Prevalence and Risk factors of Infertility in a Mongolian Population

Tuvshinbayar Negdel (✉ tuvshinbayar.n@mnums.edu.mn)

Mongolian National University of Medical Sciences Dornogobi Medical College <https://orcid.org/0000-0002-7702-4583>

Khishigjargal Ulziisaikhan

Mongolian National University of Medical Sciences

Davaakhuu Sengebaljir

Mongolian National University of Medical Sciences

Arigbukh Enkhbat

Mongolian National University of Medical Sciences

Badrakh Munkhbayar

Mongolian National University of Medical Sciences

Khantushig Bilegsuren

Mongolian National University of Medical Sciences School of Medicine

Ariunaa Ganbold

Regenerative Medical Center IVF Ulaanbaatar, Mongolia

Khuderchuluun Nanjid

Mongolian National University of Medical Sciences

Carol W. Readhead

California Institute of Technology

Lkhagva-Ochir Erkhembatar

First Maternity Hospital of Mongolia

Ekhembaatar Tuduvdorj

Mongolian National University of Medical Sciences

Munkhzol Malchinkhuu

Mongolian National University of Medical Sciences

Odkhuu Enkhtaivan

Mongolian National University of Medical Sciences

Research

Keywords: Epidemiology, Infertility, Mongolia, Prevalence, Risk factor, Treatment-seeking, Population survey

Posted Date: May 11th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-26781/v1>

License: This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Worldwide, the median prevalence of infertility is 9%, but rates in different countries vary from 3.5% to 16.7%. Infertility, which is defined by the World Health Organization (WHO) as the failure to conceive after 12 months of unprotected regular sexual intercourse, is not considered a medical condition but carries a social stigma and can greatly impact a couple's self-esteem and wellbeing. There are a number of risk factors associated with infertility such as: genetic background, age, socio-economic factors, and health care including treatment of sexually transmitted diseases. We have achieved the first population-based study on the prevalence of infertility in reproductive aged women in Mongolia, and the factors that influence it.

Method: We conducted a population-based, cross sectional study in 4 regions of Mongolia and the capital city, Ulaanbaatar: East, West, Central Khangai, Central, and Ulaanbaatar. Our questionnaire consisted of categories that influenced infertility such as: socio-economic status, lifestyle factors, health, reproductive history, present status and sexual function. Trained staff conducted face-to-face interviews with the participants.

Results: A total of 1,920 couples residing in 4 regions of Mongolia and the capital city, Ulaanbaatar were studied. The median prevalence rate was 7.2%, which is similar to the worldwide infertility rate of 9%. Primary and secondary infertility was 2.5% and 5% respectively. Sexual transmitted diseases (STIs) contributed to secondary infertility. Our study showed that the most important risk factors for infertility were rural living and low levels of education. Only 14.8% of infertile patients received hormone therapy, and even fewer infertile patients (0.8%) received *in vitro* fertilization (IVF) treatment.

Conclusions: Our study shows that two most significant risk factors for infertility were: reliving in rural communities and having a low level of education. Occupational conditions, and monthly household income were not significant risk factors for infertility. Since this is the first population-based study in Mongolia we were not able to measure trends in infertility prevalence but intend to do so in the future.

Plain English Summary

Infertility is not considered a life threatening medical condition, but it nevertheless carries a stigma that can affect the wellbeing of a couple, and lead to depression and low self-esteem. The World Health Organization (WHO) defines infertility as the failure to conceive after at least 12 months of regular unprotected intercourse. The average prevalence of infertility worldwide is 9%, although it varies from country to country depending on a number of risk factors. Relevant risk factors are the socio-economic conditions of a country and its health care.

We studied infertility amongst married couples living in 4 regions of Mongolia as well as in the capital city, Ulaanbaatar. In Mongolia the average infertility rate was 7.2%, which is similar to the average infertility rate worldwide. We found that in Mongolia infertility prevalence was significantly higher in rural

communities and with couples who had lower levels of education. These two risk factors were often associated.

Background

Infertility, as defined by WHO, is the failure to conceive after at least 12 months of regular unprotected sexual intercourse[1]. Infertility is a medical problem that carries a social stigma and leads to a decrease in the quality of life, emotional instability, and low self-esteem[2]. There are around 186 million married women in developing countries between the ages of 15 and 49 that are infertile[3]. Worldwide, the overall median prevalence of infertility is 9% but varies from 3.5 to 16.7% in different countries[4]. This reflects differences in risk factors such as socio-economic status, educational level, culture and available health care[5]. It is for this reason that infertility is more prevalent in less-developed countries.

Primary infertility is defined as couples that do not achieve a pregnancy after one year of unprotected sex, while secondary infertility, is defined as couples who have had at least one pregnancy, but are no longer unable establish a pregnancy. In an analysis of 277 health surveys from 190 nations, primary infertility had an occurrence of 1–1.99% while secondary infertility was 13%[6]. Mongolia has one of the highest rates of secondary infertility. This can largely be attributed to high rates of sexually transmitted infections (STIs). For instance, the rate of gonorrhea among women and men in Mongolia is 3.3% and 2.9% respectively, while chlamydia was 19.5% and 15.6% respectively[7].

A comparison of infertility between Mongolian men and women showed that the female infertility rate was 45.8%, while for males it was 25.6%. Unexplained infertility had rate of 9.8%, with a combined rate for couples of 18.8%[8]. In Mongolia, the major factors influencing female infertility were tubal adhesions and endocrinal factors, while in the male they were varicocele, azoospermia and testicular damage[9].

Infertility studies in Mongolia have mainly been hospital-based with limited epidemiological studies. In addition, differences in age, demographics and methods all factor into contrasting outcomes. Therefore accurate assessment of infertility using epidemiological studies are crucial in order to provide high quality assessment, treatment, and management. We have striven to achieve the first population-based study on causative factors leading infertility in women of a reproductive age in Mongolia.

Methods

We conducted a population-based cross-sectional study from September 2016 to 2018 in the 4 regions of Mongolia as well as the capital city of Ulaanbaatar. Mongolia's provinces are divided into 4 regions based on geographical and economic factors: East, West, Central Khangai and Central, while the capital city Ulaanbaatar is viewed as a separate region. For the study we selected married couples who were citizens of Mongolia and who had been living together at least one year at a permanent residence in one of the selected regions. The women were between 20–45 years of age while there was no age selection for men. Couples excluded from the study were those who had lived apart for longer than 3 months, used

birth control in any form, were presently breastfeeding, or those women in early menopause. The Mongolian National University of Medical Sciences approved these studies (No 16/3/2016–16).

The appropriate sample size was calculated by taking the average international rates of infertility of around 8–10%. International infertility rates were used to calculate the appropriate sample size since there were no previous infertility studies undertaken in Mongolia. With an allowable error of 5% and a confidence level of 95%, a total sample size of 2000 couples was required for the study. A simple random sampling strategy was proportionally applied for each province, resulting in: Ulaanbaatar (n = 575); the central region represented by Umnugobi (n = 150) and Orkhon province couples (n = 218); the Western region represented by Govi-Altai province (n = 300); the Eastern provinces represented by Dornod (n = 163) while the Khangai region was represented by Darkhan (n = 174), and Khuvsgul province (n = 220). Our questionnaire consisted of categories that influenced infertility such as: socio-economic status, lifestyle factors, health, reproductive history and status along with sexual function and fertility. Trained interviewers conducted face-to-face interviews.

For our study we used WHO's definition of infertility as "a disease of the reproductive system defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse"[1]. Couples who were unable to achieve a clinical pregnancy were classified as having primary infertility, while secondary infertility was defined as couples that were unable to achieve a clinical pregnancy either before or after treatment. We calculated the epidemiology of infertility from female data as recommended worldwide.

Data analysis was performed using the Statistical Program for Social Sciences (SPSS v 20, IBM). Continuous measurements were shown as mean standard deviation (SD) and categorical variables were expressed as percentages. For statistical analysis distributions were compared using Pearson's chi-square test and Fisher's exact test when appropriate. Binary logistic regression analyses were then performed within each subgroup, adjusting for confounders. For comparison of variables t-test and ANOVA test were used; 95% confidence interval was considered statistically significant $p < 0.05$.

Results

Study population

Our study consisted of Ulaanbaatar city and four geographic and economic regions of Mongolia (West, East, Central and Khangai). Total of 1920 couples were included. The characteristics of the couples are shown in Table 1.

Table 1. The characteristics of participants

Characteristic			n
Age	M±SD		32.57±6.61
Age group	n/(%)	20-24	216 (11.3%)
		25-29	482 (25.1%)
		30-34	471 (24.5%)
		35-39	373 (19.4%)
		40-45	378 (19.7%)
Duration of schooling	M±SD		12.81±3.13
Educational level	n/(%)	Elementary	55 (2.9%)
		Secondary	690 (35.9%)
		Bachelor	1175 (61.2%)
BMI kg/m ²	M±SD		25.08±4.52
		Normal	1075 (56%)
		Overweight	555 (28.9%)
		Obese 1 class	246 (12.8%)
		Obese 2 class	35 (1.8%)
		Obese 3 class	9 (0.5%)
Occupational condition	n/(%)	Normal	1663 (86.6%)
		Abnormal	257 (13.4%)

Table 1 shows the characteristics of the female participants: age, Body Mass index (BMI), occupational conditions, and educational level.

As defined by WHO, 7.2% (n = 138) couples were infertile with 2.2% (n = 42) having primary infertility, and 5% (n = 96) with secondary infertility. The prevalence of infertility in the 4 regions and Ulaanbaatar is shown in Table 2.

Table 2. The prevalence of infertility of the 4 regions and Ulaanbaatar

Regions participants' n/(%)	Prevalence of infertility n/(%)
Ulaanbaatar 695 (36.2%)	25 (3.6%)
Central 368 (19.2%)	30 (8.2%)
Khangai 394 (20.5%)	49 (12.4%)
West 300 (15.6%)	21 (7%)
East 163 (8.5%)	13 (8%)

Table 2 shows the prevalence of infertility in 4 regions of Mongolia and the capital city Ulaanbaatar. The prevalence of infertility is significantly higher amongst rural couples than those in urban areas ($p < 0.001$).

The age of the female is well known to be a key factor in fertility (Figure 1).

Figure 1 shows the rate of infertility of women 20 and 25 years of age. As expected women between the ages of 40 to 45 years of age had the highest rate of infertility of 10.6%

In agreement with previous studies, women between 40–45 years of age had the highest rate of infertility (10.6%) compared to women between 20–24 years of age who had a low infertility rate (1.4%) ($n = 40$) ($p < 0.0001$). Using a binary logistic regression, we find that each additional year of maternal age increases the risk of infertility by 1% (OR: 0.012 CI: 1.03–1.08, $p < 0.0001$).

We have divided the participants into age groups and have calculated the risk in comparison to the 20–24 year age group (Table 3)

Table 3. Risk of infertility by age group

Age group	Exp (B)	95% CI	p value
20-24 age ^c			
25-29 age	4.048	1.21-13.52	0.023
30-34 age	6.053	1.84-19.85	0.003
35-39 age	6.663	2.01-22.02	0.002
40-45 age	8.402	2.56-27.5	0.0001

^c**Comparison group**

Table 3 shows that infertility increases with increase in maternal age with the 40–45 year age group being at the highest risk (OR: 8.402 CI: 2.45–27.5, $p < 0.0001$).

Risk factors for infertility

We divided our participants into two groups of infertile and fertile females. Adjusting for age (aOR) with a 95% CIs we calculated for the association between infertility and risk factors among women. Using social factors such as educational level, monthly household income, region of residence, and occupation conditions we calculated the odds ratio. Social factors, such as: occupational conditions and monthly household income were not a significant risk factor, but rural residency and lower levels of education had a significant impact on fertility (Table 4).

Table 4. Socio-economic risk factors of infertility (aOR)

Risk factors	Comparison category^C	Exp B	95% CI	p value
Education level	High school ^C			
	Middle school	2.2	0.99-5.12	p>0.05
	Primary school and below	1.4	1.03-2.11	p<0.03
Monthly household income	Above average ^C			
	Under average	1.2	0.84-1.77	p>0.286
Occupational conditions	Normal ^C			
	Abnormal	0.77	0.43-1.36	p>0.372
	Urban ^C			
	Rural	2.72	1.74-4.24	p<0.0001

Table 4 shows the socio-economic risk factors that affect infertility. The highest risk factors for infertility were the level of education and rural living.

A questionnaire was used to evaluate lifestyle factors that impacted infertility. Factors such as physical activity, smoking and alcohol consumption were assessed (Table 5)

Table 5. Risk of lifestyle factors

Factors	Comparison category ^c	Exp B	95% CI	p value
Physical activity	Active	4.4	2.61-7.49	p<0.0001
	Inactive			
Smoking	Non-smoker	0.59	0.23-1.48	p>0.05
	Smoker			
Alcohol consumption	Abstinent ^c	1.3	0.88-1.94	p>0.05
	Alcohol User			

Table 5 shows lifestyle factors, which affect fertility.

Calculating aOR intrauterine growth-retardation, ectopic pregnancy had a 2.1 and 2.6 times the risk for infertility, respectively. A key risk factor for infertility is the diseases of the female reproductive system. Therefore, we used the participant's self-reported gynecological history to calculate the risk it imposed. Gynecological chronic diseases played a major role in the development of infertility, along with participants who had a gynecological operative history (95%) with a risk of 3.4 times more.

Clinical consultations for infertile couples

Only 29.7% (n = 41) of infertile women in the study received some form of treatment for their condition (Figure 2). This was broken down as follows: 77.5% (n = 107) of infertile women sought clinical consultation regarding their infertility, while 22.5% (n = 31) never sought clinical consultation. Of those who sought clinical consultation, 44 % (n = 62) had radiological and laboratory testing. Of those infertile women that were tested only 29.7% received some form of treatment. Most treatments were hormonal therapy but assisted reproductive technology (ART) was hardly used (Figure 2).

Figure 2 shows the types of treatment for infertile women. Most infertility was treated with hormone therapy while intrauterine insemination (IUI) or in vitro fertilization (IVF) was seldom used.

Although the same definition of infertility and study methods were used, the prevalence of infertility varies greatly between nations due to governmental policy on reproduction, inclusion criteria, the age of the participants, socio-economic values and other factors (Table 6). Larsen et al.'s study of primary and secondary infertility in sub-Saharan Africa showed a prevalence of primary and secondary infertility of 3% and 5% respectively [10]. This was in keeping with our study, which showed a prevalence of primary and secondary infertility of 2.2% and 5% respectively. However, their definition of infertility as 5 years or

more of failure to conceive was not the same as our definition of infertility, which was 12 months of failed conception. Both Mongolia and the Sub-Saharan region had a high rate of gonorrhea and chlamydia [11, 12], which are risk factors for secondary infertility and could explain the similar results of the two studies.

Table 6. Demographic studies of infertility

Author	Region	Type of study	Sample size	Age group of women (years)	Definition of infertility	Current infertility (%)
Webb and Holman (1992) ¹⁴	Australia	Cross sectional	1495	16-44	Inability to become pregnant after 1 year of unprotected intercourse (without surgical sterility)	3.5%
Zargar et al. (1997) ¹⁵	Kashmir, India	Cross sectional	10063	15-44	Inability to conceive despite >12 months of unprotected intercourse in a couple trying to conceive	4.66%
Philippov et al. (1998) ¹¹	Tomsk	Cross sectional	2000	18-45	Inability to conceive despite unprotected intercourse for over a year	16.7%
Geelhoed et al. (2002) ¹⁶	Ghana	Cross sectional	2179	15-49	Failure to achieve conception after 1 year of unprotected intercourse	11.8%
Ahmadi Asr Badr et al. (2006) ¹⁷	Iran	Cross sectional	3183	15-49	No conception during marriage after at least 12 month of intercourse without using contraception	3.27%
Herbert et al. (2009) ¹⁸	Australia	Cross sectional	5936	28-33	Women who had reported difficulties conceiving. i.e. more than 12 months of trying to conceive	17.3%
Our study (2016)	Mongolia	Cross sectional	1920	20-45	Failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse	7.2%

Discussion

Infertility in a population in Ulaanbaatar, and four regions of Mongolian was 7.2% and this is in agreement with similar studies from around the world that had a median infertility prevalence ranging from 6.9% to 9.3% [4] (Table 6). A population-based study conducted in our neighboring country China, had a prevalence of 15.5% [13]. Some nations or regions had a high prevalence of infertility such as Iran (17.3%) [14, 15], Western Siberia (16.7%)[16], and Australia (17.3%)[17]. However, it should be noted that another study from Perth, Australia showed an infertility prevalence of 3.5%[18].

There are a number of risk factors that contribute to female subfertility and it is important to diagnose these carefully in order to treat patients appropriately [19]. Risk factors which vary between different regions of the world, include: the genetics of the population, socio-economic factors, differences in government policy, health care, nutrition, age of the participants, and the level of STIs present in the population [20]. Our study shows that important risk factors for infertility in Mongolia are: age of the participants, rural community living, and the level of education of the couple. High levels of STIs contributed to secondary infertility [20].

Infertility is expected to change in populations over time. In a US National Health report it was shown that infertility fell from 8.5% in 1982 to 7.4% in 2002[21]. Further declines in infertility were seen in 2006 [22]. These declines in infertility may be due to improved nutrition and general health of the population and improvements in assisted reproductive techniques. In Mongolia we were unable to look for these trends as this was our first report, but we hope in the future to conduct further studies in infertility.

Strengths and Limitations:

Our study used a population-based method consisting of 4 regions and the city of Ulaanbaatar; this resulted in our study being very effective in terms of sample size and method. We used only one definition to determine infertility, which limited us to using strict inclusion criteria. We used a self-reporting method to assess infertility and this can be subject to bias.

Conclusions

Our study shows that two most significant risk factors for infertility were: reliving in rural communities and having a low level of education. Occupational conditions, and monthly household income were not significant risk factors for infertility. Since this is the first population-based study in Mongolia we were not able to measure trends in infertility prevalence but intend to do so in the future.

Declaration

Details of ethics approval

We gained approval from the Mongolian National University of Medical Sciences' ethics committee (No16/3/2016–16) to conduct our survey. All participants agreed to an informed consent form, after

accepting to be included.

Consent for publication:

Not applicable

Availability of data and materials:

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Competing interests:

The authors declare that they have no competing interests

Funding:

Our study was supported by the Mongolian National University of Medical Sciences' Science and Technology Support Fund's "Domestication of IVF technology in Mongolia project." The funders of this study had no influence in the design, implementation, analysis, or the manuscript preparation of this study.

Authors' contributions

OE, MM, ET, LE, CWR, substantively revised the draft as well as the design conception. TN, KhU, DS, KhB, AE, AG, BM, have participated in the acquisition and analysis of data, as well as drafted this manuscript. KhN worked on the interpretation of data. All authors read and approved the final manuscript.

Acknowledgements:

We express our sincere gratitude to the Mongolian National University of Medical Sciences for their immense support. We thank the School of Bio-Medicine and Department of Pathophysiology for the crucial advice and organization. We extend our appreciation to ZEPH (Young Pathophysiologists' Club) for their contribution for the integrity of our survey.

Abbreviations

ANOVA: Analysis of variance

ART: Assisted reproductive technology

IVF: in vitro fertilization

SD: Standard deviation

SPSS: Statistical Program for Social Sciences

STI's: Sexually transmitted infections

WHO: World Health Organization

References

1. Zegers-Hochschild F, et al. *International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary of ART terminology*. 2009.
2. Chachamovich JR, et al. Investigating quality of life and health-related quality of life in infertility: a systematic review. *J Psychosom Obstet Gynaecol*. 2010; 31(2):101–110. doi: 10.3109/0167482X.2010.481337. Review.
3. Shea O, and Rutstein IHS. Infecundity, Infertility, and Childlessness in Developing Countries. *DSH Comparative Reports* 2004; 3 (4): 257–266.
4. Boivin J, et al. International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care. *Human reproduction* 2007;22(6):1506–1512.
5. Ombelet W. Global access to infertility care in developing countries: a case of human rights, equity and social justice. *ObGyn*. 2011;3 (4):257–266.
6. Mascarenhas MN, Flaxman SR, Boerma T, Vanderpoel S, Stevens GA. National, regional, and global trends in infertility prevalence since 1990: a systematic analysis of 277 health surveys. *PLoS medicine* 2012;9(12):e1001356.
7. Badrakh J, et al. Trends in adult chlamydia and gonorrhoea prevalence, incidence and urethral discharge case reporting in Mongolia from 1995 to 2016 estimates using the Spectrum-STI model. *Western Pac Surveill Response J*. 2017;8(4): 20–29.
8. Bayasgalan G, et al. Clinical patterns and major causes of infertility in Mongolia. *The journal of obstetrics and gynaecology research*. 2004;30(5):386–393.
9. Bayasgalan G, et al. Clinical patterns and major causes of infertility in Mongolia. *The journal of obstetrics and gynaecology research*. 2004;30(5):386–393.
10. Larson U. Primary and secondary infertility in sub-Saharan Africa. *Int. J. Epidemiol*. 2000;29:285–291.
11. Zhou Z, Zheng D, Wu H, et al. Epidemiology of infertility in China: a population-based study. *BJOG: an international journal of obstetrics and gynaecology*. 2018;125(4):432–441.

12. Badrakh J, et al. Trends in adult chlamydia and gonorrhoea prevalence, incidence and urethral discharge case reporting in Mongolia from 1995 to 2016 estimates using the Spectrum-STI model. *Western Pac Surveill Response J.* 2017;8(4):20–29.
13. Dubbink JH, et al. Genital Chlamydia trachomatis and Neisseria gonorrhoeae infections among women in sub-Saharan Africa: A structured review. *International journal of STD & AIDS.* 2018;29(8):806–824.
14. Zhou Z, et al. Epidemiology of infertility in China: a population-based study. *BJOG: an international journal of obstetrics and gynaecology.* 2018;125(4):432–441.
15. Kazemijaliseh H, et al. The Prevalence and Causes of Primary Infertility in Iran: A Population-Based Study. 14. *Glob J Health Sci.* 2015;19;7(6):226–32. doi: 10.5539/gjhs.v7n6p226.
16. Badr Y, Madaen K, Ebrahimi S, Nejad A, Koushavar H. Prevalence of infertility in Tabriz in 2004. *Urology journal.* 2006;3:87–91.
17. Philippov OS, et al. Estimation of the prevalence and causes of infertility in Western Siberia. *Bulletin of the World Health Organization.* 1998;76(2):183–187.
18. Herbert DL, Lucke JC, Dobson AJ. Infertility, medical advice and treatment with fertility hormones and/or in vitro fertilisation: a population perspective from the Australian Longitudinal Study on Women's Health. *Australian and New Zealand Journal of Public Health.* 2009;33(4):358–364.
19. Webb S and Holman DA. A survey of infertility, surgical sterility and associated reproductive disability in Perth, Western Australia. *Australian Journal of Public Health.* 1992;16(4):376–381.
20. Farquhar, CM et al. Female subfertility. *Nat Rev Dis Primers* 2019; 7.
21. Tsevat DG, et al. Sexually transmitted diseases and infertility. *Obstet. Gynecol.* 2017; 216: 1–9.
22. Chandra A, et al. Infertility and impaired fecundity in the United States. 1982–2010: Data from the National Survey of Family Growth. *National health statistics reports.* 2013;67:1–18
23. Stephen E, and Chandra A. Declining estimates of infertility in the United States: 1982–2002. *Fertility and sterility.* 2006;86:516–523.

Figures

Figure 1

The age of the female is well known to be a key factor in fertility (Figure 1).

Figure 2

Treatment for Infertile Couples