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Sexually transmitted infection incidence among adolescents in Ireland

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ABSTRACT

Objective The burden of sexually transmitted infections (STIs) rests with young people, yet in Ireland there has been very little research into this population. The purpose of this study was to determine the incidence rate and establish risk factors that predict STI occurrence among adolescents in Ireland.

Design Routine diagnostic, demographic and behavioural data from first-time visits to three screening centres in the southwest of Ireland were obtained. Univariate and multivariable logistic regression models were used to assess risk factors that predict STI occurrence among adolescents.

Results A total of 2784 first-time patients, aged 13–19 years, received 3475 diagnoses between January 1999 and September 2009; 1168 (42%) of adolescents had notifiable STIs. The incidence rate of STIs is 225/100 000 person-years. Univariate analysis identified eligible risk factors ($p<0.2$) for inclusion in the multivariable model. Multivariable logistic regression showed the dominant risk factors for STI diagnosis to be: males who sometimes [odds ratio (OR) 2.02] or never (OR 1.83) use condoms; and females 18–19 years (OR 2.26) and 16–18 years (OR 1.8), with 2 (OR 1.33) or 3+ (OR 1.56) partners in the last 12 months, who are non-intravenous drug users (OR 0.72), are most likely to receive a positive STI diagnosis.

Conclusions STI diagnosis has become increasingly common in Ireland. The proportion of notifications among those aged under 20 years is increasing. These data illustrate the significance of age, condom use and number of sexual partners as risk factors for STI diagnosis. Furthermore, providing data for the first time, we report on the high incidence rate of STIs among adolescents in Ireland. The high levels of risk-taking behaviour and STI acquisition are highlighted and suggest that there is a need for an integrated public health approach to combat this phenomenon in the adolescent population.

Key message points

- There is a high incidence rate of sexually transmitted infections (STIs) among adolescents in Ireland (225/100 000 person-years).
- Age and condom use are risk factors that predict STI diagnosis in adolescents.
- A large proportion reported smoking and alcohol consumption, highlighting the need for an integrated public health approach to combat risk-taking behaviours among adolescents.

INTRODUCTION

Sexually transmitted infections (STIs) are a major global cause of acute illness and infertility, with severe medical and psychological consequences for millions of men, women and infants.[1] In Ireland, the total number of STIs reported to the Health Protection Surveillance Centre (HPSC) has increased almost five-fold from 1989 to 2009.[2] During the same period there has been no change in reporting mechanisms for notifiable STIs and no new screening programmes have been introduced, therefore it is likely that this is reflective of 'real' growth.[3] It is also most likely an underestimate of the incidence of STIs since these figures are calculated from aggregate, rather than disaggregate, data.

The burden of STIs rests predominantly with the youth of society. In the USA, adolescents represent one-quarter of those individuals infected with STIs, while two-thirds of STIs occur in those aged under 25 years.[4–6] The situation is similar in Australia,[7] where over 25% of chlamydia infections in 2011 were in those aged <20 years.[8] Ireland is no

different, and in 2009 almost 75% of STI diagnoses occurred in individuals aged <29 years and 12.7% were in those aged <19 years.[2] Although there is some published work on the prevalence and incidence of STIs among adults in Ireland,[3 9–11] to our knowledge there are only two published studies on adolescents[12 13] and neither of these comment on the incidence of STIs in this population or the risk factors associated with STI acquisition.

Recent studies have highlighted that Ireland, unlike the UK, does not have a national strategy for sexual health and HIV.[3 9–11 14 15] Compounding this further, the data reported by the HPSC is not up to date. STI figures from 2009 were not published until 2011.[2] In addition, data published by the HPSC provide no demographic information and make no reference to risk factors, contraceptive use or sexual behaviour.[2 3]

This study links STI clinic data from 1999 to 2009 with patient records, which provide demographic and behavioural information. In this article we attempt to highlight the risk factors that predict STI occurrence in adolescents so that this information can be used to maximise the effectiveness of the limited resources that are available for prevention, diagnosis, treatment and subsequent control of STIs.

METHODS

Subjects

Adolescents aged between 13 and 19 years were the focus of this study. The data were obtained from records of 2784 first-time visits to three STI screening centres in the southwest of Ireland [males n=861 (30.9%); females n=1923 (69.1%)]. The mean age of male and female patients presenting at these clinics was 18.8 (range 13.9–19.9) and 18.5 (range 13.2–19.9) years, respectively. All visits occurred between January 1999 and September 2009. The clinics are typical of STI clinics in Ireland and serve a population in excess of 650 000 people.[16] All three clinics are in urban locations but provide services for the rural and urban population, as they are the sole providers of STI care in southwest Ireland. Demographic and diagnostic information, in addition to behavioural information, was recorded by the attending doctor at each patient consultation. Data were collected by the physician through the use of clinical report forms. This information was then transferred to the database by a single data manager in the main site.

The majority of patients were tested for STIs as each clinic encourages all attendees to undergo a full STI screen. All attendees are offered screening for HIV, viral hepatitis, syphilis, gonorrhoea, chlamydia and trichomoniasis, with additional STI screening as deemed necessary by medical staff. External genital warts are identified by clinical examination. A laboratory technologist is available on site to process Gram stains, wet preparation and agar plates. The nucleic acid amplification test was introduced for chlamydia screening in around 2000/2001. As this study focuses on the period 1999–2009, this does not impact greatly on the trends for new diagnoses reported here. Herpes simplex virus is determined by polymerase chain reaction in swabs. Immunoglobulin M serology is outsourced to the National Virus Reference Laboratory. All other testing methods remained the same during the period of study.

Primary outcome variable and associated risk factors

STIs were initially classified according to the HPSC's list of notifiable STIs. This list includes anogenital warts, chancroid, *Chlamydia trachomatis*, genital herpes simplex, gonorrhoea, granuloma inguinale, infectious hepatitis B, lymphogranuloma venereum, non-specific urethritis (NSU), syphilis and trichomoniasis. HIV-positive diagnoses were also considered. The primary outcome variable is a positive notifiable STI. Measurements of the following risk factors were available from the patient encounter form: sex, age group, age consent, condom use, partners in the last 3 months, partners in the last 12 months, sexual orientation, smoking, alcohol, intravenous (IV) and non-IV drug use. These risk factors are typical of covariates measured in similar STI studies. Missing data in this database are the result of non-response and are missing at random.

Statistical analysis

The statistical analysis was conducted using the statistical software PASW Statistics V.18 (IBM Corporation). Considering male and female patients in all clinics separately, independent univariate logistic regression models were fitted for positive STI diagnosis for each risk factor. The p value of the likelihood ratio test for each univariate regression is reported together with 95% confidence intervals (CIs) for each level of the associated risk factor.

Multivariable logistic regression analysis, applying backward elimination, was used to investigate the combination of risk factors associated with positive STI diagnosis for male attendees at all clinics. Risk factors appearing as statistically significant (p<0.20) in the univariate logistic regressions were used to obtain an initial multivariable logistic regression fit. Terms not appearing as statistically significant using the likelihood ratio test (p<0.05) were removed from the multivariable logistic regression model on a one-by-one basis. All risk factors in the final fitted model are presented graphically as odds ratio (OR) with accompanying 95% CIs. This model fitting protocol was repeated for female attendees at all clinics.

RESULTS

Patient characteristics

A total of 2784 first-time patients presented to the STI clinics between January 1999 and September

2009. Of these, 1172 (42.1%) were diagnosed with an STI. Demographic and behavioural characteristics of male and female patients are presented in Table 1. Comparisons between male and female patients show statistically significant differences in the distribution of male and female patients by age group [$\chi^2(df=2)=24$, $p<0.001$], sexual orientation [$\chi^2(1)=183$, $p<0.001$], condom use [$\chi^2(2)=26$, $p<0.001$], partners in the last 3 months [$\chi^2(2)=60$, $p<0.001$], partners in the last 12 months [$\chi^2(2)=42$, $p<0.001$], lifetime partners [$\chi^2(2)=25$, $p<0.001$], smoking [$\chi^2(1)=8$, $p=0.003$] and non-IV drug use [$\chi^2(1)=85$, $p<0.001$]. Males dominated the 18–19-year age group, reported higher rates of homosexuality and 'always' used condoms more than their female counterparts. They were also more likely to report three or more sexual partners in the last 3 months, 12 months and during their lifetime. In addition, males were more likely to be non-IV drug users but were less likely to be smokers. Males and females were considered separately thereafter.

Table 1 Characteristics of adolescents attending three sexually transmitted infection clinics in Southern Ireland

Characteristic	Males [*n* (%)]	Females [*n* (%)]
Total attendees	861 (30.9)	1923 (69.1)
Age group (years)		
<16	15 (1.7)	77 (4.0)
16–17	165 (19.2)	485 (25.2)
18–19	681 (79.1)	1361 (70.8)
Sexual orientation		
Heterosexual	752 (87.3)	1875 (97.5)
Homosexual/bisexual	96 (10.8)	8 (0.4)
Not recorded	16 (1.9)	40 (2.1)
Symptoms		
Asymptomatic	440 (51.1)	939 (48.8)
Symptomatic	374 (43.4)	868 (45.2)
Not recorded	47 (5.5)	116 (6.0)
Condom use		
Always	156 (18.1)	220 (11.5)
Sometimes	511 (59.4)	1170 (60.8)
Never	108 (12.5)	319 (16.6)
Not recorded	86 (10.0)	214 (11.1)
Partners (3 months)		
0–1	574 (66.7)	1508 (78.4)
2	148 (17.2)	243 (12.6)
3+	126 (14.6)	129 (6.7)
Not recorded	13 (1.5)	43 (2.3)
Partners (12 months)		
0–1	269 (31.2)	826 (43.0)
2	208 (24.2)	445 (23.1)
3+	365 (42.4)	604 (31.4)
Not recorded	19 (2.2)	48 (2.5)
Partners (lifetime)		
0–1	143 (16.6)	401 (20.9)
2	97 (11.3)	314 (16.3)
3+	595 (69.1)	1144 (59.5)
Not recorded	26 (3.0)	64 (3.3)
Smoking		
Yes	447 (51.9)	1114 (57.9)
No	414 (48.1)	809 (42.1)
Alcohol		
Yes	759 (88.2)	1664 (86.5)
No	102 (11.8)	259 (13.5)
Drugs (non-IV)		
Yes	243 (28.2)	262 (13.6)
No	618 (71.8)	1661 (86.4)
Drugs (IV)		
Yes	4 (0.5)	5 (0.3)
No	857 (99.5)	1918 (99.7)

IV, intravenous.

Table 2 Number of new diagnoses of sexually transmitted infections among 15–19-year-olds presenting between 1999 and 2008

Year	Number of new STI diagnoses [*n* (%)]		
	Males	Females	Total
1999	19 (26.0)	54 (74.0)	73 (100.0)
2000	24 (32.0)	51 (68.0)	75 (100.0)
2001	23 (25.6)	67 (74.4)	90 (100.0)
2002	44 (36.7)	76 (63.3)	120 (100.0)
2003	34 (33.0)	69 (67.0)	103 (100.0)
2004	30 (26.5)	83 (73.5)	113 (100.0)
2005	43 (36.1)	76 (63.9)	119 (100.0)
2006	33 (34.7)	62 (65.3)	95 (100.0)
2007	34 (38.6)	54 (61.4)	88 (100.0)
2008	23 (26.7)	63 (73.3)	86 (100.0)

STI, sexually transmitted infection.

Incidence rate

There were 95 newly diagnosed notifiable STIs in 2006. These cases included the following diagnoses: anogenital warts, chancroid, chlamydia, granuloma inguinale, genital herpes simplex, gonorrhoea,

Table 3 Number and percentage of males and females with selected diagnoses

Diagnosis	Males [*n* (%)]	Females [*n* (%)]
Anogenital warts	157 (41.5)	558 (70.3)
Chlamydia	75 (19.8)	187 (23.6)
Non-specific urethritis	129 (34.1)	1 (0.1)
Gonorrhoea	9 (2.4)	2 (0.3)
Syphilis	0 (0.0)	1 (0.1)
Hepatitis B	2 (0.5)	1 (0.1)
Genital herpes simplex	4 (1.1)	40 (5.0)
HIV	2 (0.5)	2 (0.3)
Trichomoniasis	0 (0.0)	2 (0.3)
Total	378 (100.0)	1029 (100.0)

Table 4 Independent risk factors for sexually transmitted infection diagnosis in the three clinics surveyed

	Males			Females		
Variable	**OR**	**95% CI**	***p****	**OR**	**95% CI**	***p****
Age group (years)						
<16	1.00		0.75	1.00		**<0.001**
16–18	0.66	0.23–1.91		1.92	1.10–3.35	
18–19	0.69	0.25–1.91		2.56	1.50–4.39	
Age consent (years)						
<17	1.00		**0.07**	1.00		0.42
>17	1.30	0.98–1.72		0.93	0.77–1.12	
Condoms						
Always	1.00		**0.001**	1.00		**0.18**
Sometimes	2.02	1.38–2.94		1.13	0.84–1.51	
Never	1.83	1.10–3.03		0.89	0.63–1.27	
Partners (3 months)						
0–1	1.00		0.68	1.00		**0.15**
2	1.12	0.78–1.61		0.96	0.73–1.26	
3+	1.16	0.79–1.70		0.69	0.47–1.00	
Partners (12 months)						
0–1	1.00		0.27	1.00		**0.05**
2	1.08	0.75–1.56		1.29	1.02–1.63	
3+	1.29	0.94–1.77		1.24	1.00–1.54	
Orientation						
Homosexual/bisexual	1.00		**0.13**	1.00		**0.13**
Heterosexual	1.41	0.90–2.20		4.96	0.61–40.43	
Smoking						
Yes	1.25	0.95–1.64		1.18	0.98–1.42	
No	1.00		**0.11**	1.00		**0.07**
Alcohol						
Yes	0.95	0.63–1.43		1.20	0.92–1.58	
No	1.00		0.8	1.00		**0.18**
Drugs (non-IV)						
Yes	1.03	0.77–1.39		0.73	0.55–0.95	
No	1.00		0.84	1.00		**0.02**
Drugs (IV)						
Yes	0.42	0.04–4.10		0.95	0.16–5.69	
No	1.00		0.46	1.00		0.95

*Risk factors with $p<0.2$, highlighted in bold, were included in the multivariable model.
CI, confidence interval; IV, intravenous; OR, odds ratio.

lymphogranuloma venereum, NSU, syphilis and trichomoniasis. According to the Census 2006,[17] the population of 15–19-year-olds in the two counties in Southern Ireland where the clinics are located was 42 139. Therefore, the crude incidence rate for STIs in the region is 225/100 000 person-years. The number of annual new cases of STIs among those aged between 15 and 19 years, stratified by gender, are presented in Table 2. The female:male ratio is 3:1.

Diagnoses

Table 3 presents the first-time diagnoses for the 1172 adolescents with notifiable STIs. There were no diagnoses of chancroid, granuloma inguinale or lymphogranuloma venereum. There are few diagnoses among adults in Ireland for these infections either.[2] Among male adolescents, anogenital warts and NSU are the two most prevalent STIs, accounting for over 75% of diagnoses. Anogenital warts and chlamydia account for almost 94% of diagnoses among females. Concurrent infections are not common, accounting for less than 10% of adolescents.

Condom use

Only 11.4% of females and 18.1% of males report always using condoms. A further 60.8% and 59.4%, respectively, reported sometimes using condoms. The relationship between the use of condoms and the

number of lifetime partners is statistically significant ($p<0.001$). The greater the number of lifetime partners, the more likely one is not to use condoms consistently. Only 12.8% of those with 3+ lifetime partners always use condoms compared to 17.8% of those with 2 lifetime partners and 32.6% of those with 0–1 lifetime partners.

Analysis of risk factors

Univariate logistic regressions and STI diagnosis

The results for the independent univariate logistic regression models for male and female adolescents are presented in Table 4. At the 5% level, condom use is associated with STI diagnosis in male adolescents. Those sometimes using condoms are more likely to be diagnosed with an STI than those who report always using condoms. Age, number of partners in the past 12 months and non-IV drug use are associated with an STI diagnosis in female adolescents. Females aged under 16 years are less likely to be diagnosed with an STI compared to those aged over 16 years. Those who report 2 or 3+ sexual partners in the previous 12 months are more likely to be diagnosed with an STI compared to those with 0–1 partners. Those who reported non-IV drug use were less likely to report an STI diagnosis. Covariates with a p value under 0.2 were included in the multivariable model and included age of consent, condom use, sexual orientation and smoking status for males and age, condom use, number of partners in the last 3 months and 12 months, sexual orientation, smoking, alcohol use and non-IV drug use for females.

Multivariable logistic regressions

Given the earlier differences observed between males and females during demographic and univariate analyses, multivariable logistic regression using backward elimination was conducted for males and females separately. The final models are presented in Table 5. It was found that the risk of an STI diagnosis for male adolescents is strongly associated with condom use. The final multivariable logistic regression for female adolescents modelled positive STI diagnosis on age group and partners in the last 12 months. Female adolescents aged under 16 years are less likely to be diagnosed with an STI compared to those aged 16–18 years or 18–19 years, while those with two or more sexual partners in the previous 12 months are more likely to be diagnosed with an STI compared to those with 0–1 partners in the same time period.

Table 5 Multivariable logistic regression with sexually transmitted infection as the dependent variable

Variable	OR (95% CI)	p
Males		
Condom use		
Always	–	0.001
Sometimes	2.02 (1.38–2.94)	
Never	1.83 (1.10–3.03)	
Females		
Age group (years)		
<16	1.00	0.004
16–18	1.80 (1.01–3.21)	
18–19	2.26 (1.29–3.95)	
Partners (3 months)		
0–1	1.00	0.007
2	0.77 (0.56–1.04)	
3+	0.52 (0.34–0.81)	
Partners (12 months)		
0–1	1.00	0.002
2	1.33 (1.05–1.70)	
3+	1.56 (1.21–2.01)	
Drugs (non-IV)		
Yes	0.72 (0.54–0.96)	0.03
No	1.00	

CI, confidence interval; IV, intravenous; OR, odds ratio.

DISCUSSION

STIs have become increasingly common in Ireland and the proportion of notifications among those aged under 20 years is increasing.[2] This study is the first to report incidence and prevalence data for teenagers in Ireland using disaggregate data. The overall crude incidence for STIs in the teenage population is 225/100 000 person-years, just below the crude incidence rate for the Republic of Ireland in 2006. This finding is not at variance with the literature, where it is noted that approximately 50% of new diagnoses are in young people under the age of 25 years.[18] Females are three times more likely to be diagnosed with a new STI. Our study once again confirms the importance of age and condom use as noted in a previous Irish study of adults[4] and in the international literature.[19 20] The mean age of STI diagnosis is 18.7 years. Given that most first-year university students are aged 18+ years, this suggests that the first year at university would be an appropriate time for an intervention to prevent STI acquisition. Though the present findings might suggest that females should be targeted given the 3:1 diagnosis ratio, we would suggest that males are underrepresented at STI clinics and targeted campaigns to increase their attendance are recommended.

It is unclear what social and economic factors put these young people at risk and fuel the spread of STIs in their communities. Further studies are needed to investigate this. It is possible that access to services is a deterrent to seeking medical care. The Irish Study of Sexual Health and Relationships reported that 2.4% of men and 5.4% of women had travelled outside their own region to access sexual health services. The main reason given for this was a lack of services available locally, needing specialist care, seeking anonymity and a greater choice being available.[21] An examination of STI clinics in Ireland shows that outside Dublin

there are fewer than 10 STI clinics serving the remainder of the country, and the services are on a part-time basis, in some cases available for just 1 hour per week.

Though chlamydia represents 20% of STIs diagnosed in males and 24% in females, this proportion disguises the fact that over twice as many females are diagnosed with this condition than males (Table 3). Chlamydia infection can deprive a young woman of the chance of a successful pregnancy later in life. The CDC estimate that each year untreated chlamydia causes at least 24 000 women to become infertile in the USA.[18] School-based sex education is necessary to inform males and females, but particularly females, about this silent disease. An education programme covering all STIs, in conjunction with the human papillomavirus vaccine programme, is also recommended.

In both college and national populations condom use has been identified as the preferred method of contraception in Irish males and females.[22 23] The proportion of teenagers who always use condoms in this study is extremely low, ranging from 12% to 26% depending on the number of lifetime partners. As the number of lifetime partners increases, the proportion of those 'always' using condoms decreases. Condoms, when used correctly, have been shown to protect against both STIs and HIV infection.[24] An international study has demonstrated that more frequent changes of sex partner increases the risk of STI acquisition.[25] One of the key challenges for health and education providers is increasing the proportion of young people protecting themselves from STIs by using condoms. A possible reason for the low rates of usage is the cost of condoms in Ireland as has been discussed previously.[22] Currently, the cost of a packet of 12 condoms in Tesco supermarkets is €7.69.

The high proportion of smokers is of concern in this young population. More than 50% of males and females smoke, and of those under 16 years 59.8% were smokers and 56.5% had consumed alcohol. Non-IV drug use is also prevalent. This highlights the importance of an integrated public health intervention approach to combat negative health behaviours.

Romantic and sexual behaviours are occurring in adolescents at increasingly younger ages. The World Health Organization has estimated that 20% of the world population is currently aged under 20 years. Ireland is currently experiencing a 'baby boom', making the findings of this study more important for the future adolescent population. Young adolescents are at an increased risk of STIs and these data illustrate the importance of early sexual education in Ireland. Current national STI figures are based upon aggregate data. A major strength of our study is the use of diagnostic data linked to demographic and behavioural information allowing for the identification of risk factors associated with a positive STI diagnosis. The negative findings related to smoking and alcohol and non-IV drug use are important. We recommend an integrated public health approach to health education and STI prevention.

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Editor's note The Letters to the Editor in this issue include a letter by Igoe *et al.* (page 314) written in response to the previously published online version of this article.

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