WHY FERTILITY IS HIGHER IN REPRODUCTIVE HEALTH SURVEYS?

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* The views expressed in this paper are those of the author and do not necessarily reflect the views of the United Nations. Its contents has not been formally edited and cleared by the United Nations.

Abstract

Two main data sources exist for the study of fertility in Mongolia: the vital registration (VR) system and the nationally representative sample surveys (Reproductive Health Survey (RHS)). Yet, a puzzling issue that has remained neglected so far, but deserved further analysis, is the major differences of 0.5 to 1 child per woman in the total fertility rate that these two sources report. In an attempt to reconcile the fertility levels given by the two main sources of fertility estimates in Mongolia, I investigate the possibility that information on fertility collected in RHS surveys produce fertility estimates that are too high. The main results confirm that the discrepancies between fertility estimates in Mongolia stem from selection bias in RHS samples. Once adjusted, survey-based fertility estimates are very close to the VR-based figures. The paper shows the risks of taking survey-based demographic indicators as the 'Gold Standard' and draw attention to the fact that demographers will always need to evaluate critically demographic figures.

Key words: Fertility levels; Fertility adjustment; Reproductive Health Survey (RHS)

1. Introduction

Studies on fertility in Mongolia relied on two main data sources: the vital registration (VR) system and a series of nationally representative sample surveys. Considered of good quality—though no formal assessment has ever been conducted, fertility data from the VR system are issued by the National Statistical Office of Mongolia (NSO) and are therefore used as official national fertility figures.[49] The second source of fertility estimates are the nationally representative sample surveys that were conducted since 1998 at successive regular 5-year intervals in the country. Starting in 1998, three Reproductive Health Surveys (RHS) of Mongolia have been carried out with technical and financial support of multilateral partners (NSO and UNFPA 1999, 2004; NSO, UNFPA and MoH 2009). From the information on full birth histories or truncated birth histories that were collected among women of reproductive age (ages 15-49),[50] fertility estimates can be derived.[51]

While both data sources give fertility estimates, one is indeed puzzled by the divergence between the levels of fertility given by these two sources. For the years where fertility estimates from both sources are available, major discrepancies exist with survey-based fertility estimates between 0.5 to one child per woman above the VR figures. So far, no attempt has been made to try to resolve these differences.

Over the last 20 years or so, mainly due to the wide implementation of the Demographic and Health Survey (DHS) program, it is usually thought that information on fertility collected through the administration of structured questionnaire during face-to-face interview (as it is oftentimes done in surveys)

49 Originally set up in the 1930s, the VR system is thought to become reliable in the 1950s only.

50 Full birth histories were collected in the 1998 RHS only; truncated birth histories (i.e. births occurring during the five years preceding the survey) were collected in the 2003 RHS and 2008 RHS.

51 To note, the Multiple Indicator Cluster Surveys (MICS) conducted in 2000, 2005, and 2010 are also nationally representative sample surveys, but fertility information is not directly collected in these surveys.

is of better quality and, in countries where vital registration data are incomplete, survey-based fertility data have been considered to be the 'Gold Standard' for demographic information. In this line, one would naturally be inclined to question the quality of the VR data in Mongolia. Yet, the reality is oftentimes more nuanced and only a close examination of different factors can help to reconcile estimates from various sources in order to derive consistent fertility figures.

The objective of this short study is to investigate the reasons behind the inconsistencies between fertility estimates originating from the two main data sources in Mongolia. Based on recent contributions using Indonesian DHS data, I look at the possible bias affecting the sample surveys that could result in over-estimating fertility. As past and recent fertility development in Mongolia has been reported in details in a series of recent studies (Neupert 1994, Gereltuya 2008, Spoorenberg 2009, Spoorenberg and Enkhtsetseg 2009), factors contributing to the recent fertility changes in the country will not be discussed here. My analytical perspective is therefore purposively concise, data-driven and technical.

2. Method and data

In an attempt to reconcile the fertility levels given by the two main sources of fertility estimates in Mongolia, I investigate the possibility that the main nationally representative sample surveys collecting population data in Mongolia—the Reproductive Health Surveys—over-estimate indeed the level of fertility in the country.

To address the fact that fertility estimates from the sample surveys may be over-estimated, I apply the adjustment procedure that Hull and Hartanto proposed to correct fertility rates computed from the Demographic and Health Surveys (DHS) in Indonesia (Hull and Hartanto 2009). Studies on recent fertility in Indonesia have shed light on the fact that, due to important changes in education, occupation and living arrangements in Indonesia since the 1990s, sample surveys have excluded some categories of the population in their sample, among which young single women that are more likely living in institutional or non-standard households that are not visited by survey interviewers (Hull and Hartanto 2009). As Hull and Hartanto show in their study (2009: 65), "DHS has missed many young single women during the household listing, with the result that the denominators used to calculate fertility are under-estimated and fertility is over-stated." The adjustment method consists in correcting the denominators used to calculate fertility from surveys using the distribution of women observed during a census count close to the survey date. Of course, any census enumeration is likely to present under-count for some age groups as well, but this adjustment procedure would include *at least* in the surveys the people who were counted in the census.

Alike Indonesia, Mongolia underwent also a series of important social transformations with the end of socialism and the difficult transition to democracy and market economy during the 1990s, and the economic recovery and growth in the 2000s that have influenced the roles of women in society. Whether the sample surveys conducted in Mongolia have missed (young) single women and whether this factor could explain the higher fertility estimates computed from sample surveys remains to be determined.

My analysis employs only official data that were published in RHS reports and available in various publications from the National Statistical Office of Mongolia.

3. Missing women in RHS samples and fertility adjustment

The adjustment procedure proposed by Hull and Hartanto (2009) to correct DHS fertility rates consists in a first step to compare the proportion of single women by age groups between different types of data collection (survey and census) in order to estimate the number of single women missing from the survey samples. The second step requires adding those missing women to the total number of women in the survey and re-calculating the fertility rates accordingly.

The comparison of the proportions of single women by age group across survey and census operations in Mongolia indicates a pattern similar to what was recorded in Indonesia (Table 1). The largest differences in the proportions of single women by age group between data sources are recorded among the 20-24 and 25-29 age groups. As these age groups correspond to when the peak of fertility is reached, the non-inclusion of these women in the survey samples influence significantly the level of fertility.

Table 1: Proportion of single women of reproductive ages in successive national representative surveys and censuses in Mongolia

Age	1998 RHS	2000 Census	2003 RHS	2008 RHS	2010 Census
15-19	92.6	94.4	94.1	93.5	96.4
20-24	39.7	51.7	41.3	39.9	57.6
25-29	10.9	20.9	14.6	14.0	23.1
30-34	4.8	10.0	6.7	7.1	12.6
35-39	4.0	6.6	3.0	4.0	8.4
40-44	2.2	4.9	2.3	3.5	6.3
45-49	1.0	4.0	3.6	2.7	5.4

Sources: NSO and UNFPA 1999, 2004; NSO 2002, NSO, UNFPA and Ministry of Health 2009, NSO 2011. Notes: RHS=Reproductive Health Survey.

To return the missing women in the RHS samples, I use the following equation taken from Hull and Hartanto (2009:66):

M = [(cs * Dw) – Ds]/(1 – cs)
where, M = missing women;
Ds = single women in RHS;
Dw = all women in RHS;
cs = proportion single in census.

In order not to lengthen the text with too many tables, the calculation is given for the three RHS surveys in Tables A1, A2 and A3 in Appendix.

The proportion of missing single women that should have been included in the survey samples reached 33 per cent for the 1998 RHS, 22 per cent for the 2003 RHS, and 48 per cent for the latest 2008 RHS. These figures imply that 12 per cent of the sample was missed in the 1998 RHS, 6 per cent in the 2003 RHS, and 16 per cent in the 2008 RHS.

Adjusting the number of women in the survey sample by the census-based estimate of missing women allows computing adjusted age-specific and total fertility rates for each RHS operation by correcting the denominator.

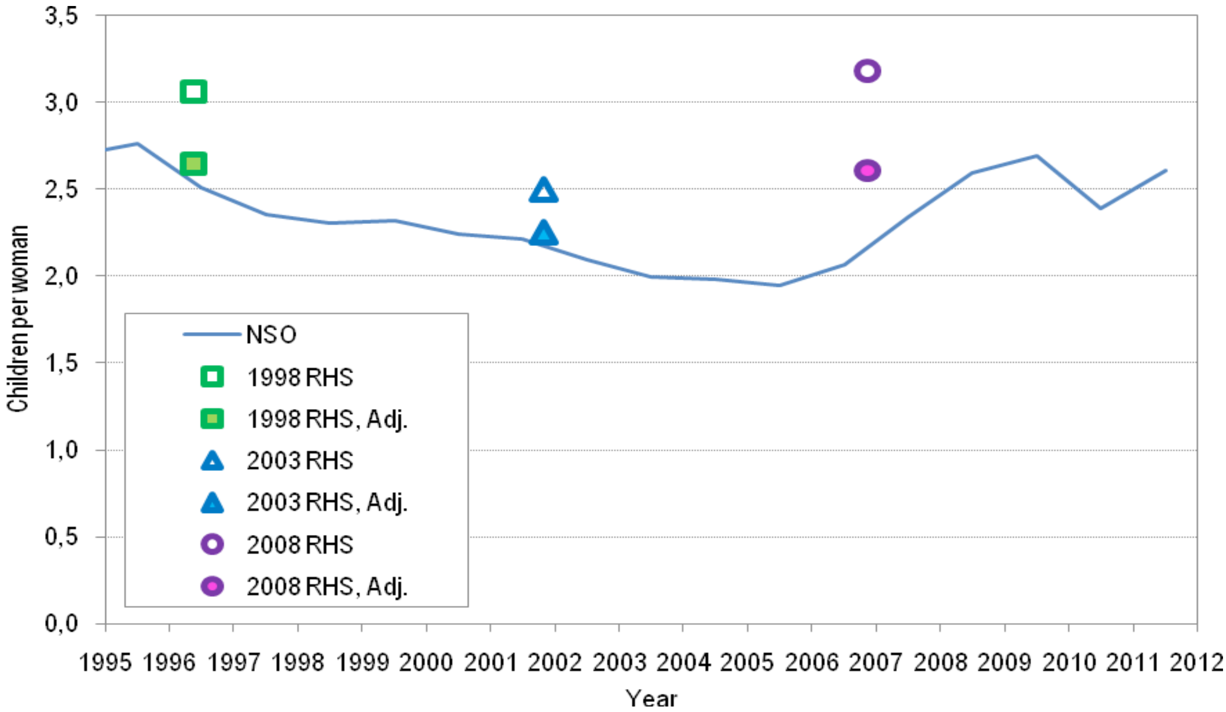
Tables A4, A5 and A6 in Appendix show the number of annual births that are implied by the age-specific fertility rates (ASFRs) and the number of women by age group that were published in the survey reports. Using the adjusted number of women who should have been included in the RHS samples if the marital status distribution from the closest census had prevailed, ASFRs are re-computed.

The application of this adjustment procedure to RHS data returns (adjusted) TFR figures well below the published values. From 3.06 children per woman published in the 1998 RHS report, the TFR value adjusted for the missing single women stands now at 2.65 children per woman. Similarly, the published 2.5 TFR value in the 2003 RHS report becomes after adjustment for the missing single women 2.25 children per woman. Finally, the adjustment procedure produces a TFR of 2.61 children per woman against 3.18

children per woman according to the value published in the 2008 RHS report. From 0.25 to 0.57 children per woman, these differences (between published and adjusted TFR values) are quite significant.

Figure 1 presents the published and adjusted RHS-based TFR estimates together with the VR-based estimates (NSO series on Figure 1). The adjustment made to the survey-based estimates produces fertility levels that are now consistent with the national official figures from the VR system (NSO series).

Figure 1. Comparison of published and adjusted survey-based TFR estimates with VR- based estimates, Mongolia, 1995-2011



Sources: RHS estimates from survey reports (NSO and UNFPA 1999, 2004; NSO, UNFPA and MoH 2009); RHS adjusted estimates computed by author; NSO estimates from various statistical yearbooks.

Note: TFR estimates were centered on the middle of the period to which they refer.

Yet, despite the fact that adding the missing women reconciles fertility estimates from these two data sources, the adjusted TFR value from the 2008 RHS still departs somewhat from the VR-based estimates with a level about 0.5 children per woman higher. A potential factor explaining this difference could be a another selection bias in the survey collection of fertility information; women with more children are more likely to be interviewed about their fertility during survey operation (Avery et al. 2013). The inclusion of the missing (single) women in the denominator accounts thus only for a portion of the survey bias and allows not to correct for the bias affecting the numerator.

4. Discussion and conclusion

In this short paper, I examined the inconsistencies in the fertility estimates derived from the two main data sources for fertility information in Mongolia. In order to reconcile the fertility estimates from these two data sources, I investigated the possibility that the three Reproductive Health Surveys conducted since 1998 in Mongolia produce estimates of total fertility rate that are too high. Assuming that the VR-based fertility estimates are of good quality, I showed that most of the discrepancies between fertility estimates in Mongolia stem from selection bias in survey samples. Once adjusted to include the single women that were missed by the surveys, RHS-based fertility estimates are indeed very close to the figures derived from the VR system. Yet, even after accounting for these missing women in the survey sample, the fertility level from the 2008 RHS still remains substantially higher, possibly due to the fact that women with more children are more likely to be interviewed on their fertility during survey operation.

The results for Mongolia corroborate the conclusions made by Hull and Hartanto (2009: 70) for Indonesia on the fact that wherever the roles of women are subject to rapid changes and households are in a state of flux, single women are likely to be harder to include in survey samples (see also Kantorova and Biddlecom 2013). Without appropriate ways to incorporate such portion of the surveyed population in the denominator, the fertility indicators calculated from these samples would remain over-estimated. Yet, as the adjusted TFR value from the 2008 RHS indicates, there are other factors that deserve further investigation in order to reconcile fully the fertility estimates in Mongolia.

As for now, what the present study provides is a first attempt to resolve divergences between fertility estimates in Mongolia and that shows that the fertility estimates published in RHS surveys should therefore not be taken as indicative of the fertility level in Mongolia. As my interest was on resolving the divergence in fertility estimates given by the main data sources, I have examined possible bias only in the samples of the RHS surveys. In regard of the ongoing societal changes in Mongolia, it is however possible that the samples of other data collection operations are affected by similar issues. Only close examination and comparison of survey datasets with an alternative data source serving as reference (e.g. a population census) can help identify such inconsistencies.

The adjustment procedure applied here supposes the use of a data source as reference. I used the 2000 and 2010 Population and Housing Censuses of Mongolia to estimate the number of women missing in the successive RHS samples. Evidently, census data are not exempt of problems. Yet, the cross-comparison of the adjusted RHS-based fertility estimates with estimates from the VR system gives a first indication on the quality of the adjustment performed and on the confidence in the conclusion that survey samples have missed a significant portion of the population.

The conclusions of this study call Mongolian statisticians to redouble their efforts to devise ways to include ‘hard to reach’ individuals in the next nationally representative sample surveys. Finally, and on a more general note, this paper shows the risks of taking survey-based demographic indicators as the ‘Gold Standard’ of demographic information and draws attention to the fact that demographers will always need to evaluate critically demographic figures.

ACKNOWLEDGMENT

The author is thankful to the National Statistical Office of Mongolia for making available the micro-data sample of the 2000 Population and Housing Census of Mongolia.

APPENDIX

Table A1: Estimate of the total number of women missing in the 1998 RHS sample

Age Group	1998 RHS numbers recorded by age group	1998 RHS single recorded by age group	1998 RHS proportion single in age group	2000 census proportion single in age group	Estimate of missing women	Adjusted total 1998 RHS women
	Dw	Ds	ds	cs	M	Dw'
15-19	1,273	1,179	0.9260	0.9440	**409**	1,682
20-24	1,343	533	0.3970	0.5170	**334**	1,677
25-29	1,351	147	0.1090	0.2090	**171**	1,522
30-34	1,182	57	0.0480	0.1000	**68**	1,250
35-39	1,124	45	0.0400	0.0660	**31**	1,155
40-44	774	17	0.0220	0.0490	**22**	796
45-49	414	44	0.1066	0.0400	**-29**	385
Total	**7,461**	**2,022**	**0.2710**	**0.3504**	**1,006**	**8,467**

Source: Author's computation based on NSO and UNFPA (1999) and NSO (2002).

Table A2: Estimate of the total number of women missing in the 2003 RHS sample

Age Group	2003 RHS numbers recorded by age group	2003 RHS single recorded by age group	2003 RHS proportion single in age group	2000 census proportion single in age group	Estimate of missing women	Adjusted total 2003 RHS women
	Dw	Ds	ds	cs	M	Dw'
15-19	1,347	1,268	0.9410	0.9440	**72**	1,419
20-24	1,420	586	0.4130	0.5170	**306**	1,726
25-29	1,509	220	0.1460	0.2090	**120**	1,629
30-34	1,520	102	0.0670	0.1000	**56**	1,576
35-39	1,428	43	0.0300	0.0660	**55**	1,483
40-44	1,276	29	0.0230	0.0490	**35**	1,311
45-49	814	29	0.0360	0.0400	**3**	817
Total	**9,314**	**2,278**	**0.2445**	**0.3504**	**647**	**9,961**

Source: Author's computation based on NSO and UNFPA (2004) and NSO (2002).

Table A3: Estimate of the total number of women missing in the 2008 RHS sample

Age Group	2008 RHS numbers recorded by age group	2008 RHS single recorded by age group	2008 RHS proportion single in age group	2010 census proportion single in age group	Estimate of missing women	Adjusted total 2008 RHS women
	Dw	Ds	ds	cs	M	Dw'
15-19	1,044	976	0.9350	0.9636	**821**	1,865
20-24	1,402	559	0.3990	0.5765	**588**	1,990
25-29	1,627	228	0.1400	0.2306	**192**	1,819
30-34	1,672	119	0.0710	0.1258	**105**	1,777
35-39	1,531	61	0.0400	0.0841	**74**	1,605
40-44	1,276	45	0.0350	0.0633	**39**	1,315
45-49	850	23	0.0270	0.0536	**24**	874
Total	**9,402**	**2,011**	**0.2139**	**0.3423**	**1,841**	**11,243**

Source: Author's computation based on NSO, UNFPA and MoH (2009) and NSO (2012).

Table A4: Fertility adjustments for the 1998 RHS

Age group	Current fertility rates of 1998 RHS published report	Women recorded in 1998 RHS	Annual births implied by fertility rates and number of women in 1998	1998 RHS women adjusted for 2000 census marital status	Adjusted 1998 RHS fertility rates using 2000 census-based estimate of women
15-19	54	1,273	69	1,682	41
20-24	216	1,343	290	1,677	173
25-29	169	1,351	228	1,522	150
30-34	105	1,182	124	1,250	99
35-39	50	1,124	56	1,155	49
40-44	18	774	14	796	18
45-49	0	414	0	385	0
Total		**7,461**	**781**	**8,467**	
TFR	**3.06**				**2.65**

Table A5: Fertility adjustments for the 2003 RHS

Age group	Current fertility rates of 2003 RHS published report	Women recorded in 2003 RHS	Annual births implied by fertility rates and number of women in 2003	2003 RHS women adjusted for 2000 census marital status	Adjusted 2003 RHS fertility rates using 2000 census-based estimate of women
15-19	53	1,347	71	1,419	50
20-24	173	1,420	246	1,726	142
25-29	140	1,509	211	1,629	130
30-34	82	1,520	125	1,576	79
35-39	43	1,428	61	1,483	41
40-44	7	1,276	9	1,311	7
45-49	1	814	1	817	1
Total		**9,314**	**724**	**9,961**	
TFR	**2.495**				**2.25**

Table A6: Fertility adjustments for the 2008 RHS

Age group	Current fertility rates of 2008 RHS published report	Women recorded in 2008 RHS	Annual births implied by fertility rates and number of women in 2008	2008 RHS women adjusted for 2010 census marital status	Adjusted 2008 RHS fertility rates using 2010 census-based estimate of women
15-19	57	1,044	60	1,865	32
20-24	189	1,402	265	1,990	133
25-29	181	1,627	294	1,819	162
30-34	119	1,672	199	1,777	112
35-39	69	1,531	106	1,605	66
40-44	16	1,276	20	1,315	16
45-49	1	850	1	874	1
Total		**9,402**	**945**	**11,243**	
TFR	**3.16**				**2.61**

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