SHORT COMMUNICATION

Chlamydia trachomatis Infections: A Rapid Decrease in Denmark from 2022 to 2024 is Driven by the Young Population

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Chlamydia is caused by the pathogen *Chlamydia trachomatis* (CT) and is the most common bacterial sexually transmitted infection (STI) worldwide. WHO estimates that more than 120 million new cases occur annually (1). Chlamydia is treated with antibiotics such as doxycycline or azithromycin; doxycycline has increasingly been recommended as the first-line antimicrobial due to its better eradication of rectal infections and a lower selection of macrolide resistance in concurrent *Mycoplasma genitalium* infections (2). If left untreated, chlamydia may cause complications such as pelvic inflammatory disease, which may lead to ectopic pregnancies and chronic pelvic pain, and epididymitis in men.

MATERIALS, METHODS AND RESULTS

In Denmark, the first diagnostic tests for CT were done in the 1980s, and since 1994 a national surveillance of all laboratory-confirmed CT infections has monitored the incidence of both ocular and genital infections (3). At present, the majority of all CT tests are done at 10 departments of clinical microbiology (DCMs) across Denmark, using 3 different PCR combo assays targeting both *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis*, Hologic Aptima®, Roche Cobas®, and BD COR® (also detecting *Trichomonas vaginalis*). In Denmark, testing for STIs is provided free of charge by general practitioners, gynaecologists, STI clinics, and specialized hospital departments. Testing is widespread and accessible regardless of symptoms, and clinicians recommend partner tracing to help reduce further transmissions.

Data presented in this paper were extracted from the Danish Microbiology Database (MiBa) (4), where a confirmed case of CT is defined by a positive nucleic acid amplification test (NAAT). Following a positive test, a 42-day window starts, whereby any positive samples within this window will not count as a new case. The same applies to negative tests, with the exception that a positive case can begin within a negative episode. Data represent all CT tests carried out in the DCMs. Microbiological data were linked to demographic information, such as age, sex, and residence, using the unique personal identification number (5). Data regarding symptoms were not available.

Chlamydia is the most common bacterial STI in Denmark and, despite fluctuations in incidence, the number of CT infections has gradually increased nationally, with reported cases nearly tripling from 2000 to a peak in 2022 (**Fig. 1**) (6). No significant decrease in the incidence of CT was observed during the SARS CoV-2 restrictions in Denmark (2020–2021). However, in 2022 a large increase (14%) from 2021 was observed. No clear explanation for the increase (Fig. 1) has been identified. The increase may be associated with the relaxation of the SARS CoV-2 restrictions and may reflect a continuation of the gradual annual increase that had been observed prior to the SARS CoV-2 pandemic.

Although, the overall incidence increased from 2000 to 2022, an apparent 11% decrease was observed from 2009 to 2012 (2009: 29,786 [9% positive rate]; 2012: 26,385 [11% positive rate]),

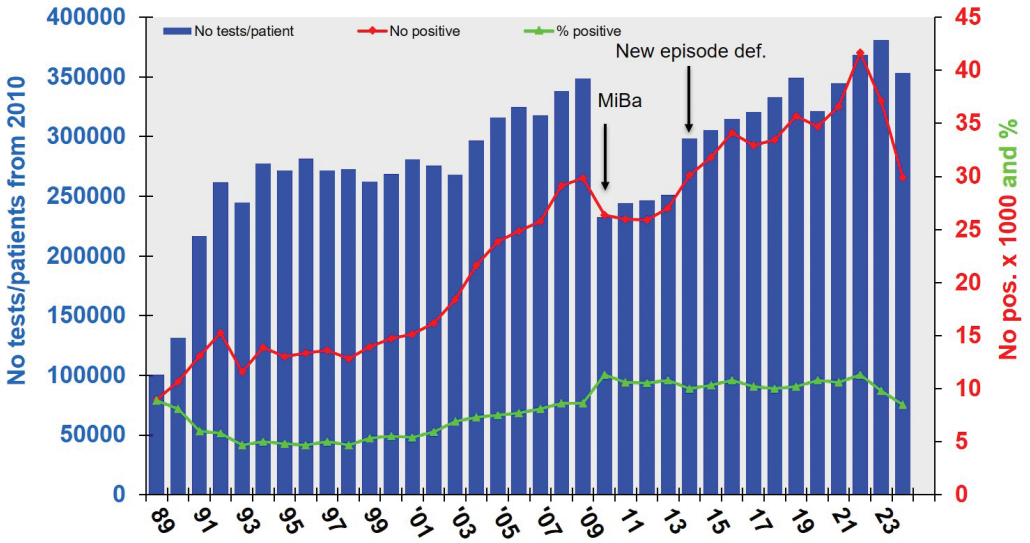

Fig. 1. Number of *Chlamydia trachomatis* tests/diagnosed patients, laboratory-confirmed tests, and positive rates, Denmark, 1989–2024. Bars represent number of CT tests (1989–2009) and number of patients tested for CT (2010–2024), red line indicates number of positive tests (1989–2009) and number of positive episodes (2010–2024), green line indicates positive rate.

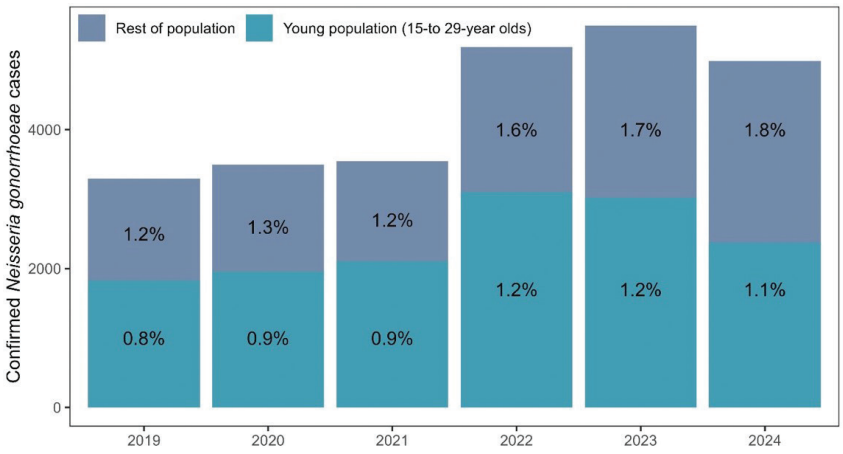

Fig. 2. Laboratory-confirmed cases of *Neisseria gonorrhoeae* (*n*=26,033), grouped by age, Denmark, 2019–2024. Bars show the number of confirmed *Neisseria gonorrhoeae* infections each year in Denmark. The figures in each bar represent the positive rate for the given year and population group.

which is attributed to the introduction of MiBa and a new case definition for CT (Fig. 1). Since then, the number of chlamydia cases increased to 41,595 (11% positive rate) in 2022 (6). Between 2022 and 2024, a 28% decrease in the number of chlamydia cases was observed in Denmark. Interestingly, this substantial decline from 2022 to 2024 followed one of the largest increases in the number of CT cases, which occurred in 2021–2022. This decrease occurred uniformly across the country, suggesting no influence of geography. Furthermore, from 2022 to 2024, the surveillance of NG in Denmark revealed only a 3% decrease (**Fig. 2**), which suggests an unchanged testing pattern based on the use of combo assays targeting both CT and NG (7).

Like most STIs, CT is overrepresented in the young population (15 to 29 years), with incidence rates peaking around 20 years of age for both men and women. In Denmark, a much higher incidence of CT is seen amongst women compared with men; this is most likely due to the 2.5 times higher testing frequency among women. Assuming similar sexual activity trends across men and women, this lower testing frequency among men could indicate a greater number of undiagnosed cases among men compared with women. Noticeably, amongst the young population, a peak in the number of cases was seen in 2022 for both men and women, followed by a large decrease from 2022 until 2024 (Fig. S1).

Testing for CT in the young population declined by 12% from 2022 to 2024, while the number of positive cases fell by 32%, and the test-positive rate decreased from 15% to 12% (Fig. S1). When examining the relative proportion of cases within each age group (**Fig. 3**), it is evident that from 2022 to 2024 the demographic distribution of CT cases shifted towards older individuals.

DISCUSSION

A decline in the number of CT cases of this magnitude without a clear explanation could raise suspicion of a diagnostic problem, such as a new mutation escaping current molecular diagnostic methods. However, this is unlikely, as the DCMs employ 3 distinct assays with independent targets, and no significant differences were

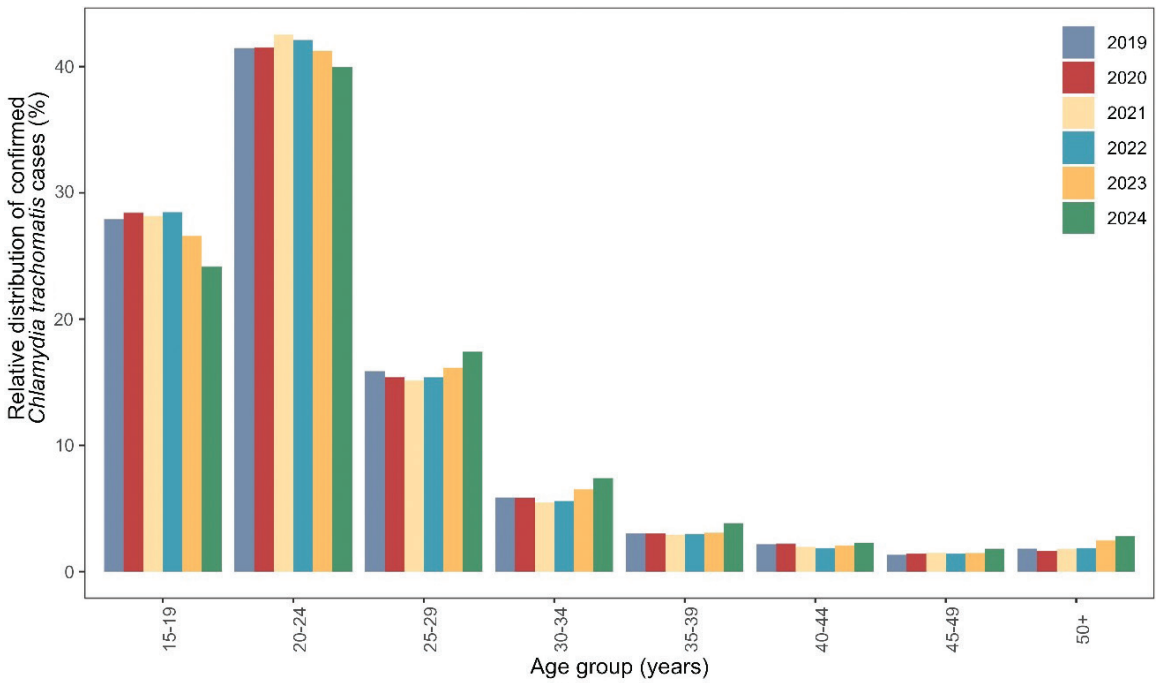

Fig. 3. Distribution of laboratory-confirmed *Chlamydia trachomatis* cases (%), grouped by age and year (n=214,013), Denmark 2019–2024. Bars show the relative distribution of all laboratory-confirmed cases of chlamydia for each age group for each year, Denmark, 2019–2024.

found across the country. Furthermore, the decrease was confined to the younger population. Another possible explanation could be the declining use of hormonal contraceptives (8), which, in combination with the increased focus on sexual consent and reduced alcohol consumption (9), may result in increased condom use, although the lack of data makes this hypothesis purely speculative. Changes in testing activity may contribute to this sudden decrease; however, since STI testing is highly accessible in Denmark and no recent changes to testing guidelines or specific screening initiatives have been implemented, it is unlikely to affect these findings. Nevertheless, this reduction in testing combined with the reduction in number of CT cases in the young population could suggest a decreased focus on testing, especially in the high-risk population, or indicate people seeking less medical assistance when asymptomatic. The smaller decrease in NG from 2022 to 2024 compared with CT in the same period suggests that the high-risk population is not less frequently tested. Otherwise, a large decrease in the number of new gonorrhoea cases would be expected because patients are tested for both CT and NG. Data regarding symptoms could enlighten these findings, but were not available.

Not only Denmark is seeing this reduction in CT cases. Sweden and Ireland saw an 18% and 16% decline in confirmed CT cases in 2024 compared with 2023, respectively (10, 11), comparable to the 19% reduction observed in Denmark in the same period. As noted by the European Centre for Disease Prevention and Control (ECDC) in their recent 2023 annual epidemiological report (12), Sweden saw an increase in CT numbers in 2022, similar to Denmark. However, they also observed that the rise from 2021 to 2022 did not persist into 2023. The decrease observed in Sweden from 2022 to 2023 was much smaller than in Denmark, indicating that this reduction in CT cases may occur at different times across Europe. As the decrease in the number of CT cases continues, publicly available real-time data are sparse, making it difficult to compare the observations in Denmark with the rest of Europe. Although the overall number of gonorrhoea cases has only slightly decreased from 2022 to 2024 in Denmark, the number of gonorrhoea cases among the young population (ages 15 to 29 years) has decreased by 23%, indicating that whatever factors contribute to the decline in CT cases may also influence the number of gonorrhoea cases in this age group (Fig. 2).

In conclusion, Denmark noted a 28% reduction in the number of CT cases from 2022 to 2024, representing the largest decrease in 2 years ever observed. The most substantial decrease occurred among individuals aged 15 to 24 years. The decline in test activity might have contributed; however, the reduced positive rate indicates sufficient testing activity. Since there is no clear reason for this sudden reduction, multiple factors such as fewer sexual contacts, a decreasing number of CT-infected individuals passing on the infection, and possibly increased condom usage due to focus on consent, and a shift away from hormonal contraceptives, may all play a part in these observations. Several European countries report similar patterns, suggesting that the factors contributing to the reduction of CT cases in Denmark may also be at play across other regions of Europe.

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Data availability: In accordance with Danish and European law (GDPR), individual participant data cannot be shared without a formal data-sharing agreement.

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