Article details: 2019-0087	
Title	**Differential association of household income with contraceptive methods among female youth: A cross-sectional study using the Canadian Community Health Survey (2009–10 and 2013–14)**
Authors	Elizabeth Nethery MSc MSM, Laura Schummers ScD, K. Suzanne Maginley MSc, Sheila Dunn MD MSc, Wendy V. Norman MD MHSc
Reviewer 1	Dr. Erin Wilson
Institution	University of Northern British Columbia, Nursing
General comments (author response in bold)	Thank you very much for the opportunity to review your manuscript. Please find my comments below. Introduction: 1. Could you clarify: Does the CCHS ask respondents if they have ever been pregnant? If yes, this could influence contraceptive use for the sample (e.g. IUD inserted after delivery or abortion). **The CCHS does ask respondents if they have been pregnant in the last 5 years; our population prevalence was 7.8% based on this study. All parous females were in the highest age strata (20-24 years). Prior pregnancy in our sample was associated with some small changes in contraceptive use patterns; specifically, an increase in non-use and a slight decrease in oral contraceptives use. Excluding those with a prior pregnancy from our study group did not alter our overall findings for income and contraceptive use.** **A priori, we agree that we would expect the strongest impact of prior pregnancy might be for IUD use. Because the CCHS surveys we report do not have data on IUDs; we cannot analyze IUD as an outcome. Thus, we did not report findings for prior pregnancy and our other contraceptive outcomes as part of this manuscript.** 2. Para 2: rural residents being disproportionately impacted by unintended pregnancy – looking at the Cdn ref you have for this (Oulman et al), they found that the territories actually had the highest rates overall for unintended pregnancy. You may wish to draw this out in more detail as you spend time in your discussion about DMPA use in the territories. **The study we referred to has some limitations with regards to their ability to assess unplanned pregnancy because they did not capture information on all pregnancies (whether they ended in a termination, miscarriage, stillbirth or live birth). Specifically, the study population was limited to those who had actually given birth.** **We agree with the reviewer that if rates of unintended pregnancy are higher in a particular region, that might impact both patient contraceptive choice and provider counseling about options. In our study, we can report on DMPA and other contraceptive methods use only. We do not have information on unintended pregnancy or how contraceptive use might correlate to pregnancies which end in a live birth or termination.** **Manuscript text (unchanged):** **Introduction (page 3): "Other vulnerable groups include recent immigrants, rural residents and those of lower socioeconomic status (7)."** 3. You report cost as a barrier – perhaps a short table that highlights costs of the contraceptives you discuss in the article? **We appreciate this suggestion and have provided a new Table 1 which highlights the relative costs and effectiveness of contraceptive methods.** Methods: This is clearly written and easy to understand how you defined the sample and handled missing data. 1. Cut-point of high vs low income based on estimate of median income is sensible, however could you add a sentence to describe why median income is an appropriate cut-off for your sample? The age range for your sample means it will include many adolescents still living at home as well as those living away from home but possibly still under their parents' /

	student drug insurance plans? The income of 15-24 year-olds could be expected to be below median household income? **Please see our responses (5.a) to the editor about household living arrangements and the relationship of this variable with household income for our sample. We agree, household income may be a poor proxy for family SES or drug insurance status; however, the majority of our sample (59%) reside with their parents.** Interpretation: 1. OCs and condoms predominant: Given that LARCs / IUC are first line (as per CPS), could further discussion be relevant here – re prescriber patterns, what young women request, what is covered by various insurance plans (which you discuss adequately) – given that OCs have a significantly higher failure rate compared to IUC? **While we agree that these additional topics are important, our findings are about the behaviors of youth with respect to contraceptive use in our study population and the impact of household income. We have no data regarding insurance coverage, prescriber patterns, or individual preferences or values in our study population. Further, as we cannot report on IUC use in this paper, we limit our discussion to our findings for other contraceptive methods.** **Manuscript text:** **Interpretation (page 11-12): "Our findings warrant further examination using both qualitative and quantitative methods to elucidate reasons for differential patterns of use in low-income and northern Canadian populations. Choices about contraceptive use are multifactorial and impacted by a variety of factors including personal experiences, provider counseling and practice patterns or access."** 2. A closer look at where young women seek care for contraceptives could be valuable to the interpretation. For example, in rural areas (such as the Territories) there may be embarrassment or fear of breach of confidentiality. One place youth commonly access free contraception is youth clinics, do youth clinics routinely provide IUC compared to OC? **While we agree that access and site of care is an important issue, our findings are about the behaviors of youth with respect to contraceptive use in our study population and the impact of household income. We do not have any information from this survey sample about where respondents sought information about contraceptives. We do note that there are a very limited number of youth clinics providing IUCs as opposed to OCs and these are almost exclusively in urban areas.** **We have added concerns regarding confidentiality or access to our list of unmeasured confounders.** **Manuscript text added:** **Limitations (page 12):** **"Despite controlling for all measured confounders in our adjusted analyses, there may be residual confounding by variables not captured in the CCHS datasets, such as religion, cultural norms, prior adverse events, or the use of contraceptives for non-contraceptive purpose (e.g., treatment of irregular menstrual periods, acne, hirsutism)."** 3. DMPA use in the territories – what is covered by NIHB? This could also be a factor. IUC is now covered but looking to see when coverage started might be informative and these prescribing patterns could be monitored over time. **NIHB did cover DMPA during our study period. Thus, cost is not necessarily a barrier for indigenous Canadians who qualify for NIHB. However, CCHS data does not include indigenous Canadians living on reserve and we do not have data on indigenous status for respondents who might be in the survey (living off reserve) to adjust for at the individual level. We cannot assume that all northerners in our study sample are status and/or covered by NIHB. Also, our findings for DMPA use are limited by extremely low numbers in the territories, thus, while the findings are interesting – they may be sensitive to the relatively few respondents in the territories who participated in the survey.** **Manuscript text changed:** **Interpretation (page 10): "This could be due to reasons we could not examine such as**

	provider counselling, access, differences in health insurance benefits or patient preferences."
Reviewer 2	Dr. Fady Hannah-Shmouni
Institution	National Institutes of Health, Eunice Kennedy Shriver National Institute of Child Health and Human Development
General comments (author response in bold)	Nethery et al describe an elegant study that examined the use of contraceptive methods in a nationally-representative sample of young Canadian females at risk for unintended pregnancy. Their major findings confirmed the substantial variation in contraceptives amongst young women and revealed that lower household income was associated with decreased use of oral contraceptives. 1. The authors demonstrated a comprehensive understanding of existing research in this field. They identified a gap in the literature and justified their decision to conduct the study. The research question and objectives were clearly explained. The study design was well outlined in figure 1 depicting inclusion and exclusion criteria with sample size. The results of the study will serve as an asset to the existing literature and will benefit various subgroups including various medical societies such as the Canadian Pediatrics Society, family physicians, public/community health government officials, young Canadian females and their parents. Thank you! 2. The authors should include an overview summarizing the cost and efficacy to provide the reader with a baseline comparison of each contraceptive method. In addition, study population age range (15-24) may have influenced the results given the potential for discrepancies with extremes of age and life stage. The authors could have acknowledged the possible variation and identified proportion of individuals of each age. **Thank you for your suggestion. We have provided this table (see new Table 1 and responses to reviewer 1 and the editor).** **We agree that age distribution (15-24 years) is an important limitation to the external generalizability of this study. The descriptive data for the ages in our is shown in Table 3. All our models did adjust for age strata.** 3. The pooled data from two different timeframes (2009-2010 and 2013-2014) may have produced different conclusions. It would be of value to compare the data from each timeframe given the fact that changes could exist based upon varying states of economy, income and trends in contraceptive methods. The depiction of the results may have benefited from 2 charts comparing high and low income, each showing the proportion of different methods used to exemplify the discrepancies with socioeconomic status. **While we agree with the reviewer that pooling two timeframes may produce different conclusions, we did examine all covariates, outcomes and exposure data for time trends. No statistically significant differences in key covariates or outcomes were noted; thus we felt it was appropriate to analyze the data pooled. As our study represents a span of 6 years, general economic trends were unlikely to have a strong impact on our findings. Last, we offered an indicator for survey cycle to the adjusted models; this covariate made no difference to the effect estimates and was not significant in multiple regressions, thus we did not include it.** **See also response to the editor (#2). We made the following changes in the manuscript.** **Revised manuscript text:** **Methods – Sensitivity analysis (new text in italics) (page 7):** **"Finally, we examined the potential impact of missing data in the covariates using multiple imputation with chained equations (26) to impute missing covariates for 20 datasets using the "mice" package in R (27), and potential variability in estimates by CCHS cycle by stratifying analyses by survey year."** **Results -Sensitivity analyses (page 8):** **"Estimates were similar after stratifying by CCHS cycle."** 4. The authors could comment on the possibility of side effects of hormonal contraceptives including adverse effects that may deter individuals from choosing them irrespective of their income. Furthermore, there may be additional benefits to using hormonal contraceptives, including acne/PCOS treatment and controlling abnormal uterine bleeding which may also

	influence contraceptive choice independent of income. **We have added a comment to the discussion regarding unmeasured confounders including religion, adverse effects and also associated benefits from contraceptives which we are unable to measure in this study.** **Manuscript text added:** **Limitations (page 12):** **"Despite controlling for all measured confounders in our adjusted analyses, there may be residual confounding by variables not captured in the CCHS datasets, such as religion, cultural norms, prior adverse events, or the use of contraceptives for non-contraceptive purpose (e.g., treatment of irregular menstrual periods, acne, hirsutism)."** 5. Finally, a comment could be made addressing a potential need for additional education around prevention of sexually transmitted disease if barriers to accessing OCPs are reduced. **We agree with the reviewer that education around prevention of sexually transmitted infections is an important feature of sexual health education programs. We have made the following change in the manuscript.** **Manuscript text added (in italics):** **Interpretation (page 11):** **"Policies and educational initiatives relating to family planning and prevention of sexually transmitted disease should consider the unique reproductive needs of young females—especially those within vulnerable populations, who are at greatest risk of unintended pregnancy."**