Understanding the Impact of the Canada Prenatal Nutrition Program: A Quantitative Evaluation

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ABSTRACT

Objectives: The objectives of this study were to assess whether high exposure to the Canada Prenatal Nutrition Program (CPNP) improved 1) the personal health practices, such as smoking and breastfeeding, of participants and 2) birth outcomes, such as low birth weight and preterm birth.

Intervention: The CPNP is a population-level health intervention that aims to contribute to improved health outcomes for pregnant women and their newborn children facing conditions of risk. The program, which is jointly managed by the federal and provincial governments, serves more than 45,000 Canadian women annually.

Participants: Participants were women who entered the program prenatally in 2002-2006 and were socially, demographically and geographically diverse. Almost 12% were adolescents, and almost 10% were over 34 years of age; 5% were recent immigrants (in Canada <10 years), and close to one quarter were Aboriginal.

Setting: This comprised a broad range of community-based projects in 2,000 communities.

Outcomes: Descriptive statistics showed that the CPNP is reaching the women for which it is intended. Participants with high CPNP exposure were more likely to reduce the number of cigarettes they smoked, to cease drinking, to breastfeed their infants and to breastfeed for longer, and to increase their use of vitamin/mineral supplements from never to daily. Furthermore, they were less likely to give birth to an infant that was preterm, had low birth weight, was small for gestational age or had poor neonatal health. Unexpectedly, participants were more likely to give birth to a large-for-gestational-age infant. Our stratified "equity" analyses showed some variation by social group, indicating that the benefits were not consistently shared by all.

Conclusion: High CPNP exposure improved the health behaviours and birth outcomes of women and their newborn children facing conditions of risk. Furthermore, our equity analysis found that the associations between higher CPNP exposure and healthy behaviour changes, and even more so, better birth outcomes, were generally found across many social groups. In the absence of a control group, the study used an innovative approach to estimating the impact of the CPNP by comparing those who received a higher "dose" with those receiving a lower dose of CPNP services.

Key words: Child development; vulnerable populations; risk factors; program evaluation; early intervention

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etween 350,000 and 400,000 infants are born in Canada every year.[1] One in 10 of them shows adverse birth outcomes, such as low birth weight and preterm birth, often related to maternal health and nutrition as well as underlying social and economic conditions.[2] Poor birth outcomes contribute to both poor short- and long-term growth and development, and can have substantial impacts over the life course, including decreased educational attainment and labour force attachment, and greater use of health care.[3-7] Therefore, preventing adverse birth outcomes through comprehensive population-based interventions that target modifiable risk factors, such as maternal health and health behaviours, and are based on principles of equity represents an important public investment in society. One such intervention is the Canada Prenatal Nutrition Program (CPNP), launched by the Government of Canada in 1995.[8,9] This paper reports the results of a comprehensive quantitative evaluation of the CPNP, including an equity analysis of outcomes for different groups of clients in the program.

THE INTERVENTION: THE CANADA PRENATAL NUTRITION PROGRAM

The CPNP aims to improve health outcomes and reduce disparities among pregnant women and their newborn children facing condi-

tions of risk, such as poverty, teen pregnancy, recent immigration to Canada, alcohol or substance abuse, and family violence. The CPNP is a federally funded program that is managed jointly with the provinces and territories, allowing each region to identify its own priorities and target groups. The program consists of approximately 330 projects in about 2,000 communities across Canada.[10] The projects encompass a wide range of services, including food supplements (e.g., milk or food), dietary assessment, one-on-one and group education on nutrition and other aspects of lifestyle, and other services (e.g., parenting education, child care support, transportation, housing, breastfeeding preparation). They involve partnerships with

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related government and non-government initiatives at all levels: local, national and First Nations organizations.

In 2004, a Results-based Management and Accountability Framework was developed to guide the management and evaluation of the CPNP; it included a program logic model that outlines the program's expected outcomes.[11] Studies have confirmed that the CPNP is meeting its short-term objective of reaching women and their infants living in conditions of risk and providing them with access to appropriate services.[12] Low-income women made up about 60% of those served by the CPNP between 1998 and 2003.[12] Additionally, in 2005/2006, 18% of clients entering the program were 19 years old or younger, 67% had less than high school education, 29% had lived in Canada less than 10 years, 23% were Aboriginal, 31% smoked and 35% were single, widowed, divorced or separated.[9]

This study adds to the ongoing understanding of the CPNP by examining whether the program has met its intermediate objective of improving maternal health behaviours and its long-term objective of improving birth outcomes and infant health. As well, we investigated whether the CPNP's impact on health behaviours and birth outcomes varied across social groups or was experienced similarly by all clients (i.e., equity analysis).

DATA SOURCE

Data on clients' health, demographic characteristics, use of CPNP services and birth outcomes came from the Individual Client Questionnaires, version 2 (ICQ2), a self- and staff-administered questionnaire used by the CPNP. The ICQ2 has three sections: Part A, Prenatal Interview; Parts B and C, Postnatal Interview; and Part D, Staff Observations. National data were collected in 2002/03, 2003/04, 2004/05 and 2005/06 for women born in the months of May, June or September who entered the program prenatally. Data available from 2002 to 2006 were merged to create one comprehensive data file on 48,184 pregnant women. Thus, the total possible pool available for investigation was 48,184 client cases; however, the number of cases for certain queries was smaller because of incomplete data entries or the inapplicability of certain variables.

STUDY MEASURES

Dependent variables

We examined two types of outcome: health behaviours and birth outcomes, including neonatal health. Clients' health behaviours consisted of weight gain during pregnancy (relative to recommended weight gain, adjusted to pre-pregnancy body mass index);[13] increased vitamin/mineral supplement use; smoking cessation; smoking reduction; drinking cessation (alcohol); and breastfeeding initiation and duration. Birth outcomes consisted of preterm birth (gestational age <37 weeks); low birth weight (LBW; birth weight <2,500 g); small for gestational age (SGA; birth weight below 10th percentile for infants of the same gestational age and sex, using Canadian standards);[14] large for gestational age (LGA; birth weight above 90th percentile for infants of the same gestational age and sex, using Canadian standards); and poor neonatal health (complications at birth).

Independent variables

This evaluation assessed the impact of two aspects of the CPNP: the degree to which clients were exposed to the program and the par-

Table 1. Results (Odds Ratios and Confidence Intervals) from Final Models Showing Effects of Overall High CPNP Exposure on Health Behaviours

	OR	95% CI
Weight gain (n=23,378)		
Below recommended weight gain	1.03	(0.95-1.11)
Above recommended weight gain	1.11*	(1.04-1.18)
Supplement use (n=7,064)		
Never to irregular	2.50*	(2.12-2.94)
Never to daily	2.19*	(1.89-2.55)
Irregular to daily	1.22*	(1.09-1.37)
Smoking reduction (n=3,793)	1.19*	(1.05-1.36)
Drinking cessation (n=10,871)	1.42*	(1.28-1.58)
Breastfeeding initiation (n=28,415)	1.08*	(1.00-1.17)
Breastfeeding duration (n=20,642)	4.20*	(2.68-6.58)

* Significant at p≤0.05; ORs are independent of the effects of type of CPNP services received and socio-demographic risk.

ticular types of services they received (previously listed). Program exposure was conceptualized as comprising three dimensions: 1) program initiation (when in her pregnancy the client started attending the program); 2) program intensity (number of contacts the client had with the program); and 3) program duration (number of weeks the client was involved in the program). We combined these dimensions into an overall CPNP exposure index, akin to a "dose", with two levels: "high" and "low" exposure. The index was created by first dividing each of the three variables at the median to create two categories for each variable: clients who had started earlier in their pregnancy vs. later; clients who had a higher number of contacts vs. a lower number; and clients who stayed in the program for a longer vs. a shorter period of time. Clients who scored high on at least two of the variables were defined as having overall high CPNP exposure. Alternative methods for combining the three exposure dimensions were considered (such as using three equal groups, or tertiles, or developing a program exposure score), but we settled on the method described here as it represented an easily understood, replicable approach.

In addition to the effects of overall CPNP exposure we present in this paper, we also estimated the effects of *each* of the three constituent program exposure variables. The results for each of these are given in the full technical report available at www.kidskan.ca. Briefly, of the three program exposure variables, having more contact with the program was associated with the most number of positive health practices. In addition, those who initiated contact with the CPNP earlier or had more contact with the program were more likely to quit smoking during their pregnancy. An exception, however, was that earlier program initiation and greater duration of contact were both associated with a slightly higher tendency to gain more than the recommended amount of weight. For the birth outcomes, clients who initiated contact with the program earlier in pregnancy, had more contact with the program and remained enrolled for longer were all associated with a lower likelihood of preterm birth, low birth weight, small for gestational age and poor neonatal health; however, they were more likely to give birth to a large-for-gestational-age infant.

Data from the ICQ2 were used to determine whether clients received any of the following types of service: food supplements, dietary assessment, one-on-one nutrition education, group nutrition education, lifestyle education, and "other services" (e.g., parenting, child care support, transportation, housing and breastfeeding preparation). In general, group services were available to all clients, whereas one-on-one services were offered to women facing conditions of especially high risk. Notably, projects

Table 2. Effects of High CPNP Exposure on Health Behaviours Across Social Groups (Odds Ratios* and Confidence Intervals)

Socio-demographic Characteristics	Maternal Weight Gain (More Than Recommended) OR	95% CI	Vitamin Use Change (Never to Daily) OR	95% CI	Smoking Reduction OR	95% CI	Drinking Cessation OR	95% CI	Breastfeeding Initiation OR	95% CI	Breastfeeding Duration OR	95% CI
Marital Status												
Single/divorced	1.35	(1.21-1.51)	1.68	(1.33-2.12)	NS		1.44	(1.24-1.67)	1.22	(1.09-1.37)	7.51	(2.32-24.30)
Married/partnered	NS		2.69	(2.21-3.27)	1.41	(1.17-1.69)	1.42	(1.22-1.66)	NS		3.20	(2.11-4.86)
Aboriginal Status												
Aboriginal	1.09	(1.01-1.17)	3.34	(2.22-5.01)	NS		1.44	(1.22-1.70)	1.27	(1.11-1.46)	2.97	(1.01-8.76)
Non-Aboriginal	1.16	(1.01-1.33)	2.10	(1.79-2.83)	1.47	(1.24-1.74)	1.46	(1.27-1.68)	NS		4.79	(2.90-7.89)
Immigrant Status												
In Canada <10 yrs	NS		3.75	(2.46-5.72)	4.56	(1.13-18.45)	2.23	(1.50-3.32)	NS		7.92	(3.58-17.52)
In Canada ≥10 yrs	1.15	(1.07-1.24)	5.77	(1.96-16.99)	1.19	(1.04-1.35)	1.37	(1.23-1.53)	1.14	(1.05-1.24)	3.35	(1.93-5.81)
Education Level												
Less than high school	1.15	(1.04-1.27)	2.16	(1.78-2.63)	1.30	(1.11-1.53)	1.53	(1.33-1.77)	1.21	(1.09-1.34)	4.12	(1.91-8.91)
High school	NS		2.24	(1.76-2.86)	NS		1.25	(1.06-1.48)	NS		4.43	(2.49-7.91)
Household Income Level												
No income	NS		NS		2.23	(1.04-4.76)	NS		NS		0.51	(0.28-0.93)
<$1,000/mo	NS		1.83	(1.30-2.59)	NS		1.49	(1.17-1.88)	NS		4.38	(1.48-12.98)
$1,000-$1,900/mo	NS		1.70	(1.17-2.48)	1.64	(1.17-2.29)	1.41	(1.06-1.88)	NS		2.60	(1.08-6.24)
>$1,900/mo	NS		4.22	(2.07-8.57)	NS		NS		NS		4.17	(1.05-16.57)
Age Group (years)												
<19	1.37	(1.13-1.65)	1.95	(1.29-2.94)	0.70	(0.50-1.00)	1.93	(1.46-2.55)	1.28	(1.05-1.56)	NS	
19-34	1.07	(1.00-1.15)	2.12	(1.79-2.51)	1.30	(1.12-1.50)	1.34	(1.19-1.51)	NS		4.36	(2.59-7.33)
>34	NS		3.79	(2.10-6.85)	NS		1.53	(1.01-2.32)	NS		4.61	(1.82-11.66)
Food Security Status												
Food insecure	1.18	(1.07-1.31)	2.00	(1.59-2.52)	1.28	(1.07-1.54)	1.36	(1.17-1.58)	1.24	(1.10-1.39)	4.07	(1.95-8.50)
Moderately food insecure	NS		2.50	(1.77-3.54)	NS		1.79	(1.37-2.33)	NS		2.99	(1.52-5.89)
Food secure	NS		2.16	(1.68-2.77)	NS		1.33	(1.11-1.61)	NS		5.25	(2.39-11.52)

* All odds ratios except those labelled NS (non-significant) are significant at p≤0.05. ORs are independent of the effects of CPNP services received and socio-demographic risk.

across the country varied in terms of how and by whom particular services were offered, the assessment process used to determine which clients received which services, the proportion of clients who received services based on the funds available for that service at a given time, a project's access to the appropriate staff to provide the service, and so on. Information on the quality, frequency and intensity of the services could not be determined from the ICQ2, a drawback that should be addressed in future program development and documentation.

Covariables

Socio-demographic characteristics and unhealthy maternal behaviours are related to poor birth outcomes. Therefore, we created three risk indices to use as covariables, based on socio-demographic factors,* health behaviours† and pregnancy-related health issues‡. In each index, clients were given a score of 1 if a variable was present and 0 if it was absent. The scores were summed across all items, and the total was divided at the median in order to produce two groups of clients for each index: low and high risk. Finally, maternal diabetes was included as a control variable.

ANALYSIS

We conducted a series of bivariate analyses involving the key independent variable (overall CPNP exposure), the outcome variables (health behaviours, and birth and neonatal outcomes) and the three risk indices (data not shown here). These associations were significant for each of the outcomes. To adjust for possible confounding factors (namely, socio-demographic risk, behavioural risk and pregnancy-related risk, depending on the analysis), we then performed three types of multivariate analysis, depending on the type of outcome variable: 1) binary logistic regression for outcome variables with two alternatives, such as either ceasing/not ceasing smoking or preterm/term birth; 2) multinomial logistic regression when the outcome of interest had more than two categories, such as weight gain in pregnancy (above, below or at recommended levels); and 3) generalized linear modeling for outcome variables that were measured on a continuous scale, such as breastfeeding duration (measured in weeks).

For the equity analysis, we conducted stratified analyses in order to investigate whether the impact of overall CPNP exposure on health behaviours and birth outcomes varied across social groups. Such analyses were conducted when we had obtained a final main effects model for each of the outcomes. At the end of the multivariate modeling process, the data set was split (or stratified) by the social "equity" variables (i.e., married/partnered vs. single/divorced; Aboriginal vs. non-Aboriginal; immigrants in Canada for less than 10 years, immigrants in Canada for 10 or more years vs. Canadian-born; women with less than high school education vs. high school or more;

* The socio-demographic risk index variables were age less than 19 or older than 34 years; having lived in Canada for less than 10 years; being a woman of Aboriginal ancestry; being single, widowed, divorced or separated; not having attained a high school diploma; having a monthly household income less than $1900; and experiencing food insecurity (based on two questions on clients' access to food).

† The behavioural risk index was created using seven items: not increasing use of vitamins/mineral supplements; not stopping smoking (if client smoked at first contact); not decreasing the number of cigarettes smoked (among smokers); not discontinuing alcohol use (among clients reporting drinking at first contact); number of drinks (≥5 drinks in one day, after becoming pregnant); experiencing abuse during pregnancy (physical, emotional or sexual); and reporting exposure to second-hand smoke (sometimes or daily).

‡ The pregnancy-related risk index variables were history of miscarriages, stillbirths or LBW infants; whether the client had consulted with a doctor, midwife and/or nurse/practitioner since becoming pregnant; interval between births (<12 months); parity (nulliparas or primiparas – no previous births and current birth non-viable, and no previous births and current birth viable); pre-pregnancy body mass index (<19.8 or >26); and weight gain more or less than the recommended amount during pregnancy.

women with no income, less than $1000/month, $1000-1900/month vs. more than $1,900/month; women less than 19 years, 19-34 years vs. 34 years or older; and women with food insecurity, moderate food insecurity vs. food security), and the models were rerun in order to obtain multivariate models for the stratified groups.

The results of the multivariate and stratified analyses are presented in Tables 1 through 4 as odds ratios (ORs). We used the standard threshold of p≤0.05 for determining whether a result was statistically significant. We also present 95% confidence intervals (CIs) for each OR estimated.

OUTCOMES

Clients

The clients involved in this evaluation were socially, demographically and geographically diverse. Almost 12% were adolescents, and almost 10% were over 34 years of age. Nearly 15% were recent immigrants (in Canada <10 years), and close to one quarter were Aboriginal. Approximately one third were not married or living with a partner, and just less than half had not completed high school. Over 80% of clients had household monthly incomes of $1,900 or less, with 9% reporting no income at all. Also, more than half of the clients (57.9%) reported at least moderate food insecurity. This is consistent with the client profile presented by previous studies of the CPNP,[2,12] which further supports the claim that the CPNP is reaching the women for whom it is intended.

As for program exposure, just over 40% of clients began attending the CPNP by the 20th week of their pregnancy, but another 30% did not initiate contact until after the 29th week. The number of contacts with CPNP staff varied widely, just over half of the clients having 11 or fewer contacts but about 10% having anywhere from 29 to 257 contacts. Finally, in terms of duration, about half of clients attended the program for over 20 weeks, and a small group remained involved for more than 37 weeks.

The proportion of clients who received each type of service varied considerably, almost all being provided with food supplements, four fifths receiving "other" services (which could include parenting or child care support, transportation assistance, housing assistance, and breastfeeding preparation and support), close to two thirds receiving one-on-one nutrition education and about half receiving dietary assessment, group nutrition counselling or lifestyle education.

Health behaviour change and variations across social groups

With regard to health practices, at their first contact with the program over one quarter of CPNP clients reported never using vitamin/mineral supplements, and just over half used them daily. Over three quarters of clients were smokers at program entry, most smoking fewer than 20 cigarettes a day. Slightly more than half were exposed to second-hand smoke during their pregnancy. More than 40% of clients indicated that they had consumed alcohol since becoming pregnant, over half of whom reported having at least five drinks in one day.

After adjustment for socio-demographic risk and variability in each type of CPNP service received, associations were found between overall high CPNP exposure and 1) weight gain of more than the recommended amount during pregnancy; 2) more frequent vitamin/mineral supplement use; 3) smoking reduction; 4) drinking cessation; 5) breastfeeding initiation; and 6) longer

Table 3.	Results (Odds Ratios and Confidence Intervals) from Final Models Showing Effects of Overall High CPNP Exposure on Birth Outcomes	
	OR	95% CI
Preterm birth (n=22,766)	0.74*	(0.65-0.84)
Low birth weight (n=30,613)	0.66*	(0.60-0.72)
Small for gestational age (n=22,290)	0.89*	(0.83-0.96)
Large for gestational age (n=22,290)	1.22*	(1.11-1.35)
Poor neonatal health (n=28,592)	0.83*	(0.78-0.88)

* Significant at p≤0.05; ORs are independent of the effects of CPNP services received, socio-demographic risk, behavioural risk, pregnancy-related risk and diabetes.

breastfeeding duration (Table 1). No association was found between overall high CPNP exposure and gaining less than the recommended amount of weight during pregnancy or between overall high CPNP exposure and smoking cessation.

The stratified analyses examining the relations between high CPNP exposure and health behaviours across different social groups produced very mixed results (Table 2). No consistent differences were found, with the exception possibly of maternal weight gain, smoking reduction and breastfeeding initiation. Exposure to the program was no less likely to be related to positive behaviour among higher risk groups, with the exception of clients reporting no income. These may represent a particularly disadvantaged group, and it is possible that even high CPNP exposure is not sufficient to help women in this group change their behaviour. However, it is also the case that this group is considerably smaller than the other income groups, which would reduce the likelihood of finding significant associations.

The relation between overall high CPNP exposure and the risk of gaining more than the recommended amount of weight was found only in certain social groups: single/divorced women (who showed a 35% higher risk of gaining more weight), Aboriginal women (8% higher risk), non-Aboriginal women (16%), immigrant women in Canada for 10 years or longer (15%), women with less than high school education (15%), women aged 34 years or less (37% for <19 years, 7% for 19-34 years) and women with food insecurity (18%). There was also an association between overall CPNP exposure and increased likelihood of breastfeeding initiation for single/divorced women (22%), Aboriginal women (27%), immigrant women in Canada for 10 years or longer (14%), women with less than high school education (21%), women younger than 19 years (28%) and women with food insecurity (24%).

There was an association between overall high CPNP exposure and the likelihood of smoking cessation for four social groups: Aboriginal women (45%), women with less than high school education (29%), women aged 19-34 years (21%) and women with food insecurity (26%). Also, there was an association between overall high CPNP exposure and smoking reduction for married/partnered women (41%), non-Aboriginal women (47%), immigrant women in Canada for less than 10 years (4.56 times more likely to reduce smoking), women with less than high school education (30%), women with no income or "middle" income (monthly income $1,000-$1,900) (2.23 times and 64%, respectively), women aged 19-34 years (30%) and women with food insecurity (28%).

Birth outcomes and variations across social groups

After accounting for CPNP services received, socio-demographic risk, behavioural risk, pregnancy-related risk and/or diabetes, high

Table 4. Effects of High CPNP Exposure on Birth Outcomes Across Social Groups (Odds Ratios* and Confidence Intervals)

Socio-demographic Characteristics	Preterm Birth OR	95% CI	Low Birth Weight OR	95% CI	Small for Gestational Age OR	95% CI	Large for Gestational Age OR	95% CI	Poor Neonatal Health OR	95% CI
Marital Status										
Single/divorced	NS		0.68	(0.58-0.80)	NS		1.18	(1.01-1.38)	0.86	(0.78-0.95)
Married/partnered	0.70	(0.60-0.81)	0.65	(0.57-0.73)	0.87	(0.80-0.96)	1.25	(1.11-1.40)	0.81	(0.75-0.87)
Aboriginal Status										
Aboriginal	0.72	(0.57-0.92)	0.65	(0.53-0.81)	NS		1.27	(1.08-1.50)	0.87	(0.77-0.98)
Non-Aboriginal	0.72	(0.63-0.84)	0.65	(0.58-0.72)	0.91	(0.84-0.99)	NS		0.80	(0.75-0.86)
Immigrant Status										
In Canada <10 yrs	0.64	(0.47-0.86)	0.67	(0.55-0.82)	NS		1.33	(1.08-1.63)	0.68	(0.61-0.77)
In Canada ≥10 yrs	0.74	(0.65-0.85)	0.66	(0.59-0.74)	0.87	(0.79-0.95)	1.17	(1.05-1.30)	0.87	(0.81-0.93)
Education Level										
Less than high school	0.69	(0.57-0.83)	0.71	(0.61-0.83)	0.87	(0.77-0.98)	1.36	(1.17-1.57)	0.81	(0.74-0.89)
High school	0.78	(0.66-0.92)	0.62	(0.54-0.71)	NS		NS		0.84	(0.78-0.91)
Household Income Level										
No income	NS		NS		NS		NS		0.70	(0.51-0.95)
<$1,000/mo	0.67	(0.50-0.91)	0.62	(0.49-0.78)	0.82	(0.68-0.99)	NS		NS	
$1,000-$1,900/mo	0.69	(0.51-0.94)	0.71	(0.55-0.91)	NS		NS		0.72	(0.62-0.82)
>$1,900/mo	NS		0.65	(0.44-0.96)	NS		NS		0.68	(0.55-0.84)
Age Group (years)										
<19	NS		0.61	(0.45-0.83)	NS		NS		0.84	(0.71-1.0)
19-34	0.72	(0.63-0.83)	0.69	(0.62-0.77)	0.89	(0.81-0.97)	1.20	(1.08-1.34)	0.82	(0.77-0.88)
>34	NS		0.48	(0.35-0.65)	0.75	(0.60-0.95)	1.34	(1.00-1.79)		
Food Security Status										
Food insecure	0.78	(0.64-0.94)	0.67	(0.58-0.78)	NS		NS		0.84	(0.77-0.92)
Moderately food insecure	NS		0.64	(0.50-0.81)	NS		1.32	(1.04-1.69)	0.80	(0.69-0.92)
Food secure	0.72	(0.59-0.88)	0.63	(0.54-0.74)	0.88	(0.79-0.99)	1.21	(1.05-1.39)	0.82	(0.75-0.90)

* All odds ratios except those labelled NS (non-significant) are significant at p≤0.05. ORs are independent of the effects of CPNP services received, socio-demographic risk, behavioural risk, pregnancy-related risk and diabetes.

CPNP exposure, overall, was associated with lower risk of having 1) a preterm birth (26% less likelihood); 2) an LBW infant (34% less likelihood); 3) an SGA infant (11% less likelihood); and 4) an infant with poor neonatal health (17% less likelihood). Unexpectedly, however, overall high program exposure was associated with a higher risk of having an LGA infant (22% more risk) (Table 3).

The associations between overall high CPNP exposure and lower risk of preterm birth and of an SGA infant varied by social group, whereas the associations between overall high CPNP exposure and lower risk of LBW and of poor neonatal health were found virtually across all social groups (Table 4). The relation between overall high CPNP exposure and higher risk of an LGA infant differed across social groups.

High overall CPNP exposure was associated with lower risk of preterm birth for some social groups but not others, specifically married/partnered women (31% lower risk), immigrants in Canada for less than 10 years (36%), women aged 19-34 years (28%), low and middle income women (monthly income <$1,000 or $1,000-$1,900) (33% and 31%, respectively) and women with food security (28%). Additionally, a stronger association was found between overall high CPNP exposure and lower risk of preterm birth for women with less than high school education than for women with high school education (31% lower risk vs. 22%).

The association between CPNP exposure and lower risk of having an SGA infant differed considerably across social groups. Overall, high CPNP exposure was associated with a lower risk of having an SGA infant for married/partnered women (13%), non-Aboriginal women (9%), immigrant women in Canada for 10 years or longer (13%), women with less than high school education (13%), low income women (monthly income <$1,000) (18%), women aged 19 or older (11% for 19-34 years and 25% for >34 years) and women who were food secure (12%).

The relation between CPNP exposure and higher risk of having an LGA infant also varied across social groups. Overall, high CPNP exposure was associated with increased risk of having an LGA infant for married/partnered women (25% higher risk), Aboriginal women (27%), immigrant women in Canada for less than 10 years (33%), women with less than high school education (36%), women aged 19 or older (20% for 19-34 years and 34% for >34 years) and women with moderate food insecurity or food security (32% and 21%, respectively).

DISCUSSION AND CONCLUSION

Clients with overall high CPNP exposure tended to make more positive health behaviour changes and to have fewer negative birth outcomes than those with overall low exposure to the program. They were more likely to reduce the number of cigarettes they smoked and to cease drinking; to breastfeed their infants and, in particular, to breastfeed for longer; and to increase the use of vitamin/mineral supplements from never to daily. Furthermore, clients who had more exposure to the CPNP were consistently less likely to have a preterm birth or give birth to an infant who was LBW, SGA or otherwise in poor health.

A few findings, however, were contrary to expectations. Among clients in some social groups, overall high CPNP exposure was associated with a higher likelihood of gaining more than the recommended amount of weight during pregnancy and, in most social groups, of giving birth to an LGA infant. Further research is needed to determine whether, in fact, greater participation in the CPNP may contribute to excess weight gain, thereby increasing the likelihood of giving birth to an LGA infant among certain clients. (Surprisingly, bivariate analysis found that gaining more than the recommended amount of weight during pregnancy was not associated with a greater likelihood of LGA among CPNP clients.) It is important to note that these relations were found after statistical adjustment for maternal diabetes.

In general, the effects of CPNP exposure did not differ greatly across different social groups, with most subgroups showing posi-

tive relations between exposure and outcomes. However, in terms of health behaviours, slightly more and/or stronger relations were found between high CPNP exposure and healthy behaviour among single/divorced versus married/partnered clients; among recent immigrants versus women in Canada for 10 years or more; among those who had not completed high school versus those who had; and among clients reporting food insecurity versus those who were food secure. It is noteworthy that these are client groups that are at higher risk of adverse birth outcomes, and therefore the slightly stronger relations between high CPNP exposure and health behaviours seen among these clients are encouraging. With regard to birth outcomes, few differences were seen in terms of CPNP benefits across social groups. Married/partnered women, non-Aboriginal women, immigrant women in Canada for 10 years or longer, women between 19 and 34 years of age and women who were food secure had more and/or stronger relations between high CPNP exposure and reduced risk of adverse birth outcomes. Adding some complexity to these findings, women with less than high school education also showed consistently lower risk of adverse birth outcomes.

In conclusion, in the absence of a control group, this evaluation used an innovative approach to estimating the impact of the CPNP on clients' behaviours and birth outcomes by comparing those who received a higher "dose" of CPNP services – by starting to attend earlier in pregnancy, having more contacts, and/or participating for a longer time – with those who received a lower "dose". While this method does not take into account possible differences between these two groups other than CPNP exposure, the strong, generally consistent findings suggest that the CPNP is indeed meeting its intermediate and long-term objectives. Furthermore, our equity analysis found that the associations between higher CPNP exposure and healthy behaviour changes, and even more so, better birth outcomes, were generally present across many social groups.

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RÉSUMÉ

Objectifs : Nos objectifs étaient de déterminer si une exposition élevée au Programme canadien de nutrition prénatale (PCNP) améliorait 1) les habitudes de santé personnelles des participantes, comme le tabagisme et l'allaitement, et 2) les issues de la grossesse, comme l'insuffisance de poids à la naissance et la naissance avant terme.

Intervention : Le PCNP est une intervention sanitaire populationnelle qui vise à contribuer à l'amélioration des résultats sanitaires pour les femmes enceintes et leurs enfants nouveau-nés à risque. Le programme, géré conjointement par les gouvernements fédéral et provinciaux, sert plus de 45 000 Canadiennes par année.

Participantes : Les participantes étaient des femmes inscrites au programme avant d'accoucher, en 2002-2006, et qui présentaient une diversité sur le plan social, démographique et géographique. Près de 12 % étaient adolescentes, et près des 10 % avaient plus de 34 ans; 5 % étaient des immigrantes récentes (au Canada depuis <10 ans), et près du quart étaient autochtones.

Lieu : L'étude englobait un vaste éventail de projets communautaires menés dans 2 000 collectivités.

Résultats : Des statistiques descriptives ont montré que le PCNP joint les femmes à qui il s'adresse. Les participantes très exposées au PCNP étaient plus susceptibles de réduire le nombre de cigarettes qu'elles fumaient, de cesser de consommer de l'alcool, d'allaiter leur nourrisson et d'allaiter plus longtemps, ainsi que d'accroître leur utilisation de suppléments de vitamines et minéraux (de jamais à quotidiennement). En outre, elles étaient moins susceptibles d'accoucher prématurément et d'accoucher d'un nourrisson de poids insuffisant à la naissance, petit pour son âge gestationnel ou en mauvaise santé néonatale. Nous avons observé un résultat inattendu : les participantes étaient plus susceptibles d'accoucher d'un nourrisson gros pour son âge gestationnel. Nos analyses stratifiées de « l'équité » montrent des écarts selon le groupe social, ce qui indique que les avantages obtenus n'étaient pas systématiquement partagés par toutes.

Conclusion : Une exposition élevée au PCNP améliorait les habitudes de santé et les issues de la grossesse chez les femmes et leurs enfants nouveau-nés à risque. De plus, notre analyse de l'équité a montré que les associations entre une exposition élevée au PCNP et l'adoption de comportements plus sains, et plus encore en ce qui a trait à l'amélioration de l'issue de la grossesse, ont en général été relevées à l'échelle de nombreux groupes sociaux. En l'absence d'un groupe témoin, l'étude a fait appel à une démarche novatrice pour estimer l'impact du PCNP en comparant les femmes ayant reçu une forte « dose » à celles ayant reçu une « dose » plus faible des services du PCNP.

Mots clés : développement de l'enfant; populations vulnérables; facteurs de risque; évaluation de programme; intervention précoce