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Urogenital Chlamydiosis in Adolescents: Risk Factors and Knowledge regarding Sexually Transmitted Infections

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Abstract
Objective – To investigate the characteristics and individual risk factors for chlamydia infection, as well as the knowledge about sexually transmitted infections (STIs) of sexually active women under 18 years of age who have had intercourse without a condom at least once. **Methods** – Adolescent girls aged 14 to 17 when attending a gynecologist filled in the questionnaire about their reproductive data and knowledge regarding STIs; they also stated where they had been tested for chlamydia infection. **Results** – 101 patients were included in the study. Less effective methods of contraception were used by 73.2% of the study participants. None of the study participants could correctly identify all named STIs. 15 (14.9%) of the study participants were diagnosed with chlamydia infection. **Conclusions** – The study found that many sexually active women under 18 years of age in Latvia use less effective contraception methods and have limited knowledge regarding STIs. The number of sexual partners per lifetime was found to be a risk factor for chlamydia infection.

Key Words: Urogenital Chlamydia ▪ Adolescents ▪ Knowledge Regarding STIs.

Introduction

Chlamydia trachomatis is the most common sexually transmitted infection (STI) and its incidence continues to rise (1). Chlamydia infection is usually asymptomatic but can lead to pelvic inflammatory disease, diminished reproductive function and chronic pain (2)which most frequently are asymptomatic, are major public health concerns globally. The 2015 European C. trachomatis guideline provides: up-to-date guidance regarding broader indications for testing and treatment of C. trachomatis infections; a clearer recommendation of using exclusively-validated nucleic acid amplification tests for diagnosis; advice on (repeated. Screening of risk groups plays a key role in its detection (3). The main risk group for chlamydial infection is young women (4).

The incidence of chlamydia infection in Latvia is 2.5 times lower than the average for European Union (EU) countries (157/100,000 inhabitants in the EU vs. 65.1/100,000 in Latvia) (1). This is most likely because there is no organized screening program for chlamydia infection in Latvia and the fact that, until early 2022, STI testing was only available free of charge for strictly limited patient groups (pregnant women and children). Latvia is characterized by the high use of ineffective contraceptive methods (such as withdrawal), as well as inconsistent use of condoms, even if they are mentioned as the main method of contraception (5). Recent, national-level data on young people's knowledge regarding STIs in Latvia are not available, but the frequent use of less effective contraceptive methods and low rates of diagnosed chlamydia infection suggest a lack of knowledge about

sexual and reproductive health. A better understanding of the characteristics, sexual-life habits and knowledge regarding STIs of the at-risk group can improve the provision of health care services for these patients and contribute to the early detection and prevention of the disease (6,7)such as the number of sex partners, new or more than one sex partners, and previous infection, also can serve as criteria for screening women aged > 25. Because reinfection rates are high and occur within a few months, complications may be reduced further if partners are treated and women rescreened 4 to 6 months after initial infection. Revised recommendations for C trachomatis screening programs have stated that more frequent screening may be considered among women < 20 and those with recent infection [104]. Screening in nontraditional settings and careful evaluation of local prevalence and risk factor information should be encouraged. Private providers and emergency room providers should discuss screening recommendations and adopt a C trachomatis screening policy for the population they serve. The HEDIS measure should serve to encourage at least annual screening of 15- to 25-year-old sexually active females through providers linked to managed care organizations. In general, high yields (ie, percentage of tests that are positive.

The aim of the study was to investigate the characteristics, individual risk factors for chlamydia infection, and knowledge about STIs of sexually active women under 18 years of age who have had intercourse without a condom at least once.

Materials and Methods

The study included 101 patients aged 14–17 who visited an out-patient pediatric and adolescent gynecology clinic at the Children's Clinical University Hospital (Riga, Latvia) during a one-year period (01.01.2021 – 31.12.2021), and who reported having had sexual intercourse without using a condom at least once. Patients completed a structured questionnaire designed specifically for this study, which asked about their sexual habits and assessed their knowledge of STIs. Knowledge was assessed using an 17-question test (see Appendix No1). The first part of the test involved naming the nine STIs and asking the participants to identify which items on the list are STIs. In the second part, 8 statements about STIs were presented and patients had to indicate whether the statement was correct or not. The maximum score for all parts of the test was 17. In addition, all participants were tested for *Chlamydia trachomatis* infection using RT-PCR in a certified laboratory. A swab was taken from the cervix during a routine gynecological inspection.

The participants gave written informed consent to participate in the study. According to the Law on the Rights of Patients in force in Latvia, patients can visit a doctor alone from the age of 14 years, and the research did not involve any additional medical procedures. Therefore, no signatures from legal representatives were required.

Ethics Statement

The study was approved by the Ethics Committee of the University of Latvia (17.10.2017).

Statistical Analyses

The Kolmogorov–Smirnov test was used to test the data for normal distribution. Non-normally distributed data were characterized by using the median and interquartile range (IQR). The Spearman correlation coefficient (ρ) was used for correlation analysis. The correlation coefficients were interpreted as follows: $P \leq 0.20$ – non-significant correlation; $0.20 < P < 0.40$ – weak correlation; $0.40 \leq P \leq 0.69$ – moderately close correlation; $P \geq 0.70$ – close correlation (8). A P value of less than 0.05 was considered statistically significant. The data were processed using Microsoft Excel 97-2003. Statistical analysis of the data was performed in IBM SPSS v.27 software.

Results

101 patients were included in the study. The median age of the participants was 17 (IQR 1). The median age at which sexual activity commenced was 15 (IQR 2). The lowest age was 10, the highest

17. One third of the participants (N=37 (36.6%)) had had only 1 sexual partner. The median number of sexual partners in the previous 12 months was 1 (IQR 1), with a maximum of 9 partners.

Contraception Practices

The contraceptive methods used by the study participants are shown in Table 1. Less effective methods of contraception (withdrawal/calendar method) were used by 73.2% of the study participants at least once during the previous 6-month period. Six patients did not use any contraceptive method at least once. Fewer than one fifth of the study participants (16.9%) used a hormonal method of contraception.

Knowledge About STIs

The median result for the entire knowledge test was 9 (IQR 3.0), with the minimum score obtained by the study participants being 0 points, and the maximum score being 15. None of the study participants was able reach the maximum score. The number of participants that correctly identified each STI is shown in Table 2.

The study participants' knowledge regarding STIs and their consequences is shown in Table 3. There was no statistically significant correlation between the number of sexual partners during their lifetime (ρ -0.34; P=0.733) or during the previous year (ρ 0.12; P=0.903) and theoretical knowledge

Table 1. Contraception Methods Used at Least Once in the Six-month Period. Multiple Methods Could Be Selected

Method of contraception	N (%)
Male condom	88 (87.1)
Withdrawal	67 (66.3)
Combined oral contraception	12 (11.9)
Calendar method	7 (6.9)
No contraception	6 (5.9)
Contraceptive patch	3 (3)
Contraceptive ring	1 (1)
Intrauterine device	1 (1)
Subdermal implant	1 (1)

Table 2. Number of Participants Correctly Identifying each Sexually Transmitted Infection

Sexually transmitted infection	N (%)
HIV	94 (94.9)
Chlamydia	71 (71.7)
Syphilis	70 (70.7)
Genital herpes	69 (69.7)
Gonorrhea	42 (42.4)
Human papilloma virus	31 (31.3)
Hepatitis C	25 (25.3)
Trichomonas	16 (16.2)
Hepatitis B	15 (15.2)

Table 3. Knowledge regarding STIs and Their Consequences

Statement	True N (%)	Not true N (%)	Don't know N (%)
Sexually transmitted infections cannot be contracted after just one instance of unprotected sex	8 (7.9)	85 (84.2)	8 (7.9)
The withdrawal method protects against unwanted pregnancy and STIs	5 (5)	88 (87.1)	8 (7.9)
HPV can cause the development of cervical cancer	24 (23.8)	1 (1)	76 (75.2)
All STIs are easy to cure	1 (1)	85 (84.2)	15 (14.8)
Chlamydial infection can cause infertility	21 (20.8)	3 (3)	77 (76.2)
One can tell if the guy is an STI carrier by visually examining his penis; so one can know if there is a need to use a condom	6 (5.9)	65 (64.4)	30 (29.7)
A higher number of sexual partners does not increase the risk of developing STIs	7 (6.9)	84 (83.2)	10 (9.9)
STIs can only be contracted during vaginal intercourse (there is no risk during oral or anal sex)	13 (12.9)	57 (56.4)	31 (30.7)

regarding STIs. No statistically significant differences where observed between the knowledge about STIs of girls with 1-2 lifetime partners and the girls who had more than 2 partners (P=0.947). There was no statistically significant difference between the knowledge about STIs of girls who had only had strictly protected sex (using male condoms) and those who had not. (P=0.373). The respondent's age did not correlate with their level of knowledge regarding STIs (ρ 0.75; P=0.454).

Chlamydia-Positive Participants

Fifteen (14.9%) of the study participants were diagnosed with chlamydia infection. The age of the participants who had chlamydia infection did not significantly differ from those who tested negative (P=0.693).

The median time from sexual debut did not statistically significantly differ between those who had chlamydia infections and those who did not (P=0.509).

No difference was observed between the level of knowledge regarding STIs among participants with positive chlamydia infection and those with negative tests (P=0.966), with the median score in the test being 10 (IQR 4) in both groups. Patients with positive chlamydia infection had a higher median number of sexual partners in their lifetime (3 (IQR 3) vs. 2 (IQR 2); P=0.016), but no statistically significant differences were observed in the median number of sex partners during the previous 12-month period (1 (IQR 2) vs. 1 (IQR 1); P=0.136).

Discussion

We found a high prevalence (73.2%) of use of less effective methods of contraception (withdrawal/calendar method) or unprotected intercourse (6%) among the study participants. Non-use of contraception by young females in the neighboring countries of Estonia and Lithuania is 1.1% to 16%, respectively (9, 10)"ISSN":"00107824","PMID":"35122729","abstract":"Objective: To evaluate the sexual behavior of Lithuanian high school students. Study design: School-based anonymous self-administered survey of high school students, conducted from February to June 2017. Results: Of 167 invited schools, 113 (67.7%. The latest extensive national data regarding use of contraception in Latvia are available for 2011 (5). Unfortunately, the statistics in Latvia have not changed significantly – also 12 years ago very effective methods of contraception (hormonal contraception, long-acting reversible contraceptives) were used by less than 20% of young women (5). These results confirm the vulnerability of the younger population to sexually transmitted diseases and unwanted pregnancy.

Condoms were used by 87.1% of our study population, which is higher than the findings of other researchers in the USA, who found 69% among females aged 14 to 17 (11)educational, clinical, and public health endeavors. Aims.: This study has two purposes: to describe the recent and lifetime prevalence of a variety of sexual behaviors; and, to describe factors associated with condom use at last penile-vaginal intercourse. Methods.: Data included those from male (N = 414. It was also higher than another study, from Australia, which reported that 56% of adolescents had used a condom during their latest act of intercourse (12) national sample of secondary school students from Australia. Methods A large, national online survey of 14- to 18-year-olds in Australia was conducted in 2018; a sub-analysis of sexually active participants (n = 2989. 66.3% of the study participants had used the withdrawal method during the previous six months, demonstrating that condoms are often used inconsistently by adolescent females, increasing the risk of STI infection. Similar findings have been reported among adolescents and young adults by other researchers in different countries (13,14)there is a dearth of local research focusing on this age group. AIM: The aim of this study was to explore the sexual repertoires and sexual health practices among teenagers in New Zealand with a view to better understanding levels of risk in this age group. METHODS: This study comprised a cross-sectional online survey designed to ask questions about sexual behaviours. A convenience sample of young people (n = 52 and also in the last

national survey in Latvia (5). Further education is needed regarding the fact that condoms are the single method that protects against STIs, and are only effective if used in every instance of intercourse.

More than 50% of patients correctly identified HIV (93%), chlamydia (70.3%), and syphilis (69.3%) as STIs. None of the study participants were able to correctly identify all the named STIs. Our study shows a similar result regarding recognition of STIs to other studies conducted in different geographic locations (15–18)attitudes, and sexual behaviors among young adults in Romania; an effective preventive campaigns should be based on an appropriate understanding of these factors. The aim of the present study was to obtain data about sexual behavior, attitudes, and knowledge about STIs among university students aged 18-25 in Romania. 3872 persons completed an internet-based questionnaire, advertised on Facebook, regarding sexual behavior, attitudes, and knowledge about STIs from January 28 to February 28, 2016. 6.01% of the respondents had no sexual experience; of the remaining (N=3639, 945 men and 2694 women. Most of the young people recognized HIV as an STI, but chlamydia is known by a significantly lower proportion of young people – as low as 25.3% among youth in Iraq (19). Young people are fairly well informed about the risks of HIV infection, but have little knowledge about other STIs and their prevention.

Almost half (43.6%) of the study participants thought that STIs cannot be contracted during oral or anal sex, or stated that they do not know the answer to this question. Other studies showed better awareness of other STI transmission routes among young people compared to our results. For example, among young Romanian women, 77% knew about the risk of STI transmission through oral sex and 79% about the risk of anal transmission (15). Similarly, young people in Greece knew that transmission of STIs is possible during oral and anal sex (76% and 86%, respectively) (20). No difference was observed between the level of knowledge regarding STIs among participants with positive chlamydia infection and those with negative tests (P=0.966). It is known that knowledge is only one of the aspects that improves contraceptive practices, and there are other important factors that influence consistent use of condoms (e.g. individual health beliefs, communication skills, method availability) (21, 22) that were beyond the scope of this study. Nevertheless, it is unlikely that anyone will implement good health practice if they lack knowledge regarding its importance. Until very recently, sex education in Latvia was barely covered in the school curriculum (included in social science lessons and only a couple of classes in a few study years) (23)there has been increasing recognition and evidence that teaching about the cognitive, emotional, social and physical aspects of sexuality can have positive impacts on children and young people's sexual and reproductive health. Emerging evidence also suggests that delivering sexuality education programmes to children and young people at school can have a positive effect on larger societal issues, such as gender equality, human rights, and the well-being and safety of children and young people. According to UNESCO, effective sexuality education should adopt a comprehensive approach: a curriculumbased process of teaching and learning about the cognitive, emotional, physical and social aspects of sexuality. Sexuality education programmes can tackle a wide range of topics, including sexual and reproductive health (including sexually transmitted diseases and youth pregnancy. Latvia is in the process of implementing a new education standard that foresees more comprehensive sex education (24). Hopefully, it will bring an improvement in adolescent knowledge regarding STIs.

Participants with positive chlamydia infections had a higher number of lifetime sexual partners, but the number of sex partners within the previous 12 months did not differ between participants with positive and negative test results. It is widely reported that a higher number of lifetime sexual partners increases the risk of chlamydia infection (25, 26). In contrast to our results, Muzny et al. revealed that chlamydiosis was significantly more common in woman with multiple sex partners during the previous year (>4 partners) compared to women in a monogamous partnership (18% vs.

6%) (27), a finding also supported by other studies (26). Our data suggest that STI testing is necessary even in monogamous relationships, as it can be associated with decreased vigilance against STIs, a fact which has been shown by other research (28, 29)i.e. people having multiple or concurrent sexual partners, are at a high risk of sexually transmitted infections (STI.

There are several strengths in this study. The study addresses an important public health issue, namely the risk of chlamydia infection in young females, who are already a known risk group for infection and the later consequences. Multiple risk factors were analyzed, including sexual behavior, contraceptive use, and knowledge regarding STIs. Additionally, this is a unique research topic for the Latvian population. The research has some weaknesses. The sample size is relatively small (N=101), which may limit the generalizability of the findings. Nevertheless, the study was conducted among attendees at the Children's Clinical University Hospital, which is the only specialized children's hospital in Latvia providing a whole spectrum of services. It is also the location of the only outpatient unit in Latvia that specializes in pediatric gynecology. All services are financed by the state, and gynecologists are accessible without a referral from general practitioners or other specialists. This allows the utilization of services by patients from different regions and socio-economic backgrounds, thus encapsulating the whole population. The study relied on self-reported data, which may be subject to recall and social desirability biases. To mitigate this risk, we ensured that participants completed the survey anonymously in a private setting away from their parents, and we made efforts to create a non-judgmental and supportive environment. On account of organizational issues, only adolescent girls who reported that they had had sexual intercourse without a condom at least once were included in the study; thus it is possible that chlamydia infection status was a result of pure chance. It is also possible that contraceptive practices in this particular group are skewed towards less effective methods and that knowledge about STIs could be worse than in adolescent girls who always used condoms. On the other hand, some adolescents are afraid to admit that they have had intercourse without a condom, or have simply forgotten that they had unprotected intercourse; therefore, we conducted a continuation of the study, recruiting a sample of sexually active girls, irrespective of their condom use status. The results will be summarized and published in the near future.

Implications in Practice

The results of this study suggest that the target population has a low knowledge of STIs; therefore, their ability to correctly assess their risk of having an infection and proactively seek testing is probably low. There is no organized screening program for chlamydia infection in Latvia, as there is in many other European countries (30). Until early 2022, STI testing was only available free of charge for strictly limited patient groups (pregnant women and children). Now chlamydia testing is available free of charge in certain health care facilities for young people under the age of 25, and for pregnant women, without age restrictions. Despite the emerging discussion regarding the justification of widespread screening programs for chlamydia infection in unselected, asymptomatic populations (31), considering the very low incidence of chlamydia infection in Latvia (1), there is probably a high number of undetected cases. Therefore, the testing of young people in Latvia would be useful, as is still recommended in other countries (32).

Conclusions

The study found that many sexually active women under 18 years of age in Latvia use less effective contraception methods and have limited knowledge of STIs. The only risk factor for chlamydia infection in this study was found to be the number of sexual partners per lifetime. This study highlights the need for targeted interventions and education programs for sexually active young women. The high percentage of women utilizing less effective contraception methods and the lack of knowledge about STIs among the study participants underscores the

importance of comprehensive sexual health education in this population. Additionally, the statistically significant relationship between the number of lifetime sexual partners and chlamydia infection, but not between the number of sexual partners in the last 12 months, highlights the need for continued efforts to promote safe sexual practices and regular screening for sexually transmitted infections, even in young females who are in a long-term partnership. Future research with larger sample sizes and more diverse populations is necessary to confirm and expand upon these findings.

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*Equally to this work.

Conflict of Interest: The authors declare that they have no conflict of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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Appendix No1

Patient questionnaire

Good afternoon! Please answer the questions in the questionnaire honestly. If you have any questions or concerns, feel free to ask the medical staff for help.

Please provide your name:

1. Please indicate your age: ……

2. Residence (if you live in more than one place, please indicate where you stay most of the time):
   - o Riga
   - o Vidzeme
   - o Kurzeme
   - o Zemgale
   - o Latgale
   - o I do not live in Latvia
   - o Other (please specify).

3. What kind of educational institution are you currently attending?
   - o Elementary school
   - o High school
   - o Vocational high school (vocational school, technical school)
   - o University
   - o I'm not studying right now
   - o Other (please specify)….....

4. At what age did you start having sex? .....

5. How many sex partners have you had in your lifetime? .....

6. How many sex partners have you had in the last 12 months? .....

7. Please name any contraceptive methods you have used in the last 6. months (there may be more than one answer!)
   - o Condom
   - o Interrupted intercourse (guy removes penis from me before "graduation")
   - o Calendar method (counted "safe" days)
   - o Birth control pills
   - o Contraceptive patch
   - o Contraceptive ring
   - o Intrauterine coil
   - o Contraceptive implant
   - o We did not use any method

8. Do you ask your partner before sex if they have any sexually transmitted infections?
   - o Yes
   - o No
   - o It doesn't matter to me

9. Have you ever had a Chlamydia infection?
   - o Yes
   - o No
   - o I do not know

10. How many pregnancies have you had?
    - o 0
    - o 1
    - o 2
    - o > 2

11. How many births have you had?
    - o 0
    - o 1
    - o 2
    - o > 2

12. How many abortions have you had?
    - o 0
    - o 1
    - o 2
    - o > 2

13. Underline the infections that are sexually transmitted infections (infections that can be contracted during sexual intercourse):
    a. HIV;
    b. Hepatitis B virus;
    c. Hepatitis C virus;
    d. Human papillomaviruses ;
    e. Chlamydia;
    f. Gonorrhea,
    g. Trichomonas ;
    h. Syphilis;
    i. Genital herpes.

Please read the statements below and indicate for each one whether you think it is true or false. If you do not know the answer, please indicate.

Statement	True	False	I do not know
14. Sexually transmitted diseases cannot be contracted after having unprotected sex just once.			
15. Interrupted intercourse protects against unwanted pregnancies and sexually transmitted diseases.			
16. The cervical papilloma virus that is transmitted during sexual intercourse can cause a cervical tumor.			
17. All sexually transmitted infections are easy to treat.			
18. Chlamydial infection can cause infertility.			
19. By looking at his penis, it is possible to know whether a guy is a carrier of a sexually transmitted disease and whether it is necessary to use a condom.			
20. A higher number of sexual partners does not increase the risk of developing sexually transmitted diseases.			
21. Infection is possible only during vaginal intercourse (there is no risk of infection during oral or anal sex).			

Please return the questionnaire to the medical staff when you have finished completing it. Thank you for your response!