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Sexual behaviour among young Danes aged 15–29 years: a cross-sectional study of core indicators

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ABSTRACT

Objectives Sexually transmitted infections and unwanted pregnancies occur at high rates among youth. Understanding sexual behaviour is essential for planning and implementing future effective preventive interventions. The present study examines the sexual behaviour in the general Danish population aged 15–29 years using the core indicators recommended by the European Centre for Disease Prevention and Control.

Methods A nationwide cross-sectional study was conducted in Denmark among a random sample of 20 000 men and women in 2012. Respondents completed a web-based sexual behaviour questionnaire and data were linked to a nationally held demographic database. Core indicators for sexual behaviour frequency stratified by gender are presented as unweighted and weighted data after consideration of sociodemographic differences between respondents and non-respondents.

Results Response rate was 20.4%. Condoms were used at sexual debut by 69.9% of women and 62.3% of men, while 14.3% of women and 15.1% of men used no contraceptives at sexual debut. Half of the respondents used condom alone at the latest sexual encounter with a steady partner (women 51.8%, men 55.2%), while 10% used no contraceptives. Having a sexual encounter with a casual partner decreased the likelihood of using condoms (women 43.7%, men 49.5%) and increased the likelihood of using no contraceptives (women 14.8%, men 20.9%). Data on sexual behaviour characteristics showed only minor changes when weighted for non-response.

Conclusions The findings call for interventions addressing the use of appropriate contraception at sexual debut and at last sexual encounter; this seems particularly important when the sexual partner is a casual partner.

BACKGROUND

Sexually transmitted infections (STIs) remain a significant public health problem among the youth in Western countries: 75% of all *Chlamydia trachomatis* infections and 41% of all gonorrhoea infections are reported in the population aged 15–24 years.^{1 2} In addition, 13.6% of all syphilis cases are reported in the population aged 20–24 years.² STIs have major medical, social and public health implications in both genders.^{3 4} Furthermore, Western women aged 20–24 years also have the highest abortion rates compared with women in other age groups.^{5–7} The high prevalence of STIs and unwanted pregnancies is probably related to risky sexual behaviour. A better understanding of

the sexual behaviour is thus essential for ensuring effective preventive interventions in the future.

The European Centre for Disease Prevention and Control (ECDC) made an analysis in 2008 of the STI/HIV behavioural surveillance data in Europe on the general adult, the general young population (15–24 years) and six high-risk groups.^{8 9} Thirteen countries reported to have a national population surveillance system in the general young population, while five reported to collect similar data through consecutive surveys. As considerable diversity was identified among the used indicators in all target groups, the ECDC recommended a set of future core indicators for each group to identify sexual risk behaviour, monitor progress in interventions and facilitate international comparisons.^{8 9} No systematic data collection has yet been performed in the general Danish youth. Therefore, it is difficult to monitor changes in sexual behaviour over time that may have contributed to the spread of STIs.

A key challenge in sexual behaviour surveys is to generate representative, unbiased and accurate measures of behavioural characteristics at individual and population levels. Previous postal surveys in the general young population have reported response rates between 16.7% and 68%.^{10 11} Thus, a potential risk of non-response bias is present.

The objective of this cross-sectional study was to examine the sexual behaviour in the general Danish population aged 15–29 years using the ECDC core indicators after considering the sociodemographic differences between respondents and non-respondents.

METHODS

Study design and study population

We conducted a nationwide population-based cross-sectional study of sexual behaviour core indicators^{8 9} among a sample of Danes aged 15–29 years. The study population included 20 000 men and women who were randomly selected from the Danish Civil Registration System (CRS) and living in Denmark at the time of retrieval. The selection was based on well-established statistical methods for random sample selection from the CRS, which contains records on more than 99% of the Danish population (including updated postal addresses).¹² Residents holding publicly recorded protection from research participation (12%–25% of 15–29 year olds) were excluded¹³ as were residents with unknown address.

Each eligible individual (9735 women, 10 625 men) received a written invitation by surface mail

on 26 October 2012, including description of study objectives, information on anonymity, a personal link to the web-based questionnaire, instructions on how to access the questionnaire and estimated completion time. The invitation letter gave no information on the linkage between questionnaire data and registry-based sociodemographic data since the procedure was decided after the inclusion period had ended (due to the low response rate). Non-respondents received a reminder on 16 November 2012, and the inclusion period ended on 17 January 2013. Respondents received no compensation.

Questionnaire development

A comprehensive 95-item self-administered web-based questionnaire was developed on the basis of literature search,^{11 14–17} the research group's profound experience in the field and a qualitative study on sexual behaviour.¹⁸ Items on sexual behaviour (63 items) concerned: age and use of contraceptives at sexual debut, number of sexual partners during the last year, details of the last three partners during the last year (including type of partner, ie, casual or steady, and use of contraceptives), and giving or receiving payment for sex (table 1). To ensure that stated information on contraceptive methods was related to either vaginal or anal intercourse, the following definition of sex was provided before the sexually related items: 'Sex can be many things, but, in this context, we refer to vaginal (vagina) or anal (rectum) intercourse'. Items on STI/HIV testing and earlier STI/HIV diagnosis were added (table 1). The questionnaire also contained items on sociodemography, personality and lifestyle factors (not included in the present study).

All items were evaluated and commented on by a group of experts. The self-administered web-based questionnaire was first pilot tested among 13 students (aged 18–23 years) at a Danish *folkehøjskole* (ie, a traditional Nordic 'school of life' boarding academy providing adult education during a full-time stay of 4–12 months) by using cognitive interviewing to identify challenging items and response categories. The survey administration software was then tested, and completion time was 20 min. Finally, the questionnaire was pilot tested in a sample of 120 Danish students at the end of their secondary education (aged 18–20 years). Potential floor/ceiling effects and test–retest reliability were investigated, and the survey was adjusted accordingly.

Measures

Data on sexual behaviour were categorised as proposed by the ECDC and supplemented with our own indicators (table 1). Online supplementary material data include testing of STIs in general, not only of HIV as proposed by the ECDC.

Sociodemographic data for respondents and non-respondents were obtained from the Integrated Database for Labour Market Research.¹⁹ Included variables were age, ethnicity, and educational level of respondents and their parents. Variables updated at the end of 2012 were used. Data were linked at the individual level by the CRS through a unique 10-digit personal identification number assigned to every Danish citizen at birth or immigration. Missing information for registry-based variables ranged from 0% for age and gender to 3.4% for ethnicity.

Age was categorised into ranges of 15–18, 19–24 and 25–29 years. Ethnicity was divided into Danish, Western immigrant,

Table 1 Core indicators for sexual behaviour and sociodemographic characteristics of respondents in the Danish sexual behaviour survey

ECDC-suggested core indicators in youth*	Included variables in the Danish sexual behaviour survey	Data handling of included variables
▶ Sexual orientation	▶ Sexual orientation	▶ Categorised into: heterosexual, homosexual, bisexual, other
▶ Age at sexual debut or at least proportion of sexually active at age 15	▶ Age at sexual debut ▶ Age difference between index person and partner at sexual debut	▶ Age at sexual debut: mean (SD) and grouped into: 10–13, 14–18, 19–24, 25–28 ▶ Age difference categorised into: partner younger, no difference, partner 1–5 years older, partner more than 5 years older
▶ Use of contraception at sexual debut	▶ Use of contraception at sexual debut ('Did you or your partner use...')	▶ Contraception categorised into: dual protection†, condom alone, non-condom contraception alone‡, no contraception (If men reported 'Do not know', they were categorised as having used 'No contraception')
▶ Number of sexual partners during the last year	▶ Number of sexual partners during the last year	▶ Categorised into four groups for each period of time: no partner, 1 partner, 2–5 partners, >5 partners
▶ Use of contraception at last sexual encounter during the last year, including type of partner (steady, casual or paid)	▶ Use of contraception at last sexual encounter during the last year, including type of partner (steady or casual‡)	▶ For both steady and casual‡ partner, use of contraception is categorised into: dual protection†, condom alone, non-condom contraception alone‡, no contraception (If men reported 'Do not know', they were categorised as having used 'No contraception')
▶ Experience of HIV testing (ever tested, date and result)	▶ Experience of HIV testing and other STIs (ever tested)	▶ History of test dichotomised into: ever tested yes/no
▶ Having paid for sex in the last 12 months and condom use at last paid sexual intercourse	▶ Have ever paid for sex	▶ Dichotomised into: 'Had ever paid for sex' or not
▶ Knowledge of HIV (UNGASS 13)	▶ Not included	▶ Not included
▶ Sociodemographic indicators: level of education and nationality/ethnic origin	▶ Sociodemographic indicators: ethnicity§, ongoing and highest completed education, highest level of parents' education	▶ Ethnicity: Danish, Western or non-Western immigrants§ ▶ Ongoing and completed education (in years)¶: ≤10, 11–15, >15 ▶ Highest level of parents' education (in years)¶: ≤10, 11–15, >15

*Refs.^{8 9}

†Dual protection indicated both condom and non-condom contraception. Non-condom contraception encompassed hormonal contraception methods, intrauterine devices and barrier methods.

‡Steady and casual partners are defined based on the item: 'Would you say that you have/have had a steady relationship with this person?'

§Categorised according to the definition of developed countries by Statistics Denmark.²⁰

¶Classified according to UNESCO's classification as low (≤10 years), middle (11–15 years) and higher education (>15 years).

ECDC, European Centre for Disease Prevention and Control; STI, sexually transmitted infection; UNGASS, United Nations General Assembly Special Session on HIV/AIDS.

and non-Western immigrant and subsequently categorised according to the definition by Statistics Denmark.²⁰ Educational level of respondents was determined according to ongoing or highest completed education according to UNESCO's classifications, that is, low (≤ 10 years), middle (11–15 years) or higher education (> 15 years). For each respondent, the educational level of both parents was obtained, but only the highest achieved educational level of (any) of the parents was used in the calculations. Level of parents' education was determined according to UNESCO's classification (table 1).

Sample size and data analysis

Sample size was calculated to enable detection of 10% differences between individuals engaging in unsafe versus safe sex, with 90% power at the 0.05 significance level and an estimated 25% response rate. The estimated sample size was further multiplied by four to enable subgroup analyses.

All respondents were included in the analysis on sexual experience, except for 13 outliers who reported to be less than 10 years old at sexual debut or their partner's age to be either less than 10 years or above 45 years at sexual debut. Further analysis of sexual behaviour characteristics was restricted to respondents who already had their sexual debut ($n=3127$). Frequencies of sexual behaviour core indicators stratified by gender are presented in tables 3 and 4 as percentages of nominal data and mean and SDs for numeric normally distributed continuous data. *p* Values of 0.05 or less were regarded statistically significant. Both unweighted and weighted results are given. Weighted results were provided by adjusting non-responses related to the included registry-based sociodemographic characteristics. This procedure was performed by inverse probability weighting.²¹ First, each respondent's

probability of participating, adjusted for sociodemographic characteristics, was calculated using a logistic regression model. Then, each respondent was assigned a weight that was inversely proportional to this estimated probability. Finally, the weights were used to set a value for the frequencies of the reported sexual behaviour after adjusting for selection bias due to non-response.

All analyses were performed using Stata V.12.1 (StataCorp LP, College Station, Texas, USA).

Ethics

The study was approved by the Danish Data Protection Agency (file no. 2010-41-5610).

Although no approval was required according to Danish law as no biomedical intervention was performed, the study was conducted with ethical clearance from the National Committee on Health Research Ethics (file no. 162/2010). Respondents gave their consent by completing the web-based questionnaire.

RESULTS

Of the 20 000 individuals invited to participate in the Danish sexual behaviour survey, 4072 (20.4%) completed the questionnaire (63.7% women, 36.3% men). Respondents were generally younger (aged 15–18 years (31.5% women, 32.3% men)) than non-respondents (21.6% women, 22.9% men) (data not shown).

Sociodemographic characteristics

A higher proportion of respondents than non-respondents were Danes (94.0% vs 81.9%). Respondents were more likely to be engaged in ongoing formal education (71.5% vs 56.7%) and to have parents who completed an education of more than 15 years (43.7% vs 29.9%) (data not shown).

Table 2 Sociodemographic factors associated with respondents (women, $n=2595$; men, $n=1477$) compared with non-respondents (women, $n=7140$; men, $n=8788$); crude and adjusted OR with 95% CIs

	Women				Men			
	Crude OR	95% CI	Adj. OR*	95% CI	Crude OR	95% CI	Adj. OR*	95% CI
Age group								
15–18 years	Ref		Ref		Ref		Ref	
19–24 years	0.61	(0.55 to 0.69)	0.61	(0.50 to 0.74)	0.63	(0.55 to 0.72)	0.70	(0.56 to 0.89)
25–29 years	0.58	(0.52 to 0.66)	0.52	(0.42 to 0.65)	0.62	(0.54 to 0.71)	0.66	(0.50 to 0.87)
Ethnicity								
Danish	Ref		Ref		Ref		Ref	
Western immigrant	0.35	(0.26 to 0.46)	0.84	(0.45 to 1.56)	0.33	(0.22 to 0.50)	0.73	(0.37 to 1.43)
Non-Western immigrant	0.23	(0.19 to 0.27)	0.30	(0.23 to 0.39)	0.29	(0.22 to 0.38)	0.33	(0.24 to 0.45)
Education								
Ongoing								
≤ 10 years	Ref		Ref		Ref		Ref	
11–15 years	0.75	(0.66 to 0.86)	1.10	(0.91 to 1.33)	0.69	(0.59 to 0.81)	0.90	(0.71 to 1.13)
> 15 years	0.91	(0.79 to 1.05)	1.48	(1.16 to 1.89)	1.13	(0.95 to 1.35)	1.61	(1.19 to 2.17)
Highest completed								
≤ 10 years	0.33	(0.27 to 0.41)	0.61	(0.47 to 0.80)	0.26	(0.20 to 0.33)	0.40	(0.29 to 0.56)
11–15 years	0.57	(0.49 to 0.67)	0.98	(0.77 to 1.26)	0.57	(0.48 to 0.68)	0.81	(0.60 to 1.10)
> 15 years	1.05	(0.86 to 1.28)	1.89	(1.39 to 2.56)	0.98	(0.70 to 1.36)	1.38	(0.89 to 2.14)
Highest level of parents' education								
> 15 years	Ref		Ref		Ref		Ref	
11–15 years	0.67	(0.61 to 0.74)	0.74	(0.67 to 0.82)	0.66	(0.59 to 0.74)	0.78	(0.69 to 0.88)
≤ 10 years	0.36	(0.30 to 0.44)	0.50	(0.41 to 0.62)	0.35	(0.28 to 0.45)	0.55	(0.43 to 0.71)

Numbers in bold show a significantly increased or decreased OR for respondents compared with non-respondents.

*Adjusted for age group, ethnicity, educational level and highest achieved level of parents' education.

After adjustment for sociodemographic characteristics, a reduced association was found between non-Western immigrants and being a respondent; this trend was found for both female (OR 0.30, 95% CI 0.23 to 0.39) and male respondents (OR 0.33, 95% CI 0.24 to 0.45) (table 2). Enrolment in higher education (>15 years) was associated with being a female (OR 1.48, 95% CI 1.16 to 1.89) or male respondent (OR 1.61, 95% CI 1.19 to 2.17) compared with non-respondents. In addition, an association was found between having completed an

education of more than 15 years and being a female respondent (OR 1.89, 95% CI 1.39 to 2.56). Finally, parents of respondents were higher educated than parents of non-respondents.

Sexual behaviour characteristics

Tables 3 and 4 show the sexual behaviour characteristics stratified by gender and displayed by unweighted and weighted scores. A total of 932 respondents (23.0%) had no sexual experience (table 3) ranging from 28.7% among the youngest

Table 3 Sexual behaviour core indicators related to sexual debut and number of partners among respondents aged 15–29 years (women, n=2592; men, n=1467)

Characteristics	N	Category	Respondent's sexual behaviour			
			Unweighted data		Weighted data ^a	
			Women % (n) (95% CI)	Men % (n) (95% CI)	Women % (95% CI)	Men % (95% CI)
Sexual experience	4059	No	20.9 (543) (19.4 to 22.6)	26.5 (389) (24.3 to 28.9)	20.5 (18.7 to 22.4)	24.2 (21.8 to 26.8)
		Yes	79.1 (2049) (77.4 to 80.6)	73.5 (1078) (71.2 to 75.7)	79.5 (77.6 to 81.3)	75.8 (73.2 to 78.2)
Age of index person at sexual debut†	3121	Mean age (SD)	16.1 (2.0) 6.1 (123) (5.1 to 7.1)	16.4 (2.4) 6.6 (71) (5.3 to 8.2)	16.0 6.9 (5.8 to 8.3)	16.4 7.1 (5.4 to 9.2)
		10–13 years	83.8 (1714) (82.2 to 85.3)	77.8 (837) (75.2 to 80.2)	83.3 (81.2 to 85.1)	77.9 (74.6 to 80.7)
		14–18 years	9.8 (201) (8.6 to 11.2)	14.8 (159) (12.8 to 17.0)	9.3 (7.9 to 10.9)	14.1 (11.8 to 16.8)
		19–24 years	0.3 (7) (0.2 to 0.7)	0.8 (9) (0.4 to 1.1)	0.5 (0.2 to 1.5)	0.9 (0.4 to 2.0)
Age difference between index person and partner at sexual debut†	3111	Partner younger	6.3 (128) (5.3 to 7.4)	32.2 (345) (29.5 to 35.0)	6.1 (5.1 to 7.3)	32.2 (29.0 to 35.5)
		No age difference	28.9 (589) (27.0 to 30.9)	37.7 (404) (34.8 to 40.6)	28.0 (25.9 to 30.1)	37.0 (33.6 to 40.4)
		Partner 1–5 years older	58.0 (1183) (55.9 to 60.2)	27.1 (290) (24.5 to 29.8)	58.6 (56.2 to 61.0)	27.3 (33.6 to 40.4)
		Partner more than 5 years older	6.8 (139) (5.8 to 8.0)	3.2 (33) (2.2 to 4.3)	7.3 (6.1 to 8.7)	3.6 (2.3 to 5.5)
Contraceptive use at sexual debut†	3117	Dual protection‡	16.9 (345) (15.3 to 18.6)	14.3 (154) (12.3 to 16.5)	17.4 (15.6 to 19.2)	14.3 (12.1 to 16.8)
		Condom alone	53.0 (1082) (50.8 to 55.2)	48.0 (516) (45.0 to 51.0)	50.8 (48.4 to 53.3)	45.2 (41.7 to 48.7)
		Non-condom contraception alone ^c	15.8 (322) (14.3 to 17.4)	22.6 (244) (20.3 to 25.3)	16.3 (14.6 to 18.3)	24.2 (21.3 to 27.4)
		No contraception	14.3 (292) (12.9 to 15.9)	15.1 (162) (13.0 to 17.3)	15.5 (13.6 to 17.5)	6.8 (13.6 to 19.4)
Sexual orientation†	3126	Heterosexual	92.8 (1902) (91.6 to 93.9)	94.1 (1013) (92.5 to 95.3)	92.7 (91.3 to 93.9)	93.5 (90.9 to 95.4)
		Homosexual	0.5 (11) (0.3 to 1.0)	2.3 (25) (1.6 to 3.4)	0.6 (0.3 to 1.2)	2.0 (1.1 to 3.6)
		Bisexual	5.6 (114) (4.7 to 6.6)	2.9 (31) (2.0 to 4.1)	5.7 (4.6 to 6.9)	3.1 (2.0 to 4.8)
		Other	1.1 (22) (0.7 to 1.6)	0.7 (8) (0.4 to 1.5)	1.0 (0.6 to 1.6)	1.4 (0.5 to 3.9)
Number of sexual partners during the last 12 months†	3127	0	3.8 (77) (3.0 to 4.7)	7.3 (79) (5.9 to 9.0)	3.7 (2.9 to 4.7)	8.3 (6.4 to 10.7)
		1	62.4 (1278) (60.3 to 64.5)	57.8 (623) (54.8 to 60.7)	61.9 (59.5 to 64.2)	57.5 (53.9 to 61.0)
		2–5	29.0 (595) (27.1 to 31.0)	27.9 (301) (25.3 to 30.7)	29.1 (26.9 to 31.4)	28.0 (24.9 to 31.3)
		>5	4.8 (99) (4.0 to 5.9)	7.0 (75) (5.6 to 8.6)	5.3 (4.3 to 6.5)	6.2 (4.8 to 8.0)

Data are shown as unweighted and weighted after correction for non-response.

Numbers vary due to missing data.

Numbers in bold show statistically significant differences between women and men.

^aAdjusted for gender, age, ethnicity, educational level and highest level of parents' education.

†Core indicators as proposed by the ECDC.

‡Dual protection indicated both condom and non-condom contraception. Non-condom contraception encompassed hormonal contraception methods, intrauterine devices and barrier methods.

ECDC, European Centre for Disease Prevention and Control.

Table 4 Distribution of sexual behaviour core indicators related to last sexual encounter and STIs among respondents aged 15–29 years (women, n=2593; men, n=1473)

Characteristic	N	Category	Respondent's sexual behaviour			
			Unweighted data		Weighted data*	
			Women % (n) (95% CI)	Men % (n) (95% CI)	Women % (95% CI)	Men % (95% CI)
Contraceptive use at last sexual encounter (within the last 12 months)†						
With a steady partner‡	2284	Dual protection‡	20.8 (317) (18.8 to 22.9)	18.9 (143) (16.2 to 21.8)	20.4 (18.2 to 22.6)	18.8 (15.9 to 22.1)
		Condom alone	31.0 (473) (28.7 to 33.4)	36.3 (275) (32.9 to 39.0)	28.7 (26.2 to 31.2)	34.0 (30.3 to 38.0)
		Non-condom contraception alone‡	39.8 (608) (37.4 to 42.3)	34.9 (264) (31.5 to 38.3)	42.1 (39.3 to 45.0)	36.5 (32.6 to 40.6)
		No contraception	8.4 (128) (7.1 to 9.9)	10.0 (76) (8.1 to 12.4)	8.9 (7.3 to 10.8)	10.6 (8.0 to 13.8)
With a casual partner‡	673	Dual protection‡	16.6 (73) (13.4 to 20.4)	6.8 (16) (4.2 to 10.9)	16.2 (12.8 to 20.1)	5.1 (3.0 to 8.7)
		Condom alone	27.1 (119) (23.1 to 20.4)	42.7 (100) (36.5 to 49.2)	25.2 (21.1 to 29.8)	44.5 (36.8 to 52.5)
		Non-condom contraception alone‡	41.5 (182) (36.9 to 46.1)	29.5 (69) (24.0 to 35.7)	42.5 (37.5 to 47.6)	31.8 (25.0 to 39.5)
		No contraception	14.8 (65) (11.8 to 18.5)	20.9 (49) (16.2 to 27.7)	16.2 (12.5 to 20.5)	18.6 (13.5 to 25.0)
STIs						
HIV†	3127	Ever tested	18.5 (379) (16.9 to 20.2)	14.8 (159) (12.8 to 17.0)	18.8 (16.9 to 20.8)	13.8 (11.7 to 16.2)
		<i>Chlamydia</i> infection	54.7 (1121) (52.5 to 56.9)	32.7 (352) (29.9 to 35.5)	56.7 (54.3 to 59.1)	33.6 (30.4 to 37.0)
Gonorrhoea	Ever tested	14.7 (302) (13.3 to 16.3)	13.5 (146) (11.6 to 15.7)	14.5 (12.9 to 16.4)	12.9 (10.8 to 15.3)	
Syphilis	Ever tested	10.1 (207) (8.9 to 11.5)	9.2 (99) (7.6 to 11.1)	10.3 (8.8 to 11.9)	8.5 (6.8 to 10.5)	
Have ever paid for sex†	3120	Yes	0.2 (4) (0.1 to 0.5)	9.0 (97) (7.5 to 10.9)	0.2 (0.1 to 0.6)	10.5 (8.3 to 13.5)
		No	99.8 (2042) (99.5 to 99.9)	91.0 (977) (89.1 to 92.5)	99.7 (99.4 to 99.9)	89.4 (86.7 to 91.7)

Data are shown as unweighted and weighted after corrections for non-response.

Numbers vary due to missing data.

Numbers in bold show statistically significant differences between women and men.

*Adjusted for gender, age group, ethnicity, educational level and highest achieved level of parents' education.

†Core indicators as proposed by the ECDC.

‡Dual protection indicated both condom and non-condom contraception. Non-condom contraception encompassed hormonal contraception methods, intrauterine devices, and barrier methods.

ECDC, European Centre for Disease Prevention and Control; STI, sexually transmitted infection.

(15 years) to 0.2% for individuals aged 29 (data not shown). The mean age at sexual debut was 16 years, and the majority of respondents were heterosexual (93.3%, 95% CI 92.3 to 94.1).

Most respondents used a condom at sexual debut. Non-condom use was reported by approximately a third of the included individuals. Condom use was more common among men (37.7%, 95% CI 34.9 to 40.7) than women (30.1%, 95% CI 28.1 to 32.1). In addition, 14.3% (95% CI 12.9 to 15.9) of women and 15.1% (95% CI 13.0 to 17.3) of men used neither condom nor non-condom contraception at sexual debut.

During the last 12 months, 62.4% (95% CI 60.3 to 64.5) of women and 57.8% (95% CI 54.8 to 60.7) of men had only one sexual partner, but more than 30% of both genders reported multiple sexual partners (table 3).

At the last sexual encounter, half of both the responding women (51.8%, 95% CI 49.3 to 54.3) and the responding men (55.2%, 95% CI 51.6 to 58.7) used either condom alone or dual protection with a steady partner. A sexual encounter with a casual partner decreased the likelihood of using either

condom alone or dual protection for women (43.7%, 95% CI 39.1 to 48.4), but not for men (49.5%, 95% CI 43.2 to 56.0). In addition, a sexual encounter with a casual partner compared with a steady partner increased the likelihood of not using any contraception for both women (casual 14.8%, 95% CI 11.8 to 18.5 vs steady 8.4%, 95% CI 7.1 to 9.9) and men (casual 20.9%, 95% CI 16.2 to 26.6 vs steady 10.8%, 95% CI 8.1 to 12.4).

More women than men had been tested for STIs. The highest testing rate was found among respondents who had ever been tested for *C. trachomatis* infection (women 54.7%, 95% CI 52.5 to 56.9, men 32.7%, 95% CI 29.9 to 35.5) (table 4) and this was also the most common diagnosis (women 27.6%, 95% CI 25.0 to 30.3, men 31.3%, 95% CI 26.7 to 36.4).

Data on sexual behaviour showed only minor changes after weighting for non-response (tables 3 and 4). In addition, when sexual behaviour was examined by each of the key weighted variables (age, ethnicity and education), no significant differences were found between the strata (data not shown).

DISCUSSION

This study indicates that a third of the Danish youth had sex without a condom at their sexual debut. Half of the respondents did not use a condom at the last sexual encounter; a higher proportion was found among individuals who had sex with a casual partner compared with a steady partner. A sexual encounter with a casual partner increased the likelihood of not using any contraception for both women and men. The collected data on sexual behaviour showed only minor changes after weighting for sociodemographic non-response.

To our knowledge, no prior studies have examined sexual behaviour in the general Danish youth by systematically using the sexual behaviour core indicators recommended by the ECDC^{8,9} nor have these been studied in combination with sociodemographic differences between respondents and non-respondents.

The wording of the items was adjusted to a Danish context and subsequently tested for cognitive interpretation, floor/ceiling effects and test-retest reliability in a representative sample. Thus, we believe that the questionnaire was a reliable measurement tool.

All eligible study participants were recruited by mailed invitation letters containing a link to the web-based questionnaire. This procedure allowed us to invite all individuals with a postal address (>99%).¹² We could also have chosen to use web panels, but this would not have given us any knowledge of non-respondents and would have limited our possibilities for obtaining register data for analysis of non-response. Furthermore, 99% of all Danish households have access to a computer and the internet,²² and the choice of a web-based questionnaire is thus unlikely to have caused selection bias.

The register-based sociodemographic variables obtained from reliable Danish nationwide registries with detailed data at the individual level enabled identification of differences between respondents and non-respondents. In addition, these variables allowed us to use statistical weighting techniques to adjust for differential non-response.²³ However, due to the low response rate (in spite of adjustments), no sexual behaviour data exist for 80% of the sample.

The main limitation of this study is, therefore, the risk of non-response selection bias that may result from reported differences in sexual behaviour between respondents and non-respondents.²³ Still, an additional analysis of early and late respondents' sexual behaviour showed no significant differences (data not shown). Furthermore, systematic errors caused by recall and social desirability bias might have occurred.²³ To overcome social desirability bias and improve the validity of the data, we used an anonymous self-administered web-based questionnaire which has formerly been shown to minimise social desirability bias and increase respondents' willingness to participate and also report sensitive behaviour.²⁴ In total, we believe that potential differences in the reported behaviour and the possible information bias are in the direction of normal rather than extreme behaviour. Thus, the estimates of sexual risk behaviour are expected to be lower than in a totally unbiased sample.

Another limitation of this study is the high proportion of residents holding publicly recorded protection from participation in research surveys. In the years 2000–2006, such protection was routinely obtained in Denmark as it was granted simply by ticking a box when registering a new postal address. This procedure was changed in 2007 and subsequently by new Danish legislation in 2014. Young people generally tend to regularly change addresses during their education, and individuals holding research protection might consequently represent a

random sample of the general population. Nevertheless, we do not believe that this induces differential bias in our sample, but we have no data to confirm the statement, which is a weakness of our study.

Sexual behaviour in the general young population has been studied for years, but we have no knowledge of any European surveys using the core indicators recommended by the ECDC. Corresponding with our findings, a European review from 2008 found that the mean sexual debut age was between 15.7 and 18 years (lowest in Iceland, highest in Slovakia).²⁵ Similar to our findings, this review found condoms to be the most common contraception at sexual debut,²⁵ but did not identify the proportion of individuals using no contraception. In another Danish study, the rate of young people who did not protect themselves against STIs at sexual debut was lower (20%) than in our study.²⁶

With regard to the last sexual encounter, a cross-European study found that condoms were used among more than 65% of the sexually active adolescents²⁷ compared with the approximately 50% found in our study. In a recent Dutch study, inconsistent or no use of condoms was found in 86.1% of steady relationships and in 66.5% of casual relationships.²⁸ An Italian study found that inconsistent or no use of condoms occurred in 46.4% of steady relationships and in 9.5% of casual relationships.²⁹ As different investigative methods have been applied, we cannot carry out direct comparisons with our findings. Nevertheless, we find it interesting that our study revealed a higher proportion of individuals who did not use a condom with a casual partner (women 14.8%, men 20.9%) compared with a steady partner (women 8.4%, men 10.0%).

The number of *C. trachomatis* tests in our study is high, which corresponds to the fairly high testing rate in Denmark.³⁰

The findings of this paper call for new preventive strategies. A special focus should be directed towards the many young individuals who had condomless sex at their sexual debut and/or at the last sexual encounter. More attention should also be given to the high frequency of unprotected sex at the last sexual encounter with a casual partner, for example, by ensuring easy access to condoms at places where casual partnerships are known to be established and/or by condom promotion campaigns and sex education in primary and secondary schools.

Our results may serve as a baseline study of sexual behaviour among the Danish youth. The use of core indicators further enables comparisons of STI trends and applied preventive strategies at national and European levels in cross-sectional and longitudinal studies, which may be useful for understanding the current spread of STIs. However, future survey administration methods must be considered, including development of new strategies that may better reach the target population, for example, by sampling at schools, web panels or other sources to improve survey response rates.

Key messages

- ▶ The general young population is at high risk of getting a sexually transmitted infection (STI): approximately 30% at the sexual debut and 50% at the last sexual encounter.
- ▶ Individuals in casual partnerships are more likely to use no protection than individuals in steady partnerships.
- ▶ The high number of individuals at risk of getting an STI calls for efficient preventive strategies.

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Contributors All authors participated in the design of the study and the drafting the manuscript. MJJ coordinated the study, carried out the questionnaire survey, performed the statistical analyses and wrote the first draft of the manuscript. All authors have read and approved the final manuscript.

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