A brief summary of the Canadian literature on prenatal nutrition programs is provided in our Web Appendix.

[4]The same research design was used to independently estimate the impact of the Food Stamp Program (FSP) during the 1960s and early 1970s (Almond, Hoynes and Schanzenbach, 2011) with similar results for average birth weight and incidence of LBW. By 1975, all counties had implemented FSP, and by 1978 changes in FSP led to an increase in the take-up rate. Hoynes et al. (2011), in their study of WIC, included an indicator for availability of FSP in the county-year since their observation period (1972 to 1982) overlaps with that of the FSP implementation.

weeks) and the probability of delivering preterm (less than 37 weeks). Our observation period is more recent (1986 to 2008 compared to 1971 to 1982), and we have exact figures on the number of treated mothers for certain years during the implementation to infer the treatment-on-the-treated (TOT).

For this study, we use the birth records of every child in the province between 1986 and 2008. Not only can we observe the early health outcomes (birth weight and gestational age) of over 1.5 million newborns, but also the mother's place of residence, age, education, language and marital status – all measured at the time of birth. We also have information on the child's gender, birth order, multiple birth indicator and month of birth. We find that the program increased the birth weight of treated children by 69.8 grams on average and reduced the probability of being LBW by 3.6 percentage points, but had no significant effect on gestation measured in weeks. The long-term effects of the program further suggest an increase in birth weight of 121.6 grams and a reduction in LBW of 4.1 percentage points. These effects are larger than comparable estimates for WIC. In sum, this paper reinforces the conclusions of WIC studies but points to differences that might explain the larger impacts of OLO.

Finally, our cost-benefit analysis suggests that a large part of the program costs are recovered through neonatal cost savings. Accounting for additional gains from increased birth weight shows that the benefits outweigh the costs.

The rest of the paper is organized as follows. Section 2 provides information about the program and health services in Québec. Section 3 describes the data sets and the implementation of the program. Section 4 discusses the identification strategy, and section 5 presents the main results and investigates the mechanisms. Section 6 presents a simple cost-benefit analysis, and section 7 concludes.

2 The OLO program

Pregnant mothers who are disadvantaged because of undernourishment, thinness, unfavorable past pregnancies, closely spaced pregnancies, or serious emotional or social problems, as well as lack of support, generally have smaller babies. Inspired by the Higgins method,[5] the OLO program provides nutrition counselling along with protein and calorie corrective measures to reduce the incidence of LBW among disadvantaged mothers. More specifically, mothers participating in the program receive per day one egg, one liter of milk, 125 ml of orange juice and a prenatal vitamin tablet. The frequency and the type of counselling vary by LCSC, but generally a minimum of one counselling session per month is offered.

The program first started in the early 1980s through a pilot project financed by the Ministry of Health and Social Services (MHSS) in the LCSC of Matane semiurban region, and the LCSC of St-Henri, a Montreal neighborhood with a high level of poverty. At the time, only milk was provided to disadvantaged pregnant mothers. The program, as described above, was initiated in the LCSC of Valleyfield in 1983. At the beginning of the program, these free packages included either the goods themselves or vouchers to be redeemed at local participating food stores. According to our matched data set, in 1986, 17 (out of 163) LCSCs offered these free packages along with nutrition counselling (see Table 1). Over the years, a number of LCSCs joined the OLO program and, today, almost every LCSC offers the program. LCSCs provide both preventative and curative services and are one of the entry points into the free public health care system in Québec. There are 163 LCSC territories, once you exclude those located on First Nations reserves. A variety of professionals work in LCSCs (e.g., physicians, nurses, occupational therapists, nutritionists and social workers), but the OLO program mainly relies on nurses and nutritionists.

The OLO program is targeted. Only mothers below Statistics Canada low-income cutoffs (LICOs) are eligible. These income thresholds depend on family size and essentially measure the point at which families are expected to spend 20 percentage points more than the average family on food, shelter and clothing. Mothers are not automatically signed up for the program and must present themselves at their local LCSC to register for the program. Eligibility is determined during the first visit to the LCSC, and mothers typically start receiving the food supplements and nutrition counselling by the 12^{th} to 15^{th} week of gestation.

[5]In an experimental setting, Higgins (1976) showed the benefit on infant health of providing food and nutrition counselling to pregnant women in situations of poverty.

Mothers residing in adjacent LCSCs that had not yet implemented the program were not eligible for the program. In sum, the mother's place of residence and poverty status strictly determines whether and when she is eligible for the program. During our observation period, approximately one in every thirteen babies were treated by the program through their mothers.

3 Data sets and program implementation

Since the OLO program was implemented by LCSCs, and because LCSCs serve specific geographic areas linked to the postal codes of residences of the population served, we are able to determine the geographic progression of the program using the LCSCs geographical territories data set in combination with the historic implementation of the OLO program data set. The LCSCs geographical territories data set contains the association between the LCSCs and the residential postal codes served by each LCSC. This data set is the property of the MHSS. The historic implementation of the OLO program data set contains both historic records of implementation provided by the OLO Foundation and data collected by the authors directly from the LCSCs.

Figures 1 and 2 were constructed using these data sets and show the progression of the program's implementation throughout Québec and the city of Montréal, where a majority of the Québec population lives. Together, these figures show that the greater part of the implementation took place between 1986 and 1998 and that the progression was not concentrated in specific geographic areas within the province.

The birth registry data set of the Institut de la Statistique du Québec (ISQ) contains administrative data on all live births in the province of Québec from 1986 to 2008. We can observe not only the early health outcomes (birth weight and gestational age) of over 1.5 million newborns but also the mother's postal code, age, education, language and marital status at the time of the birth. Since the average number of households served by a postal code is approximately 19, the postal code allows us to precisely geolocate mothers at the time of birth and accurately determine if the OLO program was available to them while they were pregnant. This data set also contains information on the child's gender, birth order, multiple birth indicator and month of birth.

We restrict our attention to children born in LCSC territories for which we have complete historic information regarding the OLO program (157 LCSCs out of 163).[6] We also exclude children whose birth weight and gestation length are missing, along with children for which the mother's age, years of education, place of birth or primary language at home are missing.[7] Based on the medical perception of medical viability in the 1990s (Alexander et al., 2003; Sanders et al., 1995), children whose birth weight was under 500 grams or whose gestation was under 25 weeks of gestation are excluded in our analysis.[8] Finally, following the literature, multiple births are excluded from our main sample.[9] Multiple births are very distinct in terms of birth outcomes and have been on the rise since the introduction of in vitro fertilization (IVF). Nonetheless, we test the robustness of our results to their exclusion in Section 5. Table 2 presents the summary statistics of our main sample.

The top panel of Table 2 shows the outcome variables (birth weight and gestation), while the bottom panel shows the control variables. The first column presents the birth summary statistics for the entire sample, while columns 2 to 9 show the statistics by subperiod and by LCSC's participation status during the period in which the program is in expansion. Note that we do not observe which mothers were participating in the OLO program within an LCSC. We can only determine eligibility based on the mother's postal code and the LCSC's participation status. As such, all births within an LCSC's territory are classified either as being eligible for the OLO program or not eligible. Furthermore, if an LCSC participates in the program at one point during the period, all births during that period are classified as being in the OLO program. This allows us to compare the statistics of births within LCSCs already in the program or joining the program during the observation period compared

[6] This restriction implies that we use 93.3 percent of the birth records.

[7] These restrictions imply that we discard 8 percent of the birth records, of which maternal education accounts for 6 percent and maternal place of birth accounts for 1 percent. The birth weight distribution for observations with missing data is extremely similar to the rest of the sample. This suggests that our results are unlikely to be impacted by these restrictions.

[8] This represents less than 0.2 percent of our observations. Including these children slightly increases the estimated impact of the OLO program on each of the outcomes that we use. These results can be obtained from the authors on request.

[9] This exclusion represents, on average, 2 percent of all our observations.

to LCSCs not yet in the program. Since LCSCs with more at-risk mothers may have an incentive to join the program earlier, comparing the statistics by participation over several periods helps us assess the importance of such selection for treatment.

If we compare the mean value of the control variables by participation status within a period, we do not find evidence of LCSCs with more disadvantaged mothers joining the program earlier. For example, looking at the 1986–1989 period, we see that the mean value of mother's age and years of education is almost identical for births in the territories of LCSCs participating in the OLO program and births in LCSCs not participating in the program. This is also true during other periods, except for the last one. Between 1998 and 2001, compared to mothers in OLO LCSCs, mothers in LCSCs not yet in OLO are generally younger, slightly less educated, and more likely to be single, French speaking and born in Québec. During that period, less than 2 percent of all births were in LCSCs not yet offering the OLO program. This pattern does not support the idea that disadvantaged areas received the program first. Nonetheless, we test in Section 5 the robustness of our results to the exclusion of LCSCs never joining the program during our observation period. Below, we also use our empirical strategy to further check the selection pattern.

Looking at the outcome variables, we find that birth weight increases over time (from 3,335 to 3,397)[10] while gestation is fairly stable and even slightly decreasing (from 39.2 to 39.0). Table 2 shows that both LCSCs participating and not participating in the program follow similar trends. The increase in birth weight is slightly larger in LCSCs participating in the program (+73 versus +29). While this suggests a positive impact of the OLO program, clearly the increase is not restricted to LCSCs participating in the program. Technological changes and modifications to other safety net programs that have an impact on disadvantaged pregnant women likely contributed to the increase in birth weight over time. The empirical strategy allows us to isolate the impacts of underlying trends not due to the OLO program.

[10] These are the average birth weights for all observations for the 1986–1989 period versus the 1998–2001 period.

4 Empirical strategy

We exploit the progressive geographic implementation of the program in a differences-in-differences framework, where LCSCs not yet participating in the program serve to control for underlying trends in the outcome variables. The empirical model is as follow:

$$Y_{ict} = \alpha + \delta OLO_{ct} + \gamma X_{it} + \vartheta_c + \rho_t + \varepsilon_{ct} \tag{1}$$

where Y_{ict} is the outcome variable (e.g., birth weight) of child i in LCSC c in time t. The term OLO_{ct} equals 1 if the LCSC is running the OLO program at time t, and 0 otherwise. The terms ϑ_c and ρ_t are fixed effects for LCSC and year. The LCSC fixed effects account for regional permanent differences, while the fixed effects for year account for underlying trends in the outcome variables which could result from technological progress during the period or changes to programs affecting disadvantaged pregnant women (e.g., cash transfers). The estimated impacts of the program are unbiased if there are no LCSC-level variations that are correlated with the implementation of the program and influence infant health at birth. To verify the robustness of our results, we also control for cofounding factors, including child and family characteristics X_{it}. More specifically we include the following controls: male (dummy), maternal age categories (16 or less, 17 to 35, above 35 omitted), years of education dummies, months of birth[11] dummies, birth order (first birth, second birth, third or more omitted), language at home dummies (French, English, other omitted), and the mother's place of birth dummies (Québec, Rest of Canada–RoC, other omitted).

In some specifications, we also have the OLO_{ct} dummy interact with years in the OLO program dummies to allow for a progressive impact of the program. Indeed, one can expect that it takes a few years for a LCSC to reach 100 percent of its targeted population. The empirical model becomes as follows:

$$Y_{ict} = \alpha + \delta_1 OLO^1_{ct} + \delta_2 OLO^2_{ct} + \delta_3 OLO^3_{ct} + \delta_4 OLO^4_{ct} + \delta_5 OLO^5_{ct} + \gamma X_{it} + \vartheta_c + \rho_t + \varepsilon_{ct} \tag{2}$$

[11] Season of birth has been shown to affect birth outcomes (Currie and Schwandt, 2013).

where OLO_{ct}^1 equals 1 if the LCSC c is running the OLO program for the first year in time t, and 0 otherwise, and the same logic holds for OLO_{ct}^2 to OLO_{ct}^4 while the term OLO_{ct}^5 equals 1 if the LCSC c is running the OLO program for the fifth year or more in time t, and 0 otherwise. We cluster on LCSC and report cluster-robust standard errors.

Four outcome variables are used: birth weight, LBW dummy (equal to 1 for birth weights under 2,500 grams), weeks of gestation, and preterm dummy (equal to 1 for gestation periods of fewer than 37 weeks). As mentioned above, birth weight is a key indicator of health at the time of birth and has been shown to influence health and socioeconomic outcomes in later life. Gestation is also an important measure as it is closely related to birth weight. Furthermore, a number of permanent health conditions may result from preterm birth.

5 Results

Before proceeding to the results, we first check that the program rollout is orthogonal to changes in maternal characteristics. In theory, mothers could change their area of residence to become eligible for the program, so we want to make sure that selective manipulation of treatment status is not a serious concern. Table 3 shows the estimates of our baseline model (1) on maternal characteristics. In specification 1, only the fixed effects are included, while specification 2 also includes our main control variables (except those used as the dependent variable). Clearly, the program is not correlated with maternal characteristics as none of the estimates are significant once the controls are included.

Figure 3 shows the evolution of maternal characteristics over time, where $t = 0$ marks the year prior to the implementation and $t = 1$ marks the implementation year. Since the rollout takes place over many years, we need to aggregate multiple implementation periods. First, we aggregate the data by implementation year. For example, LCSCs joining the program in 1996 are aggregated together to form the OLO group, and all other LCSCs (those who joined prior to or after 1996) are aggregated together to form the control group. This gives us the evolution of the characteristics over time for LCSCs joining in 1996 versus all others, with 1996 being set to $t = 1$. We then repeat this exercise for each year between 1986 and

1999. Second, we aggregate over all implementation periods. As a result, in Figure 3,[12] each LCSC is eventually included in the control group since each LCSC eventually serves to control for underlying trends in our empirical approach. We find that the trends in maternal and infant characteristics are extremely similar and that there are no jumps around the discontinuity point. Maternal age and years of education increase over time in both groups. The percentage of French speaking mothers and the percentage of female infant is stable in both groups, while the percentage of Québec born mothers and the percentage of first birth decreases in both groups. The percentage of Québec born mothers is higher in OLO LCSCs at first, but eventually becomes identical in both groups. This variation is, however, not significant as shown in Table 3. In sum, our control group captures well the evolution of maternal and infant characteristics over time, and there is no evidence of selection into treatment.[13]

Our identification strategy also relies on the assumption that control and treated LCSCs share a common trend in the outcome variables. Figure 4 shows the descriptive evolution of mean birth weight, LBW, gestation and preterm. Prior to the program, birth weight is on average smaller in treated LCSCs but follows an upward trend similar to that of control LCSCs. As of $t = 1$, the gap between treated and control LCSCs is almost completely eliminated, and then vanishes as of $t = 2$. This suggests a progressive impact of the program. The effect on birth weight is mirrored by a decreased probability of delivering an LBW baby. Again the trends prereform are similar and may even suggest a slight increase in the gap between the two groups. As of $t = 1$, the gap is completely eliminated. For gestation (measured in weeks), both the treatment and control groups show a slightly negative trend over time. There are no apparent significant differences suggesting a positive or negative impact of the program. This is also true for the probability of delivering preterm. This is not surprising given that gestation is measured very imprecisely (in weeks) and that the apparent impact on birth weight is relatively small. Indeed, from Figure 4, we could expect

[12] We give the same weight to each implementation cohort even if some cohorts include many more LCSCs than others to ensure that each fiscal year is weighted equally in any given t. We aggregate cohorts with fewer than three LCSCs to avoid over representation of small cohorts.

[13] This is reasonable given the cost of moving compared to the monetary value of the OLO program (about $543 in 2008).

the intention-to-treat (ITT) to be about 10 grams. We discuss the TOT below. Together, these figures suggest that our empirical approach is well suited to isolate the impact of the OLO program from the underlying evolution of the outcome variables.

Birth weight and low birth weight (LBW) Table 4 presents the estimates of the impact of the OLO program on birth weight and LBW (top panel), and on gestation and the probability of delivering preterm (bottom panel). For each panel, we first present the average impact of the program (δ) estimated using model (1). Then we present the progressive impact of the program (δ_1 to δ_5) estimated using model (2). In columns 1 and 4, we include year dummies (ρ_t) and LCSC dummies (ϑ_c) only, while we additionally include the child and family characteristics (X_{it}) in columns 2 and 5. In columns 3 and 6, we add LCSC specific trends. First, we estimate both models using the full sample to which we have access that covers all births between 1986 and 2008 (Table 4). Second, we estimate both models using only birth records between 1986 and 2004 (Table A.1 in Appendix). Since most of the OLO program implementation took place between 1986 and 1999, this shorter period allows a maximum of 5 years post implementation for the last LCSCs joining the OLO program. We do this to ensure that our larger data set is not driving our results.

Improving the birth weight outcome is one of the primary objectives of the OLO program. It is expected that, through improved proteins and caloric intakes, babies of disadvantaged mothers should attain a more desirable weight. Since we do not identify which babies are treated by the program and which are not, Table 4 reports the ITT effects of the program. In other words, it reports the average effect of the program across all births as opposed to the specific effect of the program on babies of mothers participating in the program. To recover TOT effects, we multiply the estimated impacts by a factor of 13.16, which is the inverse of the percentage of treated births in 1995. The OLO Foundation provided the information on the number of babies born under the OLO program between 1993 and 1995, and between 2006 and 2008. The percentage of treated babies (through their mothers) in the LCSC who joined the OLO program during our observation period is 4.8 percent in 1993 and increases to 7.6 percent by 1995. By 2008, it is 8.0 percent, with a high of 9.0 percent in 2006. Since 1995 marks the middle point of our main observation period, we assume that 7.6 percent is likely to be the average number of treated babies during our sample period, with the percentage being smaller prior to 1995 and slightly higher afterward as the program progresses. Therefore, the average treatment effect is weakly significant and suggests an increase in birth weight of the order of 76.2 grams (column 1: 5.636/0.076) if we do not control for child and family characteristics, and 69.8 grams (column 2: 5.306/0.076) if we do. Since the composition of LCSCs may have changed over time, it appears important to control for child and family characteristics. Restriction to births prior to 2005 leads to comparable results: 75.1 and 69.9 grams ($p < 0.05$) for our specifications without and with controls respectively. Finally, the inclusion of LCSC specific trends is in line with our previous results and suggests an increase of 75.9 grams ($p < 0.01$,column 3: 5.768/0.076).

The progressive impacts suggest that during the first year the estimated effect (δ_1) is positive but not significant. As time progresses the impact increases and eventually reaches 121.6 grams (column 2: 9.239/0.076) when we control for X_{it} (and 142.8 grams (column 3: 10.851/0.076) when we include LCSC specific trends). These effects are not only large (larger than those estimated by Hoynes et al., 2011, for WIC), they are also significant ($p < 0.05$). One interpretation is that the OLO program takes time to reach its target population. The process by which pregnant women are referred to the program is not automated. Doctors and health practitioners may refer pregnant women to the program, and pregnant women may also directly contact the administrators of the program in their LCSCs. It is therefore highly plausible that in the first few years, only a small fraction of eligible pregnant women participated in the program. At the end of the observation period (year 2008), the OLO Foundation estimates that most of its target population was being served across the province.

We now turn to the probability of delivering an LBW baby (under 2,500 grams). The results suggest that the program decreases the probability of having an LBW baby by 0.27 percentage point across the entire population, or that participation in the program decreases the probability by 3.6 percentage points for the treated group (column 6: $-0.270/0.076$). This effect is not only positive but highly significant, and holds across all specifications. Again the progressive effects suggest that in the first year the program has a smaller effect, but eventually reaches 0.30–0.32 percentage point, which implies that participating pregnant mothers have a probability of delivering an LBW baby that is 4.1 percentage points lower (column 6: $-0.315/0.076$). Since the 2,500 grams threshold marks a point where the likelihood of having birth defects leading to chronic health conditions is greatly reduced, these findings have potentially important implications for the health care system. We come back to these when we conduct the cost-benefit analysis.

Gestation and preterm Increasing the number of weeks of gestation also contributes to improving the health of the newborn. The bottom panel of Table 4 presents the ITT effects of the OLO program on weeks of gestation (left panel) and the probability of delivering preterm (right panel). These results suggest that the program did not have any significant effects on gestation on average (δ) or in the first five years (δ_1 to δ_5). The TOT after five years, once we include controls, is 0.21 weeks (column 2: $0.016/0.076$), which is about 1.5 days. This effect is small but comparable to other findings in the WIC literature. Once we include the LCSC specific trends this effect, however, becomes virtually zero. One important limitation relates to the accuracy and precision of the gestation measure available to researchers. Not only is gestation measured in weeks, it is measured rather imprecisely. Therefore, it remains possible that the supplemental nutrition program increases gestation by a few days, but the available measures prevent us from detecting this effect.

We now look at the impact of the program on the probability of delivering preterm (under 37 weeks). We find that the probability decreases following the introduction of the program but the effects are generally not significant. We find that the probability of delivering preterm decreases by between 0.17–0.18 percentage point (columns 5 and 6) across the entire population, or that participation in the program decreases the probability of delivering preterm by between 2.2–2.4 percentage points for the treated group. Looking at the progressive effects, we find that the effect is generally increasing over time, but the pattern is not stable.

Robustness checks In this section, we test the robustness of our main results. For convenience, Table 5 presents the estimates from our benchmark specification (3) in the first column of each of our four outcomes.

To further address the selection concern we additionally include postal codes fixed effects (specification 4). Given that postal codes represent extremely small geographical areas (19 households on average), these can account for a number of fixed characteristics of households within the same postal code. We find that our results are generally comparable. We find a positive impact on birth weight of 82.3 grams (column 2: 0.016/0.076) and a reduction in the probability of LBW of 3 percentage points (column 6: $-0.228/0.076$). On gestation, the results are slightly more significant, with a positive impact on gestation of 0.5 weeks or 3.7 days (column 2: 0.013/0.076) and a reduction in preterm births of 3.1 percentage points (column 6: $-0.236/0.076$).

We mentioned above that some LCSCs never joined the OLO program during our observation period. Mothers in these LCSCs were generally younger, less educated and more likely to be a single parent. To ensure that our results are not driven by the inclusion of this group, specification (5) excludes all births in LCSCs that never joined the OLO program. Again, our benchmark results are comparable to these. We find a positive impact on birth weight and a reduction in the probability of LBW. On gestation, we again find no significant effects, but the coefficients are of similar magnitude. The overall impact on preterm birth is also comparable.

Finally, our last specification (6) includes multiple births. Our main results are comparable whether we include multiples births (6) or not (3). They are slightly smaller in magnitude when multiple births are included.

In sum, we find that our results are robust to the inclusion of postal code fixed effects, the exclusion of non participating LCSC, or the inclusion of multiple births.

Distributional effects While our main results are able to capture a shift in the average birth weight and around the 2,500 grams threshold, refining our understanding of the distributional impact of the program is essential to estimating the cost benefits of the program.

Table 6 shows the impact of the program at various points of the birth weight distribution: under 750 grams; 750 to 999 grams; 1,000 to 1,499 grams; 1,500 to 1,999 grams; 2,000 to 2,499 grams; and more than 2,499 grams. The coefficients across one row sum to one since a reduction in one part of the distribution must be paralleled by an increase somewhere else in the distribution. Our results suggest a net positive gains in the percentage of babies reaching the fair weight threshold of 2,500 grams. In each other birth weight category, we find a net negative impact of the program. This implies that the program led to a shift of the entire birth weight distribution, but with much smaller impacts in the left tail of the distribution.

More specifically, we find that the program reduced the number of babies (in the overall population) weighing under 750 grams by 0.014 percentage point and the number weighing 750 to 999 grams by 0.016 percentage point. There are also 0.024 percentage point fewer babies of 1,000 to 1,499 grams and 0.053 percentage point fewer babies of 1,500 to 1,999 grams. The vast majority of the net positive gain of 0.27 percentage point in the number of babies reaching at least 2,500 grams comes from a reduction of 0.164 percentage point in the number of babies weighing 2,000 to 2,499 grams. These effects show that the OLO program mainly had an impact on infants who would, without the program, have had a birth weight between 2,000 and 2,499 grams but who – thanks to the program – reached the fair weight threshold of 2,500 grams. It also shows that much smaller infants (below 1,000 grams) also benefited from the program and reached higher birth weights.

Table 7 shows the distributional impact of the program on gestation. We find that the program reduced the probability of delivering preterm. This effect is mirrored by an increase in the probability of carrying a baby to term (37 to 41 weeks). Interestingly, although not significant, the program appears to have also reduced the probability of carrying a baby post-term (42 weeks or more), and slightly reduced the probability of extreme immaturity (under 28 weeks).

Discussion We find strong evidence of a positive impact of the OLO program on birth weight and a negative impact on the probability of LBW. The average impact on birth weight is of the order of 69.8 grams. While this is two times larger than comparable estimates for the WIC program (29 grams, Hoynes et al., 2011), it is, however, smaller than the 107 to 146 grams reported by Higgins et al. (1989) using sibling fixed effect. Although the 95 percent confidence intervals of the coefficients overlap in both cases, variations in characteristics of each studied program may explain the differences. First of all, the WIC program allows mothers to choose among a large variety of food items, while the OLO program offers a fixed basket every day ensuring that all nutrients are covered. This more rigid approach may be more successful in ensuring that mothers consume all of the necessary nutrients. Second, the largest effects reported in Higgins et al. (1989) are for mothers who received at least four individual nutrition counselling sessions. The OLO program relies more on group counselling and fewer sessions. Both the OLO and WIC programs devote a similar fraction of their total costs to administration and counselling. The different effects found in the literature may be due to the nature of the treatment.

An alternative explanation is that since the OLO food baskets are complemented by nutrition counselling, there is a possibility that the estimated impacts do not result from better nutrition, but from behavioral changes resulting from counselling. For example, counselling may lead to reduced smoking while pregnant. While the magnitude of the effect of smoking while pregnant on infant birth weight remains an active research area, the consensus appears to be that it has an adverse effect on birth weight (see for example, Abrevaya, 2006). Understanding the mechanisms by which prenatal nutrition programs may work has seldom been done in this literature. Exceptions are Rossin-Slater (2013) and Bitler and Currie (2005). Bitler and Currie (2005) estimate the relationship between WIC participation and prenatal care. Rossin-Slater (2013) estimates the impact of WIC access on pregnancy behaviors (including smoking, prenatal care, diabetes and hypertension).

Using Statistics Canada's National Longitudinal Survey of Children and Youth (NLSCY), we estimate the impact of having access to the program on maternal behavior during pregnancy. Our sample includes children born between 1992 and 1998. Again, we have their residential postal code and can implement the same empirical strategy, though for a shorter period. Using equation 1, we estimate the impact of the OLO program on maternal health, prenatal care and behavior during pregnancy (Y_{ict}). The NLSCY includes several indicators of risky behaviors such as smoking, drinking alcohol, and consuming over-the-counter drugs or prescription medications during pregnancy. It also provides information on the type of prenatal care received (from a doctor or not) and the presence of diabetes and high blood pressure during pregnancy.

Our results, presented in Table 8, suggest that maternal health and behavior did not change following the introduction of the program. All estimated impacts, except for diabetes, either suggest a worsening of maternal behavior and health, or no effect at all. None are statistically significant. Rossin-Slater (2013) also finds similar evidence, although she argues that the benefit of WIC may partially reflect the fact that WIC clinics may serve as a gateway for other social services, such as Medicaid and Food Stamps. This is unlikely to be as prevalent in Canada, since health care is free for everyone[14] and the OLO program is provided in clinics that would otherwise exist even without the program (in contrast to the mobile WIC clinics presented in Rossin-Slater, 2013).

Finally, one might wonder whether the food is actually consumed by the mother. Although we cannot directly measure maternal food consumption, we know from the OLO Foundation that around 90 percent of all the vouchers are redeemed at local food stores. Obviously, purchasing does not imply that the mother consumed the food herself, but it is likely that she benefits from it at least partially. Together, these findings support the idea that better nutrition may be the leading cause of birth weight gains in the Canadian context.

6 Program cost and benefit analysis

Underweight babies drive important neonatal hospital costs and carry a greater risk of malformation leading to chronic health conditions. Studies on the effects of prenatal health on subsequent human capital and health find substantial effects (e.g., Almond and Currie 2011a; Currie and Hyson, 1999; Black, Devereux and Salvanes, 2007; Oreopolous et al., 2008). Our results suggest that the OLO program increases the birth weight of babies of treated mothers

[14]In Canada, health care is mostly free at the point of use, since the billing and reclaiming of health care costs by the government are handled by doctors, hospitals and clinics. This is fairly unique in the world, even compared to European countries where patients typically have to assume a small share of the costs, and in some cases have to pay the total amount upfront and get reimbursed later through public insurance.

and decreases the probability of delivering LBW babies. More specifically, we showed above that the probability of delivering an LBW baby for the overall population decreased by 0.27 percentage points on average due to the program.

Table 9 shows the neonatal costs by birth weight categories (<750; 750–999; 1,000–1,499; 1,500–1,999; 2,000–2,499; >=2500). In order to assess the neonatal cost savings of the OLO program, we use the estimates reported in Table 6. As mentioned above, we find that the probability of delivery diminishes in each of the categories except for the >=2,500 category, where it increases. Multiplying the average neonatal hospital cost by the average ITT effect by category allows us to infer the average neonatal hospital cost savings of the program. Using the participation rate (7.6 percent), we find a total neonatal cost savings per treated infant of $715 (reference year 2005). If we use the effects of the program in the long run (5 years or more, $OLO5$), we find a total cost savings per treated infant of $588. A lower bound estimate using today's percentage of treated infant (9.0 percent) would be $497.

In 2008, the total program cost was $7.057 million[15] and the number of treated babies was about 13,000. This implies a program cost per baby of the order of $543 (equivalent to $509 in 2005).[16] Therefore the average neonatal cost savings (average or long run) outweigh the cost of the program. If we use our most conservative estimates, the cost of the program, however, outweighs the average neonatal cost savings over the period by $46. While we account for the full cost of the program, our savings fail to account for the long-term benefits associated with increased birth weight and the cost of rehospitalization in the first year of life, which is known to be higher for babies whose birth weight is under 2,500 grams.

Existing evidence suggests that "fetal origins" shape many dimensions of life from infant mortality to later life outcomes such as chronic health conditions (Barker, 1995) – as well as cognitive development, educational attainment and earnings (Almond and Currie, 2011b).

[15] The program cost includes all costs related to the program paid by the Canada Prenatal Nutrition Program (CPNP) and all costs supported by the OLO Foundation (including the book value of services and items provided to the Foundation). The cost therefore includes the value of food items, the compensation paid to dietitians and nurses involved in the program and the overall administration cost of the program.

[16] This corresponds to a cost of $374 USD in 2004, which is comparable to WIC (Bitler and Currie, 2005), at $49 per month for 7 months ($343). We use the Statistics Canada Consumer Price Index on food purchased from stores to deflate the cost of the OLO program from 2008 to 2004 (115.2 to 103.2) and convert the amount using the yearly average exchange rate for 2004 (0.77USD, source Board of Governors of the Federal Reserve System).

The link between infant health at the time of birth and adulthood outcomes has seldom been studied, in part because of severe data constraints and also due to methodological challenges in controlling for the effects of other socioeconomic and genetic factors. Evidence on the exact size and importance of the long-term impacts of infant health at birth is scarce and leads to a wide range of estimates but all point to a positive impact on adulthood outcomes (e.g., Bartley et al., 1994; Currie and Hyson, 1999; Behrman and Rosenzweig, 2004; Case, Fertig and Paxson, 2005; Almond, Chay and Lee, 2005; Black et al., 2007; Oreopoulos et al., 2008). Studies with twins of the same cohorts (Behrman and Rosenzweig, 2004; Black et al., 2007; Oreopoulos et al., 2008; Royer, 2009; Figlio et al., 2014) find that birth weight is positively associated with height, test scores, educational attainment and wages.

More specifically, Black et al. (2007) find that a 1 percent increase in birth weight increases high school completion by 0.09 percentage points. Our average effect on treated children is of the order of 2.0 percent[17] which would imply a positive impact on high school completion of about 0.18 percentage points. In 2005 the median earnings for a full-year, full-time earner was $32,029 for someone who did not graduate from high school, while it was $37,403 for a high school graduate.[18] Assuming the real increase in wages equals the discount rate, we find that over a 35-year-long career the program would lead to an expected additional revenue of $339 per child on average. These additional gains include both the accrued revenue to the government and the additional revenue to the person. The latter wouldn't be distributed equally across all treated children, but would be concentrated among those graduating from high school. Combined with the neonatal cost savings, this clearly offsets the cost of the program.

Together, these studies suggest that the estimated neonatal cost savings of the OLO program combined with the estimated revenue gains from increased high school completion represent only a fraction of the benefits of the program. Clearly the program is cost effective.

[17] The percentage increase in birth weight is obtained using our most conservative average impact of the program on birth weight (5.306) divided by the percentage of treated children (0.076) divided by the average birth weight (3,352 grams) in Québec during the period.

[18] Source: Statistics Canada, Income and Earnings Highlight Tables, 2006 census. Ottawa. Released May 1st, 2008.

7 Conclusion

Using a combination of administrative data and survey data we created a unique data set allowing us to evaluate the impact of the OLO program on children's health measured at the time of birth. The progressive implementation of the program across the province of Québec allows us to identify the impact of treatment while controlling for underlying trends in the outcome variables. This study adds to the literature in several ways. First, it is the first Canadian study to exploit the progressive implementation of a prenatal nutrition program. Second, compared to research based on the WIC program, it evaluates a more targeted[19] and specific program in which pregnant women have access to the same free health care services as the rest of the population. Third, we evaluate not only the impact on health outcomes and maternal behavior, but also compare some of the benefits to the costs of the program.

We find strong evidence of a positive impact by the OLO program on birth weight and the probability of delivering a fair weight baby: treated babies gain 70 grams on average and are 3.6 percentage points less likely to be LBW. We also find that prematurity decreased by 2.2 percentage points and gestation increased by 1.5 days, but these effects are generally not significant. Our estimated effects on birth weight and LBW are larger than comparable estimates of the WIC program (29 grams; Hoynes et al., 2011), but smaller than results reported in Higgins et al. (1989). While the OLO program provides a specific food basket that may better ensure the proper nutrition of pregnant mothers, counselling sessions vary by LCSC and may not be as effective as the individual sessions recommended by Higgins. Counselling may have an impact on child health at birth by changing maternal behavior with respect not only to nutrition, but also smoking, for example. Using the NLSCY, we have shown that the OLO program did not have an impact on maternal health and behavior during pregnancy or on access to health care in the Canadian context. This suggests that the program mainly works through a change in maternal nutrition.

Finally, we have shown that the program is cost effective. Our estimate suggests that

[19] WIC currently serves 53 percent of all infants born in the United States (http://www.fns.usda.gov/wic/about-wic-wic-glance), while OLO serves less than 15 percent of all infant born in Québec.

the neonatal hospital cost savings combined with revenue gains from increased high school completion rates are larger than the costs of the program. While our cost-benefit analysis includes all costs, not all savings have been accounted for (e.g., the costs of rehospitalization and the lifetime costs of chronic health conditions related to LBW). The estimated effects found in this paper may not be generalizable to other contexts but the simplicity and small cost of the program makes it an attractive policy intervention to raise infant health outcomes and reduce health inequalities among children.

This paper is limited in two ways. First, our data set did not contain any information on who was actually treated and when they were actually treated. As a result, we are not able to provide any guidance on the stage of pregnancy at which the program is most effective. Furthermore, we have provided an estimate of the long-term cost savings by exploiting the estimated impacts of birth weight on long-term outcomes found in other studies. A better approach would have been to directly estimate the impact of the program on long-term outcomes, but our data set does not contain such information. To our knowledge there is scarce evidence on the long-term educational and socioeconomic impact of nutrition programs during pregnancy.[20] These should be the focus of future research.

8 Reference

1. Abrevaya, Jason (2006), "Estimating the effect of smoking on birth outcomes using a matched panel data approach," Journal of Applied Econometrics, vol. 21(4), 489–519

2. Alexander Greg R, Michael Kogan, Deren Bader, Wally Carlo, Marilee Allen and Joanne Mor (2003), "US birth weight/gestational age-specific neonatal mortality: 1995-1997 rates for whites, hispanics, and blacks," Pediatrics 111(1): e61–e66.

3. Almond, Douglas, Kenneth Chay, and David Lee (2005), "The cost of lowbirth weight," The Quarterly Journal of Economics," 120(3): 1031–84

[20] Hoynes, Whitmore Schanzenbach, and Almond (2012) study the impact of the FSP and find that the program has effects decades after initial exposure. Almond, Mazumder, and van Ewijk (2014) study the impact of Ramadan during pregnancy on human capital at age 7 and find that children of mothers who practice Ramadan fasting have lower test scores.

4. Almond, Douglas and Janet Currie (2011a), "Human Capital Development before Age Five," Handbook of Labor Economics, David Card et Orley Ashenfelter (eds.), Elsevier, 1315–486

5. Almond, Douglas and Janet Currie (2011b), "Killing Me Softly: The Fetal Origins Hypothesis," Journal of Economic Perspectives, 25(3): 153–72

6. Almond, Douglas, Hilary Hoynes, and Diane Schanzenbach (2011), "Inside the War on Poverty: The Impact of Food Stamps on Birth Outcomes," The Review of Economics and Statistics, 93(2): 387–403

7. Almond, Douglas, Bhashkar Mazumder, and Reyn van Ewijk (2014), "In Utero Ramadan Exposure and Children's Academic Performance," The Economic Journal, 125(589): 1501–33

8. Barker, D J (1995), "Fetal Origins of Coronary Heart Disease," British Medical Journal, 311 (July): 171–4

9. Bartley M, C. Power, D. Blane, and G. Smith (1994), "Birthweight and Later Socioeconomic Disadvantages: Evidence from the 1958 British Cohort Study," British Medical Journal 309 (December): 1475–8

10. Behrman, Jere R, and Mark R Rosenzweig (2004), "Returns to Birthweight," Review of Economics and Statistics 86 (May): 586–601

11. Black, Sandra, Paul Devereux and Kjell Salvanes (2007), "From the Cradle to the Labor Market: The Effect of Birth Weight on Adult Outcomes," Quarterly Journal of Economics 122 (1): 409–39

12. Bitler, Marianne and Janet Currie (2005), "Does WIC Work? The Effect of WIC on Pregnancy and Birth Outcomes," Journal of Policy Analysis and Management, 24(1): 73–91

13. Case, Anne, Angela Fertig, and Christina Paxson (2005), "The Lasting Impact of Childhood Health and Circumstance," Journal of Health Economics 24 (March): 365–89

14. Currie, Janet and Rosemary Hyson (1999), "Is the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Birth Weight," American Economic Review 89(2): 245–50

15. Currie, Janet and Hannes Schwandt (2013), "Within-mother analysis of seasonal patterns in health at birth," Proceedings of the National Academy of Sciences, 110(30): 12265–70.

16. Doyle, Orla, Colm P Harmon, James J Heckman, and Richard E Tremblay (2009), "Investing in early human development: timing and economic effciency," Economics and Human Biology, 7(1): 1–6

17. Figlio, David, Sarah Hamersma, and Jeffrey Roth (2009), "Does pre-natal WIC participation improve birth outcomes: new evidence from Florida," Journal of Public Economics, 93(1): 235–245.

18. Figlio, David, Jonathan Guryan, Krzysztof Karbownik and Jeffrey Roth (2014), "The Effects of Poor Neonatal Health on Children's Cognitive Development," American Economic Review, 104(12): 3921–55.

19. Gueorguieva, Ralitza, Steven B Morse, and Jeffrey Roth (2008), "Length of prenatal participation in WIC and risk of delivering a small for gestational age infant: Florida," 1996-2004. Maternal and Child Health Journal, 13(4): 479–488.

20. Higgins, Agnes (1976), "Nutritional status and the outcome of pregnancy," J Can Diet Assoc 37(1): 17–34

21. Higgins, Agnes C, John E Moxley, Paul B Penchartz, Denise Mikolainis, and Sheila Dubois (1989), "Impact of the Higgins Nutrition Intervention Program on birth weight: A within-mother analysis," J Am Diet Assoc, 89:1097–103

22. Hoynes, Hilary, Marianne E Page, and Ann Huff Stevens (2011), "Can Targeted Transfers Improve Birth Outcomes? Evidence from the Introduction of the WIC Program", Journal of Public Economics, 95 (Issues 7-8): 813–27

23. Hoynes, Hilary, Diane Whitmore Schanzenbach, and Douglas Almond (2012), "Long Run Impacts of Childhood Access to the Safety Net," NBER Working Paper No. 18535

24. Jeans, P, M Smith, and G Stearns (1955), "Incidence of prematurity in relation to maternal nutrition," J. Am Diet Assoc, 31: 576–81

25. Joyce, Ted, Diane Gibson, and Silvie Colman (2005), "The changing association between prenatal participation in WIC and birth outcomes in New York city," Journal of Policy Analysis and Management, 24(4): 661-85

26. Joyce, Ted, Andrew Racine, and Cristina Yunzal-Butler (2008), "Reassessing the WIC effect: evidence from the pregnancy nutrition surveillance system," Journal of Policy Analysis and Management, 87(2): 277-303

27. Kowaleski-Jones, Lori and Greg Duncan (2002), "Effects of participation in the WIC program on birthweight: evidence from the National Survey of Youth," Am J Public Health, 92(5): 799–804

28. Oreopoulos, Philip, Mark Stabile, Leslie Roos, and Randy Walld (2008), "The Short, Medium, and Long Term Effects of Poor Infant Health," Journal of Human Resources 43, 1: 88–138

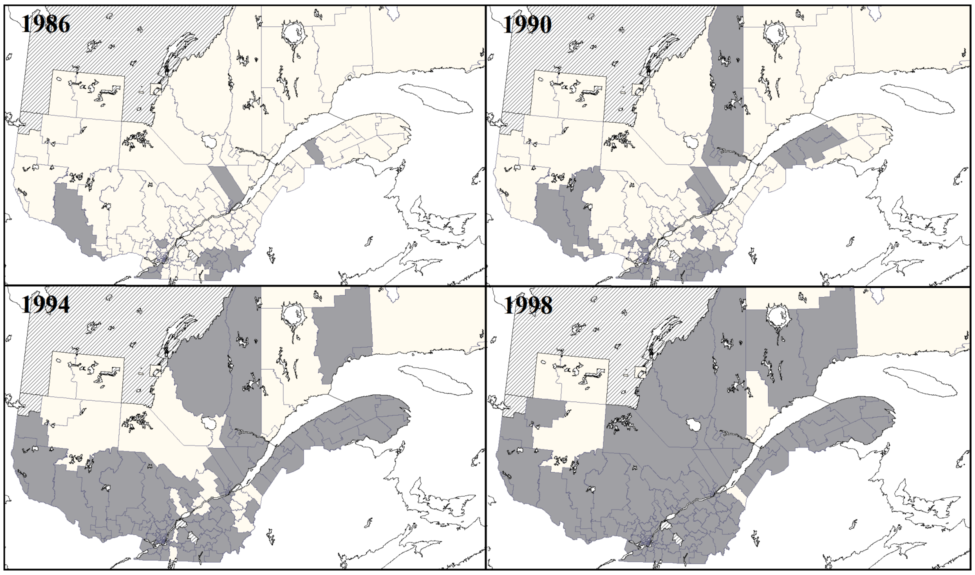
29. Rossin-Slater, Maya (2013), "WIC in your neighborhood: New evidence on the impacts of geographic access to clinics," Journal of Public Economics, Volume 102: 51–69

30. Royer, Heather (2009), "Separated at birth: US twin estimates of the effects of birth weight," American Economic Journal: Applied Economics, 1(1): 49–85

31. Sanders, MR, Pam Donohue, M A Oberdorf, T S Rosenkrantz, and M C Allen (1995), "Perceptions of the limit of viability: neonatologists" Journal of Perinatology, 15(6): 494–502

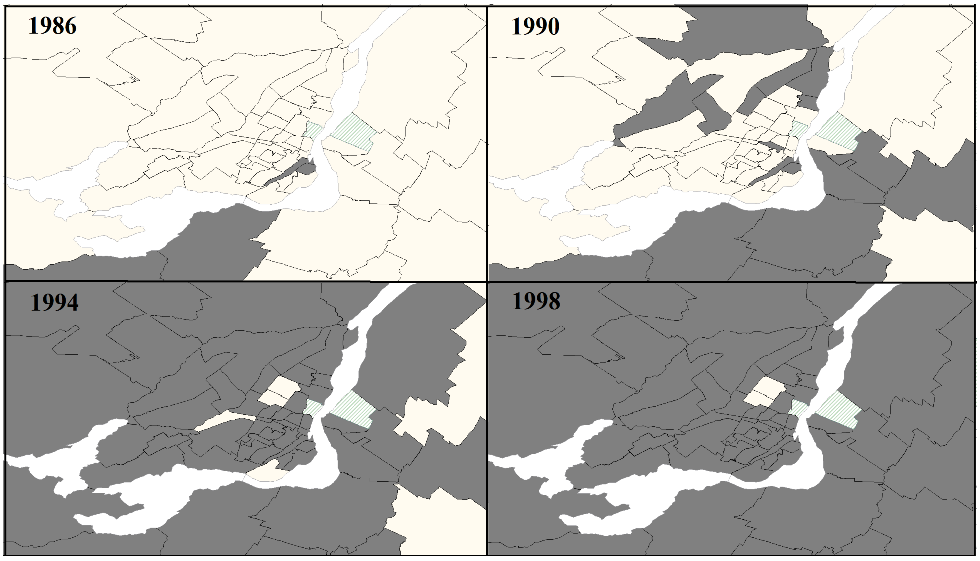
9 Figures

Figure 1: Program progressive implementation – province of Québec



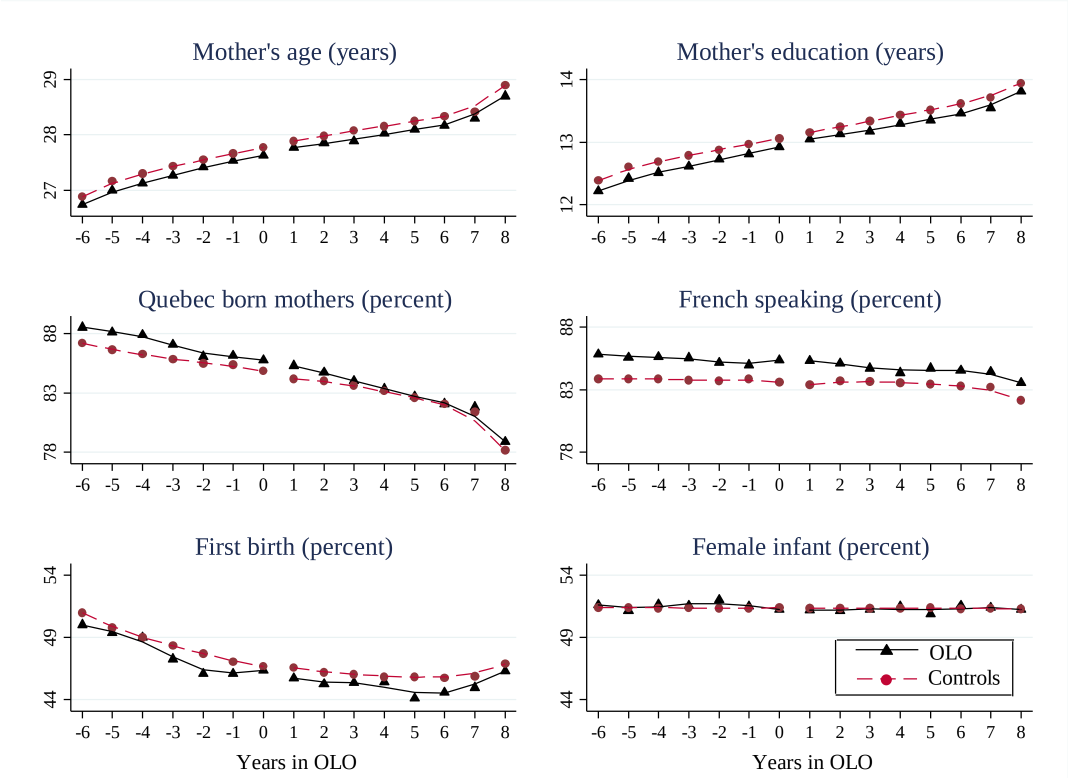
Note: This figure shows the progressive implementation of the program throughout the province. LCSC territories running the OLO program are in black, those not running it are in grey, and unknown status are indicated by the shaded areas.

Figure 2: Program progressive implementation – Montréal area



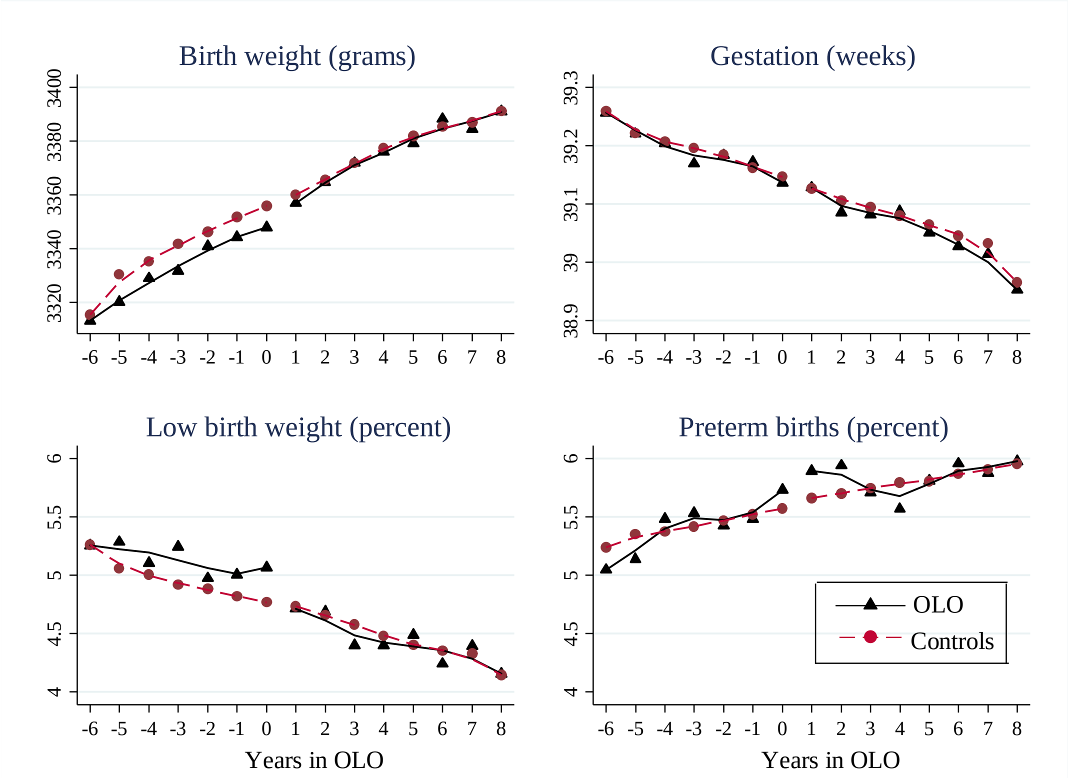
Note: This figure shows the progressive implementation of the program throughout the greater metropolitain area of Montréal. LCSC territories running the OLO program are in black, those not running it are in grey, and unknown status are indicated by the shaded areas.

Figure 3: Individual characteristics by treatment status



Note: This figure shows the trends in individual characteristics by treatment status over time. We use triangles for OLO and circles for the controls, and $t = 0$ marks the last year prior to observing treated OLO babies.

Figure 4: Outcomes by treatment status



Note: This figure shows the trends in the outcome variables by treatment status over time. Again we use triangles for OLO and circles for the controls, and $t = 0$ marks the last year prior to observing treated OLO babies.

10 Tables

Table 1: Number of LCSCs by OLO participation status and year

Year	Before 1986	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Full history															
OLO	7	17	25	33	41	55	69	84	106	125	138	142	144	144	146
Not in OLO	150	140	132	124	116	102	88	73	51	32	19	15	13	13	11
Missing	6														
Total	163														

Table 2: Summary statistics - Birth registry

Period	1986-2008	1986-1989		1990-1993		1994-1997		1998-2001	
LCSC of residence	All obs.	In OLO	Not in OLO	In OLO	Not in OLO	In OLO	Not in OLO	In OLO	Not in OLO
Outcome variables									
Weight (grams)	3 374.94	3 325.84	3 338.10	3 365.37	3 369.72	3 373.57	3 380.79	3 398.49	3 367.02
	(525.53)	(527.96)	(523.92)	(526.30)	(528.19)	(529.22)	(552.32)	(523.88)	(540.22)
N	1,581,394	65,233	192,162	229,208	101,639	276,804	12,190	250,067	4,479
Gestation (weeks)	39.06	39.14	39.21	39.15	39.14	39.07	39.02	39.00	38.85
	(1.69)	(1.73)	(1.70)	(1.71)	(1.72)	(1.70)	(1.76)	(1.67)	(1.66)
N	1,570,863	65,233	192,162	229,208	101,639	276,804	12,190	250,067	4,479
Control variables									
Male	0.51	0.52	0.51	0.51	0.52	0.51	0.51	0.51	0.51
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Birth order	1.80	1.71	1.74	1.79	1.81	1.85	1.89	1.80	1.84
	(0.97)	(0.88)	(0.91)	(0.96)	(0.94)	(1.00)	(1.07)	(1.00)	(1.04)
Birth month	6.47	6.51	6.50	6.43	6.43	6.41	6.44	6.41	6.38
	(3.37)	(3.37)	(3.37)	(3.38)	(3.38)	(3.37)	(3.38)	(3.37)	(3.42)
Mother's									
Age	28.25	27.10	27.38	27.85	27.81	28.28	27.39	28.47	26.77
	(5.03)	(4.49)	(4.63)	(4.77)	(4.76)	(5.12)	(5.28)	(5.29)	(5.26)
Years of education	13.47	12.71	12.73	13.15	12.98	13.49	12.36	13.81	12.96
	(3.04)	(2.70)	(2.82)	(2.90)	(2.91)	(3.06)	(3.13)	(3.13)	(3.11)
Mother's place of birth									
Québec	0.82	0.91	0.85	0.86	0.84	0.84	0.69	0.80	0.96
	(0.38)	(0.29)	(0.36)	(0.35)	(0.37)	(0.37)	(0.46)	(0.40)	(0.19)
RoC	0.04	0.02	0.03	0.03	0.03	0.04	0.05	0.04	0.03
	(0.19)	(0.15)	(0.16)	(0.18)	(0.18)	(0.20)	(0.21)	(0.20)	(0.16)
Other	0.14	0.07	0.13	0.10	0.13	0.12	0.26	0.16	0.01
	(0.35)	(0.25)	(0.33)	(0.31)	(0.33)	(0.33)	(0.44)	(0.36)	(0.11)
Language at home									
French	0.83	0.91	0.81	0.86	0.81	0.84	0.67	0.83	0.92
	(0.37)	(0.28)	(0.39)	(0.35)	(0.39)	(0.37)	(0.47)	(0.37)	(0.27)
English	0.10	0.06	0.13	0.09	0.11	0.1	0.11	0.11	0.04
	(0.31)	(0.23)	(0.33)	(0.29)	(0.31)	(0.3)	(0.32)	(0.31)	(0.21)
Other	0.06	0.03	0.06	0.05	0.08	0.06	0.21	0.06	0.04
	(0.24)	(0.17)	(0.24)	(0.22)	(0.27)	(0.25)	(0.41)	(0.23)	(0.19)
Marital status									
Married or common-law	0.87	0.68	0.70	0.88	0.87	0.90	0.87	0.91	0.90
	(0.34)	(0.47)	(0.46)	(0.33)	(0.34)	(0.3)	(0.33)	(0.29)	(0.3)
Single	0.05	0.00	0.00	0.05	0.05	0.07	0.10	0.07	0.09
	(0.22)	(0.03)	(0.03)	(0.21)	(0.21)	(0.26)	(0.31)	(0.26)	(0.29)
Missing	0.08	0.32	0.30	0.08	0.09	0.02	0.02	0.02	0.01
	(0.27)	(0.47)	(0.46)	(0.26)	(0.28)	(0.15)	(0.15)	(0.14)	(0.11)
N	1,584,066	65,800	193,906	229,212	101,641	276,986	12,198	250,142	4,479

Note: Shows the mean and standard deviation (in parentheses) of the main variables available in the birth registry data. The sample used to construct this table is restricted to children born in LCSC territories for which we have the complete historic information regarding the OLO program (157 LCSC out of 167) and children for which the following variables are not missing: mother's age, years of education and place of birth, as well as primary language at home and multiple births. Multiple births as well as children whose birth weight was under 500 grams or whose gestation was under 25 weeks of gestation are also excluded.

Table 3: Orthogonality of the rollout to maternal characteristics

	OLO (δ)	
	(1)	(2)
Dependent variable	FE	FE + X_{it}
Mother's age	0.077	0.041
	(0.060)	(0.040)
Mother's education (years)	0.075*	0.067
	(0.036)	(0.034)
Quebec born mother	-0.002	-0.003
	(0.007)	(0.006)
French speaking mother	0.003	0.003
	(0.004)	(0.003)
First birth	0.001	0.000
	(0.003)	(0.003)
Male	-0.002	-0.002
	(0.002)	(0.002)

Note: N=1,548,066. Shows the impact of the program on maternal characteristics. Set 1 includes only year and LCSC dummies. Set 2 also includes our main control variables (except those used as the dependent variable). LCSC clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 4: Estimated impacts (ITT)

	Birth Weight (grams)			Low Birth Weight (percentage points)		
	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends
OLO (δ)	5.636*	5.306*	5.768***	-0.259***	-0.247***	-0.270***
	(2.978)	(2.818)	(2.188)	(0.081)	(0.077)	(0.077)
Year 1 (δ_1)	3.258	2.819	3.746*	-0.184*	-0.169*	-0.201**
	(2.781)	(2.583)	(2.219)	(0.097)	(0.094)	(0.094)
Year 2 (δ_2)	6.483*	5.969*	7.253**	-0.233**	-0.216**	-0.252**
	(3.412)	(3.313)	(2.853)	(0.097)	(0.095)	(0.098)
Year 3 (δ_3)	4.633	4.763	6.050**	-0.350***	-0.346***	-0.379***
	(3.501)	(3.352)	(2.686)	(0.103)	(0.101)	(0.109)
Year 4 (δ_4)	9.340**	8.976**	10.361***	-0.321**	-0.312**	-0.343***
	(4.230)	(4.070)	(3.435)	(0.127)	(0.122)	(0.126)
Year 5 (δ_5)	9.769**	9.239**	10.851***	-0.315**	-0.302**	-0.315**
	(4.145)	(3.892)	(3.166)	(0.123)	(0.118)	(0.128)
N	1,581,394	1,581,394	1,581,394	1,581,394	1,581,394	1,581,394
	Gestation (weeks)			Preterm (percentage points)		
	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends
OLO (δ)	0.011	0.010	0.010	-0.185	-0.168	-0.181**
	(0.014)	(0.014)	(0.875)	(0.113)	(0.111)	(0.082)
Year 1 (δ_1)	0.012	0.010	0.012	-0.193*	-0.175	-0.204**
	(0.013)	(0.012)	(0.888)	(0.109)	(0.107)	(0.087)
Year 2 (δ_2)	0.008	0.007	0.007	-0.050	-0.030	-0.053
	(0.015)	(0.015)	(1.093)	(0.139)	(0.137)	(0.121)
Year 3 (δ_3)	0.005	0.004	0.002	-0.166	-0.155	-0.167
	(0.017)	(0.017)	(1.229)	(0.149)	(0.148)	(0.126)
Year 4 (δ_4)	0.022	0.021	0.018	-0.396**	-0.385**	-0.385***
	(0.019)	(0.018)	(1.412)	(0.156)	(0.154)	(0.129)
Year 5 (δ_5)	0.017	0.016	0.002	-0.274	-0.254	-0.170
	(0.023)	(0.023)	(1.580)	(0.192)	(0.186)	(0.134)
N	1,570,863	1,570,863	1,570,863	1,570,863	1,570,863	1,570,863

Note: Shows the estimated impacts of the OLO program on birth weight, the probability of delivering a low birth weight baby ($< 2,500$ grams), gestation and the probability of delivering preterm. The OLO coefficient refers to the average impact across years, while the Year 1 to Year 5 coefficients refer to the progressive impact of the program from year 1 to year 5 plus. Therefore, each column reports the results of two different specifications. Set 1 includes only year and LCSC dummies. Set 2 includes year and LCSC dummies, and the following control variables: male (dummy), maternal age categories (16 or less, 17 to 35, above 35 omitted), years of education dummies, months of birth dummies, birth order (first birth, second birth, third or more omitted), language at home dummies (French, English, other omitted), and the mother's place of birth dummies (Québec, RoC, other omitted). Set 3 additionally includes LCSC specific time trends. LCSC clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 5: Robustness checks

	Birth Weight (grams)				Low Birth Weight (p.p.)			
	(3)	(4)	(5)	(6)	(3)	(4)	(5)	(6)
OLO (δ)	5.768***	6.256***	5.479**	5.556**	-0.270***	-0.228***	-0.257***	-0.260***
	(2.188)	(2.158)	(2.181)	(2.293)	(0.077)	(0.087)	(0.077)	(0.094)
Year 1 (δ_1)	3.746*	3.999	3.570	2.432	-0.201**	-0.152	-0.191**	-0.160
	(2.219)	(2.614)	(2.208)	(2.46)	(0.094)	(0.107)	(0.094)	(0.106)
Year 2 (δ_2)	7.253**	8.146***	6.967**	6.877**	-0.252**	-0.232**	-0.239**	-0.223*
	(2.853)	(2.808)	(2.851)	(2.97)	(0.098)	(0.112)	(0.098)	(0.127)
Year 3 (δ_3)	6.050**	6.340**	5.627**	7.127***	-0.379***	-0.339***	-0.363***	-0.406***
	(2.686)	(2.925)	(2.679)	(2.693)	(0.109)	(0.119)	(0.109)	(0.127)
Year 4 (δ_4)	10.361***	11.083***	9.730***	11.069***	-0.343***	-0.283**	-0.321**	-0.371**
	(3.435)	(3.176)	(3.426)	(3.753)	(0.126)	(0.128)	(0.125)	(0.153)
Year 5 (δ_5)	10.851***	10.955***	9.890***	10.204***	-0.315**	-0.282**	-0.285**	-0.263*
	(3.166)	(3.257)	(3.138)	(3.576)	(0.128)	(0.129)	(0.127)	(0.156)
N	1,581,394	1,581,394	1,552,055	1,619,730	1,581,394	1,581,394	1,552,055	1,619,730
	Gestation (weeks)				Preterm (p.p.)			
	(3)	(4)	(5)	(6)	(3)	(4)	(5)	(6)
OLO (δ)	0.010	0.013*	0.009	0.007	-0.181**	-0.236**	-0.180**	-0.110
	(0.875)	(0.717)	(0.880)	(0.959)	(0.082)	(0.096)	(0.082)	(0.100)
Year 1 (δ_1)	0.012	0.014	0.011	0.005	-0.204**	-0.245**	-0.203**	-0.101
	(0.888)	(0.868)	(0.891)	(1.014)	(0.087)	(0.117)	(0.087)	(0.112)
Year 2 (δ_2)	0.007	0.012	0.006	0.003	-0.053	-0.123	-0.052	0.032
	(1.093)	(0.923)	(1.098)	(1.188)	(0.121)	(0.127)	(0.121)	(0.141)
Year 3 (δ_3)	0.002	0.009	0.001	0.004	-0.167	-0.257*	-0.169	-0.130
	(1.229)	(0.988)	(1.237)	(1.259)	(0.126)	(0.134)	(0.127)	(0.139)
Year 4 (δ_4)	0.018	0.022**	0.016	0.018	-0.385***	-0.422***	-0.386***	-0.344**
	(1.412)	(1.049)	(1.421)	(1.468)	(0.129)	(0.14)	(0.129)	(0.155)
Year 5 (δ_5)	0.002	0.011	0.001	-0.001	-0.170	-0.258*	-0.170	-0.046
	(1.580)	(1.056)	(1.587)	(1.684)	(0.134)	(0.144)	(0.134)	(0.166)
N	1,570,863	1,570,863	1,541,669	1,609,017	1,570,863	1,570,863	1,541,669	1,609,017
FE+X_{it}+trends	yes	yes	yes	yes	yes	yes	yes	yes
Postal code fixed effects	no	yes	no	no	no	yes	no	no
Excluding non participants	no	no	yes	no	no	no	yes	no
Including multiple births	no	no	no	yes	no	no	no	yes

Note: Shows the estimated impacts of the OLO program on birth weight, the probability of delivering a low birth weight baby, gestation and the probability of delivering preterm. Set 3 is our benchmark specification and includes the same control as in Table 4. Set 4 uses postal code fixed effects. Set 5 excludes LCSC never participating in the OLO program. Set 6 includes multiple births. Clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 6: Distributional impacts on birth weight

	Birth Weight Intervals (grams)					
	<750	750-999	1000-1499	1500-1999	2000-2499	> 2499
OLO (δ)	-0.014	-0.016	-0.024	-0.053	-0.164**	0.270***
	(0.009)	(0.014)	(0.022)	(0.031)	(0.067)	(0.077)
Year 1 (δ_1)	-0.026***	-0.018	-0.018	-0.045	-0.094	0.201**
	(0.010)	(0.017)	(0.031)	(0.041)	(0.083)	(0.094)
Year 2 (δ_2)	-0.011	-0.004	-0.005	-0.048	-0.184**	0.252**
	(0.010)	(0.018)	(0.027)	(0.039)	(0.081)	(0.098)
Year 3 (δ_3)	-0.004	-0.027	-0.028	-0.078	-0.242***	0.379***
	(0.013)	(0.018)	(0.028)	(0.045)	(0.090)	(0.109)
Year 4 (δ_4)	-0.007	-0.015	-0.056**	-0.029	-0.237**	0.343***
	(0.014)	(0.019)	(0.028)	(0.046)	(0.107)	(0.126)
Year 5 (δ_5)	-0.016	-0.012	-0.004	-0.029	-0.254**	0.315**
	(0.014)	(0.018)	(0.034)	(0.051)	(0.101)	(0.128)

Note: N=1,581,394. Shows the estimated impacts in percentage points of the OLO program on key birth weight intervals using set 3 (our benchmark specification) and includes the same controls as in Table 4. LCSC clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 7: Distributional impacts on gestation

	Gestation Intervals (weeks)			
	<28	28-36	37-41	>41
OLO (δ)	-0.018	-0.163**	0.268**	-0.087
	(0.014)	(0.079)	(0.110)	(0.082)
Year 1 (δ_1)	-0.040**	-0.164	0.243**	-0.038
	(0.018)	(0.084)	(0.114)	(0.089)
Year 2 (δ_2)	-0.008	-0.044	0.128	-0.076
	(0.017)	(0.117)	(0.148)	(0.094)
Year 3 (δ_3)	-0.004	-0.163	0.295	-0.127
	(0.020)	(0.123)	(0.163)	(0.113)
Year 4 (δ_4)	-0.004	-0.381***	0.675***	-0.290**
	(0.022)	(0.127)	(0.178)	(0.122)
Year 5 (δ_5)	-0.018	-0.153	0.472**	-0.302**
	(0.022)	(0.130)	(0.201)	(0.151)

Note: N=1,570,863. Shows the estimated impacts in percentage points of the OLO program on key gestation intervals using set 3 (our benchmark specification) and includes the same controls as in Table 4. LCSC clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 8: Average impact on maternal behavior and health

	Set 1		Set 2		
	coef	s.e.	coef	s.e.	N
Diabetes	-0.02	(0.03)	-0.03	(0.03)	2,556
Highblood pressure	0.00	(0.03)	0.01	(0.02)	2,556
Prenatal care by a doctor	-0.00	(0.03)	0.00	(0.03)	2,555
No prenatal care	0.01	(0.02)	0.01	(0.02)	2,555
Smoking	-0.01	(0.04)	-0.00	(0.04)	2,556
Alcohol	0.01	(0.04)	0.02	(0.04)	2,555
Prescription medication	0.03	(0.04)	0.03	(0.04)	2,555
Over the counter drugs	0.00	(0.04)	0.00	(0.04)	2,555
Trend + CLSC	yes		yes		
Maternal characteristics	no		yes		

Shows the estimated impacts of the OLO program on maternal health and risky behavior. Maternal characteristics include the age group of the mother at child birth (25-29, 30-34, 35 or more with 14-24 the omitted group), the mother's highest level of education (less than a high school diploma, high school diploma, some postsecondary education, with postsecondary diploma, the omitted group), the presence and number of older or younger siblings or the presence of a child of the same age, and the size of the community (five groups from rural to 500,000 or more the omitted group). Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.

Table 9: Average neonatal cost by birth weight in Canada

Birth Weights Intervals (grams)	Avg. Neonatal Hospital Costs ($)	OLO (p.p.)	Avg. Cost Savings ($)	OLO5 (p.p.)	Avg. Cost Savings ($)
<750	117,806	-0.0142	16.78	-0.0164	19.3
750-999	89,751	-0.0159	14.24	-0.0117	10.54
1000-1499	42,133	-0.0236	9.92	-0.0037	1.56
1500-1999	15,952	-0.0526	8.39	-0.0289	4.60
2000-2499	4,617	-0.1640	7.57	-0.2540	11.73
>=2500	952	0.2702	2.57	0.3146	3.00
Savings (ITT)			54.33		44.72
Savings per treated child (TOT 7.6%)			714.91		588.43

Source: Statistics Canada, CANSIM Table 102-4509, year 2005 and own calculation.

Web Appendix

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1 Canadian literature on prenatal nutrition

In the Canadian research literature a few studies stand out. The Montreal Diet Dispensary (MDD), under the guidance of a professional dietitian (Higgins 1976) developed the (Higgins) nutritional intervention programs to treat the risk of adverse pregnancy outcomes (pregnant women in states of under-nutrition, under-weight or stress). The program involved regular and individual nutrition counselling in addition to the provision of specific food items. The program was applied in collaboration with a number of Montreal hospitals having a public maternity clinic. Using sibling fixed-effect on 552 sibling pairs, Higgins and al. (1989) found that the average weight gain was 107 grams ($p<0.01$) for the 552 participants, 146 grams ($p<0.001$) for the 142 considered as undernourished, and 119 grams ($p<0.05$) for those 100 considered to have multiple risk conditions (excluding underweight). The LBW odds ratio decrease was significant only for the overall sample. Effects on neonatal mortality and IUGR indicators were not significant. For the 327 pairs involved in a minimum of four counselling sessions during pregnancy, the average weight gain was 190 grams ($p<0.001$), suggesting that counselling is an important part of the treatment. For both the overall sample (552 pairs) and the high counselling sample (327 pairs) higher birth weights were observed for almost all risk categories (undernourished, underweight, stress conditions, multiple conditions). Also, for the overall group the likelihood of LBW decreased significantly. Similar but less marked results were obtained for twin pregnancies (Dubois et al., 1991).[21]

Muhajarine et al. (2012)[22] study the link between birth outcomes and the Canada Prena-

[21]Dubois, S., C. Dougherty, M-P. Duquette, J. Hanley, and J.M., Moutquin (1991), "Twin pregancy: the impact of the Higgins nutrition Intervention Program on maternal and neonatal outcomes," *Am J Clin Nutr*, 53: 1397-1403.

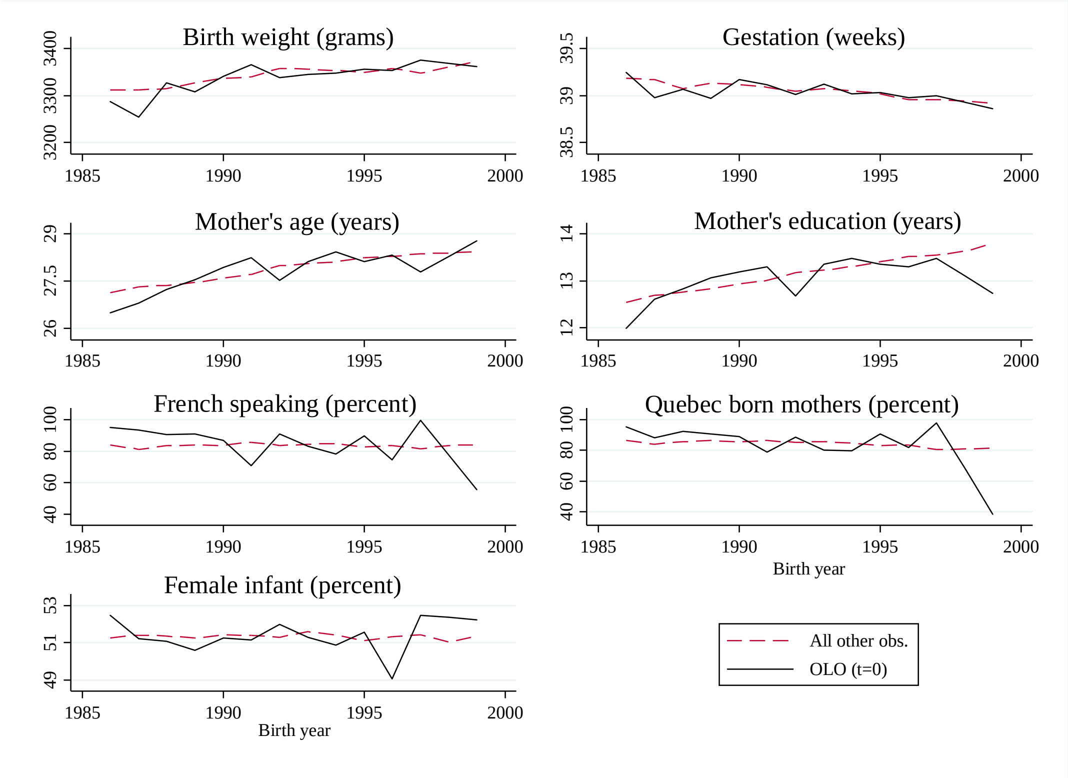
[22]Muhajarine, Nazeem, John Ng, Angela Bowen, Jennifer Cushon, and Shanthi Johnson (2012), "Understanding the Impact of the Canada Prenatal Nutrition Program: A Quantitative Evaluation," *Canadian Journal of Public Health*, 103(Supplement 1): S26-S31

tal Nutrition Program (CPNP) initiated in 1995 and financed by the government of Canada. The CPNP consists of more than 330 projects involving 2,000 communities across Canada but outside the province of Québec (see next section). Data on mothers participating in the program during pregnancy were collected in 2002-2005. A diversity of health behaviors and birth outcomes as well as neonatal health measures were collected for approximately 23,000 mothers (and infants). The link between program exposure (high and low from dimensions of time initiation, intensity, and duration) and outcomes was estimated using a multivariate approach. In general, high exposure was correlated with better outcomes, except, surprisingly, with large weights for gestational age. This study did not account for selection into treatment and other cofounding factors, such as time trends due to technological changes or other programs affecting birth outcomes.

2 Selection

Another way to look at selection into the program is to compare the profile of LCSC entering the program (new entrants) with the profile of all other LCSC in a given year. If new entrants are consistently below the average in the early years, this would be evidence that the program was first implemented in areas most in needs of the program. Figure A.1 below however shows the opposite.

Figure A. 1: Descriptive statistics of new entrants versus all others



Note: This figure shows the descriptive statistics of newly added LCSCs at $t = 0$ compared to all other LCSCs.

The characteristics of new entrants fluctuate below and above the average over time which does not suggest any clear relationship between LCSCs characteristics and the order in which the program was deployed. The last LCSCs to join in 1999 were in one of the most cosmopolite and disadvantaged area of Montreal (Quebec's largest city). This explains the sudden drop in maternal education and percent of Quebec born and French speaking mothers in 1999. Obviously, this pattern is highly sensitive to the number of new entrants in each year. In 1999, only two LCSC joined.

3 Tables

Table A. 1: ESTIMATED IMPACTS (ITT) - PERIOD 1986 TO 2004

	Birth Weight (grams)			Low Birth Weight (percentage points)		
	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends	(1) FE	(2) FE + X_{it}	(3) FE + X_{it} + Trends
OLO (δ)	5.710**	5.314**	5.082**	-0.285***	-0.275***	-0.247***
	(2.771)	(2.648)	(2.771)	(0.081)	(0.077)	(0.076)
Year 1 (δ_1)	3.522	3.016	3.274	-0.207**	-0.193**	-0.184*
	(2.604)	(2.446)	(2.604)	(0.097)	(0.094)	(0.095)
Year 2 (δ_2)	6.917**	6.322*	6.674**	-0.264***	-0.249***	-0.230**
	(3.285)	(3.215)	(3.285)	(0.098)	(0.095)	(0.097)
Year 3 (δ_3)	5.118	5.147	5.365**	-0.387***	-0.385***	-0.356***
	(3.259)	(3.133)	(3.259)	(0.107)	(0.106)	(0.108)
Year 4 (δ_4)	9.942**	9.464**	9.580***	-0.364***	-0.358***	-0.319**
	(4.028)	(3.900)	(4.028)	(0.129)	(0.123)	(0.125)
Year 5 (δ_5)	10.798***	10.041***	9.96***	-0.380***	-0.372***	-0.305**
	(3.913)	(3.666)	(3.913)	(0.129)	(0.123)	(0.135)
N	1,317,081	1,317,081	1,317,081	1,317,081	1,317,081	1,317,081
	Gestation (weeks)			Preterm (percentage points)		
	(1)	(2)	(3)	(1)	(2)	(3)
OLO (δ)	0.014	0.013	0.006	-0.218**	-0.206**	-0.163*
	(0.012)	(0.012)	(0.012)	(0.104)	(0.102)	(0.084)
Year 1 (δ_1)	0.015	0.013	0.008	-0.226**	-0.210**	-0.189**
	(0.012)	(0.011)	(0.012)	(0.103)	(0.101)	(0.089)
Year 2 (δ_2)	0.012	0.010	0.002	-0.090	-0.074	-0.037
	(0.014)	(0.014)	(0.014)	(0.135)	(0.133)	(0.122)
Year 3 (δ_3)	0.009	0.008	-0.003	-0.214	-0.206	-0.152
	(0.016)	(0.015)	(0.016)	(0.142)	(0.141)	(0.131)
Year 4 (δ_4)	0.027	0.026	0.012	-0.451***	-0.445***	-0.370***
	(0.017)	(0.017)	(0.017)	(0.150)	(0.149)	(0.133)
Year 5 (δ_5)	0.023	0.022	-0.003	-0.348*	-0.336*	-0.170
	(0.021)	(0.021)	(0.021)	(0.178)	(0.174)	(0.146)
N	1,306,547	1,306,547	1,306,547	1,306,547	1,306,547	1,306,547

Note: Shows the estimated impacts of the OLO program on birth weight, the probability of delivering a low birth weight baby, gestation and the probability of delivering preterm. The OLO coefficient refers to the average impact across years, while the Year 1 to Year 5 coefficients refer to the progressive impact of the program from year 1 to year 5 plus. Therefore, each column reports the results of two different specifications. Set 1 includes only year and LCSC dummies. Set 2 includes year and LCSC dummies, and the following control variables: male (dummy), maternal age categories (16 or less, 17 to 35, above 35 omitted), years of education dummies, months of birth dummies, birth order (first birth, second birth, third or more omitted), language at home dummies (French, English, other omitted), and the mother's place of birth dummies (Québec, RoC, other omitted). Set 3 additionally includes LCSC specific time trends. LCSC clustered standard errors are in parentheses. Significance is denoted using asterisks: *** is p<0.01, ** is p<0.05, and * is p<0.1.