Child care use and maternal labour supply: Evidence from Impacts of COVID-19 on Canadians [2020]

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Abstract. This paper examines the impacts of COVID-19 on child care use and maternal labour supply in Canada. Using the data from Impacts of COVID-19 on Canadians - Parenting during the Pandemic [2020], I see sharp drops both in child care use[1] and maternal labour supply during the quarantine and possibly when the lockdown is over[2]. Meanwhile, mothers who have 0 - 5 years old children, university degrees, and immigrants show stronger dependence on child care services. Mothers with disabled children tend to spend more time helping their children with learning activities related to school.

1. Introduction

Are women in the labour force hit harder in the pandemic? This question could be manifold. As the whole country was in quarantine since mid-March, especially that most child care services and elementary schools have been closed, what are the changes in childcare arrangements? Are mothers more likely to spend more time on parenting? At the same time, what happens to their workforce participation?

The household has been long regarded as playing a role in determining the supply of factors of production and the demand for goods and services. Gronau(1973) and Grossbard-Shechtman(1984) analyze individuals' allocation of time in terms of three divisions, labour in the market, household labour, and leisure. Marriages[3] are viewed as exchange of household labour, which tends to take longer time if living alone. Household labour benefits one's family such as cooking, gardening, fixing the roof, or child care. Though there is no strict definition of female household labour or male household labour, when regards to child care, there is some household labour that mothers could do but not the fathers, such as breastfeeding. Also, it is assumed that mothers are the primary child caregivers.[4]

[1] Refers to formal child care, like daycare centres or licensed home child care.

[2] Data is collected in June when there is no clear sign of the second wave of COVID-19 in Canada, nor a new lockdown is applied. In this paper, "during the quarantine" refers to the time period from the outbreak of COVID-19 in Canada in mid-March till June when the society reopens generally, including child care services.

[3] For the purpose of discussion, no distinction is made between formalized marriages and common-law arrangements. Under the Canadian Income Tax Act, common-law status applies to relationships after 12 continuous months.

[4] As discussed before, mothers take the responsibilities of some child care directly(such as giving labour, breastfeeding, and so on) due to physiological differences. Culturally, women are expected to take responsibilities of child care as well. One's native language is also called mother tongue, which suggests that it can be seen as a common sense that mothers are expected to be the primary caregivers.

Female labour force participation has increased dramatically since World War II. One of the possible explanations is the accessibility of child care services. Ribar (1992) first develops a reduced-form econometric specification of the general model of child care and labor force participation, which predicts that higher wages increase the likelihood of labor force participation and higher costs decrease the likelihood of child care utilization. The life-cycle model is used to explain changes in female labor supply and savings(Attanasio, Low, and Sanchez-Marcos 2008). A Search model of marriage is used to evaluate how much of the gender differences in labor supply and home production result from wages, education attainment, and family attitudes(Goussé, Jacquemet, and Robin 2017).

Market forms of child care can be seen as an (imperfect) substitution of maternal child care, which is confirmed using Canadian data. Cleveland, Gunderson, and Haytt (1996) provide Canadian evidence that child care costs have significant negative effects on maternal labour supply and their decisions to purchase market child care. They argue that children status variables play a crucial role in mothers' employment decisions and child care arrangements, and they focus on mothers with pre-school children, i.e., children younger than six years of age. By linking the 1988 Canadian National Child Care Survey and the 1988 Labour Market Activity Survey, Powell(1997) shows that the market wage has a significant positive effect on both hours of work and the labour force participation of married mothers, while the child care costs have a negative impact. Powell (2002) also examines the impact of child care prices and wage rates on the joint employment and childcare mode (center, sitter, relative, and husband) choice decisions of married mothers. Subsidies directly aimed at formal child care and unconditional childcare subsidies are shown to have the greatest potential in terms of increasing employment, while wage subsidies are found to increase employment with relatively strong impacts on formal childcare utilization. The evidence from Quebec suggests that the introduction of a subsided, universally accessible child care program in the late 1990s increases maternal labour supply in two-parent families. However it is found that this new childcare program makes parenting less consistent and more hostile, worsens both of the parents' health, and leads to lower-quality parental relationships. (Baker, Gruber and Milligan 2008)

The outbreak of COVID-19 provides us a unique perspective on how child care use and maternal labour supply change compared to previous literature. First, it is the first time there has been such a negative shock on child care services in decades while the trend has been providing parents with subsided and universal child care services in Canada. The data from Impacts of COVID-19 on Canadians - Parenting during the Pandemic [2020] covers the time period from March to June, when parents first have

adjusted their parenting given that most of the child care services had been closed, but some of them reopen generally; and elementary schools have moved to remote learning mode, but summer break did not begin or the new academic year. Also, the reason why economists focus on mothers with pre-school children, i.e., children aged 0 - 5 years, is that pre-school children usually can not take care of themselves and need concentrated care from someone else; when children turn old enough to attend elementary schools, they usually gain the skills of taking care of themselves and teachers would take care of them in school time. However, the quarantine has made the services from daycare centres or schools unavailable. Therefore it makes sense that I extend samples to mothers with children aged 0 - 14 other than only 0 -5. Mothers' struggles[5] should be paid more attention to given that the pandemic will not be brought to heel shortly in the absence of widely accessible approved vaccines.

In this paper, I examine the impact of COVID-19 on child care utilization and maternal labour supply. I also control a set of variables to examine mothers' reliance on child care utilization. Specifically, I examine hours spent on helping children with their learning activities related to school as an indicator of parenting.

I find that there are dramatic drops in both formal child care utilization and maternal labour supply. Mothers' child care arrangements are largely affected by the pandemic. Mothers who have pre-school child or children show stronger dependence on child care services. Those who give up child care services are more likely to spend more time to take care of their children aged 0 - 5 years themselves (i.e., transfer back to maternal child care arrangements) compared to pre-pandemic level. However, mothers with 6 - 14 years old children have a tendency to give up formal child care and transfer to other family members' or friends' care. Also, mothers with a university degree show more reliance on childcare services and clearly state that they need child care in order to work. Mothers who are 35 - 44 years old are more dependent on child care services. Mothers who have a university degree are less likely to lose their jobs or reduce working hours during the pandemic.

The rest of this paper is organized as follows. Section 2 describes the main data set. In section 3, the econometric model and empirical results are discussed. Finally, section 4 concludes.

[5] See 'Pink-collar recession': how the Covid-19 crisis could set back a generation of women. *The Guardian* (2020)

2. Data

In this section, I provide an overview of the main data set I use in the paper: Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020].

Impacts of COVID-19 on Canadians – parenting during the pandemic [2020] is collected by Statistics Canada. Statistics Canada invites adults in the Canadian population who are parents to children from 0 – 14 years old living in the same household to participate in a data collection exercise on a voluntary basis. The main topic is to determine concerns and experience of parents with regards to the health and social life of their children less than 15 years old, as well as time invested in child care and schooling in the context of the COVID–19 pandemic, that is, from mid–March 2020 to June 2020, when the data is collected. The unit of analysis is the household. There are 32,338 observations in total. It is noticeable that approximately 90% of the parents who participated are women. It is the first time that parents ever responded to such a public health emergency that most child care services and elementary schools have been closed, from March to June, before summer break began or the new academic year. Because the survey is conducted using online advertising, Canadians not in tune with the various channels used to advertise the crowdsourcing survey as well as individuals with lower propensity to participate in surveys and data collection exercises are not well represented by the collected data. Also, the date of response rate is not available.

In ICC – Parenting survey, respondents are asked questions related to their concerns for children and children's activities from mid-March to June. Most important for this study, the ICC asks respondents three questions: (1) 'During the COVID-19 pandemic shutdown, have you used child care services for your child or children aged 0 to 14?' (2) 'When formal child care services reopen, will your child or children attend?' (3) 'In an average week during the COVID-19 pandemic, how many hours did you help your child or your children engage in learning activities related to their schooling?' ICC – Parenting also gathers demographic, social, and economic characteristics, including respondents' age, sex, household composition, education level, employment status, and provinces of residence.

This paper restricts samples to female respondents who are parents to 0 - 14 years old children. Approximately 90% of the parents who participate in the survey are women. After dropping all male respondents and missing data, there are 26,833 samples left. The original data is released unweighted. I use the different participation rates among three kinds of households as factors to weight: households with only children 0 - 5 years

old; households with only children 6 - 14 years old; households with children 0 -14 years old. A limitation of this survey, however, is the absence of the spouse's information, such as marital status, age, or highest education attainment. Instead, I use a binary variable of the presence of adults living in the household to examine the accessibly of possible help from other family members.

I first provide a summary of my explanatory variables using the data from the Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020]. Table 1 shows descriptive statistics from the ICC - Parenting during the pandemic.

Table 1
Summary statistics: means and standard deviations in parenthesis

	Weighted mean	
Explanatory variables		
A. Age of mother		
15-34 years	0.185	(0.389)
35-44 years	0.638	(0.481)
45-54 years	0.172	(0.378)
55 years +	0.004	(0.064)
B. Education attainment		
University degree	0.740	(0.439)
C. Regions		
Newfoundland and Labrador	0.011	(0.104)
Prince Edward Island	0.003	(0.056)
Nova Scotia	0.023	(0.150)
New Brunswick	0.018	(0.133)
Quebec	0.225	(0.417)

Continued

TABLE1 *Continued*

Ontario	0.381	(0.486)
Manitoba	0.037	(0.189)
Saskatchewan	0.032	(0.177)
Alberta	0.140	(0.346)
British Columbia	0.127	(0.333)
Territories	0.004	(0.059)
D. Immigrant status		
Immigrant or non-permanent resident	0.114	(0.318)
E. Children's characteristics		
Children with a disability[6]	0.196	(0.397)

[6] Children aged 0 - 14 have a disability, including a permanent physical disability, a cognitive, behavioural, emotional disability, or another type of disability.

Presence of children aged 0 - 5	0.516	(0.500)
Presence of children aged 6 - 14	0.711	(0.453)
F. Availability of other family members' assistance		
Presence of other adults	0.899	(0.301)
Observations	26,833	

Notes: Displayed are the means for each variable, with the standard deviation in parentheses.

The data come from the Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020].

The sample contains 26,833 observations for mothers who are parents to children aged 0–14.

All means are weighted.

Table 1 shows age groups, education attainment, province of residence, immigrant status, and household composition of mothers in my samples. Almost two mothers out of three are in the 35 to 44 years old age group since the survey initiative targeted families with children less than 15 years old. 74 percent of mothers have a university degree.[7] Immigrant or non-permanent resident mothers account for 11.4 percent in my samples. 51.6 percent of mothers state that there is the presence of 0 - 5 years old child or children, while 71.1 percent with child or children aged 6 - 14, which means there are a group of mothers living with at least 2 children aged 0 - 14 years in their household. It is noteworthy that 19.6 percent of mothers claim that their child or children aged 0 - 14 have a disability. Due to the limitation of data, I use the presence of other adults living in the household to control possible child care assistance from other family members. 89.9 percent of households clarify that there is at least another adult living within the household other than the mother herself. Even though I use the different participation rates among three kinds of households as factors to weight, some provinces and age groups are oversampled.

[7] Here rises the issue of self-selection bias in the data. Without accounting for this, one would conclude that 74% of mothers in Canada have university degrees. According to a study conducted by University of Waterloo, the percentage of population who are 25 to 64 years old with a university degree in 2014 is 28.5%. See Canadian Index of Wellbeing. Similarly, the actual number of Canadian children aged 5 to 14 years who have a disability is around 5% (based on the study of Miller et al.2013, using a non-categorical approach and data from the 2006 Participation and Activity Limitation Survey).

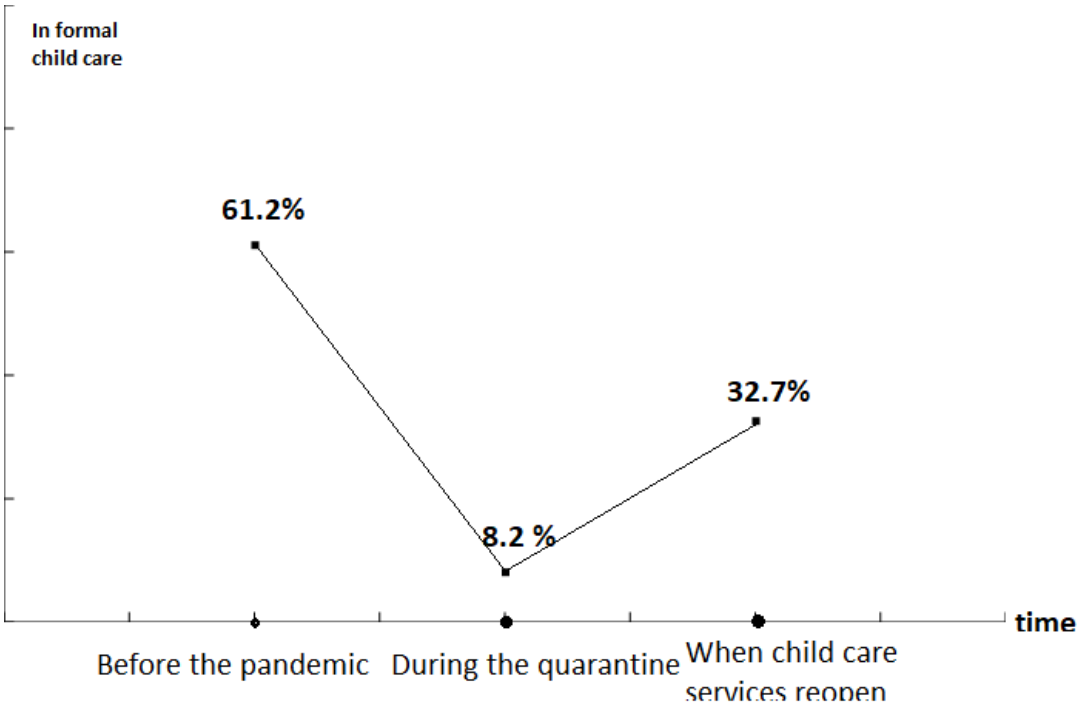

FIGURE 1 Formal child care utilization

Figure 1 and the first row of Table 2 show that there are dramatic drops in formal child care utilization during the quarantine and when child care services reopen compared to the pre-COVID-19 pandemic level. Before the COVID-19 pandemic, 61.2 percent of mothers have used formal child care services, while the figure shrinks to 8.2 percent during the quarantine. When child care services reopen, 32.7 percent of mothers state that they will use formal child care, dropped by nearly half compared to the pre-COVID-19 level.

To examine mothers' dependence on child care use, a set of binary variables are used, such as whether their child or children aged 0-14 in child care before, during the quarantine, and when such services reopen. A small group of mothers (8.2%) state that their children never stopped attending child care during the quarantine, which means they have a stronger dependence on child care services. During the quarantine, there are a small proportion of mothers who do not send their children to attend child care services but still pay the fees to hold a space. Taking the uncertainty of pandemic into consideration, these parents apparently show a strong reliance on child care use. Also, when formal child care services reopen, though 71.5 percent of parents show certain concern for their children's general physical health, 32.7 percent of mothers insist on sending their child or children to the child care services(compared to 61.2 percent before the pandemic). Among these mothers, a high proportion (87.2 percent) clearly state that they need child care services in order to work. For those who have used child care services before the pandemic but decide not to attend when child care services reopen, 7.2 percent of them transfer to (unpaid) other family members' or friends' care.

TABLE 2
Descriptive statistics: Dependent Variables

Dependent Variables	Observations	Before the COVID-19 pandemic	During the quarantine	When child care services reopen
In formal child care	26,784	0 .612 (0.487)	0.082 (0.274)	0.327 (0.470)
Do not attend but pay to hold a space	16,628		0.078 (0.268)	
Need child care in order to work	8,863			0.872 (0.334)
Transfer to other family members' or friends' care[8]	12,911			0.072 (0.334)
Hours spent on helping children with learning activities[9]	10,677		2.687 (1.057)	
Lost jobs or reduced hours	22,792		0.398 (0.489)	

Notes: Displayed are the means for each variable, with the standard deviation in parentheses.

The data come from the Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020].

All means are weighted.

I examine parenting during the pandemic using a variable that is easy to measure: hours spent to help children engage in learning activities related to school per week. I first exclude mothers who clarify that their child or children are not in school yet. Moreover, though respondents are asked 'how many child or children of 4 or 5 years old and usually attends school currently live in your home', these children are more likely to attend kindergarten, so I exclude these children as well. After restrictions, there are 10,677 observations left. On average, a mother usually spends two to five hours helping her child or children engage in learning activities related to their schooling per week.

In terms of maternal labour supply, it is worth noting that 39.8 of mothers clarify that they lose their jobs, get laid off, or reduce working hours. The recession caused by the pandemic and mothers' childcare arrangements could account for the decline of the

[8] Samples are restricted to mothers who have used child care services but no longer attend formal child care, equals one if mothers clarify that their child or children will not attend child care services because family members or friends will take care of children.

[9] The data of hours spent on helping children with schooling is given in intervals: 1 means spent less than two hours per week; 2 means spent two to five hours per week; 3 means spent five to ten hours per week; 4 means spent ten or more hours per week. The mean 2.687 means a mother spends two to five hours per week helping children with schooling typically.

maternal labour supply. How much mothers' employment decisions are affected by the changes in child care arrangements is to be examined.

3. Empirical Strategy and Results

In this section, I first describe my econometric models and then present the results: child care arrangements, parenting, and maternal labour supply.

I estimate models comparing the outcomes of mothers around the time of this public health crisis. For outcome variables such as child care arrangements(whether use formal childcare services before, during the quarantine, and when services reopen, and whether transfer from formal childcare to maternal care or relatives or friends' care), labour supply, household labour like hours spent on helping children with schooling, the generic estimating equation at the individual level is

$$Outcome_{ip} = Kid_{ip}\alpha + X_{ip}\beta + Prov_{p}\varphi + \varepsilon_{ip} \quad , \quad (1)$$

where *i* indexes individuals, *p* indexes provinces. I include Kid*ip,* a set of variables for the characteristics of kids(children's age groups, and a dummy variable for whether children have a disability)[10], along with X*ip,* a set of variables for the parents' characteristics (age groups, education level, immigrant status, and availability for other family members' assistance.)[11] $Prov_p$ represents a set of provincial fixed effects variables. ε_{ip} represents error terms, that are assumed to be distributed normally with mean 0, variance 1 and covariance p.

An important issue with this type of analysis is the self-selection bias[12] in the data.

[10] Children's age groups are 0 - 5 years old and 6 - 14 years old. Children with a disability is a dummy variable equals to one if parents claim that their child or children aged 0 - 14 have a disability, including a permanent physical disability, a cognitive, behavioural, emotional disability, or another type of disability.

[11] I define the maternal education groups as have university degrees or not. The age groups are in 15-34 years old, 35-44 years old, 45-54 years old, and 55 or more years old. Immigrant status is a dummy variable equals one if mothers state that she is an immigrant or non-permanent resident, otherwise equals zero. Availability for other family members' assistance is a binary variable equals one if there is the presence of at least another adult living in the household other than the mother herself, otherwise equals zero.

[12] Semi-parametric method is used to addressing the sample selection bias.

$Outcome_{ip} = X_{ip}\beta + \varepsilon_i$, $Outcomes_{ip}$ observed if $I_{ip} = 1$, (2)

Without accounting for this, one would conclude that 74% of mothers in Canada have a university degree. According to the study Canadian Index of Wellbeing conducted by the University of Waterloo, 28.5 percent of Canadian population who are 25 to 64 years old have a university degree in 2014. One possible explanation of why there is a higher proportion of mothers who have a university degree in my samples is that these mothers might be more willing and more patient to volunteer in such a survey, which suggests the existence of self selection bias. Similarly, based on the study of Miller et al. 2013 who use a non-categorical approach and data from the 2006 Participation and Activity Limitation Survey, the actual number of Canadian children aged 5 to 14 years has a disability is around 5 percent.[13] However, in my samples 19.6 percent of households claim that there is at least 1 child aged 0 - 14 years with a disability living with them.

Child care use

Table 3 presents the results of child care utilization before, during the quarantine, and when child care services reopen, that is, columns (1) through (3). In particular, I see column (1): child care use before the pandemic as benchmark results. To examine mothers' reliance on formal child care, I use two variables: do not attend but pay to hold a space during the quarantine and clarify they need child care so as to work, that is, columns (4) and (5). In addition, I also present the result of those who have used formal child care before the pandemic but transfer to other family members' or friends' care, that is column (6).

I first discuss the impact of children' s characteristics on child care use. Mothers with

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$I_{ip}^* = Z_{ip}\delta + \nu_{ip}$, (3)

$I_{ip} = 1$ if $I_{ip}^* \geq 0$, $I_{ip} = 0$ i f $I_{ip}^* < 0$, (4)

Where $I_{ip} = 1$ refers to individual i in province p responds to the survey, Z_{ip} refers to all possible variables that account for whether the individual i responds to the survey or not, ν_{ip} are assumed to be distributed bivariate normal with means zero, variances σ^2 and 1, and with correlation p.

If the joint distribution of ε_{ip} and ν_{ip} is independent of X_{ip} and Z_{ip}, then consistent estimates of β can be obtained:

$E(Outcomes_{ip} \mid X_{ip}, I_{ip} = 1) = X_{ip}\beta + E(\varepsilon_{ip} \mid X_{ip}, I_{ip} = 1) = X_{ip}\beta + E(\varepsilon_{ip} \mid \nu_{ip} > -Z_{ip}\delta) = X_{ip}\beta + h(Z_{ip}\delta)$

$= X_{ip}\beta + h'(Z_{ip}\delta)$, (5)

where h and h' are unknown functions and $p = Prob(I = 1 \mid Z_{ip}\delta)$.

Even in the absence of distributional assumptions, Newey et al. (1990) apply one version of the semi-parametric method to the classic wage-labor-supply model of Heckman (1974). They find that selection bias adjustment make little difference to estimation of coefficients of the wage equation and that normality could not be rejected. This article may be the source of the view that selection bias adjustments make little difference.

[13] Disabilities include difficulties with movement, cognition, hearing and vision, communication, emotion, and behaviour(same as defined in the Impacts of COVID-19 on Canadians[2020]).

pre-school child or children show a stronger and statistically significant dependence on formal child care. Prior to the pandemic, mothers of children aged 0-5 years are 30.3 percent more likely to use formal child care with all else equal, which be seen as a benchmark result. During the quarantine, despite the health concern, mothers of children aged 0-5 years are 7.2 percent more likely to use the child care services, which is statistically significant at 1% level. Also, mothers with pre-school children are 3.3 percent more likely to pay for the child care services to hold a space even though they do not attend the services during the quarantine. This estimate is statistically significant at 5% level. While when child care services reopen generally, the figure increases to 23.6%, which means mothers with pre-school children are 23.6 percent likely to send their attend formal child care, all else equal. This figure shrinks lightly compared to the pre-COVID-19 level and statistically significant at 1% level. These mothers are 3.3 percent more likely to pay for childcare services to hold a space even if they do not send their child or children to childcare services during the quarantine. I also notice that mothers with children aged 0 - 5 years are 4 percent less likely to transfer to other family members' care, which is statistically significant at 1% level. Given that formal child care utilization drops and they are less likely to transfer to other family members or friends' care, the only explanation is that these mothers spend more time on taking care of their pre-school child or children themselves(i.e., they are more likely to transfer back to maternal child care), compared to the pre-pandemic child care arrangements. On the one hand, mothers with pre-school child or children show stronger dependence on licensed child care, as taking care of child or children aged 0 - 5 years is exhausting and physically demanding. On the other hand, once these mothers give up formal child care services, they tend to transfer back to maternal childcare other than other family members' or friends' care. One possible explanation is that due to the fact that pre-school children's immune system development is not complete, mothers tend to transfer back to maternal childcare to limit the contact within household. If this is the case, mothers might adjust their working arrangements, such as making longer maternal leave, reducing working hours or managing to work from home.

Meanwhile, mothers of 6 - 14 years old children show less dependence on formal child care. Before the pandemic, mothers of children aged 6 - 14 are 7.1 percent less likely to send their children to attend child care services, which means the existence of 6 - 14 years old child or children is negatively correlated with the probability of using child care as a benchmark result. This figure is -12.1% when child care services reopen, which means more mothers with children 6-14 years old give up child care services. Before the pandemic, 6 - 14 years old children are taken care of in school on weekdays and their mothers do not need licensed childcare services as much as those with pre-school children do. When childcare services reopen, even though these 6 - 14 years old child or children have transferred to remote learning mode, their mothers are much less

likely to use childcare services. One possible explanation is health concerns. Another explanation is that some of them transfer to relatives' or friends' care. The data supports this explanation. For those who have used formal child care services but give up when child care services reopen, mothers with child or children aged 6 - 14 years are 4.1 percent more likely to use other family members or friends' care instead. All these estimates are significant at 1% level.

In terms of mothers with disabled child or children, they are 2.8 percent less likely to send their child or children to formal child care before the pandemic, with all else equal. When child care services reopen, these mothers are 2.1 percent less likely to use child care services, which is close to the pre-pandemic utilization. These estimates are statistically significant at 5% level. The possible explanations are that normal licensed childcare services are not disability-friendly enough, or these parents are more dedicated to their disabled child or children that they would rather take care of their child or children themselves than using childcare services.

Then the effects of mothers' characteristics on child care utilization are discussed. It is remarkable that mothers with a university degree show stronger reliance on formal child care services. Before the pandemic, mothers with university degrees are 8.2 percent more likely to use formal child care services(statistically significant at 1% level), all else equal. This estimate is statistically significant at 1% level. While the figures are 1.4% and 7.1%, respectively, during the quarantine and when child care services reopen. The former is significant at 5% level, and the latter is significant at 1% level. During the quarantine, mothers who have a university degree are 1.4 percent more likely to pay for the child care services to hold a space though they do not attend. These mothers apparently are more dependent on child care services. Also, these mothers are 3.1 percent more likely to state that they need child care services in order to work, which is statistically significant at 10% level.

In terms of mothers' age, mothers who are 35-44 years old show more reliance on child care services. Prior to the pandemic, mothers who are 35-44 are 15.5 percent more likely to use formal child care services, which is statistically significant at 5% level. While the figures are 2.6% and 9.6% during the pandemic and when child care services reopen, respectively. The former is significant at 1% level, and the latter is significant at 10% level. They are 4.1 percent more likely to pay to hold a space for child care services during the pandemic as well. It is worth noting that mothers who are 45 - 54 years old are also 4.9 percent more likely to pay for formal child care even though they do not send their child or children to attend, which is statistically significant at 10%

level.

For immigrant status, mothers who are immigrants or non-permanent residents are 1.2 percent more likely to use child care services prior to the pandemic, while this figure is not statistically significant. They are also more cautious about using formal child care during the quarantine, 2.3% less likely to attend, which is statistically significant at 1% level. When child care services reopen, immigrant mothers show stronger dependence than pre-pandemic level, 3% more likely to send their child or children to formal child care services with all else equal, which is significant at 5% level. These mothers are also less likely to transfer to family members or friends' care. That could be explained by the fact that these mothers are immigrants or non-permanent residents, so that they do not have many other family members or friends there to turn to for help of taking care of their child or children.

When turn to household composition, families with at least another adult other than the mother herself show less dependence on formal child care. Families with the presence of other adults in the household are 9.5 percent less likely to use formal child care prior to the pandemic, all else equal. While the figures are 2% and 7.7% during the quarantine and when child care services reopen, respectively. All these three estimates are statistically significant at 1% level. Also, if there is a presence of at least another adult living in the household, families are 2.5 percent more likely to transfer to other family members' or friends' care, which is statistically significant at 5% level. Though we do not know the relationships between the other adults living in the same household with the mothers in my samples, nor we know who exactly these mothers turn to for help of taking care of their child or children as they give up formal child care and transfer to other family members' or friends' care.

TABLE 3
Child care arrangements results

	In child care prior	In child care	In child care when	Do not attend	Need child care	Transfer to other

	to the pandemic	during the pandemic	child care services reopen	but pay to hold a space	services in order to work	family members' care
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
A. Age of mother						
15-34 years	0.113	0.016*	0.068	0.029	0.322	-0.055
	(0.058)	(0.008)	(0.038)	(0.020)	(0.231)	(0.087)
35-44 years	0.155**	0.026***	0.096*	0.041*	0.361	-0.070
	(0.057)	(0.005)	(0.037)	(0.020	(0.231)	(0.087)
45-54 years	0.056	0.006	0.029	0.049*	0.368	-0.090
	(0.058)	(0.005)	(0.038)	(0.020)	(0.231)	(0.087)
B. Education attainment						
University degree	0.082***	0.014**	0.071***	0.014*	0.031*	-0.025***
	(0.008)	(0.005)	(0.007)	(0.006)	(0.012)	(0.007)
C. Regions						
Newfoundland and Labrador	0.076	-0.022	0.021	0.078	-0.049	0.124***
	(0.052)	(0.033)	(0.051)	(0.041)	(0.054)	(0.037)
Prince Edward Island	0.125*	0.030	0.091	-0.007	-0.032	0.092**
	(0.053)	(0.040)	(0.056)	(0.034)	(0.055)	(0.034)
Nova Scotia	0.067	-0.064*	-0.059	0.015	-0.032	0.106***
	(0.039)	(0.026)	(0.040)	(0.026)	(0.038)	(0.013)
New Brunswick	0.089*	0.035	-0.019	0.177***	-0.008	0.136***
	(0.044)	(0.031)	(0.045)	(0.037)	(0.043)	(0.026)
Quebec	0.076*	-0.056*	-0.019	0.010	-0.101**	0.053***
	(0.038)	(0.026)	(0.039)	(0.026)	(0.037)	(0.008)
Ontario	0.038	-0.050	-0.101**	0.029	-0.039	0.086***
	(0.037)	(0.026)	(0.038)	(0.025)	(0.035)	0.005)
Manitoba	0.047	0.045	0.037	0.039	-0.039	0.083***
	(0.040)	(0.029)	(0.041)	(0.028)	(0.039)	(0.013)
Saskatchewan	0.050	0.092**	-0.018	0.088**	-0.044	0.074***
	(0.044)	(0.033	(0.045)	(0.033)	(0.045)	(0.018)
Alberta	0.030	0.0515	-0.025	0.042	-0.021	0.052***
	(0.038)	(0.027)	(0.039)	(0.026)	(0.036)	(0.008)
British Columbia	0.001	0.022	-0.031	0.009	-0.044	0.078***
	(0.038)	(0.026)	(0.039)	(0.025)	(0.036)	(0.008)
D. Immigrant status						
Immigrant or non-permanent resident	0.012	-0.023***	0.030**	0.014	-0.025	-0.015*
	(0.011)	(0.005)	(0.011)	(0.008)	(0.014)	(0.007)

Continued

TABLE 3 *Continued*

E. Children's characteristics						
Children with a disability	-0.028**	-0.002	-0.021**	-0.002	-0.049***	-0.006
	(0.010)	(0.004)	(0.008)	(0.007)	(0.014)	(0.008)

Presence of children aged 0 - 5 years old	0.303*** (0.009)	0.072*** (0.005)	0.236*** (0.009)	0.033*** (0.007)	-0.047*** (0.011)	-0.040*** (0.008)
Presence of children aged 6 - 14 years old	-0.071*** (0.008)	-0.022*** (0.007)	-0.121*** (0.010)	0.005 (0.007)	0.049*** (0.011)	0.041*** (0.006)
F. Availability of other family members' assistance						
Presence of other adults in the household	-0.095*** (0.013)	-0.020** (0.007)	-0.077*** (0.012)	-0.002 (0.009)	-0.009 (0.015)	0.025** (0.009)
R-squared	0.159	0.059	0.142	0.013	0.032	0.024
Observations	26,784	26,784	26,784	16,628	8,863	12,911

Notes: OLS regression results. Standard errors showed in parenthesis.

The data come from the Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020].

Samples are restricted to the females who are parents to 0 - 14 years old children.

For the age groups and regions, the omitted group consists of mothers who are 55 years old or more and live in Territories.

* significant at 10% level, ** significant at 5% level, and *** significant at 1% level.

All regressions are weighted.

Hours spent on helping children with their schooling

In terms of hours spent helping their 6 - 14 years old child or children engage in learning activities related to schooling, mothers with a university degree are more likely to spend more time on such activities during the pandemic. Also, mothers with disabled child or children spend more hours helping their child or children with their learning activities. This result is consistent with the hypothesis that is made before, mothers with disabled child or children are more dedicated to their children. In addition, the presence of other adults living in the household is positively correlated to the hours helping children with their schooling. All these estimates are statistically significant at 1% level.

Lose job/ Reduce working hours

Column (2) in Table 4 shows the estimate of maternal labour supply. Mothers with a university degree are 18.2 percent less likely to lose their jobs or reduce working hours. Mothers who are immigrants or non-permanent residents are 4.4 percent more likely to lose their jobs or reduce working hours. Another finding is that mothers with the presence of other adults living in the household are 7.6 percent more likely to lose their jobs or reduce their working hours. All of these estimates are statistically significant at 1% level.

TABLE 4

Hours spent on helping children with their schooling and maternal labour supply

	Hours spent on helping children with their schooling	Lose jobs, get laid off or reduce working hours
	(1)	(2)
Explanatory variables		
A. Age of mother		
15-34 years	-0.070	-0.039
	(0.136)	(0.065)
35-44 years	-0.046	-0.052
	(0.124)	(0.064)
45-54 years	-0.311*	-0.035
	(0.125)	(0.065)
B. Education attainment		
University degree	0.136***	-0.182***
	(0.027)	(0.009)
C. Regions		
Newfoundland and Labrador	-0.538**	-0.114
	(0.173)	(0.061)
Prince Edward Island	-0.246	0.093
	(0.188)	(0.066)
Nova Scotia	-0.030	0.0167
	(0.128)	(0.046)
New Brunswick	-0.613***	-0.045
	(0.147	(0.051)
Quebec	-0.014	0.004
	(0.127)	(0.045)
Ontario	-0.036	0.020
	(0.123	(0.044)
Manitoba	0.110	0.023
	(0.131)	(0.047)
Saskatchewan	-0.078	-0.015
	(0.149	(0.051)
Alberta	0.181	0.074
	(0.126)	(0.045)
British Columbia	0.118	0.078
	(0.125)	(0.044)
D. Immigrant status		
Immigrant or non-permanent resident	0.003	0.044***
	(0.040)	(0.012)

Continued

TABLE 4 *Continued*

E. Children's characteristics		
Children with a disability	0.203***	0.007
	(0.027)	(0.010)
Presence of children aged 0 - 5 years		0.002 (0.010)
Presence of children aged 6 - 14 years		0.016 (0.010)
F. Availability of other family members' assistance		
Presence of other adults in the household	0.271*** (0.038)	0.076*** (0.014)
R-squared	0.0448	0.0347
Observations	10,669	22,792

Notes: OLS regression results. Standard errors showed in parenthesis.

The data come from the Impacts of COVID-19 on Canadians(ICC) – Parenting during the pandemic [2020].

For column (1), samples are restricted to mothers who are parents to children aged 6 - 14.

For column (2), samples are restricted to mothers who are parents to 0 - 14 years old child or children.

For age groups and regions, the omitted group consists of mothers who are 55 years old or more and live in Territories.

* significant at 10% level, ** significant at 5% level, and *** significant at 1% level.

All regressions are weighted.

4. Conclusion

The examination of child care use and maternal labour supply using ICC - Parenting during the pandemic has enabled us to draw the following conclusions:

I find out that the utilization of formal child care services shrinks during the quarantine and when child care services reopen generally. Mothers with child or children aged 0 - 5 show stronger dependence on child care services and are more likely to take care of their pre-school children themselves if they decide to stop attending child care services. While mothers with 6 - 14 years old of child or children are more likely to give up formal child care and transfer to other family members or friends' care. Mothers who have a university degree are more dependent on child care services, are less likely to transfer to other family members' or friends' care, and are more likely to spend more time helping their child or children with learning activities related to schooling. In summary, mothers' previous child care arrangements are largely affected by this public health emergency, and they spend more time on maternal child care compared to pre-pandemic level.

Finally, it is observed that there is a dramatic drop in maternal labour supply during the pandemic. Mothers with a university degree are less likely to lose their jobs or reduce

working hours. How much mothers' employment decisions are affected by the changes in child care arrangements needs further investigation.

References

Anderson, Patricia M., and Phillip B. Levine (2000) 'Child Care and Mothers' Employment Decisions.' In *Finding Jobs: Work and Welfare Reform*, ed. David E. Card and Rebecca M. Blank, 420-462. New York: Russell Sage Foundation

Arim, Rubab G., Leanne C. Findlay, and Dafna E. Kohen(2016) 'What Statistics Canada Survey Data Sources are Available to Study Neurodevelopmental Conditions and Disabilities in Children and Youth?' *The School of Public Policy Publications (SPPP)* 9, 1-36

Attanasio, Orazio, Hamish Low, and Virginia Sánchez-Marcos (2008) 'Explaining Changes in Female Labor Supply in a Life-Cycle Model.' *The American Economic Review* 98, 1517-1552

Baker, Michael, Jonathan Gruber, and Kevin Milligan (2008) 'Universal Child Care, Maternal Labor Supply, and Family Well-Being.' *The Journal of Political Economy* 116*,* 709-745

Becker, Gary S (1973) 'A Theory of Marriage: Part I.' *Journal of Political Economy* 81, 813-846
— (1974) 'A Theory of Marriage: Part II.' *Journal of Political Economy* 82, 11–26

Blundell, Richard, and Thomas Macurdy (1999) 'Labor Supply: A Review of Alternative Approaches.' in *Handbook of Labor Economics.* ed. Orley Ashenfelter and David E. Card. Vol. 3, 1559–1695. Elsevier Science Pub. Co.

Cleveland, Gordon, Morley Gunderson, and Douglas Hyatt (1996) 'Childcare Costs and the Employment Decision of Women: Canadian Evidence.' *Canadian Journal of Economics* 29, 132–148.

Goussé, Marion, Nicolas Jacquemet, and Jean-Marc Robin (2017) 'Marriage, Labor Supply, and Home Production.' *Econometrica* 85, 1873-1919

Gronau, Reuben 1973 ‘The Intrafamily Allocation of Time: The Value of the Housewives' Time.’ *American Economic Review* 63, 634-651

— (1977) ‘Leisure, Home Production, and Work--the Theory of the Allocation of Time Revisited.’ *Journal of Political Economy* 85, 1099-1123

Grossbard-Shechtman, Amyra (1984) ‘A Theory of Allocation of Time in Markets for Labour and Marriage.’ *Economic Journal* 94, 863-82.

Greenwood, Jeremy, Nezih Guner, Georgi Kocharkov, and Cezar Santos (2016) ‘Technology and the Changing Family: A Unified Model of Marriage, Divorce, Educational Attainment, and Married Female Labor-Force Participation.’ *American Economic Journal: Macroeconomics* 8, 1-41

Heckman, James J. and Thomas E. Macurdy (1986) ‘Labour Econometrics.’ In *Handbook of Econometrics,* ed. Z. Griliches and M.D. Intriligator, Vol. 3, 1917-1977, Elsevier Science Publishers BV

Heckman, James J. and Edward J. Vytlacil,(2007)‘Econometric Evaluation of Social Programs, Part I: Causal Models, Structural Models and Econometric Policy Evaluation.’ In *Handbook of Econometrics*, ed. James J. Heckman and Edward E. Leamer, Vol.6, 4779-4874, Elsevier Science Publishers BV

Moffitt, Robert A. (1999) ‘New Developments in Econometric Methods for Labor Market Analysis.’ In *Handbook of Labor Economics.* ed. Orley Ashenfelter and David E. Card. Vol. 3, 1367-1397. Elsevier Science Pub. Co.

Powell, Lisa M. (1997) ‘The Impact of Childcare Costs on the Labor Supply of Married Mothers: Evidence from Canada.’ *Canadian Journal of Economics* 30, 577–594

— (2002) ‘Joint Labor Supply and Childcare Choice Decisions of Married Mothers.’ *Journal of Human Resources* 37, 106-128

Ribar, David C. (1992) ‘Child Care and the Labor Supply of Married Women: Reduced Form Evidence.’ *Journal of Human Resources* 27, 134-165

The Guardian. (2020) ‘'Pink-collar recession': how the Covid-19 crisis could set back a generation of women.’ https://www.theguardian.com/world/2020/may/24/pink-collar-recession-how-the-covid-19-crisis-is-eroding-womens-economic-power

Vella, Francis. (1998) ‘Estimating Models With Sample Selection Bias: A Survey.’ *Journal of Human Resources* 33, 127-172.