

# UNDER-REPORTING OF SEXUALLY TRANSMITTED INFECTION WITH *CHLAMYDIA TRACHOMATIS* - A REVISION OF SURVEILLANCE SYSTEM IS REQUIRED

## NEPOPOLNA PRIJAVA SPOLNO PRENESENE OKUŽBE Z BAKTERIJO *CHLAMYDIA TRACHOMATIS* - POTREBNA JE REVIZIJA SISTEMA EPIDEMIOLOŠKEGA SPREMLJANJA

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### ABSTRACT

**Introduction.** To consider whether a revision of the national chlamydia surveillance system is needed, the objectives were to estimate the proportion of laboratory confirmed cases at the Institute of Microbiology and Immunology (IMI) not reported to the National Institute of Public Health (NIPH), and to assess the completeness of reporting for individual data items.

**Keywords:**  
surveillance,  
chlamydia  
infection,  
underreporting,  
Slovenia

**Methods.** The dataset with information about the cases diagnosed at the IMI during 2007-2010, and the national chlamydia surveillance data at the NIPH, were linked using SOUNDEX code and the date of birth as unique identifier. The proportion of unreported cases was calculated. The proportions of records with missing data for individual variables were estimated for all reported cases during the same period. Chlamydia testing and reported rates for the period 2002-2010 were presented.

**Results.** Of 576 laboratory confirmed chlamydia cases at the IMI during 2007-2010, 201 were reported to the NIPH, corresponding to 65.1% of the overall underreporting (50.4% among dermatovenerologists, 90.1% among gynaecologist and 100% among other specialists). Item response was above 99% for demographic variables and from 69% to 81% for sexual behaviour variables. Higher testing rates corresponded to higher diagnosed rates.

**Conclusions.** Surveillance data underestimated diagnosed chlamydia infection rates. Mandatory reporting of cases by laboratories with less variables, including unique identifier, gender, date of diagnosis, and reporting physician specialty, together with numbers of tests performed (for estimating testing and positivity rates) would simplify the surveillance system and eliminate underreporting of laboratory confirmed cases, while still providing necessary information for public health policies.

### IZVLEČEK

**Ključne besede:**  
epidemiološko  
spremljanje,  
klamidijska  
okužba,  
nepopolna  
prijava,  
Slovenija

**Uvod.** Da bi presodili, ali je treba spremeniti nacionalni sistem epidemiološkega spremljanja spolno prenesene klamidijske okužbe, je bilo treba oceniti delež laboratorijsko potrjenih primerov na Inštitutu za mikrobiologijo in imunologijo (IMI) Medicinske fakultete Univerze v Ljubljani v obdobju 2007-2010, ki niso bili prijavljeni Nacionalnemu inštitutu za javno zdravje (NIJZ), in med vsemi prijavljenimi primeri v Sloveniji oceniti deleže manjkajočih podatkov za vse spremenljivke.

**Metode.** Podatki laboratorijsko potrjenih primerov klamidijske okužbe na IMI v obdobju 2007-2010 so bili povezani s podatki nacionalne zbirke o prijavljenih primerih na NIJZ z uporabo šifre Soundex (šifriran priimek) in datuma rojstva, ki sta služila kot enoten identifikator. Izračunan je bil delež neprijavljenih primerov v celoti in glede različnih specializacij zdravnikov. Ocenjeni so bili deleži z manjkajočimi podatki za posamezne spremenljivke med vsemi prijavljenimi primeri v istem obdobju. Prikazane so tudi letne stopnje testiranja in prijavne stopnje klamidijske okužbe za obdobje 2002-2010 na osnovi podatkov iz nacionalne zbirke na NIJZ.

**Rezultati.** Od skupno 576 laboratorijsko potrjenih primerov klamidijske okužbe na IMI v obdobju 2007-2010 je bil na NIJZ prijavljen le 201 primer, kar pomeni, da kar 65,1% laboratorijsko potrjenih primerov ni bilo prijavljenih. Dermatovenerologi niso prijavili 50,4% primerov, ginekologi 90,1% primerov, ostali specialisti pa niso prijavili nobenega primera laboratorijsko potrjene klamidijske okužbe. Pri prijavljenih primerih NIJZ v istem obdobju so bili podatki zelo popolni pri demografskih spremenljivkah (>99% prijav je imelo vse podatke), medtem ko je bilo poročanje javnozdravstveno odločanje, poenostavilo bi sistem epidemiološkega spremljanja in povečalo njegovo občutljivost (prijavljeni bi bili vsi laboratorijsko potrjeni primeri) ter obenem zmanjšalo delovno obremenitev zdravnikov. Obenem bi moralo laboratorijsko epidemiološko spremljanje dati tudi podatke o številu opravljenih testiranj, kar bi omogočilo oceniti stopnje testiranja in stopnje pozitivnosti (skupaj in po starosti in spolu pacientov in tudi po specialnosti zdravnikov, naročnikov).

**Zaključki.** Podatki o prijavni incidenčni stopnji klamidijskih okužb močno podcenjujejo incidenčno stopnjo laboratorijsko potrjenih primerov. To prispeva k nizki občutljivosti epidemiološkega spremljanja spolno prenesene klamidijske okužbe, ki pa je odvisna tudi od obsega testiranja. Obvezno prijavljanje prepoznanih primerov iz laboratorijev z manjšim naborom spremenljivk (šifra Soundex, datum rojstva, spol, regija bivanja, datum diagnoze, specialnost zdravnika, ki je naročil preiskavo) bi vsebovalo vse potrebne informacije za na dokazih temelječe javnozdravstveno odločanje, poenostavilo bi sistem epidemiološkega spremljanja in povečalo njegovo občutljivost (prijavljeni bi bili vsi laboratorijsko potrjeni primeri) ter obenem zmanjšalo delovno obremenitev zdravnikov. Obenem bi moralo laboratorijsko epidemiološko spremljanje dati tudi podatke o številu opravljenih testiranj, kar bi omogočilo oceniti stopnje testiranja in stopnje pozitivnosti (skupaj in po starosti in spolu pacientov in tudi po specialnosti zdravnikov, naročnikov).

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## 1 INTRODUCTION

Sexually transmitted infection (STI) with bacteria *Chlamydia trachomatis* (chlamydia infection) is the most frequently reported bacterial STI in Slovenia and in Europe (1, 2). Prevention and control of chlamydia infection is important mainly because untreated infection may result in pelvic inflammatory disease, subfertility and poor reproductive outcomes in women (3). Opportunistic screening of young sexually active females has been recommended in several countries (4). Good quality surveillance data is necessary for evidence-based public health decisions on prevention and control (5, 6).

During 2004-2013, reported incidences of chlamydia infection in Slovenia varied from 6 to 12/100,000 population, which was rather low in comparison to most other European Union/European Economic Area (EU/EEA) countries (1, 2). Slovenian reported incidence rates of chlamydia infection are believed to substantially underestimate the true incidence (7). It is well known that differences in reported incidence rates between countries to a great extent reflect the differences in testing rates (8, 9). In addition, there may be underreporting of diagnosed cases.

Our objectives were to estimate the underreporting of chlamydial infection cases with laboratory confirmation in one of Slovenian laboratories, in particular at the Institute of Microbiology and Immunology (IMI), Medical Faculty, University of Ljubljana, to the National Institute of Public Health (NIPH) during the period 2007-2010, and to assess the completeness of reporting for different data items during the same period, with the aim to consider whether a revision of the national chlamydia surveillance system is needed.

## 2 METHODS

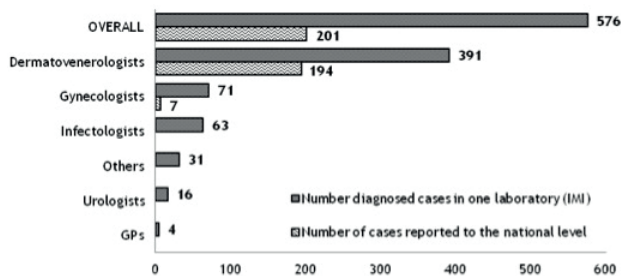
The Slovenian chlamydia surveillance system is based on mandatory reporting of all laboratory confirmed cases by physicians according to the Contagious Diseases Act (10), Health Care Databases Act (11), and communicable diseases reporting regulation (12). The Centres for Disease Control and Prevention (CDC) case definition that had been used since 2000 was replaced in 2008 by the European surveillance case definition (13-16). A common reporting form is used for the notification of all STI cases (15). The reported data items include: date of birth, gender, municipality of residence, citizenship, nationality, ethnicity, country of birth, occupation, marital status, diagnosis, date of diagnosis, results and dates of laboratory examinations, sexual behaviour, sexual

orientation, countries and time spent living abroad, type and duration of medical therapy or prophylaxis, data on counselling and referrals, identity of the notifying physician and date of report. Data are collected without information about the identity of individuals (15). SOUNDEX code of the surname together with the date of birth is used as unique identifier to eliminate duplicates (15). Until the end of 2013, diagnosed cases data were reported to Regional Institutes of Public Health (RIPH) that archived paper notification forms, entered the data according to the instructions of the NIPH, and sent quarterly electronic databases to the NIPH four times per year, where the data were analysed, interpreted, and the results were published in annual reports (1). To complement information on reported chlamydia cases, the NIPH annually collated information on overall chlamydia diagnostic testing rates and positivity rates from all microbiology laboratories (10-12, 15, 17, 18). Since 2009, the data have been also reported to ECDC (European Centre for Disease Prevention and Control) according to Decision 2119/98/EC of the European Commission (19), so that ECDC can publish epidemiological reports with the data from European countries (2).

To estimate the underreporting of all chlamydia infection cases (of which a great majority, more than 90%, were confirmed by real-time PCR (COBAS® TaqMan® 454 CT Test, v2.0, Roche, Germany)) at the IMI to the NIPH during 2007-2010, we linked the dataset containing the information about cases diagnosed at the IMI to the national chlamydia surveillance data at the NIPH. SOUNDEX code of the surname together with the date of birth was used as unique identifier. In addition to the overall estimate of underreporting, we also estimated underreporting according to different specialisations of reporting physicians. We also estimated the completeness of reporting for different data items, and triangulated chlamydia reported rates for the period 2002-2010, with information about overall chlamydia testing rates obtained from microbiology laboratories with annual postal surveys.

## 3 RESULTS

Of the total of 576 chlamydia cases with laboratory confirmation at the IMI during 2007-2010, only 201 cases (34.9%) were reported to the NIPH. There was a great variation in underreporting pertaining to different specialties of reporting physicians (Figure 1). Dermatovenerologists reported 49.6% of the diagnosed cases and gynaecologist 9.9% of the diagnosed cases. Other specialists did not report diagnosed cases at all.

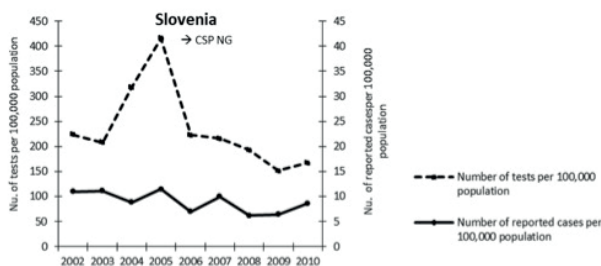


**Figure 1.** The number of reported chlamydia cases to the national surveillance system of all laboratory confirmed cases at the Institute of Microbiology and Immunology, overall and by physician speciality, Ljubljana, 2007-2010.

During 2007-2010, a total of 633 chlamydia infection cases in Slovenia were notified to the NIPH, with an average of 164 cases per year. Table 1 shows the proportions of notified chlamydia cases to the NIPH with missing information for individual variables for this period.

The data were fairly complete with respect to demographic variables, while non-response pertaining to sexual behaviour variables was rather high.

Figure 2 shows sexually transmitted chlamydia infection reported and testing rates for Slovenia in the health region of Nova Gorica for the period from 2002 to 2010.



**Figure 2.** Chlamydia reported rates and testing rates, Slovenia, 2002-2010.

The peaks in national testing rates and reported incidence rates in 2005 reflected the implementation of Chlamydia screening project in the region of Nova Gorica (CSP NG), a pilot study of chlamydia screening in women from 18 to 30 years old, in which all women examined at 10 primary health gynaecological practices in the region of Nova Gorica from April to September 2005 were offered chlamydia testing (20, 21).

**Table 1.** The proportion (%) of the 633 notified chlamydia cases to the NIPH with missing information for individual variables, Slovenia, 2007-2010.

Variable	2007-2010 (%)
SOUNDEX	0.5
Date of birth	0.0
Gender	0.2
Region	0.6
Citizenship	1.1
Country of birth	2.0
Profession/work	12.9
Marital status	19.2
Previous STI	9.7
The number of male sexual partners in the last three months	25.8
The number of female sexual partners in the last three months	18.6
The number of foreign male sexual partners in the last three months	29.7
The number of foreign female sexual partners in the last three months	28.7
The number of male sexual partners to whom the patient paid for sex in the last three months	31.0
The number of female sexual partners to whom the patient paid for sex in the last three months	30.6
Date of diagnosis	0.0
Date of notification	0.0
Speciality of the treating physician	0.3
Place of notification	0.0

Shaded data for these variables are available in medical microbiology laboratories.

**4 DISCUSSION**

Our results show that sexually transmitted chlamydia infection surveillance data in Slovenia substantially underestimate the diagnosed chlamydia infection cases, which contributes to the low sensitivity of chlamydia infection surveillance system. We have also shown that chlamydia reported rates depend on testing rates. Since Slovenian testing rates are rather low in comparison to other European countries (2), and thus substantial proportion of cases are not diagnosed, and since, in addition, physicians do not always report diagnosed

cases after having received laboratory confirmation, the sensitivity of our surveillance system is very low.

Given the often asymptomatic nature of chlamydia infection, especially in women, all over Europe, the reported incidence rates are highly affected by testing policies and practices in individual countries (2). An important limitation to the interpretation of the epidemiological situation in Slovenia, as well as in the EU/EEA, is that many infections are either not diagnosed or, if diagnosed, not reported (1, 2). The overall increase of cases seen across the EU/EEA in the past decade was most likely due to a combination of effects: improved diagnostics tools, increased case detection, improved surveillance systems and the introduction of chlamydia screening programmes in a number of countries (1, 4, 8, 9). Although not many countries have implemented screening programmes, routine chlamydia testing in young sexually active females is on-going in clinical services in many countries (2, 8, 9). This could account for the high rates being reported in the west and north of EU/EEA. On the contrary, the decreasing or low rates in Eastern and Central EU/EEA may reflect changes in healthcare systems (from public to private sector) and reporting routines, so that the number of infections that remain undiagnosed and underreported may have increased substantially (2).

In the ECDC chlamydia reports data, the completeness of the variables 'age' and 'gender' was above 95%. The completeness of the variable 'transmission category' increased over time, but it is still missing for 85% of the cases due to countries with the highest case reports (2). In Slovenia, the data of demographic variables that are important for public health decisions (gender, age (calculated from date of birth and date of diagnosis), region, speciality of the treating physician) are complete or almost complete (>99%). These data, together with the data about the number of people tested according to gender, age, region, and speciality of the treating physician, would enable us to understand whether chlamydia testing is targeted to population groups at increased risk for chlamydial infection (e. g. men and women less than 30 years old) and whether testing is implemented through appropriate health care services (e. g. gynaecologists). In addition, it would be also interesting to look at the differences in positivity rates. In contrast to some other, much less common STIs, such as syphilis and gonorrhoea, that disproportionally affect population groups with increased risk on average, such as men who have sex with men, information about sexual behaviour (e.g. homosexual sex) will not have implications for targeting public health interventions aiming to prevent and control chlamydia infection.

The major limitation of our study was that the underreporting of diagnosed chlamydia cases was assessed by only linking the diagnosed cases in one laboratory (the IMI) to the national chlamydia surveillance system dataset. Thus, the estimated overall underreporting of laboratory confirmed cases, as well as differences in underreporting between different specialisations of reporting physicians, reflect mainly the differences in Ljubljana health region.

## 5 CONCLUSIONS

The Slovenian chlamydia surveillance system should be improved by the introduction of mandatory reporting of laboratory confirmed cases with less variables (including coded surname and date of birth (or some other unique identifier), gender, date of diagnosis, reporting physician specialty - all routinely collected in microbiology laboratories), to the NIPH by laboratories, instead of by physicians. Information on rather numerous variables currently reported by physicians, e.g. sexual behavioural data, is both incomplete and not essential for public health decisions about prevention and control of chlamydia infections, and it could be omitted. Laboratory based surveillance of chlamydia infections should also enable the monitoring of the types of tests used, testing rates in various age groups of women and men, and in groups of patients using different healthcare services, as well as according to the specialisation of physicians ordering laboratory tests. Such a revision would simplify the chlamydia surveillance system, eliminate the underreporting of laboratory confirmed cases, and reduce the workload of physicians, while still provide the necessary information for evidence-based public health policies.

Finally, as the rate of testing for Chlamydia infection in Slovenia is very low, many infections remain unrecognized, and we are missing opportunities for early diagnosis, treatment and prevention of late sequelae primarily in women. Access to opportunistic testing for sexually transmitted chlamydia among young, sexually active women should be considered (4).

## CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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## ETHICAL APPROVAL

All the data analysed in this study were collected at the National Institute of Public Health, without information about the identity of individuals diagnosed with chlamydial infection, according to the Contagious Diseases Act, Health Care Databases Act and Communicable Diseases Reporting Regulation. The study was conducted in accordance with the code of Ethics of the World Medical Association (Declaration of Helsinki).

## REFERENCES

1. Klavs I, Kustec T (eds.). Spolno prenešene okužbe v Sloveniji: letno poročilo 2014. Ljubljana: National Institute of Public Health, 2015. Available September 11, 2015 from: <http://www.nijz.si/epidemiolosko-spremljanje-nalezljivih-bolezni-letna-porocila>.
2. European Centre for Disease Prevention and Control. Annual epidemiological report 2014: sexually transmitted infections, including HIV and blood-borne viruses. Available September 24, 2015 from: <http://ecdc.europa.eu/en/publications/Publications/sexually-transmitted-infections-HIV-AIDS-blood-borne-annual-epi-report-2014.pdf>.
3. Holmes KK, Sparling PF, Stamm WE, Piot P, Wasserheit JN, Corey L, et al. Sexually transmitted diseases. New York: McGraw-Hill, 2008.
4. Grgič-Vitek M, Učakar V, Klavs I. Presejanje na spolno prenosljivo klamidijsko okužbo: pregled priporočil. Zdrav Var 2008; 47: 8-17.
5. World Health Organization. Global strategy for the prevention and control of sexually transmitted infections: 2006-2015. Geneva: World Health Organization, 2007.
6. Centers for Disease Control and Prevention. Updated guidelines for evaluating public health surveillance systems. MMWR. Recommendations and reports. 2001; 50(13). Available June 1, 2015 from: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5013a1.htm>.
7. Klavs I, Rodrigues LC, Wellings K, Keše D, Hayes R. Prevalence of genital Chlamydia trachomatis infection in the general population of Slovenia: serious gaps in control. Sex Transm Infect 2004; 80: 121-3.
8. European Centre for Disease Prevention and Control. Chlamydia control in Europe: a survey of member states, 2012. Available September 8, 2015 from: <http://ecdc.europa.eu/en/publications/Publications/chlamydia-control-survey-europe-2012.pdf>.
9. European Centre for Disease Prevention and Control Guidance. Chlamydia control in Europe: literature review, 2014. Available September 9, 2015 from: <http://ecdc.europa.eu/en/publications/Publications/chlamydia-control-europe.pdf>.
10. Contagious diseases act. Ljubljana: Official Gazette of the Republic of Slovenia 2006; 33. Available June 1, 2015 from: <http://www.uradni-list.si/1/objava.jsp?urlid=200633&stevilka=1348>.
11. Health care databases act. Official Gazette of the Republic of Slovenia 2000; 65. Available June 1, 2015 from: [http://zakonodaja.gov.si/rpsi/r09/predpis\\_ZAKO1419.html](http://zakonodaja.gov.si/rpsi/r09/predpis_ZAKO1419.html).
12. Communicable diseases reporting regulation. Official Gazette of the Republic of Slovenia 1999; 16. Available June 1, 2015 from: [http://zakonodaja.gov.si/rpsi/r05/predpis\\_PRAV765.html](http://zakonodaja.gov.si/rpsi/r05/predpis_PRAV765.html).
13. Guidelines for STI Surveillance. UNAIDS/WHO Working Group on Global HIV/AIDS/STI Surveillance, 1999.
14. Centre for Disease Control and Prevention. CDC prevention guidelines database (archive). Available September 11 2015 from: <http://wonder.cdc.gov/wonder/prevguid/prevguid.html>
15. Grgič-Vitek M, Klavs I. Navodila za prijavo spolno prenosljivih okužb. Zdrav Var 2000; 39 (Suppl): 1-39.
16. Commission Decision of 28/IV/2008 amending Decision 2002/253/EC laying down case definitions for reporting communicable diseases to the Community network under Decision No 2119/98/EC of the European Parliament and of the Council. Available June 1, 2015 from: <http://ecdc.europa.eu/en/activities/surveillance/sti/pages/case%20definition.aspx>.
17. Klavs I, Hočevar-Grom A, Sočan M, Grgič-Vitek M, Pahor L, Kraigher A. Communicable disease surveillance, prevention and control in Slovenia. EuroSurveill 2004; 8: 2488.
18. Kraigher A, Sočan M, Klavs I, Frelih T, Grilc E, Grgič Vitek M, et al. (eds.). Epidemiološko spremljanje nalezljivih bolezni v Sloveniji v letu 2013. Ljubljana: National Institute of Public Health, 2014. Available June 1, 2015 from: [http://www.nijz.si/sites/www.nijz.si/files/publikacije-datoteke/epidemiolosko\\_spremljanje\\_nalezljivih\\_bolezni\\_2013.pdf](http://www.nijz.si/sites/www.nijz.si/files/publikacije-datoteke/epidemiolosko_spremljanje_nalezljivih_bolezni_2013.pdf).
19. European Centre for Disease Prevention and Control. Decision No 2119/98/EC of the European Parliament and of the Council. Available September 11, 2015 from: [http://ecdc.europa.eu/en/aboutus/key\\_documents/Pages/key\\_documents.aspx](http://ecdc.europa.eu/en/aboutus/key_documents/Pages/key_documents.aspx).
20. Frelih T. Project »Prevention of Reproductive Health in Young Women«. Program Phare CBS Slovenija/Italija 2002. Nova Gorica: IPH Nova Gorica, 2005.
21. Frelih T. Chlamydia screening project starts in Nova Gorica, Slovenia. EuroSurveill 2005; 10: 4-6.