TITLE:

Differential association of household income with contraceptive methods among female youth: Results from the Canadian Community Health Survey (2009–10 and 2013–14)

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Abstract

Background: Low socioeconomic status is one of many barriers that may limit access to family planning services. We aimed to examine the relationship between household income and contraceptive methods among female youth in Canada.

Methods: Our study population included sexually active females aged 15–24 who were trying to avoid pregnancy. We used cross-sectional data from the 2009–2010 and 2013–2014 Canadian Community Health Surveys to compare household income and other sociodemographic covariates for those using oral contraceptives, injectable contraceptives, condoms or a dual method (condoms plus an oral or injectable contraceptive).

Results: Among female youth at risk for unintended pregnancy, 59% used oral contraceptives, 29% used dual methods, 17% used condoms only, 2.5% used injectables and 14% did not use contraception. In multiple regression models, lower household income (<$80,000 per year) was associated with decreased use of oral contraceptives (relative risk [RR] 0.85, 95% confidence interval [CI] 0.80–0.91) and dual methods (RR 0.81, 95% CI 0.71–0.91); increased use of condoms (RR 1.36, 95% CI 1.1–1.7) and injectables (RR 1.69, 95% CI 0.98–2.9), and a greater risk of contraceptive non-use (RR 1.19, 95% CI 0.94–1.5).

Interpretation: We found that lower household income was associated with decreased use of oral contraceptives and increased reliance on injectable contraceptives and condoms-only. Young, low-income females may face barriers to accessing the full range of contraceptive methods available in Canada. Easier access to affordable contraception may decrease the number of female youth at risk of unintended pregnancy due to financial barriers.

Introduction

Access to safe and reliable contraception is critical for reproductive-aged females and their male partners. On average, Canadian females aged 30 and older spend three years trying to conceive, pregnant, or immediately postpartum (1), while the remainder of their reproductive years are spent trying to avoid pregnancy. An estimated 30–40% of pregnancies in Canada are unintended (1,2). As a public health measure, equitable access to affordable contraception supports healthy spacing between planned pregnancies, reduces the number of high-risk pregnancies (3) and decreases avoidable health care expenditures associated with unintended pregnancies (2,4). Despite growing evidence of the benefits associated with increasing access to contraception, both publicly-funded provincial and private insurance plans often limit access to the full range of contraceptive options available in Canada.

In Canada and worldwide, adolescents and young adults are disproportionally impacted by unintended pregnancy (5,6). Other vulnerable groups include recent immigrants, rural residents and those of lower socioeconomic status (7). Canadian researchers have identified numerous barriers to contraceptive use, including high cost, lack of education about options; peer/partner pressure; access to care; and limitations in health care providers' knowledge or counseling (8–11).

Among contraceptives currently available in Canada, intrauterine contraceptives (IUCs) are the most effective at preventing unintended pregnancy (99.2–99.8% effective); followed by injectable medications (94%); combined hormonal contraceptives, including oral contraceptives (OCs); transdermal patches and intravaginal rings (all 91%); and condoms (70–80%) (3). Effective contraceptive methods are underutilized in Canada, particularly among vulnerable populations (3). Although oral contraceptives are the most commonly used hormonal method in Canada (12), over 50% of youth report using condoms only (1), which may be due to ease of

access (non-prescription, no health care visit required, relatively inexpensive or available free of cost) (13). Data on IUC use in Canada is limited because national surveys had not included questions about this method.

In a recent qualitative study, Canadian health care providers cited cost as the primary barrier to contraception access nationwide (14). In the province of Quebec, where contraception is subsidized, residents report the lowest proportion of unmet contraceptive needs compared with other provinces (15). Low income and immigrant status are also associated with non-use of contraceptives (16,17). Despite evidence of financial barriers to contraception access (18), no studies have examined how income might impact choice of contraceptive method among young Canadian females. In this study, we investigate the association between household income and contraceptive method using a nationally-representative survey sample of sexually active Canadian females aged 15–24.

Methods

Data source, design and study population: This cross-sectional study used public use microdata files from two cycles (2009–2010 and 2013–2014) of the Canadian Community Health Survey (CCHS) (19). The CCHS collects information related to health care utilization, health status and determinants of health in Canada. The survey sample is derived from a multistage stratified cluster random sampling design. Further details of CCHS sampling methods are available from Statistics Canada (19,20). Ethics approval for using publicly available CCHS data is covered by University of British Columbia policies (21) and the Tri-Council Policy Statement (22).

Analytic sample: The sample was drawn from CCHS respondents who were asked about contraceptives, which included persons aged 15–24. We considered those "at risk" of unintended pregnancy to be females who were ever sexually active, were not currently pregnant, did not

have a hysterectomy, and who responded "agree" or "strongly agree" to the statement: "It is important to me to avoid getting pregnant right now." Those with invalid responses ("don't know, refusal, not applicable, not stated") were coded as missing. Records with missing covariates (6.5%) were excluded. The primary analysis was conducted using complete cases. Inclusion/exclusion criteria and sample sizes are shown in Figure 1.

Non-users of contraception were defined as those who responded "no" to the question: "In the past 12 months, did you and your partner usually use birth control?" For contraceptive users, we determined each respondent's method of contraception based on their response to the question: "What is your usual form of birth control?" Respondents could select one or more "usual" method: "the pill, injections, condoms, diaphragm, spermicide or other." Of note, intrauterine contraceptives were not offered as a possible response and are therefore excluded from this analysis. Respondents who used the contraceptive patch or ring, IUCs, calendar methods or withdrawal would be included in the "other" group. Outcome variables were: the use of (1) any OCs, (2) injectable contraceptives (depot medroxyprogesterone acetate - DMPA), (3) non-prescription methods (condoms only, condoms and spermicide, or spermicide only) or (4) dual method (condoms plus OCs or DMPA). We refer to (3) as "condoms only" method, although this includes <0.2% of respondents who used spermicide without condoms or condoms and spermicide. As these outcomes were not mutually exclusive, we considered each outcome independently. Our exposure variable was household income greater than $80,000 per year (yes/no), derived from the 5-level household income variable provided in the CCHS datasets. The cut-point for high versus low income was based on the estimated median family income in Canada for two-parent families with children in 2010 ($78,800) (23).

Statistical analysis: We examined the prevalence of each contraceptive method according to sociodemographic characteristics. We used survey weights provided with the CCHS public use

data (19,20) to account for the complex survey design. These enable accurate weighted point estimates but conservative variance estimates compared with cluster and primary sampling units or bootstrap weights. Bivariate associations between each covariate and contraceptive method were assessed using a modified F-test (with Thomas-Rao modification) (24).

We used log binomial regression to estimate risk ratios assessing the association between household income and the prevalence of each contraceptive method. For each contraceptive type, we estimated crude and adjusted risk ratios (RRs). The latter adjusted for all potential confounders identified on *a priori* grounds using causal diagrams: age, self-identified race/ethnicity, highest level of education in the household, northern resident (Northwest Territories, Yukon or Nunavut), student, married, recent immigrant (1,3,8,9,11,12,14,18,25). We conducted analyses using SAS 9.4 (26) and R-3.5.1 (27). All analyses applied sampling weights to achieve nationally-representative estimates (19). Because we pooled two CCHS survey cycles, weights were divided by two to obtain a representative weighted population across both survey cycles.

Sensitivity analysis: We explored whether our results were robust to different definitions of household income by fitting additional models: first, with the original 5-level household income variable obtained from the CCHS and, second, adjusted for household size. To examine whether results may differ in Quebec due to publicly-funded drug benefits (1), we estimated risk ratios separately for Quebec and compared with all other provinces excluding Quebec. Finally, we examined the potential impact of missing data in the covariates using multiple imputation with chained equations (28) to impute missing covariates for 20 datasets using the "mice" package in R (29). All possible covariates (with an absolute correlation with the response/imputed variable >0.1) were considered as predictors for imputation. Survey-weighted logistic regression models were repeated among imputed datasets to obtain pooled effect estimates.

Results

Among all female survey respondents aged 15–24 (n=15,290, representing a population of N=2,137,242), 62% reported being sexually active and 48% were considered "at risk" for unintended pregnancy. Sexual activity differed by age group: 82% of respondents aged 20–24 had ever been sexually active, compared to 26% (15-17 years) and 63% (18–19 years) of younger respondents. Among those who were sexually active, 92% were trying to avoid a pregnancy. Contraceptive non-use was reported by 14% of respondents. By province, rates of non-use were lowest in Quebec (9.2%) and highest in the northern territories (19.4%), compared to the rest of Canada (15%). Oral contraceptives were the most popular method (59.2%), followed by condoms (47.6%), "other" methods 7.7%) and injectable DMPA (2.5%) (Table 1). Over one-third (36.5%) of respondents used more than one method, typically condoms with OCs or DMPA (29.0%).

Table 2 shows the number of survey respondents, corresponding population estimates and weighted prevalence estimates for each contraceptive method, according to sociodemographic characteristics. The lower income group reported less OC use (53.3%, versus 69.0%), while the inverse is seen for DMPA (3.0% versus 1.5%) and condoms only (18.9% versus 13.3%). Although DMPA use was low overall, it was slightly higher in the two lowest educational attainment groups (4.6% and 5.0%). Oral contraceptives were more prevalent among white females (63.2%) compared with those who identified as a visible minority (43.3%), but demonstrated no difference by marital status. Patterns of contraceptive use were different in the northern territories compared to the rest of Canada. Specifically, northern residents reported lower OC use, and higher condom-only and DMPA use, compared to non-northern residents.

Table 3 presents unadjusted and adjusted RRs for all outcomes, comparing prevalent method-specific use for lower versus higher household income categories. In adjusted models, lower

household income was associated with decreased OC (RR=0.85, 95% CI 0.80–0.91) and dual-method use (RR=0.81, 95% CI 0.71–0.91, and increased DMPA (RR=1.7, 95% CI 0.98–2.9) and condom-only use (RR=1.4, 95% CI 1.1–1.7), compared to the higher household income group. Adjustment for confounding variables attenuated associations for all outcomes. In models for OCs and DMPA, adjusting for household education level had the strongest impact on associations. By contrast, estimates for condom-only use were attenuated after adjusting for marital status, ethnicity and immigration status.

Sensitivity analyses: We estimated the association of low versus high household income on contraceptive outcomes with imputed data for missing covariates (supplemental S1), and the results were similar to our primary analyses for all outcomes (Table 3). Using a household size-adjusted income variable (supplemental S2) yielded effect estimates with a consistent trend across income categories for all outcomes. Stratifying by the province of Quebec also yielded similar results for all outcomes (supplemental S3), with the exception of lower prevalence of non-use.

Interpretation

Using a nationally-representative survey sample, we found that lower household income was associated with lower usage of effective contraception methods, specifically OCs. Those with lower household income reported a 15% decrease in OC use and a 19% decrease in dual-method use (condoms plus OCs or DMPA) compared with higher-income respondents. Conversely, those with lower household income reported a 70% higher use of DMPA and a 36% higher use of condoms only compared with the higher-income group. These findings are important as there is a paucity of recent nationally-representative data on contraceptive patterns, as well as limited information about how household income may be related to choice of contraceptive methods among youth at risk for unintended pregnancy in Canada (3). Similar to findings from previous

Canadian studies, OCs and condoms were the predominant methods of contraception (1,12,18),

and the highest prevalence of OCs use was amongst the youngest age group (15–17 years)

(1,18,30). We also note that the association with income differed for OCs compared to DMPA or

condoms, in unadjusted analyses and after controlling for confounders. This trend was consistent

in models using a 5-level household size-adjusted income variable (supplemental S2).

Our study is novel in reporting a significant association with higher household income and an

increase in both OC and dual-method use, after adjusting for other risk factors, in a

representative sample of young Canadian females at risk of unintended pregnancy. While

previous Canadian studies have identified an increase in OC use by higher income status (18,30),

these analyses did not focus on income as the exposure of interest. Our findings suggest young

females from higher-income households may be able to access a broader range of effective

contraceptive methods, perhaps because cost has been reduced or eliminated as a barrier (14).

Higher-income families may also have prescription drug benefits to subsidize costs of

contraceptives. Further, young females from higher-income households were also more likely to

use multiple contraceptive methods, which would provide greater protection against unintended

pregnancies than OCs alone, while also reducing the risk of sexually transmitted infections.

Although DMPA use is relatively low in Canada, our study is the first to report increased use of

DMPA among low-income female youth across Canada, with even higher use in the northern

territories. This could be due to provider preference and counselling for this population or patient

preferences, though we could not examine reasons or preferences in this study. In the United

States, DMPA use is similarly higher among vulnerable populations, including indigenous (31),

racial or ethnic minorities (32) and those with low income (33,34). While DMPA provides

effective contraception and is preferred by some, it has a controversial history, including

targeted marketing and provision to vulnerable groups that may indicate reproductive coercion

(35–38). Further, side effects of bone density loss and weight gain (39,40) may be particularly

important for youth, as well as recent research linking DMPA and elevated risk of acquisition of

HIV (41). Therefore, our finding of higher use among low-income youth and youth in the

north warrant further examination in studies of provider preferences and patient decision-making

to elucidate reasons for higher injectables use in these Canadian populations.

Our findings signal a need for further research aimed at identifying and eliminating barriers to

accessing safe, effective contraception in Canada (42). Policies and educational initiatives

relating to family planning should consider the unique reproductive needs of young females—

especially those within vulnerable populations, who are at greatest risk of unintended pregnancy.

Limitations

Our results are based on self-report survey data and could be misclassified, which would

underestimate our measures of association. We could not include the 2011–12 CCHS cycle in

this study as contraception questions were only asked in one province (Ontario) and two

territories (Northwest Territories and Nunavut), which would limit the generalizability of our

results. Unfortunately, these CCHS cycles did not include questions about IUCs, which

prevented us from extending our analyses to these long-acting, highly effective contraceptive

methods. While newer CCHS cycles (from 2015) do ask about IUCs, questions relating to

pregnancy intention have been eliminated. Thus, new CCHS surveys cannot directly identify

people with a need for contraception, those at risk of unintended pregnancy. As this group forms

the denominator to assess contraception use, it is no longer possible in Canada to use the CCHS

to determine the unmet need for contraception, nor the rates of methods used among those with a

need for contraception. Because the CCHS only asks those aged 18 or older about sexual

orientation, our sample may include a small number of homosexual females not at risk of

unintended pregnancy; however, others report <2% of all CCHS respondents identified as

homosexual (43). We used household income as a proxy for an individual's ability to pay for

contraceptives, and this may not perfectly equate to individual financial status or could be a

marker for other unmeasured confounders. Finally, by nature of the CCHS's cross-sectional

design, associations between income and contraceptive use cannot be interpreted causally.
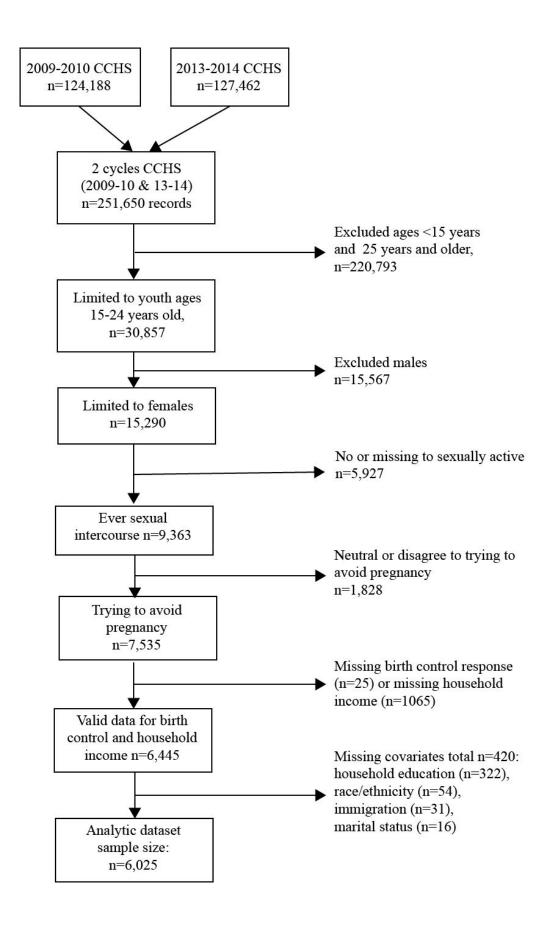
<u>Conclusions</u>

In a nationally-representative sample of young Canadian females who are at risk for unintended

pregnancy, we found that lower household income was associated with decreased use of OCs

and increased reliance on injectable contraceptives and condoms. Our results are consistent with

other recent findings that show substantial variations in contraceptive use within Canada (3),

with lower use of more effective contraceptive methods among vulnerable groups. Collectively,

these findings suggest that subsidizing or eliminating costs for contraceptives, as called for in a

recent position statement by the Canadian Pediatric Society (44), could promote equitable access

to more effective methods of birth control among low-income youth who are at risk of

unintended pregnancy.

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┌─────────────────┐   ┌─────────────────┐
│ 2009-2010 CCHS  │   │ 2013-2014 CCHS  │
│  n=124,188      │   │  n=127,462      │
└─────────────────┘   └─────────────────┘
          │                   │
          └────────┬──────────┘
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         ┌─────────────────────┐
         │   2 cycles CCHS     │
         │ (2009-10 & 13-14)   │           Excluded ages <15 years
         │ n=251,650 records   │           and  25 years and older,
         └─────────────────────┘──────────▶ n=220,793
                   │
                   ▼
         ┌─────────────────────┐
         │ Limited to youth ages│
         │  15-24 years old,   │           Excluded males
         │    n=30,857         │           n=15,567
         └─────────────────────┘──────────▶
                   │
                   ▼
         ┌─────────────────────┐
         │ Limited to females  │           No or missing to sexually active
         │    n=15,290         │           n=5,927
         └─────────────────────┘──────────▶
                   │
                   ▼
         ┌─────────────────────┐
         │   Ever sexual       │           Neutral or disagree to trying to
         │ intercourse n=9,363 │           avoid pregnancy
         └─────────────────────┘──────────▶ n=1,828
                   │
                   ▼
         ┌─────────────────────┐
         │ Trying to avoid     │           Missing birth control response
         │  pregnancy          │           (n=25) or missing household
         │   n=7,535           │           income (n=1065)
         └─────────────────────┘──────────▶
                   │
                   ▼
         ┌─────────────────────┐           Missing covariates total n=420:
         │ Valid data for birth│           household education (n=322),
         │ control and household│          race/ethnicity (n=54),
         │ income n=6,445      │──────────▶ immigration (n=31),
         └─────────────────────┘           marital status (n=16)
                   │
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         ┌─────────────────────┐
         │ Analytic dataset    │
         │ sample size:        │
         │   n=6,025           │
         └─────────────────────┘
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Usual contraceptive methods	Total= 6,025 n	%[1] (95% CI[2])
Survey responses[3]		
Oral contraceptives (OC)[4]	3,634	59.2 (57.2, 61.2)
Condom	2,953	47.6 (45.6, 49.6)
Other	471	7.7 (6.6, 8.8)
Injectable contraceptives (DMPA)[5]	190	2.5 (1.9, 3.0)
Diaphragm	72	1.0 (0.7, 1.4)
Non-use (no contraceptive method)	815	13.6 (12.3, 15.0)
Derived results		
Condom and/or spermicide (no other methods indicated)[5]	902	16.8 (15.3, 18.4)
≥2 contraceptive methods reported	2,105	36.5 (34.5, 38.6)
Condom+: Condom plus OCs or DMPA[5]	1,927	29.0 (27.3, 30.8)

[1] Population-weighted prevalence estimates (survey weighted) for female youth, ages 15–24 in Canada

[2] 95% confidence intervals

[3] Respondents could indicate more than one method to the question: "What is your usual method of birth control?" (results for spermicide only not shown due to low numbers)

[4] Primary outcome

[5] Secondary outcomes: injectable contraceptives and condom/spermicide

Covariates	Total survey (N=6,025) n	Population estimates (N= 826,711) n (%)	Oral Contraceptives % (95% CI)	Injections % (95% CI)	Condoms only[1] % (95% CI)	Non-users % (95% CI)
Household income						
<$80,000/year	3,689	516,241 (62.4)	53.3 (50.7, 55.9)	3.0 (2.2, 3.8)	18.9 (16.9, 21.0)	15.5 (13.7, 17.3)
≥ $80,000/year	2,336	310,470 (37.6)	69.0 (66.0, 71.9)	1.5 (0.8, 2.2)	13.3 (11.0, 15.6)	10.5 (8.5, 12.5)
Age						
15 to 17 years	1,045	95,467 (11.5)	63.7 (59.7, 67.8)	2.4 (1.3, 3.6)	15.2 (12.2, 18.3)	16.3 (13.3, 19.4)
18 to 19 years	1,325	157,515 (19.1)	59.2 (54.8, 63.5)	2.6 (1.4, 3.7)	17.8 (14.1, 21.5)	14.9 (11.6, 18.1)
20 to 24 years	3,655	573,729 (69.4)	58.4 (55.9, 60.9)	2.4 (1.7, 3.1)	16.8 (14.9, 18.7)	12.8 (11.2, 14.5)
Race or ethnicity						
white	4,910	660,166 (79.9)	63.2 (61.0, 65.3)	2.3 (1.7, 2.9)	14.9 (13.2, 16.6)	11.3 (10.0, 12.7)
visible minority	1,115	166,545 (20.1)	43.3 (38.5, 48.1)	3.2 (1.8, 4.6)	24.3 (20.5, 28.2)	22.6 (18.7, 26.5)
Current student						
no	2,618	369,334 (44.7)	52.5 (49.4, 55.7)	2.8 (1.9, 3.7)	18.1 (15.5, 20.6)	17.1 (14.8, 19.5)
yes	3,407	457,377 (55.3)	64.5 (62.1, 67.0)	2.2 (1.5, 2.9)	15.8 (13.9, 17.7)	10.8 (9.2, 12.3)
Married or common-law						
no	5,063	676,199 (81.8)	59.9 (57.8, 62.1)	2.4 (1.8, 3.0)	17.7 (15.9, 19.5)	13.2 (11.8, 14.7)
yes	962	150,513 (18.2)	55.9 (50.9, 60.9)	2.8 (1.4, 4.2)	13.0 (10.0, 15.9)	15.3 (11.7, 19.0)
Recent immigrant[2]						
no	5,871	787,812 (95.3)	60.2 (58.2, 62.2)	2.5 (1.9, 3.0)	15.8 (14.3, 17.4)	13.5 (12.1, 14.9)
yes	154	38,899 (4.7)	37.9 (27.3, 48.5)	<2.0	37.0 (27.4, 46.7)	16.5 (10.1, 22.9)
Highest level education - Household						
< secondary	284	29,935 (3.6)	32.9 (23.8, 42.1)	4.6 (1.8, 7.5)	16.6 (4.8, 28.4)	27.5 (19.4, 35.7)
secondary grad	730	89,807 (10.9)	46.0 (40.1, 51.9)	5.0 (2.6, 7.4)	20.7 (15.7, 25.7)	19.6 (15.4, 23.8)
some post-sec	502	70,826 (8.6)	55.0 (47.7, 62.3)	2.3 (0.3, 4.3)	16.4 (11.5, 21.3)	17.3 (11.9, 22.6)
post-sec grad	4,509	636,143 (76.9)	62.7 (60.5, 65.0)	2.0 (1.4, 2.6)	16.3 (14.6, 18.1)	11.7 (10.2, 13.2)
Consulted a doctor or nurse in past 12 months						
no	744	104,844 (12.7)	42.4 (36.3, 48.5)	1.5 (0.4, 2.6)	26.8 (21.9, 31.8)	22.9 (17.9, 27.8)
yes	5,278	721,490 (87.3)	61.6 (59.5, 63.7)	2.6 (2.0, 3.2)	15.4 (13.7, 17.0)	12.3 (10.9, 13.6)
Has family doctor						
no	1,132	168,906 (20.5)	48.1 (43.2, 53.0)	2.0 (0.8, 3.3)	21.0 (17.2, 24.8)	18.2 (14.5, 21.9)
yes	4,887	656,656 (79.5)	62.0 (59.9, 64.2)	2.6 (2.0, 3.2)	15.7 (14.0, 17.4)	12.5 (11.0, 13.9)
Resident of the northern territories[3]						
No	5,823	823,779 (99.6)	59.3 (57.3, 61.3)	2.4 (1.9, 3.0)	16.8 (15.2, 18.4)	13.6 (12.2, 14.9)
Yes	202	2,933 (0.4)	33.9 (26.3, 41.6)	9.6 (4.2, 15.0)	22.5 (15.4, 29.7)	19.4 (12.7, 26.1)
Quebec[4]						
no	4,747	619,576 (74.9)	57.9 (55.6, 60.2)	2.6 (2.0, 3.3)	17.2 (15.4, 19.0)	15.1 (13.5, 16.7)
yes	1,278	207,135 (25.1)	63.1 (59.1, 67.1)	1.9 (0.9, 2.9)	15.8 (12.8, 18.7)	9.2 (6.8, 11.6)

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[1] Includes those reporting using only spermicide and/or condoms
[2] Immigrated to Canada within the last 10 years
[3] Province of residence was one of the Yukon, Northwest Territories or Nunavut
[4] Quebec has a publicly funded prescription benefit program and contraceptives are covered for youth who are not under a private drug plan

Primary outcomes	Crude RR[1] (95% CI[2]) *for low income group*	Adjusted RR[3] (95% CI) *for low income group*
Oral Contraceptives	0.77 (0.72, 0.83)	0.85 (0.80, 0.91)
Injections (DMPA)	1.96 (1.16, 3.32)	1.69 (0.98, 2.92)
Condoms only	1.42 (1.16, 1.74)	1.36 (1.11, 1.67)
Non-users	1.47 (1.17, 1.84)	1.19 (0.94, 1.5)
Multiple methods		
Condom plus OCs or DMPA	0.67 (0.59, 0.75)	0.81 (0.71, 0.91)

[1] Risk ratio
[2] 95% confidence intervals (CI) using robust standard errors.
[3] Adjusted for: household income, age, race/ethnicity, recent immigrant, student status, marital status, household level of education, northern residence

Supplemental material for: **Differential association of household income with contraceptive methods among female youth: Results from the Canadian Community Health Survey (2009–10 and 2013–14)**

Supplemental S1 - Multiple imputation results

Dataset with missing data (for imputation) included 6,445 survey responses. Imputation for 420

missing values (<7% of the full dataset); details of missing data are shown in Figure 1.

Table S1-1. Pooled effect estimates for the odds of contraceptives use based on the effect of lower household income using datasets with missing data imputed, from the Canadian Community Health Survey (2009–2010 and 2013–2014).

Outcome	Pooled RR	95% CI
Oral contraceptives	0.86	0.80, 0.92
Injectable contraceptives	1.68	1.00, 2.83
Condoms only	1.33	1.09, 1.63
Non-users	1.20	0.96, 1.51
Condom plus OCs or DMPA	0.83	0.74, 0.93

Supplemental S2 - Two alternate definitions of household income

The original 5-level categorical variable for household income from the CCHS was also assessed in bivariate and logistic regression models with the outcomes of interest. Further, we refined the household income variable by adjusting for the number of individuals living in the household using the relevant CCHS categorical variable for household size. Because only categorical data was available for both household income and household size, we first created a continuous variable for household income using the midpoint of the range (except for the highest range, which was assigned as $100,000). Then, we assigned household size based on the categorical variable from the CCHS (1-person household = 1, … 5-person household = 5). The adjusted per-person household income was calculated based on commonly used approaches: an "equivalence scale"[1,2] adjustment to account for economies of scale in larger households, which would impact a per-person "adjusted household income". Adjusted household income in this study was calculated as follows:

$$Adjusted\ household\ income = Household\ income\ /\ (Household\ size)^{0.5}$$

Descriptive statistics and prevalence estimates for both household income variables are shown in Table S2-1 below. Adjusted and unadjusted logistic regression model estimated odds ratios using the 5-level categorical household income variable and adjusted household income are shown in Table S2-2.

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[1] Smeeding TM. Poor People in Rich Nations: The United States in Comparative Perspective. Ssrn. 2005;20(1):69–90.
[2] Kochhar R, Cohn D. Fighting Poverty in a Bad Economy, Americans Move in with Relatives. Pew Research Center's Social & Demographic Trends Project. 2011.

Table S2-1. Descriptive statistics and population prevalence estimates for contraceptive outcomes by household income and adjusted income among female youth, from the Canadian Community Health Survey (2009–2010 and 2013–2014).

Income variables	Survey responses (N=6025)[2] n	Population estimates (N= 826 711) n (%)	Oral contraceptives % (95% CI)	Injectable DMPA % (95% CI)	Condoms[1] % (95% CI)	Non-users % (95% CI)
Yearly household income[3]						
None or <$20,000	681	94 298 (11.4)	48.1 (42.2, 53.9)	4.2 (2.4, 6.0)	19.0 (14.6, 23.5)	19.8 (15.4, 24.1)
$20,000–$39,999	1030	143 975 (17.4)	52.2 (47.2, 57.3)	3.0 (1.4, 4.6)	17.5 (14.0, 21.0)	17.7 (14.0, 21.3)
$40,000–$59,999	1047	146 608 (17.7)	54.5 (49.7, 59.4)	3.4 (1.8, 5.1)	18.2 (14.5, 21.8)	13.7 (10.5, 16.9)
$60,000–$79,999	931	131 361 (15.9)	56.9 (51.4, 62.3)	1.7 (0.6, 2.8)	21.2 (16.3, 26.1)	12.0 (8.7, 15.4)
$80,000 or more	2336	310 470 (37.6)	69.0 (66.0, 71.9)	1.5 (0.8, 2.2)	13.3 (11.0, 15.6)	10.5 (8.5, 12.5)
Household size-adjusted income[4]						
less than $20,000 pp[5]	1159	158 009 (19.1)	45.9 (41.1, 50.6)	4.3 (2.8, 5.8)	20.0 (16.3, 23.6)	21.0 (17.5, 24.5)
20-<40k pp	1888	273 599 (33.1)	56.7 (53.1, 60.3)	2.3 (1.3, 3.3)	17.7 (15.1, 20.4)	14.0 (11.5, 16.6)
40-<60k pp	2696	359 083 (43.4)	65.7 (62.8, 68.6)	1.7 (1.0, 2.4)	15.5 (13.1, 17.9)	10.4 (8.6, 12.2)
60k pp or more	282	36 021 (4.4)	71.4 (63.9, 78.8)	2.9 (0.2, 5.7)	9.1 (5.2, 13.0)	10.0 (4.2, 15.9)

[1] Includes those reporting usually using only spermicide and/or condoms
[2] N for this analysis, 6 cases excluded due to missing data for household size
[3] Original yearly household income variable from CCHS
[4] Adjusted household income based on household size
[5] pp = per person

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4 Table S2-2. Effect of yearly household income and household size-adjusted income on
5
6 contraceptives used by female youth (ages 15–24 years), from the Canadian Community Health
7
8 Survey (2009–10 and 2013–14), adjusted and unadjusted regression models.

Covariate (main exposure only)	Oral contraceptives		Injectable DPMA		Condoms only		Non-users	
	Crude RR[1] (95% CI[2])	Adjusted[3] RR (95% CI)	Crude RR (95% CI)	Adjusted RR (95% CI)	Crude RR (95% CI)	Adjusted RR (95% CI)	Crude RR (95% CI)	Adjusted RR (95% CI)
Model 1: Yearly household income								
≥ $80,000	baseline	baseline	baseline	baseline	baseline	baseline	baseline	baseline
$60,000 – $79,999	0.82 (0.74, 0.92)	0.86 (0.78, 0.96)	1.11 (0.51, 2.44)	1.05 (0.46, 2.38)	1.59 (1.19, 2.12)	1.59 (1.20, 2.10)	1.14 (0.81, 1.60)	1.03 (0.74, 1.45)
$40,000 – $59,999	0.79 (0.72, 0.87)	0.86 (0.78, 0.95)	2.23 (1.14, 4.34)	1.97 (1.01, 3.81)	1.36 (1.05, 1.78)	1.32 (1.01, 1.72)	1.30 (0.96, 1.76)	1.06 (0.78, 1.44)
$20,000 – $39,999	0.76 (0.68, 0.84)	0.85 (0.76, 0.94)	1.97 (0.99, 3.96)	1.74 (0.85, 3.56)	1.31 (1.01, 1.71)	1.23 (0.93, 1.61)	1.68 (1.27, 2.22)	1.34 (1.00, 1.81)
None – $19,999	0.70 (0.61, 0.79)	0.81 (0.72, 0.92)	2.72 (1.45, 5.08)	2.23 (1.15, 4.33)	1.43 (1.07, 1.91)	1.25 (0.91, 1.71)	1.88 (1.40, 2.52)	1.48 (1.08, 2.02)
Model 2: Household size-adjusted income								
≥ $60,000 or more	baseline	baseline	baseline	baseline	baseline	baseline	baseline	baseline
$40,000 – $59,999	0.92 (0.82, 1.03)	0.89 (0.80, 1.00)	0.58 (0.21, 1.61)	0.58 (0.21, 1.58)	1.71 (1.08, 2.70)	1.52 (0.95, 2.45)	1.03 (0.56, 1.90)	1.07 (0.60, 1.92)
$20,000 – $39,999	0.79 (0.70, 0.90)	0.83 (0.73, 0.94)	0.78 (0.28, 2.21)	0.71 (0.25, 1.98)	1.95 (1.24, 3.08)	1.70 (1.07, 2.71)	1.40 (0.76, 2.58)	1.26 (0.69, 2.28)
none – $19,999	0.64 (0.56, 0.74)	0.72 (0.62, 0.83)	1.46 (0.54, 3.97)	1.22 (0.45, 3.26)	2.20 (1.38, 3.51)	1.75 (1.07, 2.85)	2.09 (1.14, 3.85)	1.70 (0.94, 3.07)

[1] Risk ratio

[2] 95% confidence intervals (CI) using robust standard errors.

[3] Adjusted for: household income, age, race/ethnicity, recent immigrant, student, marital status, household level of education, northern residence

Supplemental S3 – Stratification by Quebec

To examine whether results may differ in Quebec, we ran all analysis stratified by for the

province of Quebec only (n=1278 surveys) compared to all other provinces/territories (n=4747

surveys). Table S3-1 presents the prevalence estimates using weighted populations for all

contraceptive outcomes when the survey was stratified by Quebec compared with the rest of

Canada. Table S3-2 presents results from regression models predicting risk of contraceptive use

in stratified groups.

Table S3-1. Stratified for Quebec versus rest of Canada: descriptive statistics and population prevalence estimates for contraceptive outcomes by 2-level household income and adjusted income among female youth, from the Canadian Community Health Survey (2009–2010 and 2013–2014).

Household income	Surveys n	Population estimates n (%)	Oral contraceptives	Injectable DPMA	Condoms only	Non-users
Quebec Only	(n=1278)	(n= 207 135)	63.1 (59.1, 67.1)	1.9 (0.9, 2.9)	15.8 (12.8, 18.7)	9.2 (6.8, 11.6)
Household income						
higher income group	440	70 450 (34.0)	79.2 (74.3, 84.1)	1.0 (0.0, 2.0)	8.8 (5.4, 12.3)	5.4 (2.7, 8.1)
lower income group	838	136 685 (66.0)	54.8 (49.6, 60.0)	2.4 (0.9, 3.8)	19.3 (15.2, 23.4)	11.2 (7.9, 14.5)
Rest of Canada	(n=4747)	(n=619 576)	57.9 (55.6, 60.2)	2.6 (2.0, 3.3)	17.2 (15.4, 19.0)	15.1 (13.5, 16.7)
Household income						
higher income group	1896	240 020 (38.7)	65.9 (62.5, 69.4)	1.7 (0.8, 2.6)	14.6 (11.9, 17.4)	12.0 (9.5, 14.5)
lower income group	2851	379 556 (61.3)	52.8 (49.7, 55.8)	3.2 (2.3, 4.2)	18.8 (16.4, 21.2)	17.0 (14.9, 19.2)

Table S3-2. Stratified by Quebec versus rest of Canada: effect of low household income (<80,000$/year) on contraceptives used by female youth, from the Canadian Community Health Survey (2009–2010 and 2013–2014), adjusted and unadjusted regression models.

	Quebec only		Rest of Canada	
Primary outcomes	Crude RR[1] (95% CI[2]) for low income group	Adjusted RR[3] (95% CI)	Crude RR (95% CI) for low income group	Adjusted RR[3] (95% CI)
Oral contraceptives	0.69 (0.62, 0.77)	0.75 (0.67, 0.84)	0.8 (0.74, 0.87)	0.89 (0.82, 0.96)
Injections (DMPA)	2.38 (0.74, 7.68)	2.20 (0.71, 6.84)	1.92 (1.07, 3.43)	1.61 (0.88, 2.94)
Condoms only	2.18 (1.4, 3.41)	2.12 (1.35, 3.31)	1.28 (1.02, 1.61)	1.23 (0.98, 1.55)
Non-users	2.07 (1.16, 3.69)	not estimable[4]	1.42 (1.11, 1.8)	1.14 (0.88, 1.47)
Multiple methods Condom plus OCs or DMPA	0.67 (0.52, 0.86)	not estimable[4]	0.67 (0.58, 0.77)	0.82 (0.71, 0.94)

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[1] Risk ratio

[2] 95% confidence intervals (CI) using robust standard errors.

[3] Adjusted for: household income, age, race/ethnicity, recent immigrant, student status, marital status, household level of education, northern residence (rest of Canada group only)

[4] Model was not estimable for income status due to low cell counts for outcome of interest (household income)

Supplemental S4 – Addendum to Table 2

Table S4-1 Estimated population prevalence (%) for dual-method use (condoms plus OCs or DMPA), by various covariates, from Canadian Community Health Survey (2009–2010 and 2013–2014). Addendum to Table 2.

Covariates	*Multiple method:* *Condom + OCs or DMPA* *% (95% CI)*
Household income	
<$80,000/year	24.5 (22.3, 26.6)
≥ $80,000/year	36.6 (33.7, 39.6)
Age	
15 to 17 years	42.8 (38.5, 47.1)
18 to 19 years	33.0 (29.1, 36.9)
20 to 24 years	25.7 (23.5, 27.8)
Race or ethnicity	
White	31.0 (29.0, 33.0)
visible minority	21.2 (17.6, 24.8)
Current student	
no	22.6 (20.1, 25.1)
yes	34.2 (31.8, 36.7)
Married or common-law	
no	32.0 (30.0, 34.0)
yes	15.7 (11.8, 19.6)
Recent immigrant[1]	
No	29.5 (27.7, 31.3)
Yes	18.7 (9.8, 27.7)
Highest level education – Household	
< secondary	12.6 (7.2, 18.1)
secondary grad	25.2 (20.1, 30.3)
some post-sec	23.3 (18.0, 28.6)
post-sec grad	31.0 (28.9, 33.0)
Consulted a doctor or nurse in past 12 months	
No	20.7 (15.8, 25.6)
Yes	30.3 (28.4, 32.2)
Has family doctor	
No	21.1 (17.6, 24.7)
Yes	31.0 (29.0, 33.0)
Resident of the northern territories[2]	
No	29.1 (27.3, 30.8)
Yes	20.7 (13.9, 27.6)
Quebec[3]	
no	29.4 (27.4, 31.5)
yes	27.8 (24.2, 31.4)

[1] Immigrated to Canada within the last 10 years
[2] Province of residence was one of the Yukon, Northwest Territories or Nunavut
[3] Quebec has a publicly-funded prescription benefit program; contraceptives are covered for youth who do not have coverage under a private drug plan

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	3 - abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3 abstract
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*5-6*
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	6-7
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6-7
		(*e*) Describe any sensitivity analyses	7
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	7, suppl.

Outcome data	15*	Report numbers of outcome events or summary measures	8
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8, Table 3,4
		(*b*) Report category boundaries when continuous variables were categorized	6
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9, suppl.
Discussion			
Key results	18	Summarise key results with reference to study objectives	9-10
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	9-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	10
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	online (none)

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.