

## 論文の内容の要旨

The relationship between self-awareness of secondhand smoke (SHS) exposure and urinary cotinine, and factors related to SHS exposure among Mongolian pregnant women

(モンゴル人妊婦の受動喫煙の自覚と尿中コチニンとの関連、  
および受動喫煙の関連要因)

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### 1. INTRODUCTION

Secondhand smoke (SHS) is known to be associated with several adverse health effects in not only adults and children but also fetuses. In particular, exposure to SHS during pregnancy harms both the mother and child. It decreases infants' birthweight and increases the risks of fetal congenital malformation, stillbirth, premature birth, being small for gestational age, and pre-eclampsia.

In Mongolia, approximately 42.9% of nonsmokers are exposed to SHS at home, which is a much higher rate than the global average of 33% among men and 35% among women. The high smoking rate among adults could be the reason for the high SHS exposure rate in Mongolia. The World Health Organization (WHO) used the STEPwise approach to surveillance (STEPS) of noncommunicable disease risk factors in Mongolia in 2009 and reported that the smoking rate among 15- to 64-year-old males was 48.0%, while that for females of the same age was 6.9%. The Mongolian government enacted a tobacco regulation law forbidding smoking in public areas. However, nonsmokers' exposure to SHS at home might be increasing, although statistics confirming this have not yet been reported, especially with regard to pregnant women.

The level of cotinine, one of the main metabolites of nicotine, in serum, urine, or saliva, is considered the “gold standard” measure of SHS exposure. Cotinine is a widely used biological marker of passive exposure to tobacco smoke among nonsmokers. Past studies in Mongolia, however, did not measure cotinine when assessing rates of active smoking and SHS; instead, they relied on self-reports. Questionnaires are simple, convenient, and inexpensive to administer compared with biological markers; meanwhile, using biological markers to estimate SHS exposure in developing countries has some difficulties, such as the lack of funds, measurement instruments, and insufficient infrastructure. It is, however, necessary to verify whether self-reported SHS exposure is accurate, because it would be meaningless if it is not reliable. Self-report measures might be unsuitable for surveys among Mongolian pregnant women—the tobacco regulation law is widely known among the population of Mongolia, which might mean that Mongolian pregnant women will underreport their own consumption of tobacco because of the fears of social pressure or criticism from health personnel.

There is a large body of research on the risk factors of SHS during pregnancy. There has been only one study on factors related to SHS in Mongolia, although it did not target pregnant women, but adolescents. It is important to understand the precise risk factors of SHS among Mongolian pregnant women, as the findings might help devise policies aimed at reducing SHS in the environment surrounding pregnant women and reducing passive smoking. Thus, this study aims to investigate the current rates of smoking and SHS among pregnant women in Mongolia using both a biological marker (UC level) and self-report measures; verify whether self-reported SHS rates are consistent with those determined by UC level and identify the characteristics of women who underestimate their SHS exposure; clarify the factors related to SHS; and, determine the relationship between partners' and pregnant women's UC levels to confirm whether pregnant women are exposed to SHS at home.

## 2. MATERIALS AND METHODS

This was a cross-sectional study conducted in Darkhan-Uul Province, Mongolia. The participant recruitment and data collection took place from November 2015 to January 2016 at ten public health facilities in Darkhan-Uul Province, including five health centers, three *Soum* hospitals (i.e., primary health care facilities), one general hospital, and one health department.

All pregnant women who visited public health facilities for antenatal health check-ups in Darkhan-Uul Province, Mongolia, and who were considered to be within 20 weeks of gestation (calculated from their last menstrual period), were selected as participants for this study, along with their partners. The medical personnel informed participants of the purpose and details of this study using instruction pamphlet. Data were collected using self-administered questionnaires and analysis of urine samples. For participants with low literacy or those who had difficulty in answering the questions, the trained medical personnel read the questions and wrote their answers.

Participants were asked their current smoking status and self-awareness of SHS exposure (using the question, "How much SHS do you think you are exposed to?" with response options of *not at all*, *a little*, *a lot*, and *very much*). We determined whether women were exposed to SHS using their UC level during pregnancy. Participants with a UC level of  $<5$  ng/ml (the lowest detectable level of UC) were classified as "not exposed to SHS," while those with a UC level of  $\geq 5$  ng/ml were classified as "exposed to SHS." We stratified pregnant women exposed to SHS (UC level of 5–100 ng/ml) into three groups, according to a previous study; low exposure (5–42 ng/ml), middle exposure (43–82 ng/ml), and high exposure ( $>83$  ng/ml). Women whose UC levels exceed 100 ng/ml were considered as "biochemically determined smokers."

We calculated descriptive statistics for all variables according to the UC level groups. The Kruskal–Wallis test was used to compare the means between the five UC groups, while the chi-squared and Fisher's exact tests were used to compare distributions of categorical data. Spearman's rank-correlation coefficient and Cohen's kappa were used to assess the correlation or consistency between pregnant women's UC levels and their self-awareness of SHS exposure. We further performed a univariate logistic regression analysis to

determine the associations between pregnant women's characteristics and UC levels, after which we performed a multiple logistic regression analysis while adjusting for those variables with  $p$  values of  $<0.1$ . Finally, we calculated the Spearman's rank-correlation coefficient between pregnant women's and partners' UC levels.

This study was approved by the Research Ethics Committee of the Graduate School of Medicine, The University of Tokyo, Japan, and the Ethical Review Board of the Ministry of Health, Mongolia.

### 3. RESULTS

A total of 508 pregnant women and 227 of their partners participated in this study. Some participants were excluded because they did not meet our criteria. As such, the sample used for analysis included 493 women and 219 partners.

Maternal age (mean  $\pm$  SD) was  $27.8 \pm 6.0$  years, 385 (78.9%) were married, and 293 (60.2%) had graduated from a technical college or university. Of all pregnant women, four (0.8%) self-reported that they smoked daily, 23 (4.7%) smoked less than daily, and 438 (88.8%) were nonsmokers; additionally, 9 (1.8%) answered "don't know" and 19 (3.9%) did not answer the question. There were 58 (11.7%) biochemically determined smokers (UC level  $>100$  ng/ml), and all self-reported daily smokers had UC levels of  $>100$  ng/ml. According to their self-report, there were 27 (5.5%) smokers, while the potential number UC-determined smokers were 65 (13.2%) and the rest of the pregnant women (428, 86.8%) were UC-determined nonsmokers. Among 438 self-reported non-smoking pregnant women, according to UC level, 229 (52.3%) had not been exposed to SHS, while 153 (34.9%) were defined as low exposure, 21 (4.8%) as middle exposure, and 1 (0.2%) as high exposure. Furthermore, 34 (7.8%) were biochemically determined smokers.

According to their self-awareness of SHS exposure, 158 (36.1%) mothers were considered to have not been exposed to SHS; 206 (47.0%) were exposed to SHS a little; 34 (7.7%) were exposed to SHS a lot; 27 (6.2%) were exposed to SHS very much; and 13 (3.0%) did not answer. Of the 158 pregnant women who reported that they were "not exposed at all," UC was not detected ( $<5$  ng/ml) in 90 (57.0%), and the rest (68, 43.0%) showed some exposure (UC level  $\geq 5$  ng/ml). The Spearman's  $\rho$  between pregnant women's self-awareness of SHS exposure and UC levels was 0.113 ( $p = 0.020$ ). The dichotomous variables of self-awareness of SHS and UC levels among self-reported nonsmoking pregnant women showed that the overall kappa coefficient was 0.073 ( $p = 0.115$ ). There was no related factor between pregnant women's characteristics and "underestimated exposure to SHS" by univariate logistic regression analysis.

Regarding the result of the multiple logistic regression analysis of the factors related to SHS exposure among self-reported nonsmoking women (excluding biochemically determined smokers), older women had lower odds of being exposed to SHS (adjusted odds ratio [AOR] = 0.94, 95% confidence interval [CI]: 0.91–0.98), as did women who had upper secondary school and technical college/university or above educations (AOR = 0.32, 95% CI: 0.12–0.83, AOR = 0.26, 95% CI: 0.10–0.65, respectively). Pregnant women who

permitted smoking in certain areas of the home had twice the odds of SHS exposure compared to women who did not permit smoking at home (AOR = 2.19, 95% CI: 1.27–3.76); notably, there was no statistically significant difference in odds of SHS exposure between women who did not permit smoking at home and those who permitted smoking everywhere in the home.

The correlation between pregnant women's and partner's UC levels was weak (Spearman's  $\rho = 0.249$ ), albeit significant ( $p < 0.001$ ).

#### 4. CONCLUSION

This study was the first to examine the current rates of active smoking and SHS exposure among pregnant women in Mongolia using a biomarker (UC levels), and to compare self-awareness regarding SHS exposure with UC levels. In this study, 5.5% of pregnant women smoked daily or less than daily according to self-reports and 60.9% of self-reported nonsmoking pregnant women reported exposure to SHS based on their self-awareness, while 13.2% of pregnant women were smokers based on UC levels and 44.4% of UC-determined nonsmoking pregnant women were exposed to SHS (UC levels  $\geq 5$  ng/ml). Notably, pregnant women's self-awareness of SHS exposure was weakly correlated with their UC levels and did not coincide. Especially for pregnant women, honestly reporting that they are active smokers might be difficult because of factors pressuring people to avoid smoking during pregnancy, such as social pressure, a sense of guilt, or worrying about appearances. Therefore, health professionals must be careful when obtaining self-reported smoking rates, and health education on the harm of smoking and SHS should be given to all pregnant women because of the likely underestimation that might occur when using only self-reported rates of smoking and SHS.

We also examined the factors that related to the underestimation of SHS exposure; however, we could not find any. We also identified the factors that related to SHS exposure among pregnant women in Mongolia: women of younger age, who had low educational attainment, and who allowed smoking at home were more likely to be exposed to SHS.

Overall, our results suggest that we could not accurately assess active smoking and SHS exposure among pregnant women in Darkhan-Uul Province, Mongolia using self-reported smoking and self-awareness of SHS. Although biochemical analysis is the best way to measure smoking and SHS exposure, a reliable questionnaire to estimate smoking and SHS exposure should be developed because the biomarker is not easily available in Mongolia.