PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Fertility rates and the postponement of first births: a descriptive study with Finnish population data
AUTHORS	Roustaei, Zahra; Räisänen, Sari; Gissler, Mika; Heinonen, Seppo

VERSION 1 – REVIEW

REVIEWER	Lone Schmidt, Professor, DMSc, PhD, MD Department of Public Health University of Copenhagen Denmark
REVIEW RETURNED	16-Sep-2018

GENERAL COMMENTS	This is an interesting, relevant, and most desired study on the impact of family postponement on fertility rates. The study is a national register-based study from Finland. The study is conducted thoroughly with relevant and sufficient data analyses. Results are presented clearly and well-described.
	I have a few comments:
	1. Overall, the majority of children are born of parents being in a relationship and not by single mothers by choice. I am aware that this study is based on data regarding women/mothers only. However, leaving men/fathers completely out of the manuscript contribute to keeping family formation as a "woman thing" which is not the case.
	Hence, I suggest to add text regarding men and family formation in the Introduction section and Discussion section. For example, it is both men and women who are postponing familyformation. A short text regarding men's postponement could be included. Advanced male age – and not advanced female age only - is also a risk factor for infertility/involuntarily childlessness/ adverse reproductive outcome (reviews: Sartorius & Nieschlag, 2010; Eisenberg & Meldrum, 2017). The proportion of childless men at age 50 has increased substantially to one in five (Denmark, Norway – I am not sure regarding Finland) and is substantially higher compared to childless women. In the Discussion section is suggested "awareness of family policies that encourage motherhood at earlier ages". I find it really important that family policies are targeting both men and women. Studies shows that men desires to postpone family formation to even higher ages than women (See e.g., Virtala et al., Eur J Contracep Reprod Health Care, 2011; review Hammarberg et al., Human Reproduction Update, 2017) .
	2. A suggestion is in the Introduction to explain the term "replacement level" and add the figure (2.1) as probably not all readers' are familiar with this concept.

	3. A suggestion is to state in the Methods section that no distinction between voluntary and involuntary childlessness was possible (register data).
	4. In the Result section is mentioned assisted reproductive technology (ART) treatment (p. 6, line 10). ART includes only *in vitro* treatment methods where egg and semen are handled in the laboratory (e.g., IVF, ICSI). On the other hand the term Medically Assisted Reproduction (MAR) includes all *in vitro* as well as *in vivo* (e.g., insemination treatment) fertility treatment methods (See international glossary on assisted reproduction by Zegers-Hochschild et al., Human Reproduction 2017). I think MAR is better to use here, as all kinds of fertility treatment have an impact on number of children born (not only the *in vitro* treatment techniques).
	5. When referring to Virtala et al.'s study (p.8, line 45), I suggest to add also the most recent study on this topic from this group (Virtala et al., 2011) and to add that both of these studies are conducted among university students.

| **REVIEWER** | d'Albis
Paris School of Economics, France |
| **REVIEW RETURNED** | 20-Sep-2018 |

| **GENERAL COMMENTS** | This short paper uses Finnish register data, which are not publicly available, to compute some basic fertility indicators such as TFR or maternal age. The exercise is methodologically simple and I do not see what the scientific contribution of the article is. I guess that the statistical offices of Finland are producing such estimates and a quick look on the internet allowed me to find the website of Statistics Finland that provides online[1] the same graph as the one that is proposed by the authors in Figure 1A. Moreover, most of the measures computed by the authors could be easily done using the publicly available data provided by the Human Fertility Database[2] that cover 30 countries, including Finland. At least, the authors should demonstrate that their data provide better information than that publicly available.

The only part of the paper that could be innovative relies on the decomposition of those fertility indicators between educational groups. However, this does not seem to be important in the paper as the authors devote only one line to this issue. The evolution over time of fertility differences across education groups could nevertheless be a nice research project. And I suggest the authors to focus on that issue. Recent papers that address the topic[3]indeed did not consider the historical evolution. |

VERSION 1 – AUTHOR RESPONSE

Reviewer #1
1. Overall, the majority of children are born of parents being in a relationship and not by single mothers by choice. I am aware that this study is based on data regarding women/mothers only. However, leaving men/fathers completely out of the manuscript contribute to keeping family formation as a "woman thing" which is not the case. Hence, I suggest to add text regarding men and family formation in the Introduction section and Discussion section. For example, it is both men and women

who are postponing family formation. A short text regarding men's postponement could be included. Advanced male age – and not advanced female age only- is also a risk factor for infertility/involuntarily childlessness/ adverse reproductive outcome (reviews: Sartorius & Nieschlag,2010; Eisenberg & Meldrum, 2017). The proportion of childless men at age 50 has increased substantially to one in five (Denmark, Norway – I am not sure regarding Finland) and is substantially higher compared to childless women. In the Discussion section is suggested "awareness of family policies that encourage motherhood at earlier ages". I find it really important that family policies are targeting both men and women. Studies shows that men desires to postpone family formation to even higher ages than women (See e.g., Virtala et al., Eur J Contracep Reprod Health Care, 2011; review Hammarberg et al., Human Reproduction Update, 2017).
Response:
Thanks for the positive comments.
We revised the introduction and discussion of the paper, as suggested.
** We have added the following sentences regarding men and family formation in the introduction. "In addition, men play an important role in delaying parenthood because of having inadequate knowledge about reproductive lifespan and postponing forming partnerships and parenting with women (Hammarberg et al. 2017)."
** We changed female age in the introduction to maternal and paternal age.
** We changed the following sentences in the discussion "Awareness of policies that encourage both fatherhood and motherhood at earlier ages, support young couples, and influence spacing between first and second and higher order births, might increase fertility rates."
References:
- Hammarberg K, Collins V, Holden C, Young K, McLachlan R. Men's knowledge, attitudes and behaviours relating to fertility. Hum Reprod Update. 2017;23:458-80.
- Sartorius GA, Nieschlag E. Paternal age and reproduction. Hum Reprod Update. 2010; 16:65-79.

2. A suggestion is in the Introduction to explain the term "replacement level" and add the figure (2.1) as probably not all readers' are familiar with this concept.

Response:
Changes have been made to address the comments. We explained the term replacement level in the Introduction and for all figures legends containing the total fertility rate.

3. A suggestion is to state in the Methods section that no distinction between voluntary and involuntary childlessness was possible (register data).

Response:
We added more information on the variable childlessness in our methods section on Page 5.
** The following sentence was added. "We were unable to distinguish between voluntary and involuntary childlessness, because the data were not originally gathered for the current research."

4. In the Result section is mentioned assisted reproductive technology (ART) treatment (p. 6, line 10) . ART includes only in vitro treatment methods where egg and semen are handled in the laboratory (e.g., IVF, ICSI). On the other hand the term Medically Assisted Reproduction (MAR) includes all in vitro as well as in vivo (e.g., insemination treatment) fertility treatment methods (See international glossary on assisted reproduction by Zegers-Hochschild et al., Human Reproduction 2017). I think MAR is better to use here, as all kinds of fertility treatment have an impact on number of children born (not only the in vitro treatment techniques).

Response:
The reviewer is completely correct; here the term medically assisted reproduction is a better term to use. We have replaced Assisted Reproductive Technology with Medically Assisted Reproduction.

5. When referring to Virtala et al.'s study (p.8, line 45), I suggest to add also the most recent study on this topic from this group (Virtala et al., 2011) and to add that both of these studies are conducted among university students.

Response:
The more recent study on this topic from Virtala et al. 2011 has now been added on page 9, and we

have added that the studies are conducted among university students, thank you.

Reviewer #2
This short paper uses Finnish register data, which are not publicly available, to compute some basic fertility indicators such as TFR or maternal age. The exercise is methodologically simple and I do not see what the scientific contribution of the article is. I guess that the statistical offices of Finland are producing such estimates and a quick look on the internet allowed me to find the website of Statistics Finland that provides online1 the same graph as the one that is proposed by the authors in Figure 1A.

Response:
The current study is a descriptive population-based register study, for that data analysis should begin with examinations of the data distributions of the analysis variables, including exposures, outcomes, and confounders.1 Thus, we first presented basic fertility indicators such as the total fertility rate and maternal age to provide background information for the understanding of further statistical evaluations. We are aware that purely descriptive analysis can easily be seen unimportant. Such analyses, however, can make it easy to detect important statistical information for instance by policy makers, which was one of our main reasons for choosing this research approach and methodology.

Moreover, most of the measures computed by the authors could be easily done using the publicly available data provided by the Human Fertility Database2 that cover 30 countries, including Finland. At least, the authors should demonstrate that their data provide better information than that publicly available.

Response:
Thanks for your comments. In this study, we provided the information on the total fertility rate and maternal age as the background information for the readers. We calculated age-specific fertility rate by maternal age at first birth, age-specific fertility by maternal age at first birth across educational groups, and the effect of postponement and childlessness on total fertility rates by use of register-based data, which are in this format not publicly available in any other database. As suggested, we added more information to the Method section to demonstrate that the register data provide better information than publicly available data.

** The following sentences were added to the Method section. "Individual-level register data cannot be publicly available, because of data protection laws and the sensitive nature of the data. The data on variables in registers are complete and their content is in accordance with reality (Gissler & Haukka 2004). Moreover, the quality of the registered data has been constantly improved due to active use of data in research and decision-making (Gissler et al. 2010). Thus, we believe that register data provide valid and reliable results." "We provided the information on the total fertility rate and maternal age as the background information. We calculated age-specific fertility rate by maternal age at first birth, age-specific fertility by maternal age at first birth across educational groups, and the effect of postponement and childlessness on total fertility rates by use of register-based data."

The only part of the paper that could be innovative relies on the decomposition of those fertility indicators between educational groups. However, this does not seem to be important in the paper as the authors devote only one line to this issue. The evolution over time of fertility differences across education groups could nevertheless be a nice research project. And I suggest the authors to focus on that issue. Recent papers that address the topic3 indeed did not consider the historical evolution.

Response:
We stratified age-specific fertility rate to evaluate educational differences in completed fertility rate. Surprisingly, the differences across educational groups in completed fertility rate were relatively small. Therefore, the main result was the reduction of the completed fertility rate by increasing maternal age at first birth even in each educational group. We agree that the evaluation over time of completed fertility rate across educational groups could be a relevant question. In the study period of 30 years, however, it was impossible to evaluate the effect of educational attainment on completed fertility rate over time.
We further elaborated on the results of fertility indicators between educational groups in the Discussion section.

** The following sentences were added to the Discussion. "Previous studies on the association between women educational level and completed fertility rate suggested that women with higher educational levels tend to have fewer children than women with short education (Blossfeld & Huinink 1991, Liefbroer & Corijn 1999, Lappegård & Rønsen 2005). In the Nordic countries, the median maternal age at first birth has increased across all educational groups, with the largest postponement of first birth among highly educated women (Andersson et al. 2009). The result of current study indicated that in Finland, as a welfare state with compatibility of employment and family formation, the negative impact of women's educational attainment on the total number of children was relatively weak. This may be also attributed to the fertility recuperation at higher ages among highly educated women in Finland (Andersson et al. 2009, D'Albis et al. 2017)."

References:
- Blossfeld HP, Huinink J. Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation. Am J Social 1991;97(1): 143−168.

1 Rothman KJ, Greenland S, Lash TL. Modern epidemiology. 3rded. Philadelphia: Lippincott Williams & Wilkins; 2008.