Full Length Research Paper

Prevalence and risk factors of lower reproductive tract infections among women in an Urban Area of China

[1]Shenghui Wu*, [2]Zhong Liu, [3]Zhaomin Liu and [4]Lap Ah Tse*

[1]University of Texas Health Science Center at San Antonio-Laredo Campus, Department of Epidemiology & Biostatistics, Laredo, TX, USA.
[2]Vanderbilt University, School of Medicine, Vanderbilt University, Nashville, TN,USA.
[3,4]School of Public Health and Primary Care, the Chinese University of Hong Kong, Hong Kong SAR, PR China.

This study aimed to investigate the prevalence of lower reproductive tract infections (RTIs) and the influential risk factors among Chinese women from the poorest families. A face-to-face interview and a gynecological examination were performed for 848 Chinese women from the poorest families. The prevalence of lower RTIs among the poorest women was 53.80%, and cervix presented the most prevalent cite of lower RTIs (46.93%). Women with lower education level [odds ratio (OR) = 1.49, 95% confidence intervals (CI) 1.09-2.04] and under unemployment (1.47, 1.07-2.01) were associated with significantly increased risk of lower RTIs after adjustment for other covariates. High prevalence of RTIs was associated with low education and unemployment status and perceived poverty was the main reason for not seeking medical consultation for reproductive problems. Specific reproductive health educational promotion programs and adequate services should be offered to this group of disadvantaged women from the lowest socioeconomic class.

Key Words: Reproductive tract infection, poverty, women, prevalence, risk factors.

INTRODUCTION

Reproductive tract infections (RTIs) are being increasingly recognized as a serious public health issue worldwide (World Health Organization, 2013; Population Council, 2013). Inflammation in lower reproductive tract is very common particularly for women from low-income families in developing countries (World Health Organization, 2013; Population Council, 2013). Serious lower RTIs may cause women infertility, ectopic pregnancy, chronic pain, and increased vulnerability to human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS) (Population Council, 2013; Jejeebhoy et al., 2003). Women with lower RTIs may experience considerably emotional distress and the potential consequences are usually more than health (Khawaja et al., 2009). The presence of physical symptoms and the comorbidities associated with lower RTIs may largely affect woman's individual economic productivity and quality of life and increasing theecono-

mic burden of the families involved (World Health Organization, 2013; Population Council, 2013). Huge amount of costs has to be used to diagnose and treat the disease as well as prevent its spreading (Jejeebhoy et al., 2003).

RTIs are common among Chinese women but the epidemiology of lower RTIs has not been well understood (Wang et al., 2004; Zhang et al., 2009; Yongjun et al., 2009; Caiyan et al., 2012). Previous studies had examined the epidemiology of female's RTIs in different socioeconomic backgrounds (Caiyan, et al., 2012;Zhang, et al., 2009;Patel,et al., 2006). For example, one study reported that the prevalence rate was 11.4% from the Beijing communities with mixed socioeconomic classes (Caiyan et al., 2012). Another study showed a relatively higher rate of any sites of RTIs (58.1%) amongwomen from rural areas of Anhui province of China. However, to our best knowledge, no studies have examined the lower RTIs in poorest women from Chinese cities. Given the big threats to the women's health and the huge economic and social burden caused by RTIs, it is necessary and important to conduct epidemiological studies focusing on lower RTIs especially in disadvantaged populations to understand the prevalence and influential factors of lower RTIs so as to prevent and

*Corresponding author. E-mail:wus@uthscsa.edu or shelly@cuhk.edu.hk
Tel. 956-523-7402

control RTIs. This cross-sectional study aimed to investigate the prevalence of lower RTIs and the influential factors among women from the poorest families in Nanjing, China.

MATERIALS AND METHODS

Subjects

Nanjing had a total population of 6.86 million in 2005, of which 3.34 million were women. According to the statistics from Census and Statistics Department, approximately 2,100 women (excluding floating population) were from the poorest families in Nanjing. All these women were invited by Nanjing Municipal Chief Labor Union Council in September of 2005 and the participation was on a voluntary basis; of whom 848 (40.38%) agreed to participate in medical examination of the reproductive health study. Major reasons for women not participating in the survey were no time or no interest. Hence, it is less likely that the respondents were more women having gynecological symptoms or risks. We conducted the fieldwork after receiving the approval from Nanjing Municipal Bureau of Health. All participants have given their informed content for this study. A family was classified as the poorest family if the monthly household income was 240 RMB or below (1US dollar = 6.8 RMB).

Data collection

Trained local female interviewers conducted a face-to-face interview for each participant at Nanjing Maternal and Child Health Care Hospital using a standardized questionnaire. Main information included in the questionnaire was socio-demographics, menstrual history, reproductive history, and hygiene practices. The socio-demographic data included information on age, education, annual family income per capita, occupation, residence (urban/rural), and marital status. Body weight and height were self-reported by the participants. BMI, calculated as weight in kilograms divided by height in meters squared (kg/m^2) was used to classify underweight (≤ 18.9), normal weight (19-24.9), overweight (25-29.9), and obesity (≥ 30) (WHO, 1995). Questions about menstrual history covered age at menarche, menstrual cycle, menstrual period length and age at menopause. Data on reproductive history included pregnant status, numbers of pregnancies, abortions, delivery, andcontraception use (none, intrauterine device, condom, rhythm, oral contraceptive, tubal ligation). All participantswere asked about their hygiene practices (daily wash mode: shower or non-shower). Gynecologicalexaminations were performed and two vaginal swabs (forsmears and culture) were collected for each

married women, while only self-administered vaginal swabs were carried out for each unmarried woman. All gynecological examinations were performed by gynecologists who were the specialists in the field.

Laboratory analyses

A high vaginal swab was taken from each participant for gram-staining, and then placed in a drop of saline for immediate wet-mount examination, and a follow-up examination by light microscopy was performed to observe the organisms. Candida was diagnosed when fungal hyphae or budding yeasts were seen on wet mount (Nguyen et al., 2009). The presence of bacterial vaginosis was defined according to Nugent's criteria (Nugent et al., 1991). Acetowhitening test was used to test condylomata acuminate, with a cotton swab dipped in 3% to 5% acetic acid solution on the suspected impaired skin, usually white (white acetowhite acetate) results in one minute can be observed, but in the vulval, acetic acid bleaching need 3-5 minutes to observation (Pao et al., 1994). All the above tests were performed and read by experienced laboratory technicians at the Nanjing Maternal and Child Health Care Hospital according to a standard protocol.

Statistical analysis

Data analysis was performed using SPSS version 16.0 (Chicago, IL). Descriptive analysis regarding Chi-square test and 2-sample t-test were performed to compare the distribution of continuous variables (e.g., age) and categorical variables (e.g., education) between women with and without RTIs, as appropriate. Significant variables (using less stringent $P < 0.3$) obtained from descriptive analysis were put into unconditional univariate logistic regression models to estimate the odds ratio (OR) and the 95% confidence interval (95%CI) for the dependent variable (RTI), and a multiple logistic regression model was further carried out to calculate the adjusted OR using stepwise selection method ($P < 0.05$) (Hosmer et al., 2013).

RESULTS

Socio-demographic data and other risk factors potentially related to the presence of RTIs are presented in Table 1. The mean age of participating women was 42.1 years (SD = 5.4, ranged 25-79 years). Majority of them were at age of 40-49 years (65.33%) and lived in urban areas (88.68%); 479 (56.49%) women graduated from junior high school or below and 452 (53.30%) were employed. Most women (87.74%) were married and very few were divorced (5.19%) or widowed (6.01%). All subjects reported that they had only one sex partner in the past (Table 1).

Table 1.Comparing socio-demographic data and other potential risk factors between 848 women with and without lowerreproductive tract infections (RTIs) in Nanjing, China.[1]

Factors	Total (n = 848)	Women with RTIs (n = 456)	Women without RTIs (n = 392)	P Value [1]
Education				
Senior high school or above	352	172	138	0.012
Junior high school or below	479	276	203	
Occupation				
Unemployed [2]	370	191	179	0.237
Employed	452	252	200	
Residence				
Urban	752	403	349	0.334
Rural	74	44	30	
BMI (kg/m^2)				
19-24.9	545	289	256	0.476
< 18.9	14	9	5	
25-29.9	233	129	104	
≥ 30	29	19	10	
The age at first marriage (years)				
< 20	3	2	1	0.284
21-24	53	29	24	
≥ 25	63	26	37	
Marital status				
Married	744	399	345	0.693
Unmarried	2	0	2	
Divorced	44	21	23	
Widowed	51	31	20	
Times of pregnancy				
1	196	108	88	0.687
≥ 2	636	340	296	
Numbers of delivery				
1	704	379	325	0.338
≥ 2	116	68	48	
Times of abortion				
0	233	127	106	
1	308	168	140	0.993
≥ 2	307	161	146	0.634

one sex partner in the past (Table 1). Significant differences (using less stringent P < 0.30) were found in the following factors: education, occupation, condom use, intrauterine device use, oral contraceptive use, the age at first marriage and menstrual cycle.

Regression analysis and were significantly associated with RTIs. Women who were less educated (OR = 1.49, 95%CI: 1.09-2.04) and/or those currently under unemployment (OR = 1.47, 95%CI: 1.07-2.01) had significantly increased risk of RTIs.

Table 1 Cont.

Contraception use				
Intrauterine device use				
Yes	541	300	241	0.233
No	156	76	76	
Condom use				
Yes	72	34	38	0.206
No	621	342	279	
Rhythm use				
Yes	19	12	7	0.430
No	674	364	310	
Oral contraceptive use				
Yes	29	12	17	0.155
No	664	364	300	
Tubal ligation use				
Yes	29	17	12	0.630
No	664	359	305	
Wash mode				
Non shower	140	76	64	0.988
Shower	677	368	309	
		Mean (SD)	**Mean (SD)**	
Annual family income per capita, RMB[3]	809	1827.8 (1007.2)	1864.8 (1107.2)	0.619
Age at interview, years	848	42.0 (5.6)	42.2 (5.1)	0.760
Age at menarche, years	848	15.1 (1.8)	15.2 (1.7)	0.642
Menstrual cycle, days	827	27.8 (5.3)	28.3 (8.1)	0.268
Menstrual period length, days	824	5.5 (2.1)	5.4 (1.7)	0.855
Age at menopause, years	85	45.2 (4.8)	44.5 (4.6)	0.505
Age at first birth, years	821	26.2 (3.0)	26.2 (2.7)	0.973

RTI: Reproductive tract infection
SD: standard deviation
[1]Subjects with missing values were excluded from the analyses
[2]Unemployment including homemaker, laid-off workers or retiree
[3]1 US dollar = 6.8 RMB

Among 848 participants, 456 had infections in any sites of lower reproductive tract, giving the prevalence of 53.80% (95% CI: 48.06-59.54). Cervical infection was the most prevalent site of lower RTIs (46.93%, 95% CI: 41.18-52.69%) and vaginal infection presented in 11.32% (95%CI: 9.00-13.64%) of the women (Table 2). Among 96 subjects with vaginal infection, 31 (32.29%) were infected by trichomonasvaginalis, followed by bacterial vaginosis (22 cases, 22.92%),vaginal candidiasis (16 cases, 16.67%), and other organisms (27 cases, 28.13%). Only one woman was infected by condylomata acuminate.Table 3 shows the results of logistic regression analyses on the association between RTIs and the potential risk factors. Only 2 factors

entered into the multiple logistic.

DISCUSSION

This study was the first to investigate the prevalence oflower RTIs and the influential factors among women from the poorest families in China. A high prevalence of lower RTIs of 53.80% was indicated and cervix presented the most prevalent site of infection. Our study revealed that women with lower education level and being unemployed were significantly associated with the increased risk of lower RTIs. Many previous studies had examined the epidemiology of female's RTIs but in different socioeconomic backgrounds

Table 2. Prevalence of lower reproductive tract infection and the involved organisms in 848 women from the poorest families inNanjing, China.

Reproductive tract infection	No of subjects	Prevalence (%)	95% CI (%)
Any RTIs	456[1]	53.8	48.06-59.54
Any cervical infection	398	46.93	41.18-52.69
Any vaginal infection	96	11.32	9.00-13.64
Bacterial vaginosis	22	2.59	2.01-3.18
Vaginal candidiasis	16	1.89	1.46-2.31
Trichomonasvaginalis	31	3.66	2.84-4.46
Other vaginal infection	27	3.18	2.47-3.90

[1]38 women had vaginal and cervical infection simultaneously.

Table 3. Univariate and multivariate analysis of risk factors with lower reproductive tract infections in 848 women from the poorest families in Nanjing, China, 2005.

Factors	Odds ratio (95% confidence interval)	
	Univariate analysis	Multivariate analysis
Education		
Senior high school or above	1.00	1.00
Junior high school or below	1.42 (1.08-1.88)	1.49 (1.09-2.04)
Occupation		
Employed	1.00	1.00
Unemployed [1]	1.18 (0.90-1.56)	1.47 (1.07-2.01)
Condom use		
No	1.00	
Yes	0.73 (0.45-1.19)	
Intrauterine device use		
No	1.00	
Yes	1.25 (0.87-1.79)	
Oral contraceptive		
Yes	1.00	
No	1.68 (0.82-3.47)	
Menstrual cycle, per day	0.99 (0.97-1.01)	

[1]Unemployed included homemakers, laid-off workers or retiree.

(Caiyan et al 2012; Zhang et al.,2009; Patel et al., 2006). Caiyan et al found the prevalence rate of 11.4% among 6,339 women aged 30-49 years from the communities with mixed socioeconomic classes, they found that 8.7% of the women were infected by bacterial vaginosis and 1.0% were by trichomoniasis (Caiyan et al., 2012).Compared with Caiyan's study, a relatively high rate RTIs was observed in our study partly because of the poverty since the women included in our study came from the lowest socioeconomic class.A cross-sectional study from rural areas of Anhui province of China showed a relatively higher rate of any sites of RTIs (58.1%) and cervical infection (were 41.7%) than our findings (Zhang et al., 2009).It is expected that socioeconomic status in rural areas of Anhui province is lower than that of the poorest family in urban Nanjing. Results from Anhui's study suggest that poverty is a likely risk factor associated with an increased risk of RTIs. Compared with Chinese women, a much higher bacterial vagiansis (23.6%) was reported among Indian women coming

from the poor communities (Yasmin et al., 2012). Different socioeconomics and cultural determinants might explain the discrepancy in the distribution of RTIs between different communities and ethnicities.

Our study showed that higher level of education was associated with lower risk of RTIs, which is similar to the findings by Zhang et al (Zhang et al., 2009) and Caiyan et al (Caiyan et al., 2012). Women with low level ofeducation may have difficulties in sorting out effective ways to protect themselves without giving proper assistances and/or guidance. This group of disadvantaged womenmay also encounter numbersof stigmas and embarrassments, such as worrying about the treatment cost, preventing them from receiving timely diagnosis and treatment. Evidence has shown that RTI, if caused by bacteria, are more likely to invade the vagina during menstruation or unhealthy behaviors (Zhang et al., 2009; Caiyan et al., 2012). Women who had suffered from RTIs are partly related to their poor hygienic behaviors which might be related to their being less educated and lack of knowledge of reproductive health. A high proportion (40%) of our studied women had never received any information on reproductive health. Results from our study present an important message that reproductive health education programs specifically targeting on the group of disadvantaged women are urgently needed.

Unemployment was a possible risk factor for the occurrence of RTIs (Patel et al., 2006; Goto et al., 2005; Caiyan et al., 2012). Low socioeconomic status generally is a reflection of low education, blue collar occupation, and/or low income etc (Kaplan et al., 1993; Marmot, 2005). Health inequity is related to the socioeconomicstatus, while poverty may increase the risk of RTIs because poor women are usually of unfavorable sanitation due to lack of proper facilities, having risky sexual behavior because of low health literacy, and less seeking medical consultation (Hawkes et al., 1999; Moss, 2002). In fact, most women in our study (86%) perceived that poverty was the major reason for not seeking medical consultation if they unfortunately suffered from reproductive problems in our study. We recommend that special programs with low or no cost on prevention and control of RTIs should be implemented to improve the reproductive health of women in the lowest socioeconomic class.

Growing evidence has shown that sexual activity might be associated with the occurrence of bacterial vaginosis, candidasis and other infections (World Health Organization, 2013; Population Council, 2013; Goto et al., 2005; Calzolari et al., 2000). However, the use of condom could significantly protect against the infections (World Health Organization, 2013; Population Council, 2013; Goto et al., 2005). It has been reported that condom use is associated with statistically significant protection of men and women against chlamydial infection, gonorrhoea, herpes simplex virus type 2, and syphilis.

Condoms may also be associated with protecting women against trichomoniasis (Holmes et al., 2004). In our study, only 8.49% of women reported their sexual partners had ever used condoms. Given the HIV epidemic in China continuing to evolve rapidly, it is necessary to promote the condom use for the prevention of RTI and HIV/AIDS as well.

The limitation in this study should be noted. Selection bias could not be completely ruled out from our study because a relatively low response rate was present in the sample; nevertheless, we believe that the selection bias, if it was present, might not seriously affect the generalization. Though no demographic information was obtained for all 2,100 women from the poorest families in Nanjing (target population), indirect evidence from another source provides some support that the results from the sample of 848 participants might have a reasonable representative to the target population: We compared the major characteristics of the women who participated in the study with another study (stating a representative sample of the poorest women being included) (Wu et al., 2007), and found that the age range, education level and employment status were similar between the two groups. We did not include all sexually transmitted infections (such as viral sexually transmitted infections s and syphilis) in the analysis and no information on spousal sexual behavior or symptoms was collected, avoiding us further examining the whole picture on the epidemiology of RTIs. Nevertheless, this is the first to look into the epidemiology of lower RTIs in a special group of women from the poorest families in cities of China, which offers the major advantage of this study. In addition, we do not collect the information oncomorbidities such as anemia, thus we could not rule out the effect of the comorbidity on our results.

In conclusion, high prevalence of lower RTIs was observed in Chinese women from the poorest families. Women with lower education level and unemployment were associated with significantly increased risk of lower RTIs. Most poor women perceived not seeking medical consultation due to their poverties. Specific reproductive health educational promotion programs and adequate services should be offered to this group of disadvantaged women from the lowest socioeconomic class.

ACKNOWLEDGMENTS

REFERENCES

Caiyan X, WeiyuanZ, Minghui W, Songwen Z (2012).

Prevalence and risk factors of lower genital tract infections among women in Beijing, China. J. Obstet. Gynaecol. Res. 38, 310-315.

Calzolari E, Masciangelo R, Milite V, Verteramo R (2000).Bacterial vaginosis and contraceptive methods. Int. J. Gynaecol Obstet. the Official Organ of the International Federation of Gynaecology and Obstetrics, *70,* 341-346.

Goto A, Nguyen QV, Pham NM, Kato K,Cao TP, Le TH., Hoang QK, Le TQ, Nguyen BT, Katsube M, Ishii S, Yasumura S. (2005). Prevalence of and factors associated withreproductivetract infections among pregnant women in ten communes in NgheAn Province, Vietnam. J. Epidemiol. / Japan Epidemiological Association, 15, 163-172.

Approach. (1sted.) Cambridge, the United Kingdom: Cambridge University Press.

Kaplan GA, Keil JE (1993). Socioeconomic factors and cardiovascular disease: a review of the literature. Circulation, 88, 1973-1998.

Khawaja M, Kaddour A, Zurayk H, Choueiry N, El-Kak F (2009). Symptoms of reproductive tract infections and mental distress among women in low-income urban neighborhoods of Beirut, Lebanon. J. Womens Health (Larchmt). 18, 1701-1708.

Marmot M (2005). Social determinants of health inequalities. Lancet. 365, 1099-1104.

Moss NE (2002). Gender equity and socioeconomic inequality: a framework for the patterning of women's health. Social Science & Medicine. (1982). 54, 649-661.

Nguyen MH, Kurtzhals J, Do TT, Rasch V (2009). Reproductive tract infections in women seeking abortion in Vietnam. BMC Women's Health. 9, 1.

Nugent RP, Krohn MA, Hillier SL (1991). Reliability of diagnosing bacterial vaginosis is improved by a standardized method of gram stain interpretation. J. Clin. Microbiol. 29, 297-301.

Pao CC, Hor JJ, Fu YL (1994). Genital human papillomavirus infections in young women with vulvar and vestibular papillomatosis. Eur. J. Clin. Microbiol. Infect. Dis. 13, 433-436.

Patel V, Weiss HA, Mabey D, West B, D'Souza S, Patil V, Nevrekar P, Gupte S, Kirkwood BR.(2006). Population Council (2013). Reproductive Tract Infections: An Introductory Overview, from PopulationCouncil. http://www.popcouncil.org/pdfs/RTIFacsheetsRev.pdf.A ccecessed at 8-21-2013.

Wang LH, Fang LW, Su SQ, Qiao YP (2004). Reproductive tract infection (RTI)/sexually transmitted disease (STD) prevalence and countermeasure (I) in China. Maternal Health Care J. China. 19, 4-6.

WHO (1995). Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organization Technical Report Series. 854, 1-452.

World Health Organization. (2013). Sexual and reproductive   health.

Hawkes S, Morison L, Foster S, Gausia K, Chakraborty J, Peeling RW, Mabey D. (1999). Reproductive-tract infections in women in low-income, low-prevalence situations: assessment of syndromic management in Matlab, Bangladesh. Lancet, 354, 1776-1781.

Holmes KK, Levine R, Weaver M (2004). Effectiveness of condoms in preventing sexually transmitted infections. Bulletin World Health Organ.*82,* 454-461.

Hosmer DW, Lemeshow S, Sturdivant RX (2013). Applied Logistic Regression. (3rded) New York, NY: John Wiley & Sons.

Jejeebhoy S, Koenig M, Elias C (2003). Investigating Reproductive Tract Infections and Other Gynaecological Disorders: A Multi-disciplinary Research http://www.who.int/reproductivehealth/topics/rtis/en/.Acc ecessed at 8-21-2013.

Wu L, Shi GQ (2007).A Study on Poverty-stricken Urban Chinese Women and Countermeasures. Dissertation/Thesis.

Yasmin S, Mukherjee A (2012). A cyto-epidemiological study on married women in reproductive age group (15-49 years) regarding reproductive tract infection in a rural community of West Bengal. Indian J. Public Health. 56, 204-209.

Yongjun T, Samuelson J, Qingsheng D, Ali MM, Li X, Yanjian M , Xiaoqing C, Jun L, Jian C, Bi L(2009). The prevalence of sexually transmitted and other lower reproductive tract infections among rural women in Sichuan Province, China. Southeast Asian J. Trop. Med.Public Health. 40, 1038-1047.

Zhang XJ, Shen Q, Wang GY, Yu YL, Sun YH, Yu GB, Zhao D, Ye DQ(2009).Risk factors for reproductive tract infectionsamong married women in rural areas of Anhui Province, China. Eur. J. Obstet. Gynecol. Reprod..Biol.