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Scientific Research

Sexually Transmitted Infections among African-American Population of the Midwest United States

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Abstract

Background: Sexually transmitted infections (STIs) such as chlamydia and gonorrhea are commonly reported infections in the United States. Greater Omaha has had continually higher reported rates of chlamydia and gonorrhea for more than a decade compared to the rest of the state rates. Minority and young adults have been disproportionately affected. Purpose: The objectives of our study were to estimate the prevalence and to identify risk factors for chlamydia and gonorrhea among young adults. Methods: We conducted a cross-sectional survey with 310 young adults aged 19 - 25 years between June 2011 and June 2012. The study collected socio-demographic, behavioral and other risk factors for STIs utilizing a pre-design standardized questionnaire. Gonorrhea and chlamydia status of the participants were established by testing urine samples using PCR-based diagnostic technique. Descriptive and multivariable regression analyses were used to examine risk factors for STIs. Results: About 12.6% survey participants had at least one STI test positive. Lower education was associated with STIs but was not statistically significant (Odd Ratio for no schooling was 8.24, 95% CI 0.93 - 72.86, Odd Ratio for high school education was 2.05, 95% CI 0.25 - 16.63 compared to associate or college level education). No other predictors were associated with STIs. The average age of the first sexual intercourse was lower, and the number of sexual partners was higher compared to their national counterparts. Conclusion: We found a higher percentage of STI-positive individuals compared to previously reported county-level estimates. Education was the single and most important predictor of positive STI status.

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Keywords

Sexually Transmitted Infections; STIs; Chlamydia; Gonorrhea; African-American; Survey

1. Introduction

Chlamydia is the most common sexually transmitted infection (STI) in the United States followed by gonorrhea. In 2011, the Centers for Disease Control and Prevention (CDC) reported more than 1.4 million chlamydia and 321,849 gonorrhea cases in the United States. If untreated, chlamydia and gonorrhea can cause serious short- and long-term reproductive and other health consequences including pelvic inflammatory diseases (PID). PID can cause permanent damage to the fallopian tubes, uterus and surrounding tissues, which may lead to infertility, ectopic pregnancy, or premature delivery [1]. Further, women infected with chlamydia or gonorrhea are at higher risk for HIV infection [2].

Since 2004, rates of STIs in Douglas County, Nebraska, have been consistently higher than national and state rates. In 2010, the rate of Chlamydia trachomatis was 545.1 per 100,000 individuals compared to 284.6 per 100,000 in Nebraska and 426.0 per 100,000 in the United States [3]. Similarly, in 2010, the rate of Neisseria gonorrhea was 157.6 per 100,000 in Douglas County compared to 66.1 per 100,000 in Nebraska and 100.8 per 100,000 in the United States [3]. More than 70% of chlamydia cases and 65% of gonorrhea cases in the county were among adolescents (14 - 19 year old) and young adults (20 - 25 years old) [3]. Also, African-Americans were disproportionately affected; 44% of chlamydia cases and 63% of gonorrhea cases were African-Americans though they make up only 12% of the county's population [4] [5].

The Douglas County Health Department (DCHD) declared an epidemic of STIs in 2004 in the county because of persistently higher rates of chlamydia and gonorrhea compared to the state and the national rates, despite many interventions. Until now, reasons for these sustained high STIs infection rates have not been well understood. There has been no epidemiological study conducted to investigate factors associated with higher STIs rates in this county. This gap in knowledge prompted us to undertake this cross-sectional survey to identify factors of high prevalence of STIs in this population. Knowledge about these risk factors is necessary to plan effective intervention for this community.

The aims of the study were to estimate the most current prevalence of chlamydia and gonorrhea and to identify risk factors of these infections among young adults in this high risk geographic area.

2. Material and Methods

2.1. Study Design and Population

Between June 2011 and June 2012, we recruited 310 young adults to participate in this cross-sectional survey. Eligibility criteria included: able and willing to provide informed consent, lived in North Omaha, Nebraska at least 12 months prior to the study, and aged 19 - 25 years.

2.2. Recruitment of Study Participants

We identified prospective participants of this community-based cross-sectional survey using multiple approaches.

First, we identified community events in collaboration with the existing community network of the county health department and local health clinics. During each community event, researchers, community leaders, and partners distributed flyers regarding the study among events goers to recruit study participants. Second, we recruited study participants from the local libraries in collaboration with the STI community liaison of DCHD.

Lastly, interested participants could directly contact the study team to arrange a scheduled appointment for STIs testing at a convenient location in the community.

Consenting participants were given standardized survey questionnaires and were asked to provide urine samples (**Appendix 1:** questionnaire).

2.3. Data Collection

We collected demographic, social, behavioral and environmental risk factors for chlamydia and gonorrhea using

standardized questionnaires. We also collected urine samples from study participants to test for gonorrhea and chlamydia status. There was no cost for STIs tests to the study participants. In addition, STI-positive individuals were offered low or free cost treatment and study participants were compensated for their participation.

2.4. Sample Size

We calculated that a sample size of 310 individuals aged 19 - 25 would be needed to estimate a 5% prevalence in the population with a 5% error rate.

2.5. Urine Sample Processing and Testing

The participants were first asked to provide 20 ml (maximum 60 ml) of voided urine in a sterile preservative-free collection cup. After each event, urine from each cup was transferred into a BD Probetec urine preservative transport tube. The transport tube was then transported to the Nebraska Public Health Laboratory (NPHL) located at the University of Nebraska Medical Center within 72 hours. The laboratory technician used Nucleic Acid Amplification Tests (NAAT) to identify chlamydia and gonorrhea positive cases. The sensitivity and specificity of this test for chlamydia (96.5% and 98.7%, respectively) and gonorrhea (96.5% and 99.4%, respectively) are high (Hologic Inc, MA). Then, the NPHL transmitted the test results to DCHD via a secure web link. Lastly, the DCHD sent test results to the study team after de-identifying participants' information.

2.6. Results Disclosure with Treatment and Follow up Options

Regardless of the test result status, all participants received a letter from the in-house DCHD physician with the results included. Additionally, each positive case from the study was assigned to one of the Disease Intervention Specialists (DIS) at the DCHD. The DIS conducted normal investigative procedure to contact participants; ensured treatment and offered confidential partner notification to infected participants. As per STI treatment guidelines of the county health department, the DIS staff provided additional information about what positive results meant and explained treatment options including how to receive little or no-cost treatment at the STI clinic of the DCHD.

The study was approved by the Institutional Review Board of the University of Nebraska Medical center.

3. Data Analysis

Data were analyzed using the statistical software package, SPSS version 19 (SPSS, Chicago, IL). We performed logistic regression to calculate crude and adjusted odds ratios (OR) and 95% confidence intervals (CI) for the association between the risk factors (demographic, clinical and sexual behaviors) and the disease status (STI status). Multivariable analysis was performed by initially including all the predictor variables that had a *p*-value of ≤0.1 in univariate analyses to assess potential confounding (defined as a difference in crude and adjusted OR of more than 10%).

4. Results

4.1. Study Participants

Demographic characteristics of study participants are summarized in **Table 1**. Participants were predominantly African-Americans (81%) who had a high school or equivalent education (77%).

4.2. Prevalence and Risk Factors for STIs

Overall, 12.6% (39/310; **Table 1**) of participants tested positive for at least one STI. Of the 39 participants who tested positive, 84.6% (33/39) had one STI and 15.4% (6/39) had both STIs (data were not shown in **Table 1**).

We estimated the association between the presence of at least one STI infection and socio-demographic characteristics (**Table 1**). Participants with no schooling had significantly higher odds of testing positive for STIs ($p = 0.002$). Over half of study participants did not use condoms during the most recent sexual intercourse and 59% had been tested for STIs in the past (**Table 2**).

We also evaluated self-reported behavioral factors associated with willingness or unwillingness to seek medi-

Table 1. Univariable analysis to investigate the association between the prevalence of STI in young adults and socio-demographic factors in Douglas County, Nebraska.

Characteristic	Total Number n (%)	STI absent n (%)	STI present n (%)	*p*-value	Crude OR (95 % CI)
STI status	310 (100)	271 (87.4)	39 (12.6)	0.821	0.98 (0.84 - 1.15)
Gender				0.755	
Males	182 (58.7)	160 (59.0)	22 (56.4)		0.90 (0.46 - 1.77)
Females	128 (41.3)	111 (41.0)	17 (43.6)		Reference
Race				0.912	
Black/African American	252 (81.3)	221 (81.6)	31 (79.5)		1.05 (0.23 - 4.82)
Other	41 (13.2)	35 (12.9)	6 (15.4)		1.29 (0.23 - 7.11)
Whites	17 (5.5)	15 (5.5)	2 (5.1)		Reference
Marital status				0.962	
Never Married	283 (91.3)	247 (91.1)	36 (92.3)		1.02 (0.12 - 8.54)
Divorced/Separated/Widow	19 (6.1)	17 (6.3)	2 (5.1)		0.82 (0.06 - 10.62)
Married	8 (2.6)	7 (2.6)	1 (2.6)		Reference
Education Level				0.002*	
Associate/College	21 (6.8)	20 (7.4)	1 (2.6)		Reference
High School/GED	239 (77.1)	215 (79.3)	24 (61.5)		2.23 (0.29 - 17.38)
No Schooling	50 (16.1)	36 (13.3)	14 (35.9)		7.78 (0.95 - 63.59)

*Indicates significance at alpha = 0.05.

cal treatment. None of these factors were associated with higher odds of STIs (**Table 3**).

Next, we evaluated a range of sexual behaviors that may be associated with higher odds of STIs. The analyzed factors included drug, alcohol use and condom use during sexual experience, age at first sexual experience, and the number of sexual partners (data not shown). In the univariate analysis, using a condom OR—2.33, (95% CI—1.09 - 4.97, *p*-value 0.029) and using drugs during the most recent sexual encounter OR—2.20, (95% CI—1.01 - 4.78, *p*-value 0.048) marginally increased the risk of STI prevalence.

Multivariable analyses showed that participants with a lower education had higher adjusted odds of testing positive for STIs than participants with more education. No other predictor variables were significantly associated with the prevalence of STIs (**Table 4**).

5. Discussion

STIs have a great public health impact globally. According to CDC, STIs are one of the most critical health issues facing the nation. In 2010, estimated 19 million new infections were reported in the USA [4]. We found 12.6% prevalence of at least one STI in our study participants. These results are important for the surveillance of STIs, which is an important step for planning STIs interventions in the population.

In 2010, a national survey among individuals aged 24 years and under enrolled in a National Job Training Program reported a prevalence of chlamydia of 10.3% in females and 8% in males [6]. During 2010, the occurrence of chlamydia among females aged 15 to 24 years attending family planning clinics was 8.3% [6]. Youths entering a National Job Training Program and young females attending family planning clinics are considered high risk groups for contracting STIs. Although our participants did not fall into either of these two categories, they had a high prevalence of STIs. To sustain a higher rate of STIs in a population it is likely that there is a

Table 2. Prevalence of risk factors for STIs among study participants.

Characteristic	n (%)
Previously tested for STIs	183 (59.0)
Previously STI positive	67 (21.6)
Previously treated for STI	69 (22.3)
Current STI symptoms	11 (3.6)
Used condom in last sexual experience	176 (57.9)
Relationship with partner	
Just met him/her	18 (6.3)
Known them for a while	112 (39.3)
Serious dating partner	133 (46.7)
Spouse	22 (7.7)
Have sex to increase social status	41 (13.3)
	Median (range)
Age of first sexual experience	15 (7 - 22)
Times had sex (past 12 months)	10 (90 - 400)
Times had unprotected sex (past 12 months)	2 (0 - 300)
Number of sexual partner(s) (past 12 months)	1 (0 - 40)

higher prevalence of asymptomatic STIs cases in the community. Less than 4% of our study participants reported having any symptoms of STIs at the time of interview. Both STI positive and negative individuals were living in an environment with high STI prevalence. Studies have shown that living in a high prevalence population increases the chance for contracting STIs [7].

In our study, educational attainment was the only factor that was associated with STIs. After controlling for confounding variables, the odds of an STI diagnosis were more than eight times higher among participants who had not completed high school compared with participants who had at least a college level education. Education has long been considered a protective factor against STIs among adolescents [8] [9]. However, another study reported that educational attainment was not uniformly protective against STIs for black and white females [10]. The authors noted that, particularly for young black women, other factors may play a more prominent role in determining STIs risk. The authors also argued that social determinants, such as educational attainment, should be viewed as important factors associated with STI prevalence, but their differential impact on various racial/ethnic groups should also be considered when addressing the disproportionate rates of STIs in the US [10].

The statistical significance test does not measure the actual magnitude of observed differences in the risk factors of the STIs. Statistical significance may arise due to a large difference in outcome, a large sample size, or both. To better understand the risk of STIs and their transmission, we need to examine the individual risk factor even it is not statistically significant. Furthermore, social contextual factors, such as poverty, discrimination, illicit drug use in the community, ratio of men to women, incarceration rates, and racial segregation influence sexual behavior and sexual networks, directly or indirectly, in many ways. Disparities in these social features contribute substantially to the persistence of marked racial disparities in rates of STIs [11]. Isolation (if minority members do not often share neighborhoods with other groups) of racial residential segregation is important predictor that puts minorities at higher STI risk in the USA [12]. Sexual behaviors of local or smaller community are important predictors for local epidemic of STIs. A higher prevalence of certain STI-related risk factors can explain the higher prevalence of STIs in the study population.

Table 3. Univariable analysis to investigate the association between the prevalence of STI and reasons for not seeking or seeking treatment among participants who thought they had an STI or tested positive for an STI in last 12 months.

Characteristic	STI absent n (%)	STI present n (%)	*p*-value**	Odds Ratio (95% CI)*
Reasons cited to not seek treatment for STI				
Did not have symptoms				
No	55 (31.4)	8 (33.3)	0.851	1.09 (0.44 - 2.7)
Yes	120 (68.6)	16 (66.7)		Reference
Did not want other people to know				
No	156 (88.6)	23 (95.8)	0.479	2.95 (0.38 - 23.03)
Yes	20 (11.4)	1 (4.2)		Reference
Did not have access to medical services				
No	164 (93.2)	22 (91.7)	0.677	0.81 (0.17 - 3.84)
Yes	12 (6.8)	2 (8.3)		Reference
Could not afford it/Did not have insurance				
No	163 (92.6)	23 (95.8)	1.00	1.83 (0.23 - 14.69)
Yes	13 (7.4)	1 (4.2)		Reference
Embarrassed /No transportation/Give it to others/Other				
No	144 (81.8)	19 (79.2)	0.780	0.84 (0.29 - 2.43)
Yes	32 (18.2)	5 (20.8)		Reference
Reasons cited to seek treatment for STI				
Had symptoms				
No	120 (68.6)	20 (80.0)	0.351	1.83 (0.65 - 5.14)
Yes	55 (31.4)	5 (20.0)		Reference
Did not want to spread to others				
No	122 (69.7)	15 (60.0)	0.331	0.65 (0.28 - 1.54)
Yes	53 (30.3)	10 (40.0)		Reference
Was afraid it would become more serious				
No	135 (77.6)	21 (84.0)	0.607	1.52 (0.49 - 4.68)
Yes	39 (22.4)	4 (16.0)		Reference
Did not want partner to find out				
No	160 (91.4)	23 (92.0)	1.00	1.08 (0.23 - 5.02)
Yes	15 (8.6)	2 (8.0)		Reference
Had access to medical service				
No	151 (86.3)	19 (76.0)	0.184	0.5 (0.18 - 1.39)
Yes	24 (13.7)	6 (24.0)		Reference
Could afford it/Had insurance/Other				
No	135 (77.1)	19 (76.0)	0.899	0.94 (0.35 - 2.51)
Yes	40 (22.9)	6 (24.0)		Reference

**Chi-square test and Fisher's exact test was used to determine the significance of association; *Crude odds ratio and 95% confidence interval.

Table 4. Univariable and Multivariable analysis to investigate risk factors associated with STI prevalence in young adults in Douglas County, Nebraska (2011-2012).

Characteristic	Univariable Model		Multivariable Model	
	p-value	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)
Education Level				
Associate/College		1.00		1.00
High School/GED	0.443	2.23 (0.29 - 17.38)	0.503	2.05 (0.25 - 16.63)
No Schooling	0.56	7.78 (0.95 - 63.59)	0.058	8.24 (0.93 - 72.86)
Used condom during the last sexual experience				
Yes	0.029	2.33 (1.09 - 4.97)	0.274	1.69 (0.66 - 4.35)
No	-	1.00	-	1.00
Used drugs during the last sexual experience				
Yes	0.048	2.20 (1.01 - 4.78)	0.461	1.49 (0.52 - 4.28)
No	-	1.00	-	1.00
Drank alcohol during the last sexual experience				
Yes	0.089	1.92 (0.91 - 4.07)	0.097	2.30 (0.86 - 6.15)
No	-	1.00	-	1.00
Planning to use condoms in the next 3 months				
Yes	0.082	3.66 (0.85 - 15.78)	0.280	3.25 (0.38 - 27.63)
No	-	1.00	-	1.00
Times having unprotected sex (past 12 months)	0.058	0.95 (0.90 - 1.00)	0.135	0.95 (0.88 - 1.02)

Note: All variables with *p*-value < 0.1 in the univariable analysis were included in the multivariable model. They were: education level, used condom during last sexual experience, used drugs during the last sexual experience, drank alcohol during the last sexual experience, planning to use condoms in the next 3 months, times having unprotected sex.

The average age at which a person experiences sexual intercourse for the first time is an important risk factor for contracting STIs. On average, young people have their first sexual experience at about age 17 years [13] [14]. There are racial variations of average age at first sexual experience. The National Survey of Family Growth reported the average age at first sexual intercourse for White, Latino, and African-Americans are 17, 16, and 15 years respectively [13] [15]. Our results showed the average at first sexual intercourse is 15 years. This means that both males and females in our study population may be at increased risk for STIs, and young adult females are at risk for unintended pregnancy for a longer period of time compared to their national counterpart.

The number of and quality of sexual partners is a key risk factor for STIs transmission. The National Survey of Family Growth reported that 11.1% African American men, 4.2% African American women, 4.7% Latino Men, 3.2% Latino female, 4.2% White men, and 3.1% White female had five or more sexual partners in last 12 months. Eighty one percent of our study participants are African American. Our survey showed that 25.5% of males and 7.6% of females had five or more sexual partners in the prior 12 months. A high number of sexual partners could be responsible for such high prevalence of STIs in this community. More than 57.9% of study participants reported the use of condoms during their last sexual encounter, which is consistent with the Youth Risk Behavior Surveillance data (60.2%) [16].

Interestingly, more than 80% of our survey participants had plans for using condoms in the next three months, which they believed would protect them from acquiring STIs. They were also comfortable in getting, carrying and correctly using condoms. They had also access to condoms. This information is valuable for designing intervention programs specific to this population. There are opportunities for health education to improve condom

use for reducing STIs in this population.

6. Conclusion

This is the first epidemiological study conducted to estimate the prevalence of STIs in an urban community, which identified local risk factors for high prevalence of STIs in this population. There are several limitations of this study. First, we recruited study participants from existing community events, which might have affected recruitment by introducing selection bias. Second, our ability to perform an in-depth analysis of risk factors of higher STIs rates was limited due to the short questionnaire used (short questionnaires improve survey participation). Third, we could not assess temporal relationships between risk factors and higher STIs rates because of the cross-sectional survey design. Finally, there is potential for recall bias in this study. A follow-up study is recommended to determine the most effective community-based approach to reducing the high STI prevalence in this population.

Conflict of Interest and Sources of Funding

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The study was approved by the IRB of UNMC (IRB# 444-10-FB).

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Abbreviations

STIs	Sexually transmitted infections;
STI	Sexually transmitted infection;
CDC	Centers for Disease Control and Prevention;
PID	Pelvic Inflammatory Diseases;
DCHD	Douglas County Health Department;
NAAT	Nucleic Acid Amplification Tests;
SPSS	Statistical Product and Services Solutions;
OR	Odds Ratios;
CI	Confidence Interval.