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A comparison of sexual behaviour and attitudes of healthy adolescents in a Danish high school in 1982, 1996, and 2001

Ida Kangas*¹, Berit Andersen^{1,2}, Christine A McGarrigle³ and Lars Østergaard¹

Address: ¹Research Unit Q, Department of Infectious Diseases, Skejby Sygehus, Aarhus University Hospital, Brendstrupgaardsvej 100, Skejby Sygehus, DK-8200 Aarhus N, Denmark, ²Research Unit and Department of General Practice, University of Aarhus, Vennelyst Boulevard 6, DK-8000 Aarhus C, Denmark and ³HIV/STI Division, Health Protection Agency, Communicable Disease Surveillance Centre, 61 Colindale Ave, London NW9 5EQ, United Kingdom

Email: Ida Kangas* - ida@kangas.dk; Berit Andersen - ba@alm.au.dk; Christine A McGarrigle - christine.mcgarrigle@hpa.org.uk; Lars Østergaard - oes@sk.sks.aaa.dk

* Corresponding author

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Abstract

Aim: To assess changes in sexual behaviour among students at a high school in Denmark from 1982 to 2001.

Methods: An anonymous self-administered questionnaire was used to compare data from three identical cross-sectional surveys performed in 1982, 1996, and 2001.

Results: Girls: More girls reported their first sexual intercourse before their 16th birthday in 2001 (42%) than in 1996 (29%) In 1982 it was also 42% (Chi-square for trend: $p = 0.003$). Fewer girls with no regular partner used condoms for their personal protection in 2001 (2%) than in 1996 (9%) and 1982 (0%) (Chi-square for trend $p = 0.016$). The proportion of girls with no regular partner who considered protection from sexually transmitted disease important for their choice of contraception was 39% in 2001 compared with 71% in 1996 and only 10% in 1982 (Chi-square for trend: $p < 0.0001$).

Boys: More boys reported sexual debut before their 16th birthday in 2001 (40%) than in 1996 (37%) and 1982 (24%) (Chi-square for trend: $p = 0.023$). For boys with no regular partner, condom was preferred for personal protection by 85% in 2001, 91% in 1996 and 61% in 1982 (Chi-square for trend $p = 0.007$). Protection against sexually transmitted infection declined, especially among boys with no regular partner, from 51% in 2001 to 72% in 1996 and 21% in 1982 (Chi-square for trend: $p < 0.0001$).

The tendency towards earlier sexual debut and less use of safe sex practices to protect against sexually transmitted infections (STI) was accompanied by a rise in the number of detected STIs during this period.

Conclusions: The period from 1982 to 1996 during which sexual attitudes were directed toward safer sex seems to have given way to a reverse trend in the period from 1996 to 2001. These findings may have significant implications for health care authorities organising preventive strategies for healthy adolescents.

Background

Ten to fifteen years ago the number of new reported sexually transmitted infections (STI) fell in several countries in Western Europe [1]. The reasons for this are not known, but it has been suggested that the increased awareness of HIV contributed to this decline. This suggestion is supported by the fact that several reports have indicated changes in sexual behaviour and attitudes both among populations at high risk for HIV, like men who have sex with men (MSM), and among the general population [2,3].

Through the recent years there have been seen a rise in STIs in Western [4] and Eastern Europe [5-7] that may stem, among others, from an increase in high-risk sexual attitudes and behaviour. This is supported by data obtained from men who have sex with men (MSM) [4,8] and from adult heterosexual populations [9,10]. Data on sexual behaviour and attitudes in young healthy populations and historical data allowing longitudinal studies of changes in these features are few. However, it is of utmost importance that the changes in sexual behaviour and attitudes are monitored closely, preferably at short time intervals, in order for public health professionals to duly cater for trends when planning preventive and prophylactic measures.

The purpose of the present paper is to report the changes in sexual behaviour among healthy adolescents in one Danish high school between three time points (1982, 1996, and 2001). Of particular interest is to determine if changes in attitude towards the use of condoms and safe sex practices is broadly consistent with the observed decline and subsequent increase in reported STIs, which was done by comparing data from three identical cross-sectional surveys on sexual behaviour and contraception conducted at the same Danish high school in 1982, 1996, and 2001.

Methods

Setting

The study was carried out at Grenaa Gymnasium, Grenaa, Denmark, which is a high school in an averaged sized Danish city (Grenaa) with very few emigrants and stable cultural and religious conditions. Danish high schools correspond to grade 10–12 of a secondary school, but Danish high school education is not mandatory. Girls generally outnumber boys in Danish high schools, whereas boys are more numerous in technical educations. More than 50% of young people will complete a 12-year education, which includes high school.

Design

For each of the survey years (1982, 1996, and 2001) a brief anonymous, standardised, self-administered ques-

tionnaire was distributed to all registered students at the school. It was handed out together with a pre-stamped and pre-addressed envelope. The students could fill in the questionnaire at their convenience and anonymously mail it to the study centre or put it in a sealed box at the high school. No identifying variables were collected. The students were verbally informed about the study at a morning gathering, and were reminded about it 14 days later at a second morning gathering.

The questionnaire included questions on basic demographics like age and sex as well as relationship status. Having a regular partner was defined as being in a relationship for more than one month. Questions on sexual behaviour including age at first intercourse, number of sexual partners, previously diagnosed STI, current contraceptive method(s) and reason(s) for choosing the contraceptive strategy. The students were asked specifically about their current contraceptive method and both boys and girls could state that condoms were their preferred method. Data on the number of detected *C. trachomatis* and *N. gonorrhoea* infections (Fig. 1) during 1994–2000 was obtained from the National Danish Surveillance system.

Analyses

Age and sex-specific response rates were calculated using school registration details. The age and sex distribution of participants and non-participants were compared for the three survey years. Coding of data from 1982 and 1996 surveys has been described earlier [2] and the same procedure was used for data from 2001. Non-responders were excluded from calculation of overall percentages and the total number of participants was used as the denominator to calculate proportions, except for cumulative number of partners where only the number of sexually experienced participants were included.

All analyses were performed using SPSS 10.0. Chi-square test was used for comparing point estimates in 2×2 tables. If the exact number in one cell was <5 , Fisher's exact test was used. The χ^2 test for trend was used to assess the difference between the three time points. Binary logistic regression was used to analyse the relationship between condom use and duration of relationship. For relevant proportions, 95% confidence intervals were calculated.

Approval of ethics

The study was approved by the Research Ethics Committee in Aarhus County.

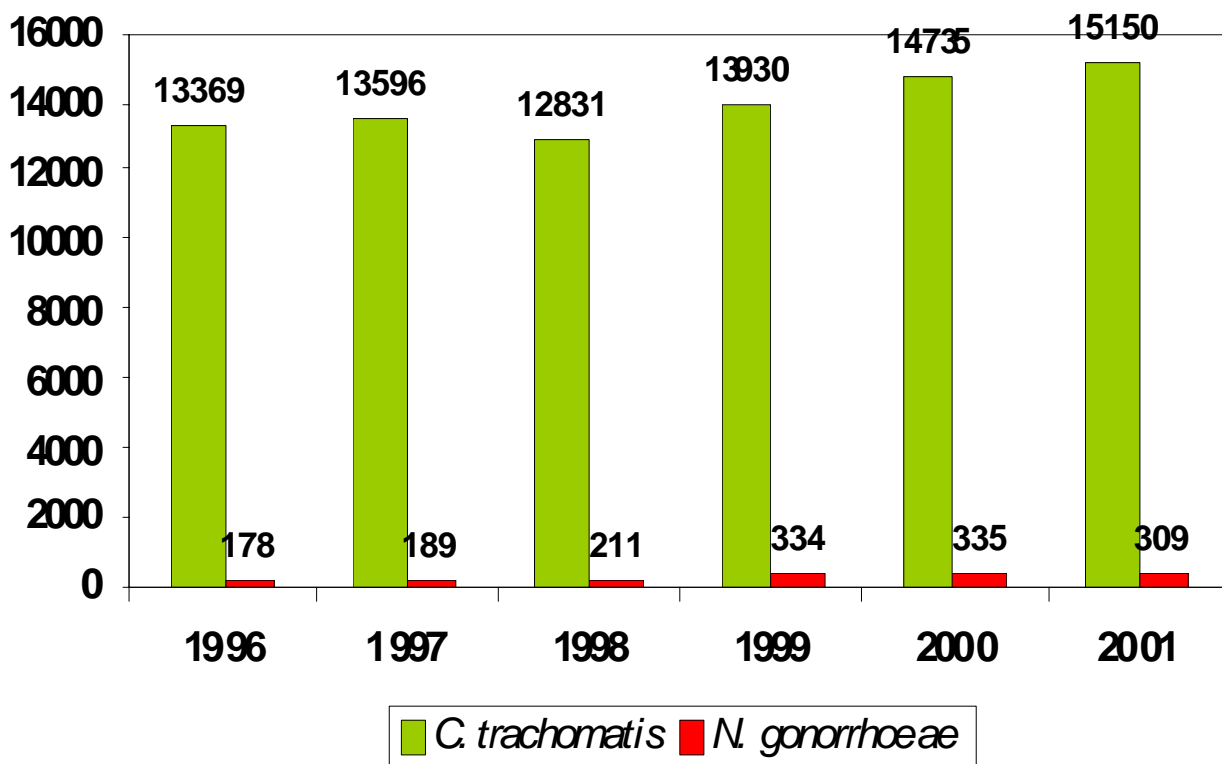


Figure 1
Number of detected infections caused by *Chlamydia trachomatis* and *Neisseria gonorrhoea* in Denmark from 1996 to 2001. Data are based on mandatory surveillance system covering infections in the whole country which has a total population of approximately 5 million people.

Results

Participation rates

The survey included 270 (66%) of the 409 students registered at the high school in 2001. The participation rate was 54% among boys (77 of 143 male students) and 73% among girls (193 of 266 female students). Among the 270 participants, 221 (82%) were under the age of 18 and all were older than 16 years. The participation rates did not differ significantly between the years 1982, 1996 and 2001, nor was there any statistically significant difference in the median age of the participants between the three survey years. (Table 1).

Sexual experience

Boys

In 2001, 40% (31 of 77) of the participating boys reported having had their sexual debut before their 16th birthday. This was slightly higher than the 37% (35 out of 94) found in 1996 and higher (24%) than in 1982 (p = 0.02) (Table 2). In 2001, 74% (55 of 77) of the boys were sexually experienced and this was not significantly different from 1996 at which time 67% (63 of 94) of the boys reported being sexually experienced (p = 0.7).

Girls

In 2001, 42% (81 of 193) of the participating girls reported having had their sexual debut before their 16th birthday. This was significantly more than the proportion found in 1996 (29%) but at the same level as in 1982

Table 1: Demographic data for the three survey years.

	No. students	No. participants	Participation rate	Mean age	Median age
Girls					
1982	398	279	70%	17.7	17
1996	330	247	79%	18.0	18
2001	266	193	73%	17.6	17
Boys					
1982	228	118	52%	18.0	18
1996	169	94	56%	18.1	18
2001	143	77	54%	17.4	17

Table 2: Age at first sexual intercourse by sex and survey year.

	Age at first sexual intercourse	1982		1996		2001		Trend*
		N (%)	95% CI	N (%)	95% CI	N (%)	95% CI	
Boys:	11	0 (0)		0 (0)		1 (1)	(0-3)	$\chi^2 = 7.5$ p = 0.023
	12	0 (0)		0 (0)		0 (0)		
	13	3 (3)	(0-6)	4 (4)	(0-8)	4 (5)	(0-8)	
	14	8 (7)	(3-13)	6 (6)	(2-10)	11 (14)	(6-16)	
	15	17 (14)	(12-22)	25 (27)	(20-30)	15 (20)	(10-20)	
	All ages < 16	28 (24)		35 (37)		31 (40)		
Girls:	12	0 (0)		1 (1)	(0-3)	2 (1)	(0-5)	$\chi^2 = 11.8$ p = 0.003
	13	15 (5)	(8-22)	8 (3)	(3-13)	8 (4)	(3-13)	
	14	35 (13)	(25-45)	20 (8)	(13-27)	23 (12)	(15-31)	
	15	66 (24)	(56-76)	42 (17)	(34-50)	48 (25)	(39-57)	
	All ages < 16	116 (42)		71 (29)		81 (42)		

* χ^2 tested for trend

(42%) (p = 0.003) (Table 2). Among the 193 female participants in 2001, 143 (74%) were sexually experienced. There was no change in the proportion of girls who were sexually experienced in 2001 compared with 1996, at which time 72% (179 out of 247) of the girls reported being sexually experienced (p = 0.8).

Regular partnerships and sexual activity

Boys

In 2001, 29 of the 55 (53%) sexually experienced boys had a regular partner with a mean and median length of the relationship of 7.7 and 7 months, respectively. This was not significantly different from 1996 when 31 of 63 (49%) boys reported having a regular partner (p = 0.8). The number of lifetime partners did not change between 1996 and 2001 (p = 0.9). The median number of partners was 3-5, with just over a quarter having only one lifetime partner.

Girls

Among the 143 sexually experienced girls in 2001, 90 (63%) had a regular partner with a mean and median length of the relationship of 11.4 and 9 months, respectively. The number of sexually experienced girls was not significantly different from the number recorded in 1996 when 101 of the 179 (56%) sexually experienced girls reported having a regular partner (p = 0.7). The number of lifetime partners did not change between 1996 and 2001 (p = 0.7) and the distribution in the number of partners was similar to the number for boys.

Primary contraceptive methods chosen by the adolescents

Table 3 shows the preferred contraceptive method in the three survey years.

Table 3: Preferred contraceptive method in the three survey years, by sex and whether have a regular partner.

Contraceptive method	1982		1996		2001		Trend*
	N (%)	95% CI	N (%)	95% CI	N (%)	95% CI	
Regular partner							
Boys:							
Condom	12 (40)	(7–17)	19 (61)	(14–24)	14 (48)	(9–19)	
No current personal use	18 (60)	(13–23)	12 (39)	(7–17)	15 (52)	(10–20)	
Sexually experienced boys (total)	30 (100)		31 (100)		29 (100)		p = 0.245
Girls:							
Oral contraception	66 (53)	(55–77)	70 (69)	(61–79)	65 (72)	(57–73)	p = 0.005
Condom and oral contraception	0 (0)	(0–3)	5 (5)	(1–11)	9 (10)	(3–15)	p = 0.009
Condom	1 (1)		1 (1)		0 (0)		
Intrauterine device	12 (10)	(6–18)	0 (0)		0 (0)		p = 0.0001
Other	5 (4)	(1–9)	1 (1)	(0–3)	3 (3)	(0–6)	p = 0.374
No current personal use	41 (33)	(31–51)	24 (24)	(16–32)	13 (15)	(6–20)	p = 0.008
Sexually experienced girls (total)	125 (100)		101 (100)		90 (100)		
No regular partner							
Boys:							
Condom	23 (61)	(17–29)	29 (91)	(26–32)	22 (85)	(18–26)	
No current personal use	15 (39)	(9–21)	3 (9)	(0–6)	4 (15)	(0–8)	
Sexually experienced boys (total)	38 (100)		32 (100)		26 (100)		p = 0.007
Girls:							
Oral contraception	30 (48)	(22–38)	27 (35)	(19–35)	33 (63)	(26–40)	p = 0.005
Condom and oral contraception	0 (0)	(0–3)	5 (6)	(1–9)	0 (0)	(0–3)	p = 0.016
Condom	0 (0)		2 (3)		1 (2)		
Intrauterine device	1 (2)	(0–3)	0 (0)		0 (0)		p = 0.594
Other	6 (10)	(1–11)	1 (1)	(0–3)	1 (2)	(0–3)	p = 0.004
No current personal use	25 (40)	(17–33)	43 (55)	(34–52)	17 (33)	(10–24)	p = 0.031
Sexually experienced girls (total)	62 (100)		78 (100)		52 (100)		

* χ^2 tested for trend

Table 4: Impact of wish for protection against sexually transmitted infections on choice of contraceptive method in the three survey years, by sex and whether have a regular partner.

Protection from STIs	1982		1996		2001		Trend*
	N (%)	95% CI	N (%)	95% CI	N (%)	95% CI	
Regular partner							
Boys:							
Impact on the chosen strategy	2 (7)	(0–5)	10 (32)	(5–15)	8 (27)	(3–13)	
No impact on the chosen strategy	28 (93)	(25–30)	21 (68)	(16–26)	22 (73)	(17–27)	
<hr/>							
Sexually experienced boys (total)	30 (100)		31 (100)		30 (100)		$\chi^2 = 6.40$ p = 0.041
Girls:							
Impact on the chosen strategy	5 (4)	(1–9)	27 (27)	(18–36)	20 (21)	(12–28)	
No impact on the chosen strategy	120 (96)	(116–124)	74 (73)	(65–83)	76 (79)	(68–84)	
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Sexually experienced girls (total)	125 (100)		101 (100)		96 (100)		$\chi^2 = 23.53$ p < 0.0001
No regular partner							
Boys:							
Impact on the chosen strategy	8 (21)	(3–13)	23 (72)	(18–28)	23 (51)	(16–30)	
No impact on the chosen strategy	30 (79)	(25–35)	9 (28)	(4–14)	22 (49)	(15–29)	
<hr/>							
Sexually experienced boys (total)	38 (100)		32 (100)		45 (100)		$\chi^2 = 18.53$ p < 0.0001
Girls:							
Impact on the chosen strategy	6 (10)	(1–11)	55 (71)	(47–63)	37 (39)	(28–46)	
No impact on the chosen strategy	56 (90)	(51–61)	23 (29)	(15–31)	59 (61)	(50–68)	
<hr/>							
Sexually experienced girls (total)	62 (100)		78 (100)		96 (100)		$\chi^2 = 53.24$ p < 0.0001

* χ^2 tested for trend

Boys

Reported condom use was lower in 2001 (85%) than in 1996 (91%) ($p = 0.567$) among boys with no regular partner and among boys in regular partnerships (48% in 2001 vs. 61% in 1996, $p = 0.689$). The proportion of boys with a regular partner who reported condom use in 2001 was almost identical to the proportion in 1982 (40%). For sexually experienced boys in 2001 with no regular partner, 51% (23 out of 45) reported that protection from STDs was important for their choice of contraception. In 1996 this proportion was 72% (23 out of 32) and in 1982 it was as low as 21% ($p < 0.0001$) (Table 4).

Girls

Among girls who were not in a regular relationship, the proportion using only oral contraception had risen significantly from 35% (27 out of 78) in 1996 to 63% (33 out of 52) in 2001 ($p = 0.002$). In 2001, 2% (1 out of 52) of the girls who were not in a regular relationship reported condom use as their primary choice of contraception during intercourse. This was lower than the 9% (7 out of 78) reported in 1996 ($p = 0.144$). For sexually experienced girls in 2001 with no regular partner, 39% (37 out of 96) reported protection from STIs as being important for their choice of contraception. This was lower than in 1996, where 71% (55 out of 78) reported that protection from STIs was important ($p < 0.0001$) (Table 4).

Boys and girls

In a logistic regression analysis among boys and girls we found that condom users were more likely to be in short relationships compared to non condom users (log likelihood OR 0.88, 95% CI 0.82–0.95). There was no significant difference in condom use between those who reported one lifetime partner and those who reported more than one lifetime partner (data not shown).

Discussion

The use of identical questionnaires and a fixed setting (a high school) in a stable population allowed us to study the sexual attitudes and behaviour at three different time points. The three time points spanned a period that both saw a fall (1982 to 1996) and a rise (1996 to 2001) [7] in the reported incidence of STIs (Fig 1). We found that after a period of increased safe sex practice, sexual behaviour among adolescents in the general population appears to be returning to levels seen in the early 1980s.

Previously published studies [4,11] have reported an increased incidence of STIs in the Nordic countries during the late 1990s. Hence, the period 1996–2000 saw a three-fold rise in the incidence of gonorrhoea and an increase in genital Chlamydia since 1994 have also been reported in most Nordic countries [12]. Denmark has also experienced a rise in the number of detected *C. trachomatis* and

N. gonorrhoea infections in recent years (Fig. 1), but the explanation for this remains unknown.

The rise in Chlamydia incidence does not seem to be due to the introduction of new, more sensitive diagnostic methods [13]. Nor is there any evidence that the infectiousness of the Chlamydia organism has changed. Multi-drug resistant Chlamydia organisms have been described [14], and untreated infections may prolong the period of infectiousness. However, up until now, there are no data on the frequency and distribution of resistant strains of Chlamydia in Scandinavia. It has also been hypothesized that the rise in the reported incidence of STIs reflects changes in sexual behaviour and attitudes. Our data support the existence of an ecological association as a minimum, as fewer high school students were using condoms in 2001 than in 1996. Their choice of contraception was also less influenced by the fear of contracting an STI than by the fear of becoming pregnant. This was further supported by the observed increase in oral contraception use among girls. This has been confirmed by studies of adolescents in Norway and Britain which found that condoms were seen as contraception and not as a method for preventing STIs, and protection against pregnancy was the overriding concern [15,16].

We may only speculate about the reasons for this change. It is known that condoms are not well-accepted by teenagers [17]. Use of condoms is associated with a feeling of embarrassment and a fear that the partner will dislike the method [18]. Behavioural surveillance of adolescents in Hungary found that non-use of condoms was associated with the partner's refusal to use the condoms rather than with individual responder's own refusal [19]. But it is not likely that this explains the changes we found over the two time periods. The discovery in 1983 of AIDS as a sexually transmitted disease boosted public awareness of safe sex practices and the role of condoms. The introduction in 1996 of highly active antiretroviral treatment for HIV caused a substantial decline in morbidity and mortality from HIV, and in our study more than 95% of the participants were aware of the existence of such effective HIV treatment. The impact of the advent of AIDS and the development of treatment opportunities for HIV may therefore play a role in the changes in the observed attitudes over the two time periods. Health care authorities organising preventive strategies among adolescents need to devise innovative strategies aimed at encouraging condom use and safe sex practices.

Our study has a number of limitations. The results obtained among the adolescents at a high school may not be representative of other demographic groups in the community. However, as more than 50% of the population attends high schools in Denmark, they will be partly

representative of the majority of this population. Although the participation rate was at an acceptable level, non-participants may have been more or less sexually active and may have used contraception for other reasons than the rest of the group, which could bias the results. Finally, as with all self-reported sexual behaviour, the validity and reliability of these behaviours could be subject to a number of biases, both in recall and interpretation and a social-desirability response bias may also exist. However, as the questionnaires were anonymous and completed in privacy, we expect these effects to be minimal.

Competing interests

None declared.

Authors' contributions

IK designed the study, collected the data, did the analyses and drafted the manuscript. BA contributed to study design, data analysis and editing of the paper. CAMcG contributed to study design, performed statistical analyses and edited the paper. LØ contributed to study design, the data analyses, and edited the paper.

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References

- van Duynhoven YT: **The epidemiology of Neisseria gonorrhoeae in Europe.** *Microbes Infect* 1999, **1**:455-464.
- Ostergaard L: **Sexual behaviour of adolescents before and after the advent of AIDS.** *Genitourin Med* 1997, **73**:448-452.
- Nicoll A, Hughes G, Donnelly M, Livingstone S, De Angelis D, Fenton K, Evans B, Gill ON, Catchpole M: **Assessing the impact of national anti-HIV sexual health campaigns: trends in the transmission of HIV and other sexually transmitted infections in England.** *Sex Transm Infect* 2001, **77**:242-247.
- Berglund T, Fredlund H, Giesecke J: **Epidemiology of the reemergence of gonorrhoea in Sweden.** *Sex Transm Dis* 2001, **28**:111-114.
- Chodyncka B, Serwin AB, Janczylo-Jankowska M, Waugh MA: **Epidemiology of syphilis and gonorrhoea in eastern Poland in the years 1988-1997.** *Int J STD AIDS* 1999, **10**:680-684.
- Hegyí V, Danilla T, Hegyí E: **Actual trends of the incidence of syphilis and gonorrhoea in the Slovak Republic in the years 1990-6.** *Sex Transm Infect* 1998, **74**:376-377.
- Nicoll A, Hamers FF: **Are trends in HIV, gonorrhoea, and syphilis worsening in western Europe?** *BMJ* 2002, **324**:1324-1327.
- Dupin N, Jdid R, N'Guyen YT, Gorin I, Franck N, Escande JP: **Syphilis and gonorrhoea in Paris: the return.** *AIDS* 2001, **15**:814-815.
- Johnson AM, Mercer CH, Erens B, Copas AJ, McManus S, Wellings K, Fenton KA, Korovessis C, Macdowall W, Nanchahal K, Purdon S, Field J: **Sexual behaviour in Britain: partnerships, practices, and HIV risk behaviours.** *Lancet* 2001, **358**:1835-1842.
- Wellings K, Nanchahal K, Macdowall W, McManus S, Erens B, Mercer CH, Johnson AM, Copas AJ, Korovessis C, Fenton KA, Field J: **Sexual behaviour in Britain: early heterosexual experience.** *Lancet* 2001, **358**:1843-1850.
- Institut Statens Serum: **Klamydia 2001.** *EPI-NYT* 2003, **uge 51, 2002**.
- Moi H: **Care of sexually transmitted infections in the Nordic countries.** *Int J STD AIDS* 2001, **12**:819-823.
- Gotz H, Lindback J, Ripa T, Arneborn M, Ramsted K, Ekdahl K: **Is the increase in notifications of Chlamydia trachomatis infections in Sweden the result of changes in prevalence, sampling frequency or diagnostic methods?** *Scand J Infect Dis* 2002, **34**:28-34.
- Somani J, Bhullar VB, Workowski KA, Farshy CE, Black CM: **Multiple drug-resistant Chlamydia trachomatis associated with clinical treatment failure.** *J Infect Dis* 2000, **181**:1421-1427.
- Garside R, Ayres R, Owen M, Pearson VA, Roizen J: **"They never tell you about the consequences": young people's awareness of sexually transmitted infections.** *Int J STD AIDS* 2001, **12**:582-588.
- Traeen B, Lewin B, Sundet JM: **Use of birth control pills and condoms among 17-19-year-old adolescents in Norway: contraceptive versus protective behaviour?** *AIDS Care* 1992, **4**:371-380.
- Persson E: **The sexual behaviour of young people.** *Br J Obstet Gynaecol* 1993, **100**:1074-1076.
- Ellen JM, Cahn S, Eyre SL, Boyer CB: **Types of adolescent sexual relationships and associated perceptions about condom use.** *J Adolesc Health* 1996, **18**:417-421.
- Gyarmathy VA, Thomas RP, Mikl J, McNutt LA, Morse DL, DeHovitz J, Ujhelyi E, Szamado S: **Sexual activity and condom use among Eastern European adolescents--the Study of Hungarian Adolescent Risk Behaviours.** *Int J STD AIDS* 2002, **13**:399-405.

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