Assessing Age-Related Risk for Gonococcal and Chlamydial Infections Among Females in Hawaii, 2001: A Comparison of Morbidity Rates With Screening Test Positivity

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Objective.—National and state public health officials generally present sexually transmitted disease (STD) surveillance information in terms of overall cases and population-based rates. Because many adolescents (especially in the younger ages) are not sexually active, the use of population-based denominators leads to the calculation of low age-specific STD rates. This study compared morbidity rates with screening test positivity for gonorrhea and chlamydia to better define age-related STD risk among females in Hawaii.

Methods.—All female gonorrhea and chlamydia cases reported to the Hawaii State Department of Health (HDOH) during 2001 were grouped by age. Population estimates were used to calculate age-specific morbidity rates. Age-specific screening test positivity was calculated by dividing the number of positive tests identified through the HDOH STD screening programs by the number of screening tests performed in each age category (×100).

Results.—Although morbidity rates for both chlamydia and gonorrhea were low among 10–14 year olds, this group had the highest screening test positivity. Screening test positivity decreased incrementally with increasing age.

Conclusions.—Screening test positivity may provide a more accurate estimate of STD risk for sexually active adolescents than population-based rates. Physicians should obtain sexual histories from their adolescent patients and provide STD prevention counseling and screening to those found to be sexually active. In addition, expanded STD screening and treatment services should be made available and accessible to young, sexually active adolescents because they appear to be at greatest risk.

KEY WORDS: adolescent females; chlamydia; epidemiology; gonorrhea; numerical data; statistics

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Chlamydia trachomatis and *Neisseria gonorrhoeae* genital infections are the two most commonly reported nationally notifiable infectious diseases.[1] Information on chlamydial and gonorrheal infections is collected by every state health department in the United States and reported to the US Centers for Disease Control and Prevention (CDC). In addition to numbers of cases, state epidemiologists and the CDC collect and analyze sociodemographic information about each case, including gender, age, and race.

Because many females with gonorrheal or chlamydial infections may be asymptomatic, sexually transmitted disease (STD) screening is a key component of an effective public health STD control program. Gonorrhea screening has been in place nationally for decades, but has recently expanded to include females at job corps training programs, antenatal clinics, school-based clinics, drug treatment centers, and correctional facilities.[2] The CDC began a limited chlamydia screening demonstration project in 1988. In 1993, this program was expanded through the National Infertility Prevention Program, and since 1995, federally subsidized chlamydia screening programs have been in place in all Public Health Service Regions. Populations targeted for chlamydia screening include females attending state-subsidized family planning clinics, community health centers, job corps training centers, and correctional facilities.[2]

The Hawaii State Department of Health (HDOH) initiated a gonorrhea-culture screening program in 1971. This service was offered to both private and nonprofit providers. In 1986, Hawaii became one of the first states to initiate chlamydia screening of females in family planning clinics.[3] The HDOH has continued to expand both gonorrhea and chlamydia screening activities targeting female clients at the state's STD clinic and state-subsidized family planning clinics, community health centers, hospital-based clinics, college health centers, and correctional facilities.

Population estimates obtained from the census are generally used to calculate age-specific gonorrhea and chlamydia morbidity rates. National morbidity rates for both gonorrhea and chlamydia are highest for 20–24 year olds with relatively low rates among 10–14 year olds.[2] Interpretation of the age-specific rates for STDs is especially problematic. The use of population-based denominators for STD morbidity rate calculations may be appropriate for older adults because almost all adults are sexually ac-

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Table 1. Age-Specific Chlamydia Cases, Rates, and Screening Test Positivity for Females, State of Hawaii, 2001

Age (y)	Number of Cases	Population Size	Rate (per 100 000)	Number of Positive Screening Test Results	Number of Screening Tests Performed	Percent Positive
10–14	59	40 366	146.2	19	257	7.4
15–19	873	38 802	2249.2	283	4945	5.7
20–24	1158	37 700	3071.6	311	5810	5.4
25–29	526	39 984	1315.5	114	3371	3.4
30–34	224	42 768	523.8	52	2235	2.3
35–39	109	47 175	231.1	26	1506	1.7
40+	80	276 777	28.9	21	2098	1.0
Total	3029	523 572	578.5	826	20 222	4.1

tive, but this process may systematically underestimate STD risk in sexually active adolescents, especially younger adolescents.[4]

The purpose of this study was to compare gonorrhea and chlamydia morbidity rates with screening test positivity among females in Hawaii to better define age-related STD risk.

METHODS

All reported gonorrhea and chlamydia cases among females in the State of Hawaii for calendar year 2001 were grouped into the following age categories (in years): 10–14, 15–19, 20–24, 25–29, 30–34, 35–39, and 40+. Statewide population estimates were obtained from the United States Bureau of Census in order to calculate age-specific disease rates.[5] Age-specific screening test positivity for chlamydia and gonorrhea was calculated by dividing the number of positive test results identified through the HDOH state-wide chlamydia and gonorrhea screening programs (grouped into the age categories noted above) by the number of screening tests performed in each age category (×100).

The HDOH gonorrhea screening program is predominantly culture-based. Endocervical swab specimens are inoculated onto Martin Lewis media. Testing done outside of Oahu (on the ''neighbor islands'') used the Gen-Probe PACE 2 DNA probe. The HDOH chlamydia screening program used the Gen-Probe PACE 2 DNA probe in all sites except the HDOH STD clinic site, which used the Syva MicroTrak direct fluorescent antibody (DFA) test.

Chi-square for linear trend in age-specific screening test positivity was assessed using Epi Info version 6.04 (CDC, Atlanta, Ga).

RESULTS

STD Morbidity Rates

For calendar year 2001, 4034 cases of chlamydia (3057 females and 977 males) were reported to the HDOH. Age-specific information was available for 4006 (99%) (3029 females and 977 males). The overall chlamydia morbidity rate was 356.4 per 100 000. The chlamydia morbidity rate for females was 578.5 per 100 000. The highest morbidity rate for females was among 20–24 year olds at 3071.6 per 100 000 (Table 1). There were 605 gonorrhea case reports (312 males and 293 females). Age-specific information was available for 594 (98%) (304 males and 290 females). The overall morbidity rate of gonorrhea was 53.5 per 100 000. The morbidity rate for females was 55.4 per 100 000. The highest morbidity rate for females was also among 20–24 year olds at 270.6 per 100 000 (Table 2).

Screening Program Results

For calendar year 2001, 20 873 chlamydia screening tests were performed on females 19 407 (93%) using the Gen-Probe PACE 2 DNA probe and 1466 (7%) using the Syva MicroTrak DFA test, with 843 (4.0%) positive results. Age-specific information was available for 20 222 (97%). The highest positivity (7.4%) was among 10–14 year olds. Positivity decreased with increasing age (Chi square for linear trend: 151.7, $P < .0001$) (Table 1). Of 30 285 gonorrhea screening tests performed on females (24 853 [82%] culture-based and 5432 [18%] using the Gen-Probe PACE 2 DNA probe), 140 (0.5%) had positive results. Age-specific information was available for 27 964 (92%). The highest positivity (1.9%) was also among 10–14 year olds. Again, positivity decreased with increasing

Table 2. Age-Specific Gonorrhea Cases, Rates, and Screening Test Positivity for Females, State of Hawaii, 2001

Age (y)	Number of Cases	Population Size	Rate (per 100 000)	Number of Positive Screening Test Results	Number of Screening Tests Performed	Percent Positive
10–14	7	40 366	17.3	5	263	1.9
15–19	61	38 802	157.2	34	5052	0.7
20–24	102	37 700	270.6	45	7133	0.6
25–29	70	39 984	175.1	23	4992	0.5
30–34	32	42 768	74.8	9	3978	0.2
35–39	8	47 175	17.0	7	3225	0.2
40+	10	276 777	3.6	8	3321	0.2
Total	290	523 572	55.4	131	27 964	0.5

age (Chi square for linear trend: 23.8, $P < .0001$) (Table 2).

The types of health care facilities/providers contributing to the gonorrheal screening program included: hospital-based primary care clinics (28%), private sector primary care providers (26%), community health center family planning (FP) clinics (19%), private nonprofit FP clinics (9%), hospital-based FP clinics (7%), the HDOH STD clinic (5%), college-based FP clinics (4%), and correctional facilities (1%). The types of health care facilities/providers contributing to the chlamydial screening program included: community health center FP clinics (36%), private non-profit FP clinics (21%), hospital-based FP clinics (13%), college-based FP clinics (9%), private sector FP providers (8%), the HDOH STD clinic (7%), and correctional facilities (2%).

DISCUSSION

The finding of highest chlamydia and gonorrhea morbidity rates for females between the ages of 15 and 24 years is consistent with nationally reported statistics.[2] Our findings of highest screening test positivity among the youngest females and the inverse age correlation with positivity are consistent with family planning chlamydia screening data from San Francisco[6] and United States Public Health Service Region X (Alaska, Idaho, Oregon, and Washington).[7]

The State of Hawaii offers free and confidential STD screening services to adolescents age 14 years or older without parental consent or mandated notification.[8] Access to free and confidential STD screening and treatment at a number of sites, including the HDOH STD clinic, state-subsidized family planning clinics, community health centers, and hospital-based clinics, allow adolescents the opportunity to receive services from a wide array of geographically dispersed providers. Adolescents younger than 14 years old are provided free STD screening and treatment services, but parental or guardian consent is required; the state serves as the legal guardian for youth under age 14 who are in the custody of the State Department of Public Safety (corrections). The large volume of Hawaii's STD screening programs (encompassing both private and public sector providers and accessing younger adolescents) allows for the generation of information to assist in better delineating age-related STD risk.

Although an estimated 85% of persons 18–49 years of age are sexually active in the United States,[9] this figure is substantially lower for adolescents. The Youth Risk Behavior Survey (YRBS), a national probability sample of high school students, has shown that only 34% of ninth graders (approximate age 13–14 years) have ever had sexual intercourse. The prevalence of sexual activity increases with each successive grade: 41% of tenth graders; 52% of eleventh graders, and 61% of high school seniors.[10] Hawaii data from the YRBS parallel that found nationally with the prevalence of sexual activity increasing from 20% of ninth graders to 27% of tenth graders, 39% of eleventh graders, and 50% of high school seniors.[11] Because many adolescents (especially in the younger ages) are not sexually active and hence are not ''at risk'' for contracting an STD, the use of census-based population estimates as denominators for age-specific STD rates leads to the calculation of low rates, an effect that is most dramatic for the youngest age group, which has the lowest proportion of sexually active individuals. This, in turn, leads to a systematic underestimation of STD risk among sexually active adolescents and young adults.

National age-specific STD risk among sexually active adolescents has been estimated by adjusting census-based population estimates using age-specific sexual activity prevalence information from national surveys. This has also demonstrated highest risk for younger females, although information is lacking for the early adolescent age group (10–14 year olds).[12] There is a paucity of data on sexual activity among younger adolescents.[13,14] The National Survey of Family Growth gathers sexual information from females between the ages of 15 and 44.[15] The YRBS samples students in high school.

The HDOH developed a middle school health survey in 1997 to assess health risk behaviors among Hawaii public school students in grades 6 through 8. This survey, modeled after the YRBS, has been administered every other year. Sexual activity questions have been added to the survey instrument for the first time in 2003.

Sexually active adolescents, especially females, are at increased STD risk for a number of reasons. Female adolescents tend to choose older male sexual partners and have an increased number of sexual partners. Female adolescents also have more exposed cervical columnar epithelium, increasing their vulnerability to sexually transmitted infections.[4,16,17]

Several limitations of this study should be noted. Young, sexually experienced adolescent females who present to STD or family planning clinics may be at higher risk for STDs than young, sexually experienced females who do not access these settings.[18] This would lead to an overestimation of STDs in young, sexually experienced adolescents as assessed by STD screening test positivity. Second, the types of providers participating in an STD screening program will greatly impact screening test positivity. Adolescents seen in private sector settings tend to have lower STD rates,[19] whereas clients entering correctional settings tend to be at high risk for STDs.[20] The population screened by the HDOH had a relatively low proportion of females from correctional settings and a high proportion of clients from private sector settings. This could lead to an underestimation of STDs in the population as assessed by screening test positivity. Third, screening test positivity does not directly measure STD prevalence. Because positivity reflects the proportion of tests taken with positive results rather than the proportion of persons with a positive test result, discrepancies between the two may arise if individuals are tested repeatedly. However, a recent study found that chlamydia positivity closely approximated chlamydia prevalence in both family planning and STD clinics.[21] Last, the screening tests used by the HDOH for gonorrhea (cultures and DNA probe) and chlamydia (DNA probe and DFA test) have

lower sensitivities than available nucleic acid amplification tests, hence our reported screening test positivity and STD prevalence may be an underestimate of the true prevalence of STDs in the population.[22]

Although the percentage of early adolescent females engaging in sexual activity is low, their risk for STDs appears to be high. It is important for pediatricians to obtain sexual histories from their patients so that sexually active adolescents may be offered appropriate STD prevention counseling and screening. Physician deficiencies in obtaining sexual histories have been well recognized.[23–26] Pediatricians and other primary care providers who avoid taking sexual histories or assume sexual inexperience because patients are young are providing inadequate care to their patients.[27]

In addition, STD screening services should be made available and accessible to sexually active adolescent females beyond the traditional clinic setting. There has been positive movement in this direction with the opening of school-based clinics[28] and screening of youth in juvenile detention facilities.[20] By enhancing the availability and accessibility of STD screening for adolescent females (especially early adolescents), one will not only allow for more precise age-related STD risk assessment, but one will also target the population that appears to be at greatest age-related risk.

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