Demographic and Reproductive Factors for High Seroprevalence of *Chlamydia Trachomatis* among Pregnant Women in Japan

Yosuke Kusano,¹,⁶ Yoshisada Shibata,² Shigeru Katamine,¹ Taro Yamamoto,³ Kenji Kurokawa,¹ Ryuozo Moruchi,¹ Kenji Kubota,⁴ Hideaki Masuzaki,⁵ Sumihisa Honda,² Kazuhiko Moji⁶ and Taichiro Takemoto⁶

Departments of ¹Bacteriology, ²Radiation Epidemiology, ⁵Gynecology and ⁶Public Health, School of Medicine, ³Department of Epidemiology, Institute for Tropical Medicine, and ⁴Department of Nursing, School of Allied Medical Science, Nagasaki University, Nagasaki 852–8523

KUSANO, Y., SHIBATA, Y., KATAMINE, S., YAMAMOTO, T., KUROKAWA, K., MORUCHI, R., KUBOTA, K., MASUZAKI, H., HONDA, S., MOJI, K. and TAKEMOTO, T. Demographic and Reproductive Factors for High Seroprevalence of *Chlamydia Trachomatis* among Pregnant Women in Japan. Tohoku J. Exp. Med., 2000, 190 (1), 1–13 — In order to elucidate demographic and reproductive factors associated with *Chlamydia trachomatis* seropositivity, serological screening and questionnaire survey were conducted on pregnant women in Nagasaki Prefecture, Japan. Serum samples were taken from 1718 pregnant women between September and December, 1996, at the cooperative obstetric hospitals and clinics, and tested for the presence of antibodies to *C. trachomatis* using the enzyme immunoassay. A questionnaire was administered on a sub-sample (n = 409), among whom 85 (20.8%) were seropositive. A multiple logistic analysis revealed that four characteristics showed a significant association with the seropositivity: (i) experience of premarital pregnancy, (ii) non use of condoms, (iii) short duration of education, and (iv) more frequent induced abortion. The unsafe sexual behavior of young people lacking proper knowledge of how to prevent STD is the most important intervention target for control of the *C. trachomatis* epidemic in Japan. ——— *Chlamydia trachomatis*; serology; epidemiology; pregnant women © 2000 Tohoku University Medical Press

*Chlamydia trachomatis* is a major cause of sexually transmitted diseases (STD) (Mardh et al. 1980; Washington et al. 1987; Cates and Wasserheit 1991). *C. trachomatis* infection can give rise to non-gonorrhea urethritis (NGU), pelvic

Received November 4, 1999; revision accepted for publication December 24, 1999.
Address for reprints: Yosuke Kusano, M.D., Department of Bacteriology, School of Medicine, Nagasaki University, Nagasaki 852–8523, Japan.
e-mail: roadstar-ngs@umin.u-tokyo.ac.jp
inflammatory disease (PID), spontaneous abortion, and female infertility (Gravett et al. 1986; Chow et al. 1990; Muylder et al. 1990; Rice and Schachter 1991; Scholes et al. 1996). Vertical transmission of C. trachomatis occurs during vaginal delivery in 50–70% of neonates born to infected mothers, causing neonatal conjunctivitis or chlamydial pneumonia (Frommel et al. 1977; Harrisson et al. 1978; Mardh et al. 1980; Heggie et al. 1981; Bell 1985; Scachter et al. 1986). Control of chlamydial infection is difficult as it is usually asymptomatic, or has ambiguous symptoms (Handsfield et al. 1981; Braverman et al. 1990; Oh et al. 1993).

Several studies have reported on the prevalence of C. trachomatis infection among Japanese women. Tanaka et al. (1996) detected C. trachomatis in genital specimens of female commercial sex workers at rates of 16.3 and 12.2% in 1990 and 1993, respectively. Koroku et al. (1994) investigated 10980 married and 1792 unmarried pregnant women who underwent induced abortion from 1986 to 1993 and detected the microorganism in 5.6 and 15.2% of genital specimens of the two groups, respectively. More recently, using a serological method, C. trachomatis seroprevalence among unselected pregnant women was reported to be 22.6% (1632/7234) in 1993–94 and 24.2% (2348/9652) in 1996–97 (Umenai et al. 1996; Yamamoto et al. 1998). This high prevalence of C. trachomatis among pregnant women in Japan has raised public health concern in terms of preventing perinatal infection of neonates. Japan was the only developed country where the low dose-pill had not been approved, while over two million women were taking the high-dose pill for birth control under the guise of treatment for menstrual disorders (Ogawa and Retherford 1991; Jitsukawa and Djerassi 1994; Nagata et al. 1997). However, the Japanese Special Committee of the Central Pharmaceutical Affairs Council recently concluded that it is appropriate to lift the ban while paying special attention to the adverse effects and potential for an increase in STD incidence, and finally approved the low-dose pill in 1999. Since in Japan, condoms have been used mainly for the purpose of birth control rather than for preventing STD, it is possible that liberation of the pill and the subsequent reduction in condom use would increase the incidence of STD including acquired immunedeficiency disease (AIDS). Epidemiological studies on sexual behaviors and risk factors for STD are therefore urgently needed to control potential STD epidemics in this country. Information on the sexual and reproductive behaviors of Japanese women, especially in relation to STD, is scarce, mainly due to the difficulty in collecting such information given the traditional nature of Japanese culture. In the present study, we evaluated reproductive factors associated with seropositivity through a questionnaire given to 409 of the women screened in Nagasaki, Japan.
Subjects and Methods

In Nagasaki Prefecture, Japan, the Nagasaki Research Project for STD Prevention started in 1995 in collaboration of Nagasaki University School of Medicine and the Nagasaki Branch of Japanese Association of Obstetrician and Gynecologists for Maternal Protection. The project has asked every pregnant woman in the prefecture for serological examination of *C. trachomatis* and human immunodeficiency virus (HIV) during the first clinic visit. Between September 1996 and December 1996, at the cooperative obstetric hospitals and clinics 1718 pregnant women were asked to cooperate with a further survey and questionnaires were administered to 409 of them. Informed consent was obtained from all the subjects, and the study was conducted in accordance with the human experimentation guidelines of Nagasaki University School of Medicine. Among 409 women who participated in the questionnaire survey, we excluded one whose age at menarche was 20 years.

Serological methods

Serum antibodies to *C. trachomatis* were detected by a commercial enzyme-immunoassay (EIA) kit (HITAZYME, Hitachi Chemical Co., Tokyo), which uses purified EB outer-membrane protein of *C. trachomatis* L2 strain as a solid phase antigen. IgA and IgG antibodies were differentially examined by use of class-specific secondary antibodies (Satoh et al. 1994). Serum samples which gave positive results in either or both of the IgA and IgG tests scored positive.

Questionnaire survey

Interviews were done in hospitals and clinics where obstetricians were willing to collaborate with the project. Questions were asked about (i) occupation, (ii) educational career, (iii) past history of STD, (iv) marital history, (v) age at menarche, (vi) history of pregnancy including the frequencies of pregnancy, childbirth, and induced abortion, and (vii) history of birth control and methods used (pill, condom, IUD, or the rhythm method; contraceptive method according to Ogino theory).

Statistical analysis

We first screened the items in the questionnaire by examining the strength of their association with the frequency of positive antibodies to *C. trachomatis*. The association with ordinary scale data, such as education level, was analyzed by the Cochran-Armitage trend test while the association with nominal scale data, such as occupation, was analyzed by the chi-square test with continuity adjustment. The association with interval or ratio scale data, such as the age of the first pregnancy, was analyzed by the Wilcoxon rank sum test. We then examined the
strength of the association or correlation between two items in the questionnaire which showed a significant or suggestive association with the frequency of positive antibodies to *C. trachomatis* by using the above mentioned tests and the Spearman’s rank correlation. We finally investigated risk factors of *C. trachomatis* infection on the basis of logistic regression. We set a logistic model with items in the questionnaire and their two-term interactions as covariates and selected the most appropriate logistic model on the basis of the AIC criterion. All of the necessary calculations were conducted by SAS (SAS Institute Inc.).

**Results**

*General features of the subjects*

The age of the subjects varied from 18 to 43 years and the quartiles (25, 50 and 75th percentiles) of the age distribution were (25, 29, 32) years. More than half (51.5% or 210/408) of the subjects were housewives and 117 (28.7%) were full-time workers. Sixteen (3.9%) were junior high school graduates and those who had left high school, 352 (86.3%) were graduates of senior high school, vocational school and junior college, and 26 (6.4%) were university graduates. Information on education was not available for 14 women (3.4%). Seventy-seven subjects (18.9%) reported a past history of STD, including 1 syphilis, 11 *C. trachomatis*, 62 candidiasis, 1 genital herpes and 1 papilloma. Seven out of 11 subjects who reported a past history of *C. trachomatis* infection were seropositive. Most of the subjects were married and 23 (5.6%) were unmarried. The age at the first marriage varied from 17 to 43 years and the quartiles of its distribution were (24, 25, 28) years. The age at menarche varied from 10 to 17 years and the quartiles its distribution were (12, 13, 14) years. About one-third (30.1% or 126/408) of the subjects were at their first pregnancy and the maximum number of past experiences of pregnancy was 7. The age at the first pregnancy varied from 16 to 43 years and the quartiles of its distribution were (23, 26, 29) years. More than half of the subjects (55.9% or 228/408) reported a past history of childbirth and the maximum number of childbirth was 3. The age at the first childbirth varied from 17 to 36 years and the quartiles of its distribution were (24, 27, 28) years. Seventy-six (18.6%) experienced miscarriage and the maximum number of miscarriages was 5. The age at the first miscarriage varied from 18 to 38 years and the quartiles of its distribution were (25, 27, 30) years. Induced abortion was reported by 59 (14.5%) and the maximum number of induced abortion was 6. The age at the first abortion varied from 16 to 34 years and the quartiles of its distribution were (19, 20, 23) years. Practice or experience of birth control was reported by 313 (76.7%) in whom condom use was the most frequent (98.7% or 307/313) while 12 (3.8%) were users of pill.

*Factors associated with C. trachomatis sepopositiveness*

Serum antibodies to *C. trachomatis* were positive in 85 subjects (20.8%). A
Table 1. Classification of subjects by major factors showing significant or suggestive association with the frequency of positive antibodies to C. trachomatis

<table>
<thead>
<tr>
<th>Factor</th>
<th>Category</th>
<th>Chlamydia trachomatis antibody</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Duration of education</td>
<td>Junior high school graduates including those who left senior high school</td>
<td>6 (37.5)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Graduates of high school, vocational school and junior college</td>
<td>76 (21.6)</td>
<td>276</td>
</tr>
<tr>
<td></td>
<td>University graduates</td>
<td>1 (3.8)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>2 (14.3)</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>85 (20.8)</td>
<td>323</td>
</tr>
<tr>
<td>Premarital pregnancy</td>
<td>Yes</td>
<td>24 (36.4)</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>59 (17.7)</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>2 (22.2)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>85 (20.8)</td>
<td>323</td>
</tr>
<tr>
<td>Frequency of induced abortion</td>
<td>0</td>
<td>58 (17.1)</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>15 (34.9)</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>7 (63.6)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>3 or more</td>
<td>4 (80.0)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>1 (11.1)</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>85 (20.8)</td>
<td>323</td>
</tr>
<tr>
<td>Condom use</td>
<td>Frequently or ever used</td>
<td>56 (18.2)</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td>Never Used</td>
<td>27 (28.4)</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>2 (40.0)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>85 (20.8)</td>
<td>323</td>
</tr>
</tbody>
</table>

*Parenthetic entries refer to the percentage of subjects with positive C. trachomatis antibody in the respective categories.

A significant or suggestive association with the frequency of positive antibodies was observed for the following seven factors: (i) duration of education, (ii) age at the first marriage, (iii) age at the first pregnancy, (iv) premarital pregnancy, (v) age at the first delivery, (vi) number of induced abortions, and (vii) condom use.

Duration of education. Seroprevalence significantly decreased with the duration of education ($p < 0.01$, Cochlan-Armitage trend test). Junior-high school graduates including those who left senior high school revealed the highest frequency of 37.5% (6/16), followed by 21.6% (76/352) in graduates of high school, vocational schools and junior colleges. University graduates had the lowest frequency, at 3.9% (1/26) (Table 1).

Age at the first marriage. The quartiles of the distribution of age at the first marriage were (23, 25, 27) years in seropositive women while they were (24, 26, 28)
years in seronegative women. The age at the first marriage was thus lower by about one year in the seropositive women than in seronegative women but the difference was not significant ($p = 0.09$, Wilcoxon rank sum test).

**Age at the first pregnancy.** The quartiles of the distribution of age at the first pregnancy were (21, 25, 27) and (23, 26, 28) years in seropositive and seronegative women, respectively (Fig. 1). The age at the first pregnancy was significantly lower in seropositive women than in seronegatives ($p < 0.01$, Wilcoxon rank sum test)

**Premarital pregnancy.** The proportion of those with premarital pregnancy was significantly higher in seropositive women (28.9% or 24/83) than in seronegatives (13.3% or 42/316) ($p < 0.01$, chi-square test with continuity adjustment) (Table 1).

**Age at the first childbirth.** The quartiles of the distribution of age at the first childbirth were (22, 25, 27) and (24, 27, 29) years in seropositive and seronegative women, respectively and the age at the first delivery was significantly lower in the former ($p < 0.02$, Wilcoxon rank sum test).

**History of induced abortion.** Seroprevalence significantly increased with the frequency of induced abortion ($p < 0.01$, Cochran-Armitage trend test) (Table 1).

**Condom use.** The proportion of condom users was significantly higher in seronegative women (78.8% or 252/320) than in seropositive women (67.5% or 56/
Correlation among major factors associated with *C. trachomatis* seropositivity

*Duration of education vs. age at the first pregnancy.* The quartiles of the distribution of age at the first marriage were (18, 21.5, 27) years in junior high school graduates including those who left senior high school, (22, 25, 28) years in graduates of high school, vocational school and junior college, and (26, 27, 29) years in university graduates. An increase in age at the first pregnancy was significantly correlated with duration of education (*p* < 0.01, Wilcoxon rank sum test).

*Duration of education vs. premarital pregnancy.* A significant decrease with the duration of education was observed in the frequency of premarital pregnancy (*p* < 0.01, Cochran-Armitage trend test). The proportion of women with premarital pregnancy was 50.0% (8/16) in junior high school graduates including those who left senior high school, 16.2% (56/345) in graduates of high school, vocational school and junior college, and 3.9% (1/26) in university graduates.

*Duration of education vs. past history of induced abortion.* Junior high school graduates including those who left senior high school reported the highest frequency of 50.0% (7/14) in the history of induced abortion, followed by 14.5% (50/346) in graduates of high school, vocational school and junior college. None of 26 university graduates reported the history of induced abortion.

*Duration of education vs. condom use.* The proportion of condom use was 50.0% (8/16) in junior high school graduates including those who left senior high school, 79.5% (276/347) in graduates of high school, vocational school and junior college, and 76.9% (20/26) in university graduates. Although a significant tendency to increase with duration of education was not observed (*p* = 0.12, Cochran-Armitage trend test), the proportion of condom users in the group with the shortest school career was significantly smaller as compared to those with a higher education level (*p* < 0.02, chi-square test with continuity adjustment).

*Premarital pregnancy vs. past history of induced abortion.* The frequency of the past history of induced abortion was significantly higher in women with premarital pregnancy (81.5% or 39/66) than those without premarital pregnancy (6.1% or 20/327) (*p* < 0.01, chi-square test with continuity adjustment).

*Premarital pregnancy vs. condom use.* There was no significant difference in the frequency of condom users between the groups with and without premarital pregnancy, 81.5% (53/65) and 75.8% (251/331), respectively (*p* = 0.40, chi-square test with continuity adjustment).

*Past history of induced abortion vs. condom use.* No significant difference in the frequency of condom users between the groups with and without past history of induced abortion, 77.6% (45/58) and 76.7% (260/339), respectively (*p* = 0.99, chi-square test with continuity adjustment).
Estimation of seropositivity risk

The form of the logistic model we first adopted was as follows:

\[
\text{logit}(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_{12} X_1^* X_2 + \beta_{13} X_1^* X_3 + \\
+ \beta_{14} X_1^* X_4 + \beta_{15} X_1^* X_5 + \beta_{23} X_2^* X_3 + \beta_{24} X_2^* X_4 + \beta_{25} X_2^* X_5 + \\
+ \beta_{34} X_3^* X_4 + \beta_{35} X_3^* X_5 + \beta_{45} X_4^* X_5
\]

where \( p \) denotes the seroprevalence of \textit{C. trachomatis} antibody and \( \text{logit}(p) \) denotes \( \log(p) - \log(1 - p) \). In the above formula, \( \beta s \) are unknown parameters to be estimated and \( X_s \) denote the following factors:

- \( X_1 \): duration of education (coded 1 for junior high school graduates including those who left senior high school, 2 for graduates of senior high school, vocational school and junior colleges, and 3 for university graduates).
- \( X_2 \): age at the first pregnancy (years).
- \( X_3 \): premarital pregnancy (coded 1 or 0 according to with or without premarital pregnancy).
- \( X_4 \): number of induced abortion.
- \( X_5 \): condom usage (coded 0 for non-users, and 1 for users).

The term \( X_i^* X_j \) denotes interaction of \( X_i \) and \( X_j \).

Complete information on the above 5 factors was available for 351 women in whom 72 (20.5\%) were positive for antibodies to \textit{C. trachomatis}. Using the data of these 351 women, we selected the most appropriate model among models of the above form on the basis of AIC by restricting to hierarchical model which can include an interaction term \( X_i^* X_j \) only if both of the main factors \( X_i \) and \( X_j \) are included. The model thus selected was:

\[
\text{logit}(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5
\]

We note that each of the \( \beta_s \) in this model is directly related to the risk of the corresponding factor. For example, we can say from the model that the risk in a condom user is about \( \exp(\beta_5) \) times higher as compared to a non-users if both of them are not different with respect to other factors.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
</tr>
<tr>
<td>Duration of education</td>
<td>0.40</td>
</tr>
<tr>
<td>Premarital pregnancy</td>
<td>2.50</td>
</tr>
<tr>
<td>Number of induced abortion</td>
<td>1.48</td>
</tr>
<tr>
<td>Condom use</td>
<td>0.48</td>
</tr>
</tbody>
</table>

*Based on logistic regression analysis. See pages 10 and 11 for details.
The results are summarized in Table 2, which indicates the following:

1. A decrease of seropositivity risk with duration of education is suggested. For example, the seropositivity risk in a graduate of senior high school, vocational school and junior college is about 0.40 times of that in a junior high school graduate or one who left senior high school if both of them are not different with respect to other factors.

2. An increase of seropositivity risk with experience of premarital pregnancy is significant. For example, a woman with premarital pregnancy will have a seropositivity risk about 2.50 times higher than one without premarital pregnancy if they are not different with respect to other factors.

3. An increase of seropositivity risk with an increase of induced abortion is suggested. For example, a woman with one time induced abortion will have a seropositivity risk higher by about 1.48 times than one without induced abortion if both of them are not different with respect to other factors.

4. Condom use decreases the seropositivity risk by about 0.48 times if a user and a non-user are not different with respect to other factors.

**Discussion**

In the present study we chose to screen serum antibodies to *C. trachomatis* rather than employing direct detection of antigens or genome of the microorganism in genital specimens to evaluate the prevalence of *C. trachomatis* infection. In general, serological testing is much simpler and more sensitive, and thus has an advantage for epidemiological studies targeting a large population. However, the two classical serological methods for *C. trachomatis* antibody detection, complement fixation and microimmunofluorescence, have been considered unreliable due to their low sensitivity and specificity (Diebel and Williams 1995). Instead, we employed an EIA kit which uses purified EB outer-membrane protein of *C. trachomatis* as an antigen and has been reported to be much more sensitive than microimmunofluorescence (Satoh et al. 1994). The kit detected IgA and IgG in 71.9 and 77.1%, respectively, of serum samples from women confirmed to be *C. trachomatis* antigen-positive in their genital specimens, and the concordance between the EIA and Western blotting was 97.2% for negative and 100% for positive results (Satoh et al. 1994). Pseudopositivity due to crossreaction with *Chlamydia pneumoniae* was shown to occur in less than 3% of the samples which scored positive (Satoh et al. 1994). *C. trachomatis* seropositivity does not always represent active infection, since the antibodies may persist in the serum well after elimination of the microorganism by treatment with antibiotics. However, some of us recently demonstrated that the serum antibody titer declined to an undetectable level in about 70% of seropositive cases within 5 years (Yamamoto et al. 1998). This indicated that the seropositivity mostly represented infection over the last few years.

The *C. trachomatis* seroprevalence, 20.8%, among 409 pregnant women who
participated in the questionnaire survey is roughly the same as reported by previous studies in Japan (Umenai et al. 1996) and in other developed countries (Jonsson et al. 1995; Persson et al. 1995).

Preliminary statistics picked up 7 characteristics, (i) duration of education, (ii) age at the first marriage, (iii) age at the first pregnancy, (iv) premarital pregnancy, (v) age at the first childbirth, (vi) number of induced abortions, and (vii) condom use, as significant or suggestive factors associated with the seropositivity. However, significant correlation was observed between some combinations of these characteristics. For instance, duration of education profoundly influenced many other characteristics including age at the first pregnancy, premarital pregnancy, past history of induced abortion, and condom use. The multiple logistic models finally extracted four characteristics correlated with seropositivity. They are (i) shorter duration of education, (ii) experience of premarital pregnancy, (iii) number of induced abortion, and (iv) non use of condoms.

In addition to avoiding intercourse with a known infected partner, using condoms throughout every act of sexual intercourse is currently the most effective measure of preventing STD. Consistent with this, the non-condom-users revealed higher seroprevalence than users. The number of induced abortions was also associated with seropositivity. Peterson reported that among sexually active U.S. females at risk of unintended pregnancy, 12% did not use any method of contraception (Peterson 1995). Since, in Japan, condoms are widely used for birth control, termination of unwanted pregnancy is most likely to represent unprotected intercourse. However, in the present study, the group with experience of induced abortion revealed high proportion of condom-users, 77.6%, which was equivalent to the value, 76.7%, of those without the experience. This strongly suggests incorrect or inconsistent usage of condoms by a significant part of users.

The pregnant women who completed their schooling in their teens were likely to be more sexually active during adolescence than those with a longer duration of education. The significant association found between the duration of education and many of other risk factors strongly suggested lack of proper knowledge of measures of STD prophylaxis and contraception in this population. However, we have to be careful to ascertain the real prevalence of C. trachomatis and risk factors associated with the infection among the general population of Japanese adolescents. Considering the mean ages for marriage (25.6 years) and first childbirth (26.3 years) of the subjects in the present study, women who become pregnant in their teens represent a minor group of the population of corresponding ages in Japan. Future studies targeting non-pregnant teenaged populations are needed to evaluate the risk of STD in Japanese adolescents.

In Nagasaki Prefecture, more than 30,000 pregnant women, corresponding to about half the total numbers, have so far cooperated with the serological screening of C. trachomatis conducted by the Nagasaki Research Project for STD Prevention since its start in 1995. Most of the seropositive pregnant women have been
subsequently subjected to the antigen- or DNA-testing of genital specimens, and those confirmed to be infected have been treated with antibiotics. Intervention involving the sexual partners of the infected pregnant women is currently under consideration, as successful treatment of the infection in both partners would greatly reduce the prevalence. Pregnant women are considered to be representative of the general female population of childbearing ages and easily monitored in an obstetric clinic or hospital. In 1996, the U.S. Preventive Services Task Force recommended the intervention targeting pregnant women with STD during their first clinic visit as one of the most cost-effective measures for the prevention of STD (Genc and Mardh 1996; U.S. Prevention Services Task Force 1996). Serological screening of pregnant women is of value in monitoring the prevalence of STD among the general population and preventing their spread. It could be expected that in Japan reduction in the rate of condom use due to the recent liberation of low-dose pill will result in increase in the incidence of STD (Clark et al. 1990; Ramstedt et al. 1992; Creatsas 1997; Jonsson et al. 1997). Changes in reproductive behaviors and the prevalence of STD in Japanese populations should thus be carefully monitored. It would be worthwhile to expand the Nagasaki screening system nationally in order to promote the control of STD in Japan.

The present study indicated that risky sexual behavior of sexually active young people lacking proper knowledge of measures to prevent STD is one at the highest risk for *C. trachomatis* infection in Japan. In certain countries, the AIDS campaign has begun to show signs of its success and the number of individuals newly infected with HIV has recently been decreasing (Nelson et al. 1996). To prevent STD, including AIDS, the early introduction of a health education program on sexual behavior, STD, and contraception targeting adolescents, especially junior and senior high school students, is a matter of great urgency in Japan.

Acknowledgments

We would like to thank members of the Japan Association of Obstetricians and Gynecologists for Maternal Protection in Nagasaki for collecting blood samples and information.

References


5) Clark, R.A., Kissinger, P. & Williams, T. (1990) Contraceptive and sexually trans-


