Research Article

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Sexually transmitted infections in privately insured adults with intellectual and developmental disabilities

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Aim: Individuals with intellectual and developmental disabilities (I/DD) may have an increased risk of sexually transmitted infections (STIs) due to limited sexual health education and higher rates of sexual abuse, yet little is known about the prevalence of STIs and STI testing in this population. **Methods:** This study compared national samples of privately insured individuals with (n = 25,193) and without I/DD (n = 25,193) on the prevalence of STIs and STI testing. **Results:** In multivariable models, individuals with I/DD were significantly less likely to have an STI diagnosis and no difference was found between groups on the odds of STI testing overall. **Conclusion:** Findings may, in part, be explained by fewer sexual experiences, increased supervision in social settings and delayed onset of sexual activity among those with I/DD.

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Keywords: developmental disabilities • developmental disorder • intellectual disabilities • reproductive health • sexual health • sexually transmitted disease • sexually transmitted infection • STD testing and screening

There are an estimated 1 million new cases of sexually transmitted infections (STIs) daily [1]. With regard to STI-specific prevalence, the Centers for Disease Control and Prevention (CDC) estimates approximately 1.1 million cases of HIV, 140 million cases of genital herpes, 1.7 million cases of chlamydia, over 500,000 cases of gonorrhea and 30,000 cases of syphilis [2]. Although most STIs are curable, they may still permanently affect reproductive health [1], increase the risk for HIV infection in young adulthood and reduce quality of life [3]. Specifically, STIs can cause fertility issues, life threatening ectopic pregnancies, increased rates of pelvic inflammatory disease, stroke and neurological impairments [1,4]. As a result, there is a widespread effort by the CDC to reduce disparities in sexual health, increase sexual education and promote safe sexual practices.

Multiple personal and behavioral characteristics have been linked with elevated risk for STIs. Females, racial minorities, individuals of middle or low-socioeconomic status [1] and individuals under 25 years of age are most likely to contract an STI [5]. Additionally, evidence suggests that individuals with mental health conditions, such as depression and anxiety [6,7], individuals with attention deficit hyperactivity disorder (ADHD) [8] and those with poor social support [9], have greater risk for contracting STIs. This is likely due to the association of these characteristics with high-risk sexual behaviors, such as increased number of partners, decreased condom use and using drugs or alcohol prior to sexual activity [10,11].

Another subgroup of the population that may be particularly vulnerable to STIs is individuals with intellectual and developmental disabilities (I/DD). Individuals with I/DD often have limited sexual knowledge, misconceptions about sexuality and reproductive health, and poor self-efficacy [10,12], which can contribute to unsafe sexual practices. Historically, sexual education for this population has been sparse and likely not tailored to the needs of individuals with I/DD. This limited formal education combined with elevated rates of substance abuse [13], increased vulnerability to sexual assault, and economic, educational, and social disadvantages [14] may place individuals with I/DD at high risk for contracting STIs. Moreover, many individuals with I/DD face disparities in access to primary

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and preventive care [15,16], where they would receive STI testing. While the prevalence of STIs in the general population has been well-characterized, there is a paucity of literature available regarding incidence and prevalence of STIs among individuals with I/DD. Although limited, results from published studies suggest that individuals with I/DD may be underserved with regard to STI testing [13] and at equal or greater risk of contracting an STI than individuals without I/DD [14,17]. Specifically, estimates reveal that 3% of males and 5% of females receiving special education are treated for STIs, which is similar to national estimates of STI prevalence in the general population of youth 10–19 years of age (2% for males, 3% for females) [14].

It is imperative to understand the risk of STIs among individuals with I/DD to determine the extent to which targeted sexual education programs are needed as individualized, developmentally appropriate sexual health education is the best approach to prevent risky sexual behaviors [18]. Furthermore, due to the serious health consequences of undiagnosed and untreated STIs, it is critical to understand the patterns of testing for STIs in this population. The purpose of the present study; therefore, is to examine the association between I/DD and the prevalence of STIs and STI testing. We hypothesize that, among individuals with I/DD, the prevalence of STIs will be higher and the prevalence of STI testing will be lower than individuals without I/DD.

Methods

Data source

Data used for this study were derived from Thompson Reuters MarketScan® Commercial Claims and Encounters Databases for the year 2014–2015. The MarketScan Databases track millions of patients throughout the healthcare system in the USA. The data are contributed by large employers, managed care organizations, hospitals, EMR providers, Medicare and Medicaid. In this study, de-identified individual-level healthcare claims billed for inpatient and outpatient encounters of privately insured patients were used.

Study design

As the purpose of this study was to examine prevalence, a cross-sectional study design [19] was used to compare individuals with and without the exposure variable of interest (I/DD diagnosis) on the following outcomes: presence of an STI and presence of STI testing. Presence of an STI was defined by encounters with an International Classification of Diseases, 9th edition (ICD-9) code for: syphilis, pubic lice, trichomoniasis, gonorrhea, genital herpes, chlamydia, HIV/AIDS or viral warts due to human papilloma virus (HPV). Presence of STI testing was defined by encounters with a procedure code indicating screening or testing for: syphilis, chlamydia, HPV, gonorrhea, trichomoniasis, herpes, HIV/AIDS or STIs (general screening). Age category, geographic region of residence, presence of ADHD and mental health comorbidities were included as covariates due to the association of these variables with STI outcomes in other populations [1,5,6].

Study sample

From the available data, we identified persons with and without I/DD aged 15–64 years. Individuals with I/DD were identified based on an outpatient medical claim between 1 January 2014 and 30 June 2014 with an ICD-9 code for: mild intellectual disability (ID), other specified ID, unspecified ID, cerebral palsy, autism spectrum disorder (ASD), spina bifida, down syndrome, fragile X syndrome, Prader–Willi syndrome, Rett syndrome or fetal alcohol syndrome. All individuals with I/DD with ≥18 months of continuous health insurance after the first date of service in 2014 were included.

Individuals without I/DD diagnoses during the study period were considered for inclusion if they were aged 15–64 years and had 18 months of continuous insurance coverage following the first date of service in 2014. Individuals without I/DD were group frequency matched to those with I/DD based on age category [2], sex and geographic region of residence.

Measures

Demographic variables, including age category, insurance plan type, sex and geographic region were extracted from the first date of service in 2014. Age categories were defined using CDC groupings for consistency with other STI prevalence studies [2]. Comorbidities that may impact the risk of contracting an STI were also identified from health records during the study period, including any encounter with an ICD-9 code for ADHD and any of the following mental health conditions: schizophrenia, psychosis, anxiety, obsessive compulsive disorder, post-traumatic stress disorder, mood disorders, substance abuse, personality disorder or delusional disorder.

Presence of STIs and STI testing was extracted from inpatient and outpatient medical records during the study period, defined as the 18 months following the first date of service in 2014. Individuals were considered to have an STI if they had any encounter during the study period with an ICD-9 code for: syphilis, pubic lice, trichomoniasis, gonorrhea, genital herpes, chlamydia, HIV/AIDS or viral warts due to HPV. Individuals were considered to have been tested for an STI based on the presence of any encounter during the study period with a procedural code for: syphilis, chlamydia, HPV, gonorrhea, trichomoniasis, herpes, HIV/AIDS or STI screening.

Statistical analysis

Participant characteristics were summarized descriptively. Prevalence was calculated as the total number of STI cases (or tests) divided by the total study population. The χ^2 tests were used to compare individuals with and without I/DD on demographic characteristics and study outcomes. To correct for multiple comparisons (17 total), the α level for significance was set at $0.05/17 = 0.003$. Multivariable logistic regression was used to assess the association between the primary predictor/exposure variable (I/DD) and primary study outcome variables (STIs and STI testing), while controlling for critical covariates. All available demographic characteristics, including: age category, sex, US region of residence, insurance plan type, presence of a mental health comorbidity and presence of comorbid ADHD, as well as the interactions between I/DD status and specific variables, were considered for inclusion in the logistic regression models. The specific interactions included were between I/DD status and age category, sex, comorbid ADHD and mental health comorbidity. The rationale for examining these interactions is that the variables listed are independently associated with risk for STIs in the general population and our intent was to determine whether the influence of these risk factors differed for individuals with and without I/DD [1,5–8]. The final multivariable models were identified using backwards stepwise regression. To assess model fit, Hosmer–Lemeshow goodness-of-fit test was utilized. To obtain a CI for the Hosmer–Lemeshow goodness-of-fit test, bootstrapping on 10% subsamples was performed 500-times.

Results

Participants consisted of 25,193 individuals with I/DD and 25,193 individuals without I/DD that were group-frequency matched for age category, sex and geographic region. Demographic characteristics are shown in Table 1. Due to the group frequency matching, both groups were a majority male (61.2%), predominately resided in the North Central region of the USA (36.2%) and aged 15–24 years (60.6%). Mental health comorbidities were less common among individuals with I/DD (29.8%) than those without (36.1%). Similarly, ADHD was less common among those with I/DD (10.1%) than those without (20.1%). Among those with I/DD, the most common diagnosis was ASD (44.7%), followed by cerebral palsy (20%).

Descriptive examination of the STI outcome variables (Table 2) revealed that the percent of individuals with at least one STI was 2.6% (n = 661) among those with I/DD and 5.6% (n = 1413) among those without. The percent of individuals with and without I/DD who received at least one STI testing procedure were 1.1% (n = 273) and 1.1% (n = 277), respectively. The three most common STIs were consistent between groups and were genital warts due to HPV, herpes and HIV/AIDS. Additionally, the three most common STI tests were similar for individuals with and without I/DD and consisted of an asymptomatic STI screening, syphilis and gonorrhea screenings. The χ^2 tests revealed a significantly higher prevalence of genital warts, herpes, HIV/AIDS, chlamydia and gonorrhea (all $p < 0.001$) among those without I/DD.

Table 3 shows the results of the best fitting logistic regression models estimating the occurrence of any STI (area under the curve [AUC] = 0.62; Hosmer–Lemeshow p = 0.55; 95% CI: 0.53–0.58) and any STI test (area under the curve [AUC] = 0.70; Hosmer–Lemeshow p = 0.60; 95% CI: 0.58–0.61) during the study period. Results revealed that individuals with I/DD had significantly lower odds of being diagnosed with an STI (odds ratio [OR]: 0.44; 95% CI: 0.40–0.49) than those without after controlling for age, ADHD and mental health comorbidities and geographic region. With regard to STI testing, results revealed no main-effect of I/DD diagnosis (OR: 0.98; 95% CI: 0.71–1.29). However, a significant interaction was observed for I/DD diagnosis and age category on the odds of STI testing; at age 20–24 years, individuals with I/DD had significantly lower odds of being tested (OR: 0.58; 95% CI: 0.40–0.84). This trend was reversed; however, at age 35–39 years where the odds of being tested for an STI were significantly higher for individuals with I/DD (OR: 2.50; 95% CI: 1.07–5.83).

Table 1. Participant demographics.

Demographics	I/DD diagnosis		p-value
	Yes (n = 25,193)	No (n = 25,193)	
Sex:			
– Male	15,420 (61.2%)	15,420 (61.2%)	–
– Female	9773 (38.8%)	9773 (38.8%)	
Age category (years):			
– 15–19	9807 (38.9%)	9807 (38.9%)	–
– 20–24	5462 (21.7%)	5462 (21.7%)	
– 25–29	2363 (9.4%)	2363 (9.4%)	
– 30–34	1906 (7.6%)	1906 (7.6%)	
– 35–39	1367 (5.4%)	1367 (5.4%)	
– 40–44	1147 (4.6%)	1147 (4.6%)	
– 45–54	1916 (7.6%)	1916 (7.6%)	
– 55–64	1225 (4.9%)	1225 (4.9%)	
I/DD category:†			
– ASD	11,257 (44.7%)	–	–
– Cerebral palsy	5057 (20.1%)	–	
– Down syndrome	3959 (15.7%)	–	
– Spina bifida	2053 (8.1%)	–	
– Unspecified ID	1413 (5.6%)	–	
– Other ID	852 (3.4%)	–	
– Mild ID	727 (2.9%)	–	
– Fragile X syndrome	354 (1.4%)	–	
– Prader Willi syndrome	130 (0.5%)	–	
– Fetal alcohol syndrome	74 (0.3%)	–	
US region of residence:			
– North central	9125 (36.2%)	9125 (36.2%)	–
– South	6678 (26.5%)	6678 (26.5%)	
– Northeast	5425 (21.5%)	5425 (21.5%)	
– West	3904 (15.5%)	3904 (15.5%)	
– Unknown	61 (0.2%)	61 (0.2%)	
Insurance plan:			
– HDHP	15,340 (61.8%)	15,341 (62.1%)	<0.001
– CDHP	2971 (12%)	2825 (11.4%)	
– EPO	2863 (11.5%)	2555 (10.3%)	
– Noncapitated POS	1541 (6.2%)	1578 (6.4%)	
– Capitated POS	1354 (5.5%)	1107 (4.5%)	
– PPO	567 (2.3%)	1093 (4.4%)	
– Unknown	379 (1.5%)	495 (2.0%)	
– HMO	131 (0.5%)	145 (0.6%)	
– Comprehensive	47 (0.2%)	54 (0.2%)	
– Mental health comorbidity	7513 (29.8%)	9103 (36.1%)	<0.001
– ADHD comorbidity	2536 (10.1%)	5053 (20.1%)	<0.001

†Individuals with I/DD may have more than one I/DD diagnosis.
χ^2 tests were not performed to test for between-group differences on sex, age and US region as the groups were matched on these variables.
ADHD: Attention deficit hyperactivity disorder; ASD: Autism spectrum disorder; CDHP: Consumer directed health plan; EPO: Exclusive provider organization; HDHP: High deductible health plan; HMO: Health maintenance organization; I/DD: Intellectual or developmental disability; ID: Intellectual disability; POS: Point of service.

Table 2. Frequency of sexually transmitted infections and sexually transmitted infection screening in individuals with and without intellectual or developmental disability.

STI diagnosis and test	I/DD diagnosis		p-value
	Yes (n = 25,193)	No (n = 25,193)	
STI diagnosis, n (%):			
– Genital warts/HPV	565 (2.2%)	1051 (4.2%)	<0.001‡
– Herpes	37 (0.2%)	156 (0.6%)	<0.001‡
– HIV/AIDS	21 (0.1%)	92 (0.4%)	<0.001‡
– Chlamydia	14 (0.1%)	58 (0.2%)	<0.001‡
– Gonorrhea	10 (<0.1%)	49 (0.2%)	<0.001‡
– Trichomoniasis	16 (0.1%)	25 (0.1%)	0.16
– Syphilis	0 (0.0%)	2 (<0.1%)	0.16
– Pubic lice	0 (0.0%)	0 (0.0%)	–
Total cases†	663 (2.6%)	1433 (5.7%)	<0.001‡
STI test, n (%):			
– Asymptomatic STI screen	171 (0.7%)	161 (0.6%)	0.58
– Syphilis	55 (0.2%)	71 (0.3%)	0.15
– Gonorrhea	37 (0.2%)	46 (0.2%)	0.32
– HIV/AIDS	16 (0.1%)	36 (0.1%)	0.01
– Chlamydia	11 (<0.1%)	11 (<0.1%)	1.00
– Trichomoniasis	0 (0.0%)	0 (0.0%)	–
– Herpes	0 (0.0%)	0 (0.0%)	–
Total cases†	290 (1.2%)	325 (1.3%)	0.86

†Individuals may be represented more than once in the total if they had multiple different STI diagnoses or tests. Prevalence estimates reported in the text reflect the proportion of individuals with at least one STI diagnosis (or STI test).
‡Statistically significant after Bonferroni correction for multiple comparisons.
I/DD: Intellectual or developmental disability; STI: Sexually transmitted infection.

Discussion

STIs are an important health indicator and are associated with potentially devastating effects on quality of life and reproductive health. The present study compared the prevalence of STIs and STI testing between individuals with and without I/DD. Our results revealed STI prevalence estimates of 2.6% and 5.6% for individuals with and without I/DD, respectively. The most common STI observed in this study (genital warts due to HPV) has also been identified as the most commonly transmitted infection in the USA by the CDC [2]. Interestingly, our results indicated the prevalence of STI testing was lower than the prevalence of STI diagnoses and STI testing was quite uncommon (1.1%) compared with national estimates of self-reported testing rates (12%) [18]. One possible reason for this is the types of STIs that were most commonly observed in this study. First, visible genital warts from HPV could be diagnosed by clinical impression alone without the need to conduct and bill for testing procedures. Second, because the most commonly observed STIs (HPV, herpes and HIV/AIDS) are not curable, the original diagnosis of these conditions through laboratory tests may have taken place prior to the study period. Thus, the medical encounters where we identified the presence of these diagnoses may have constituted follow-up visits. Third, we did not include procedure codes for Papanicolaou (Pap) tests, as we were unable to distinguish tests completed as part of routine care from those conducted to test for HPV. This may have resulted in an underestimate of the prevalence of STI testing.

Contrary to our hypotheses, individuals with I/DD had significantly lower odds of an STI diagnosis (OR: 0.44; 95% CI: 0.40–0.49) and there was no significant difference between groups in the odds of STI testing. One possible reason that individuals with I/DD had lower odds of STI diagnosis is that they may be less likely than individuals of average intellectual functioning to have sexual experiences, and therefore, have lower levels of exposure to STIs. Indeed, prior studies have found that individuals with lower cognitive abilities were significantly less likely to have experienced vaginal intercourse, oral sex or anal sex by age 28–34 years [20]. This may, in part, be explained by the limited access to privacy experienced by individuals with I/DD and the fact that social interactions are often supervised by formal and informal caregivers [21]. Another possible explanation is that individuals with I/DD have delayed onset of sexual activity compared with the general population [20], which may serve as a protective factor.

Table 3. Multivariable logistic regression estimating occurrence of any sexually transmitted infection and any sexually transmitted infection test.

Variable	Occurrence of any STI		Occurrence of any STI test	
	OR	95% CI	OR	95% CI
I/DD diagnosis:				
– No (ref)	0.44*	0.40–0.49*	1.11	0.88–1.39
– Yes				
Sex:	–	–		
– Male (ref)			1.53*	1.29–1.82*
– Female				
Age category (years):				
– 15–19 (ref)				
– 20–24	0.96	0.85–1.08	1.39*	1.10–1.76*
– 25–29	0.93	0.80–1.10	1.84*	1.39–2.43*
– 30–34	0.91	0.76–1.08	1.65*	1.21–2.25*
– 35–39	0.70*	0.56–0.88*	1.00	0.64–1.56
– 40–44	1.14	0.93–1.40	1.13	0.72–1.77
– 45–54	0.77*	0.64–0.94*	0.89	0.60–1.31
– 55–64	0.82	0.65–1.03	0.94	0.59–1.49
Geographic region:				
– West (ref)				
– Northeast	1.38*	1.19–1.60*	1.07	0.75–1.54
– North Central	1.06	0.90–1.24	1.80*	1.28–2.52*
– South	1.27*	1.10–1.46*	2.81*	2.07–3.84*
Unknown	1.41	0.61–3.25	N/A†	N/A
Comorbid ADHD	1.18*	1.04–1.34*	–	–
MH comorbidity	1.14*	1.04–1.25*	2.43*	2.05–2.89*
I/DD(+) vs I/DD(-) (ref) across-age categories:				
– 15–19	–	–	0.99	0.72–1.35
– 20–24	–	–	0.59*	0.42–0.83*
– 25–29	–	–	0.78	0.49–1.22
– 20–34	–	–	1.19	0.71–2.20
– 35–39	–	–	2.66*	1.17–6.04*
– 40–44	–	–	2.20	0.95–5.01
– 45–54	–	–	0.86	0.43–1.73
– 55–64	–	–	0.82	0.35–1.94

†Ellipse indicates a variable was not included in the final respective model.
*Indicate statistical significance.
The model was unable to produce an estimated OR for this subgroup.
ADHD: Attention deficit hyperactivity disorder; I/DD: Intellectual or developmental disability; MH: Mental health; OR: Odds ratio; STI: Sexually transmitted infection.

For example, cervical ectopy is more common in adolescent women [22] and is associated with increased risk of STI [23]. If females with I/DD tend to become sexually active at older ages, their risk for these conditions may be lower. A delayed onset of sexual activity may also explain why individuals with I/DD were less likely to be tested during age 20–24 years, but more likely to be tested between the ages of 35 and 39 years.

There are some methodologic considerations about this study to be noted. First, the findings of this study are associational and do not allow for causal inference. Second, there were a number of variables for which we were unable to control including: socioeconomic status, education level, income, race/ethnicity, sexuality and other variables that are associated with risk of contracting an STI in the general population [11], as information of this type is not contained within administrative billing data. Future, prospective cohort studies would be necessary to examine the influence of these demographic characteristics. Third, the current findings reflect prevalence of STIs and STI testing among individuals with private health insurance, and it is important to acknowledge that STI prevalence among those who are uninsured, have Medicaid or Medicare may be different. As many individuals

with I/DD have Medicare or Medicaid, the results of this study may not generalize to this population as a whole. Last, it is possible that individuals receive STI treatment or testing that is not billed to insurance, and therefore, not represented in the database. For example, individuals may seek care through community clinics, nonprofit organizations or local health departments that provide free or low-cost services. As a result, findings of this study are reflective of the prevalence of STIs and STI screening that are covered by and billed to private insurance.

Conclusion

Individuals with I/DD were significantly less likely to have an STI diagnosis, which may indicate decreased exposure to STIs. Although there was no significant difference on the odds of STI testing overall, individuals with I/DD aged 20–24 years had significantly lower odds and those aged 35–39 years had significantly higher odds of being tested than same-aged individuals without I/DD. Possible explanations for the findings of this study include that individuals with I/DD may have fewer sexual experiences overall, increased supervision in social settings leading to fewer sexual opportunities and delayed onset of sexual activity.

Summary points

- Individuals with intellectual and developmental disabilities (I/DD) may be particularly vulnerable to contracting sexually transmitted infections (STIs), yet little is known about the prevalence of STIs and STI testing in this population.
- This study compared national samples of privately insured individuals with (n = 25,193) and without I/DD (n = 25,193) on the prevalence of STIs and STI testing.
- Individuals with I/DD had significantly lower odds of an STI diagnosis, which may be due to fewer sexual experiences, increased supervision in social settings or a delayed onset of sexual activity.
- There was no significant difference between groups on the odds of STI testing overall, yet individuals with I/DD aged 20–24 years had significantly lower odds and those aged 35–39 years had significantly higher odds of being tested; this finding may also speak to a delayed onset of sexual activity in this population.

Financial & competing interests disclosure

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

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Ethical conduct of research

The institutional review board of The Ohio State University reviewed and approved this study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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