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Chlamydia and Gonorrhea: Shifting Age-Based Positivity Among Young Females, 2010–2017

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Abstract

Introduction: This study aims to determine if and how the age distribution of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in women evolved from 2010 to 2017, given changes in sexual practices over this time.

Methods: All *Chlamydia trachomatis/Neisseria gonorrhoeae* co-testing laboratory results from females aged 12–30 years tested at Quest Diagnostics during 2010–2017 (n=17,794,680) were evaluated to assess trends in *Chlamydia trachomatis* and *Neisseria gonorrhoeae* positivity over time. Data were collected and analyzed in November 2018.

Results: Age-based positivity shifted toward older ages from 2010 to 2017 for both *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. There was a declining trend in *Chlamydia trachomatis* positivity from 2010 to 2017 for the youngest age group (12–17 years; 17% decline, 8.9% to 7.4%, p<0.0001) but increasing trends for both those aged 18–24 years (21% increase, 6.1% to 7.4%, p<0.0001) and 25–30 years (50% increase, 2.2% to 3.3%, p<0.0001). The *Chlamydia trachomatis* positivity rate for 27-year-olds in 2017 (3.5%) and 24-year-olds in 2010 (3.5%) was the same. Similarly, there was a declining trend in *Neisseria gonorrhoeae* positivity from 2010 to 2017 for the youngest age group (12–17 years; 14% decline, 1.33% vs 1.17%, p<0.0001) but increasing trends for both those aged 18–24 years (27% increase, 0.79% vs 1.00%, p<0.0001) and 25–30 years (117% increase, 0.29% vs 0.63%, p<0.0001). For *Neisseria gonorrhoeae*, 30-year-old women tested in 2017 had an identical positivity rate to 23-year-old women tested in 2010, at 0.5%.

Conclusions: Healthcare providers may want to consider this positivity rate age shift in *Chlamydia trachomatis* and *Neisseria gonorrhoeae* to inform prevention and control strategies, including considering the potential for increased risk in women aged 25–30 years.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2020.05.023.

INTRODUCTION

Most infections caused by *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) in women are asymptomatic.[1] Therefore, infections often go undetected and undiagnosed, resulting in prolonged untreated disease. Untreated CT and NG infections can lead to adverse reproductive sequelae, such as pelvic inflammatory disease,[2] which is a major cause of chronic pelvic pain, ectopic pregnancy, and infertility.

Annual universal screening in sexually active women of all ages would maximize CT and NG detection, but this approach to testing is impractical because of considerations of access and cost. As such, the recommended strategy for CT and NG screening of sexually active women is selective, based on age and, in older women, the presence of risk factors. Although the incidence of both infections might be higher in some women aged ≥25 years in some communities, overall case rates are higher among women aged <25 years. Therefore, the Centers for Disease Control and Prevention (CDC) and the U.S. Preventive Services Task Force recommend annual CT/NG screening for all sexually active women aged <25 years and for women aged ≥25 years with risk factors (e.g., those with a new sex partner, more than 1 sex partner, a sex partner with concurrent partners, or a sex partner with a sexually transmitted infection).[3,4] The National Committee for Quality Assurance includes a quality measure for chlamydia screening in sexually active women aged 16–24 years,[5] which the Centers of Medicare and Medicaid Services has included as part of their Adult and Child Core Sets.[6]

As sexual practices evolve over time, it is important to periodically revalidate testing recommendations that are in part based on the age of the patient. Changes in sexual activity,[7,8] contraceptive use,[7] and pregnancies[9] all vary by age. For example, the proportion of high school students who have ever had sex has fallen from 47.4% in 2011 to 39.5% in 2017,[7] whereas the mean maternal age at first birth has increased from 24.9 years in 2000 to 26.3 years in 2014.[9] These changes likely affect the risk of exposure to sexually transmitted organisms such as CT and NG, and this risk may vary based upon the age distribution of infected patients. To test whether CT/NG positivity rates among young women have also changed by age group over time, this study utilizes a large national reference laboratory database to examine trends in CT/NG positivity among U.S. females aged 12–30 years during 2010–2017.

METHODS

Study Population

De-identified laboratory test results from all females aged 12–30 years who had CT/NG co-testing from any anatomic site (or urine) using the APTIMA Combo 2 CT/NG Assay (Hologic) or CT/NG co-testing using the Becton Dickinson ProbeTec as part of a cervical examination/Pap test performed at Quest Diagnostics during 2010–2017 were selected for potential inclusion in this analysis (n=17,795,866). Only results with outcomes of positive (determined by values positive or detected) or negative (determined by values negative or not detected) were included in the analysis, leaving the final analytic data set (n=17,794,680).

The authors also required specimens to have a unique patient identification number used by Quest Diagnostics to enable patient tracking of repeat test results over time.

Measures

CDC's "De-duplication Guidance for Gonorrhea and Chlamydia Reports"[10] was followed to determine whether positive test results represented a new episode or were part of the initial episode of infection. Specifically, when a patient had 2 specimens that tested positive for either CT or NG within a 30-day period, the second positive was considered part of the initial episode of infection and excluded from analysis. Urine specimens were included in the analysis, but the authors were unable to analyze them separately and they were thus grouped with the vaginal/cervical anatomic site specimens for analysis. Some women were tested at multiple anatomic sites during the same examination. A positive result could have come from any site, but each examination was counted as a single event regardless of the number of anatomic sites that were tested.

Statistical Analysis

Patients were classified by age group at the time of testing for analysis: 12–17, 18–24, and 25–30 years. Differences in CT/NG positivity rates between 2010 and 2017 overall and for each age group were analyzed using chi-square tests. Trends in CT/NG positivity rates from 2010 to 2017 were analyzed using the Cochran–Armitage test for trend. The authors also compared shifts in CT/NG testing volume for each age group over time. Data were collected and analyzed in November 2018. Data analyses were performed using SAS Studio, version 3.6 on SAS, version 9.4. This Quest Diagnostics Health Trends study was deemed exempt by the Western Institutional Review Board (Puyallup, Washington).

RESULTS

Of 17,794,680 specimens, most (99.8%) specimens were vaginal, cervical, or urine (n=17,752,278); oral (n=17,816) and rectal (n=24,586) specimens were also included. CT positivity rates were similar between oral and vaginal, cervical, and urine specimens (5.3% and 5.5%, respectively) but higher in rectal specimens (9.2%). NG positivity rates were 0.7% for vaginal, cervical and urine specimens; 1.2% for rectal specimens; and 2.2% for oral specimens. The final analytic data set included specimens from women residing in all 50 states and the District of Columbia.

The number of tests performed annually from 2010 to 2017 increased to a similar extent for each of the 3 age groups (Table 1). The increase was 32.9% for those aged 12–17 years, 32.5% for those aged 18–24 years, and 34.5% for those aged 25–30 years. The proportion of specimens tested from each HHS Region was also relatively stable over time, with the exception of HHS Region 2 (declined from 15.9% of specimens in 2010 to 10.4% of specimens in 2017) and HHS Region 4 (increased from 16.8% of specimens in 2010 to 23.7% of specimens in 2017).

Annual CT and NG positivity rates also increased during 2010–2017 (Figure 1). CT positivity increased by 18% overall, from a low of 4.9% in 2010 to a high of 5.8% in 2017

(p<0.0001 for trend); NG positivity increased by 33% overall, from 0.7% in 2010 to 0.9% in 2017 (p<0.0001 for trend). The lowest positivity rate for NG was in 2014 (0.6%).

The positivity changes observed over time were not distributed uniformly across all ages (Figure 1). CT positivity declined 17% from 2010 (8.9%) to 2017 (7.4%) for the youngest age group (12–17 years; p<0.0001 for trend). Conversely, CT positivity increased 21% from 2010 (6.1%) to 2017 (7.4%) for those aged 18–24 years (p<0.0001 for trend) and 50% for those aged 25–30 years (from 2.2% to 3.3%, p<0.0001 for trend). CT positivity increased significantly in every HHS Region for both those aged 18–24 years (p<0.001 for trend for all) and 25–30 years (p<0.001 for trend for all) (Appendix Table 1, available online). Significant declines in CT positivity occurred for the group aged 12–17 years in 7 of 10 HHS Regions (p<0.001 for trend).

Figure 2 shows annual CT positivity by individual age, comparing the years 2010 and 2017. Peak CT positivity increased by 1 year when comparing 2010 with 2017, from age 17 to 18 years. Comparing the CT positivity rate of 2010 with 2017, women aged 27 years in 2017 had a similar CT positivity rate to women aged 24 years tested in 2010 (3.5% for both), indicating a shift in the right tail of the distribution by 3 years among women tested by Quest Diagnostics.

Similar to CT, there was a 14% decline in NG positivity from 2010 (1.33%) to 2017 (1.17%) for the youngest age group (12–17 years; p<0.0001 for trend). Conversely, NG positivity increased 27% from 2010 to 2017 for the group aged 18–24 years (from 0.79% to 1.00%, p<0.0001 for trend) and 117% for the group aged 25–30 years (from 0.29% to 0.63%, p<0.0001 for trend). NG positivity increased significantly in every HHS Region for the group aged 25–30 years (p<0.001 for trend for all) and 6 of the HHS Regions for the group aged 18–24 years (p<0.001 for trend) (Appendix Table 2, available online). Significant declines in NG positivity occurred for the youngest age group in 5 of 10 HHS Regions (12–17 years; p<0.01 for trend), whereas significant increases in NG positivity occurred for this age group in 2 HHS Regions (p<0.001 for trend).

Figure 3 shows annual NG positivity by individual age, comparing 2010 with 2017. Peak NG positivity increased by 2 additional years when comparing 2010 with 2017, from age 16 to 18 years. Comparing the NG positivity rate of 2010 with 2017, women aged 30 years in 2017 (0.5%) had a similar positivity rate to women aged 23 years tested in 2010 (0.5%), indicating a shift in the right tail of the distribution by 7 years.

DISCUSSION

This study provides a unique perspective on CT and NG positivity among a very large population of presumably sexually active young women in the U.S. It found that positivity rates for CT and NG shifted during 2010–2017 based on age, with decreases observed in women aged 12–17 years and increases observed in women aged 18–30 years for both infections. The peak age of positivity for CT and NG increased by 1 to 2 years from 2010 to 2017. More importantly, the right tail of the distributions shifted to 3 and 7 years older for

CT and NG, respectively, indicating a general shift in positivity to older age groups among women tested by Quest Diagnostics.

Increases in CT and NG case rates at the population level are also seen in national case report data over the same time period. Between 2010 and 2017, the CT and NG case rates declined by ≤1% for women aged 15–19 years but increased by 38% and 81% in women aged 25–30 years for CT and NG, respectively.[11] Thus, despite the clear differences in the sources of national case report data and the data presented in this study, the shift in disease burden for both CT and NG toward older women appears to be indicated by both data sets. The increased positivity rate and shift of CT and NG infections to older ages may have important clinical significance, as these infections can result in pelvic inflammatory disease, which can lead to infertility.[2]

The U.S. Preventive Services Task Force released recommendations for CT screening in 2001[12] and for NG screening in 2005.[13] These recommendations have been updated a number of times, with the most recent updates released in 2014 recommending CT and NG screening in all sexually active women aged <25 years and women aged ≥25 years with risk factors.[14] Despite updates to recommendations over time, the authors believe the changes made to these guidelines would not have impacted the shifting age-based positivity rates presented in this study. Case report data from 2018 published by CDC indicate that reported chlamydia and gonorrhea infection rates have continued to increase in recent years and reported chlamydia rates are at record levels.[15] Clinicians may want to consider recent evidence, including the most recent CDC data, as well as the data presented in this study, when making screening decisions for their patients, including considering the potential for increased risk in sexually active women aged 25—30 years.

Limitations

This analysis has a number of strengths and weaknesses. A major strength is the analysis of positivity rates using a very large number of test results of women by individual age residing in all U.S. states and the District of Columbia. The near constant age distribution does not provide any discernable indication of variation by age group in testing practices during the study period. The proportion of specimens tested in 8 of 10 HHS Regions was also relatively stable over time. Analysis of test results for women who were beyond the recommended routine screening age (≥25 years) revealed important upward trends in positivity that otherwise may not have been recognized.

The population of women aged ≥25 years may be less represented in this study than women aged <25 years because current guidelines do not recommend screening all sexually active women aged ≥25 years. Available data from sources such as Title X family planning clinics show that substantial CT and NG testing does occur in women older than the age recommended for routine screening (46% are screened), and this includes many women aged >30 years.[16] However, these results should be interpreted cautiously. A limitation of this study is that the reason for testing (for all ages of patients) is not specified by the ordering clinician at the time of specimen submission; testing may have been for screening or diagnostic purposes. In older women, it may be that those who were tested were more likely to have received diagnostic testing or risk-based screening per CDC and U.S.

Preventive Services Task Force guidelines, and it cannot be concluded that infection rates have shifted to older age groups in the population not tested by Quest Diagnostics. Further, changes in risk factors over time may have affected testing in different aged women over time. However, the authors were reassured that the testing data in this study show that increases in testing volume across the age groups between 2010 and 2017 were largely similar. The authors also do not know what impact implementation of the Affordable Care Act, specifically Medicaid expansion and expanded availability of health insurance coverage of young adults on a parent or guardian's employer-sponsored health insurance plan, may have had on screening and positivity rates during the study period. The CT positivity rates for both younger and older women found in this analysis of Quest Diagnostics data are higher than the prevalence rates found in the National Health and Nutrition Examination Survey (1.7% from 2013 to 2016), a population-based survey of the non-institutionalized civilian population.[17] Various studies have reported different sensitivities and specificities for the APTIMA Combo 2 test and the Becton Dickinson ProbeTec test, although both are highly sensitive and specific.[18] The potential impact of these differences on the overall results is unclear.

CONCLUSIONS

These Quest Diagnostics data showed that CT/NG positivity rates shifted during 2010–2017 toward older women, with decreases observed in women aged 12–17 years and increases observed in women aged 18–30 years. Younger women aged <25 years still had considerably higher rates of positivity for both CT and NG. The peak positivity rate age has increased by 1 year for CT and 2 years for NG from 2010 to 2017. More importantly, the tail of the distribution has shifted older by 3 years for CT and by 7 years for NG. Annual analysis of future laboratory results will be important to determine if the shift in positivity rates toward older women is ongoing, how these changes compare to changes in CDC reported case rates, and how such changes reflect changes in sexual practices or screening for unsafe sexual behaviors. Keeping in mind the limitations with these data, an awareness of the observed elevated positivity rates in women older than the age range currently covered by recommended routine screening guidelines may be relevant for providers to consider as they seek to deliver optimal care for their patients' sexual health and well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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All authors contributed to study design, interpreted the data, revised the article for important intellectual content, and read and approved the final version of the submitted manuscript. HWK, KK, and JKN contributed to the first draft of the article. JKN acquired and analyzed the data.

HWK, JKN, and DPA are employed by Quest Diagnostics and HWK and DPA own stock in Quest Diagnostics. TLG and KK have no financial disclosures.

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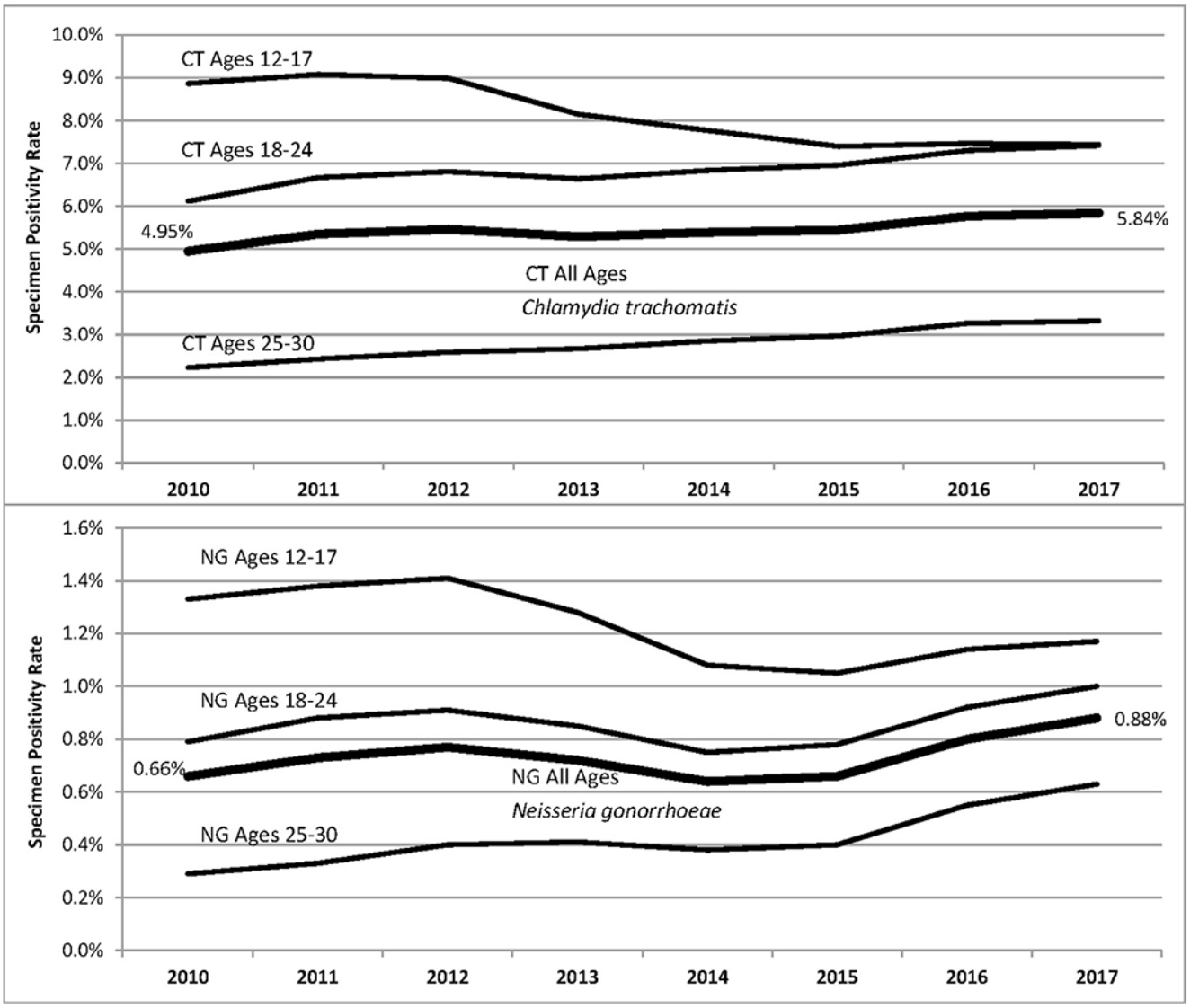

Figure 1.

Chlamydia and gonorrhea positivity rates among women aged 12–30 years tested at Quest Diagnostics, 2010–2017.

CT, *Chlamydia trachomatis*; NG, *Neisseria gonorrhoeae*.

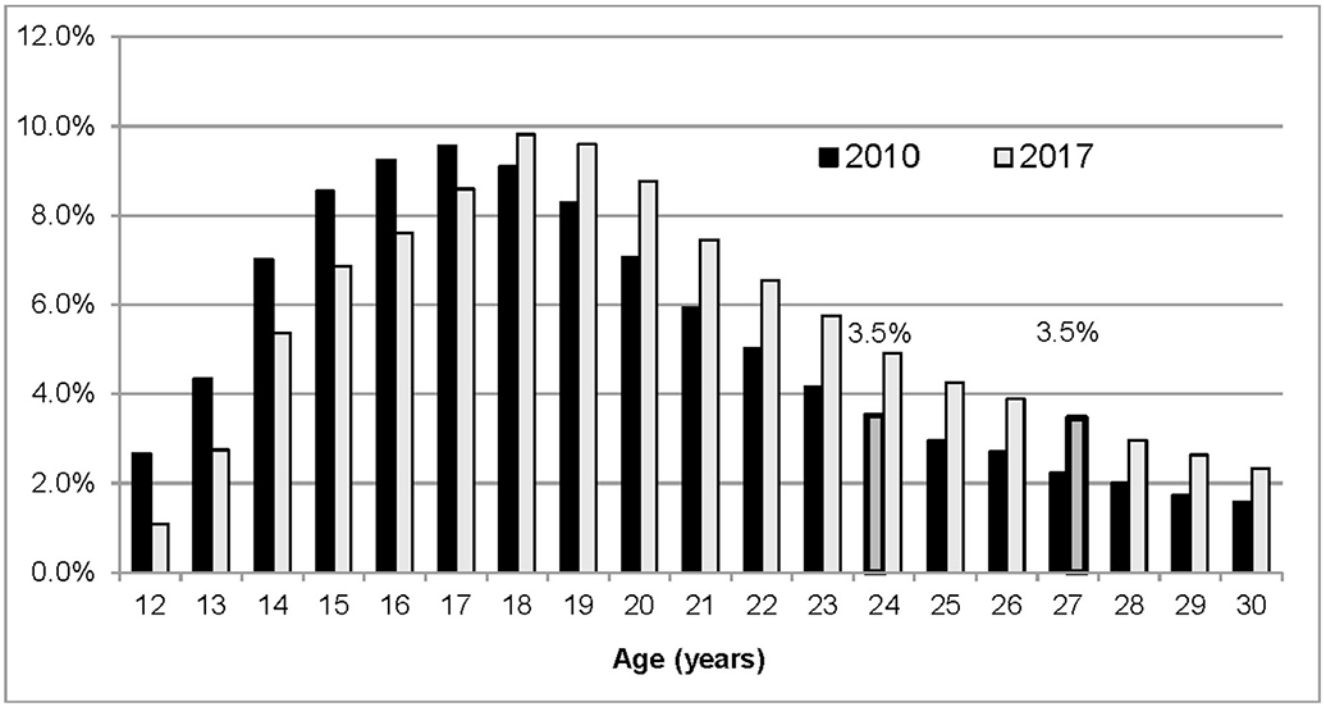

Figure 2.

CT positivity among women aged 12–30 years tested at Quest Diagnostics, by age, 2010 versus 2017.

There has been a shift in CT positivity toward older women.

The positivity rate for 27-year-old women in 2017 (3.5%) was the same as the positivity rate for 24-year-old women (the last year of currently recommended screening without risk factors) in 2010.

CT, *Chlamydia trachomatis*.

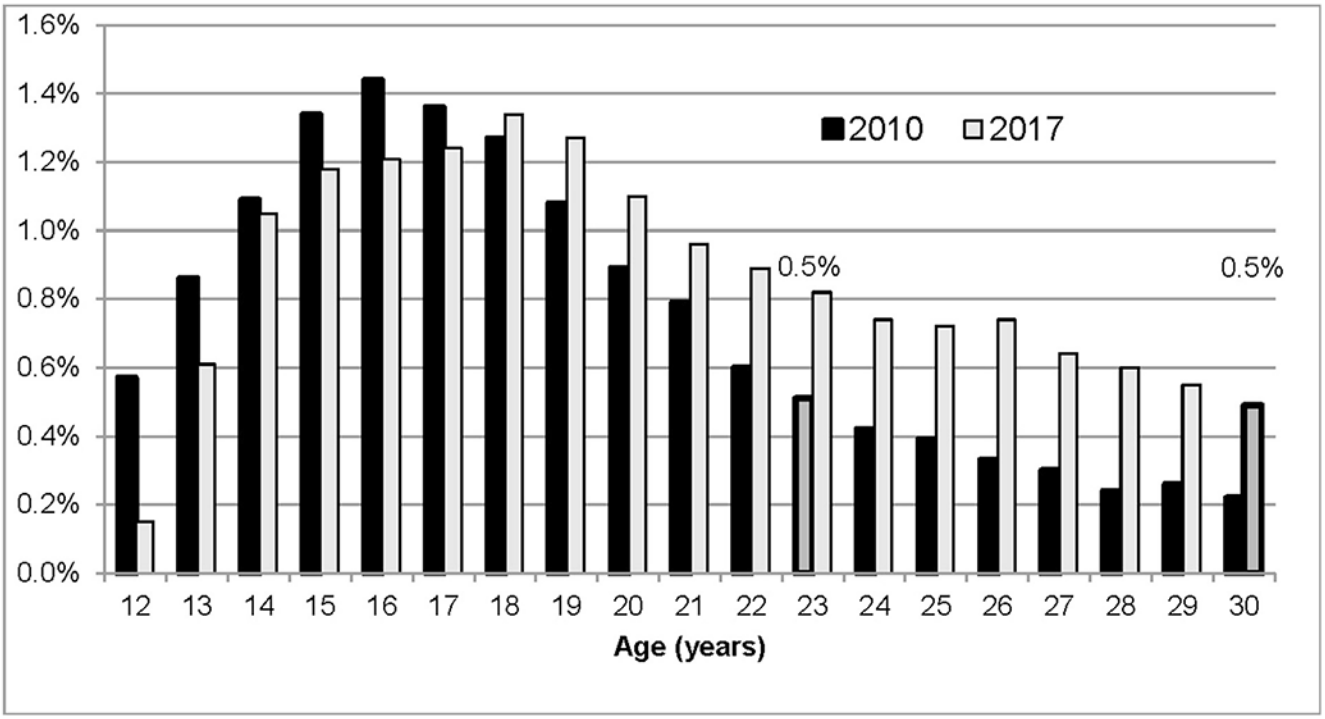

Figure 3.

NG positivity among women aged 12–30 years tested at Quest Diagnostics, by age, 2010 versus 2017.

There has been a shift in NG positivity toward older women.

The positivity rate for 30-year-olds in 2017 (0.5%) was the same as the positivity rate for 23-year-olds in 2010.

NG, *Neisseria gonorrhoeae*.

Table 1.

Study Demographics by Year

Variable	2010 *n* (%)	2011 *n* (%)	2012 *n* (%)	2013 *n* (%)	2014 *n* (%)	2015 *n* (%)	2016 *n* (%)	2017 *n* (%)	Total *n* (%)
N	2,011,347	2,037,383	2,061,377	2,104,294	2,145,714	2,259,963	2,493,592	2,681,010	17,794,680
Age group, years									
12–17	225,394 (11.2)	227,266 (11.2)	220,695 (10.7)	220,225 (10.5)	225,442 (10.5)	237,955 (10.5)	271,570 (10.9)	299,617 (11.2)	1,928,164 (10.8)
18–24	1,019,311 (50.7)	1,047,358 (51.4)	1,065,699 (51.7)	1,082,162 (51.4)	1,089,290 (50.8)	1,136,269 (50.3)	1,263,227 (50.7)	1,350,218 (50.4)	9,053,534 (50.9)
25–30	766,642 (38.1)	762,759 (37.4)	774,983 (37.6)	801,907 (38.1)	830,982 (38.7)	885,739 (39.2)	958,795 (38.5)	1,031,175 (38.5)	6,812,982 (38.3)
HHS region[a]									
1: CT, MA, ME, NH, RI, VT	126,749 (6.3)	129,673 (6.4)	126,223 (6.1)	125,564 (6.0)	145,420 (6.8)	169,794 (7.5)	204,063 (8.2)	211,732 (7.9)	1,239,218 (7.0)
2: NJ, NY	320,244 (15.9)	325,988 (16.0)	324,936 (15.8)	324,669 (15.4)	326,751 (15.3)	322,264 (14.3)	247,411 (9.9)	278,535 (10.4)	2,470,798 (13.9)
3: DE, DC, MD, PA, VA, WV	219,262 (10.9)	235,476 (11.6)	247,650 (12.0)	233,320 (11.1)	217,104 (10.1)	205,832 (9.1)	227,417 (9.1)	248,393 (9.3)	1,834,454 (10.3)
4: AL, FL, GA, KY, MS, NC, SC, TN	337,860 (16.8)	340,037 (16.7)	372,632 (18.1)	408,781 (19.4)	453,519 (21.2)	486,457 (21.5)	568,432 (22.8)	633,887 (23.7)	3,601,605 (20.3)
5: IL, IN, MI, MN, OH, WI	221,701 (11.0)	222,083 (10.9)	216,889 (10.5)	216,747 (10.3)	224,050 (10.5)	237,101 (10.5)	267,332 (10.7)	287,676 (10.7)	1,893,579 (10.7)
6: AR, LA, NM, OK, TX	180,370 (9.0)	180,415 (8.9)	184,417 (9.0)	187,948 (8.9)	193,839 (9.1)	209,574 (9.3)	251,665 (10.1)	260,678 (9.7)	1,648,906 (9.3)
7: IA, KS, MO, NE	72,756 (3.6)	73,933 (3.6)	71,561 (3.5)	62,256 (3.0)	56,694 (2.7)	59,261 (2.6)	75,830 (3.0)	77,529 (2.9)	549,820 (3.1)
8: CO, MT, ND, SD, UT, WY	12,306 (0.6)	14,222 (0.7)	13,350 (0.7)	13,074 (0.6)	13,555 (0.6)	16,256 (0.7)	23,129 (0.9)	24,776 (0.9)	130,668 (0.7)
9: AZ, CA, HI, NV	495,169 (24.6)	491,682 (24.1)	480,232 (23.3)	507,796 (24.2)	486,763 (22.7)	521,979 (23.1)	584,211 (23.4)	603,164 (22.5)	4,170,996 (23.5)
10: AK, OR, ID, WA	24,174 (1.2)	23,199 (1.1)	22,739 (1.1)	22,519 (1.1)	24,419 (1.1)	29,957 (1.3)	42,420 (1.7)	52,997 (2.0)	242,424 (1.4)

[a]A total of 355,242 specimens missing state data.