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Beliefs about the risk factors for cervical cancer in a British population sample

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Abstract

Background. The introduction of human papillomavirus (HPV) testing into cervical screening has the potential to alter public perceptions of cervical cancer by making explicit the role of a sexually transmitted virus in its etiology. HPV knowledge has been found to be poor, although there is evidence of public awareness of a link between sexual activity and cervical cancer risk. We explored beliefs about the risk factors for cervical cancer in a large population sample.

Methods. Face-to-face interviews were carried out with a representative sample of the British population. All participants were asked what they thought increased a women's chances of developing cervical cancer.

Results. The response rate was 71% (n = 1940). The most common single response was 'don't know' (38%). Forty-one percent of respondents mentioned factors relating to sex, but only 14% were aware of a link with sexual transmission and fewer than 1% named HPV. Women and more educated people had better knowledge of the established risk factors. The patterning of risk factor awareness by age varied across risk factors.

Conclusions. Awareness of the role of a sexually transmitted virus in the etiology of cervical cancer is very low in Britain. Provision of information associated with the introduction of HPV testing could change public perceptions of cervical cancer.

Keywords: Cervical cancer; Causal beliefs; Public understanding; HPV; Papillomavirus; Cervical screening

Introduction

High-risk types of human papillomavirus (HPV) are now accepted as a necessary though not sufficient etiological agent in the vast majority of cervical cancers [1]. For more than a century, the medical profession has known of a link between cervical cancer and sexual activity; Rigoni-Stern published his observations of the low incidence of cervical cancer in nuns as long ago as 1842. But only with the development of tests for HPV has the mechanism for the link been clearly established. HPV is widely acknowledged to be transmitted through sexual contact, which explains the epidemiological association between cervical cancer incidence and number of sexual partners. A range of co-factors is involved in the development of squamous intraepithelial lesions (SIL) and cancer, and current candidates include smoking, immunological factors, the contraceptive pill, having a high number of pregnancies, and other sexually transmitted infections (STIs) like chlamydia [2].

Testing for high-risk HPV has been recommended in the US for the management of women with borderline and mildly abnormal smear results (Atypical Squamous Cells of Undetermined Significance—ASC-US). Trials of HPV testing at triage are underway in the UK [3]. Using HPV testing as an adjunct to cytology in the primary screening of women over the age of 30 has been approved by the Food and Drug Administration (FDA) and has been advocated by some authors in the UK [4,5].

Despite the long-established link between sexual activity and cervical cancer, the domains of cervical screening and sexual health have tended to remain quite separate, and the role of a sexually transmitted virus in causing cervical cancer has not been emphasized in public health messages. Authors in New Zealand have investigated the discourses

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surrounding cervical screening policy in that country, and have found evidence for deliberate suppression of information about the link between sexual activity and cervical cancer. Fears of stigmatizing cervical cancer and of deterring women from attending screening seem to have been the motivation for the lack of information about sexual risk factors in the patient literature on cervical screening [6–8]. In the UK, the current National Health Service (NHS) screening leaflet mentions behavioral risk factors (having sex at an early age; many sexual partners; not using condoms) but the involvement of a sexually transmitted virus is not made clear [9]. The previous NHS leaflet made no reference to any specific risk factors and merely stated that 'cervical cancer is much less common in women who have never had sex' [10].

The introduction of HPV testing into cervical screening and the management of cervical abnormalities has the potential to make this link explicit, and to change public perceptions of cervical cancer substantially, especially if awareness of HPV and the sexual behavioral risk factors for cervical cancer is currently low. A few studies have explicitly investigated HPV knowledge (see Ref. [11] for a full review). Three UK studies, one of female university employees, one of women attending a well-woman clinic, and one of female students, found that around 30% of women reported having heard of HPV [12–14]. Only about 10% of the employees and clinic attendees were aware of the link between HPV and cervical cancer, but 50% of the students endorsed HPV as a cause of cervical cancer. Given that only 30% had heard of the virus, the validity of this finding is questionable.

Low levels of HPV knowledge have been reported in several US studies of students and adolescents [15–19], and among adult women from low socioeconomic backgrounds [20]. Knowledge has predictably been found to be higher among those with an HPV diagnosis [21]. In one student sample, 72% had heard of HPV, and 44% knew about its link with cervical cancer [22], but the response rate was extremely low, so generalizability is limited. Most of these studies focused on HPV and genital warts, therefore providing limited insights into public awareness of the link between HPV and cervical cancer. In addition, none of the studies used representative population samples and very few included men.

While relatively few studies have assessed knowledge of the role of HPV, a greater number have investigated knowledge of cervical cancer risk factors more generally. A British population survey asked people to choose risk factors for cervical cancer from a list containing both correct and incorrect responses [23]. In the sample, 51% of men and 67% of women endorsed 'many sexual partners', 21% of men and 28% of women endorsed 'smoking', and 26% of men and 31% of women endorsed 'viruses or infection' as causes of cervical cancer. HPV per se was not one of the response options. In Australian women aged 50 to 75 years, 32% recognized having many partners as a risk factor, 6% recognized smoking, and 5% recognized both of these [24]. In a large American survey, 35% of women recognized having many sexual partners as a risk factor and 13% recognized smoking [25].

Overall, survey data from developed countries indicate that between a third and a half of women in these countries (or possibly more in the UK) recognize a link between sexual behavior and cervical cancer. Other investigations have used open-ended questions and qualitative methods to gain an understanding of women's beliefs about cervical cancer and its risk factors without imposing the constraints of fixed response options. UK studies of women from ethnic minority groups and working class backgrounds found that women associated cervical cancer with promiscuity [26–28]. Sexual activity was clearly regarded as a risk factor, and attending for screening was thought to convey messages about being sexually active. In the US, women from various ethnic backgrounds were found to know about a link between sexual activity and cervical cancer [29]. For women from Anglo-American backgrounds, this was associated with STIs, but for women from Latino backgrounds, risky sexual behavior had moral implications, with cancer sometimes seen as a 'punishment from God'. Although this may point to a relatively high awareness of the link between cervical cancer and sex, it should be noted that women with abnormal smear results tend not to accept this explanation in their own case [30].

These studies indicate that although people may be aware of a link between cervical cancer and sexual activity, few know about the role of a sexually transmitted infection. Few of these studies have included men in their samples, which is consistent with a tendency to place the burden of responsibility for sexual health on women [31].

To understand the potential impact of the introduction of HPV testing on public perceptions of cervical cancer, we sought to quantify beliefs about the risk factors for cervical cancer, particularly those related to HPV and sexual activity, in a more detailed way than has previously been done in a population sample. We also examined associations between demographic characteristics and knowledge. Given the sexually transmitted nature of cervical cancer, men and women play an equal role in its etiology so it is important to establish men's knowledge as well as women's. It is plausible that knowledge might vary with age, particularly as discourses surrounding risk factors may have changed over time leading to cohort effects. Finally, social class differences in health-related knowledge are well established in other domains [32,33], and we wanted to see whether they applied in this case. To gauge the extent to which the general population currently perceives a link between STIs, sexual activity, and cervical cancer, we conducted a large, representative population survey. Though eliciting beliefs about the causes and risk factors for cervical cancer, we can gain some insight into the current state of public

knowledge into which information about HPV must be incorporated.

Methods

Data were collected as part of the Office for National Statistics monthly Omnibus survey in June 2002. Three thousand addresses were selected from the Postcode Address File of all private households in Great Britain. The sample was stratified by region and socioeconomic markers. Attempts were made to contact all households. In households with more than one adult, a random selection procedure was used to select one person aged 16 or over for interview. Computer assisted face-to-face interviews were conducted by trained interviewers in the respondents' homes.

Respondents were asked: 'What do you think are the things that cause a woman to develop cervical cancer or increase her chances of developing it?' The prompt 'What else?' was used to maximize the number of beliefs elicited. Responses were coded by the interviewer using a coding frame developed from known risk factors for cervical cancer as well other factors anticipated to be thought to increase risk. Any response, which could not be coded was recorded verbatim and coded by the researchers when all the interviews were complete.

Results

Of the 3,000 addresses selected, 266 (9%) were ineligible, leaving 2,734 eligible households. Of these, 596 (22%) refused to take part and 198 (7%) could not be contacted after three visits. The response rate was therefore 71% of eligible households (n = 1940). Three people refused to answer the question on cervical cancer risk factors and are excluded from all analyses, leaving a sample size of 1937. Demographic characteristics of the sample are shown in Table 1 and are broadly representative of the British population.

Table 1
Demographic characteristics of the sample (n =1937)

	n	%
Gender		
Men	846	43.7
Women	1091	56.3
Age		
16–24	162	8.4
25–34	342	17.7
35–44	381	19.7
45–54	289	14.9
55–64	276	14.2
65–74	254	13.1
75 and over	233	12.0
Ethnic group		
White	1792	92.8
Mixed	17	0.9
Asian	75	3.9
Black	36	1.9
Other	12	0.6
Marital status		
Married/cohabiting	1043	53.8
Single	420	21.7
Separated/divorced/widowed	474	24.5
Age of leaving full-time education		
15 and under	623	32.2
16	543	28.0
17–18	310	16.0
19 and over	437	22.6
Still in education and under 19	23	1.2
Occupation		
Managerial and professional	646	33.4
Intermediate	258	13.3
Small employers/own a/c workers	123	6.4
Lower supervisory and technical	191	9.9
Semi routine and routine	605	31.2
Not classified	114	5.9

Table 2 shows the responses, grouped into categories, for men and women. The most common single response was 'don't know' (38.1%), followed by 'having many sexual partners' (25.2%). When all risk factors relating to sexual activity or sexually transmitted infections were grouped together, 41.4% of people were found to have mentioned at least one of them. Human papillomavirus (HPV) was only mentioned explicitly by 0.6% of respondents and only 8.5% linked cervical cancer with a named or unnamed sexually transmitted infection. This rose to 13.5% when those who cited 'not using condoms' as a risk factor were included. About 2.5% mentioned a virus or infection but did not specify that it was sexually transmitted.

Another widely accepted risk factor is smoking, which was mentioned by only 14.1% of respondents. More people believed family history or genetics to play a role (17.6%). The contraceptive pill has been linked to an increased risk of cervical cancer by some studies, but this was only known by 5.6% of the sample. Not attending for regular screening was cited as a risk factor by 11.9%, and older age by only 2.1%. Having many children, which has been associated with an increased risk, was mentioned by 1.4%.

Many other factors were mentioned, including dietary factors (3.5%), fate, chance, or bad luck (3.0%), poor genital hygiene (2.6%), and stress (1.2%). Other risk factors were cited by less than 1% of the sample.

Gender differences

Chi-squared tests revealed some differences between men and women's risk factor beliefs (see Table 2). Men were significantly more likely than women to be unaware of any risk factors at all (45.9% of men compared with

Table 2
Risk factors cited by women, men, and the whole sample, with chi-squared tests for gender differences

Risk factor	All (n = 1937); % (n)	Women (n = 1091); % (n)	Men (n = 846); % (n)	χ^2 for gender difference (p); df = 1
Don't know	38.1 (738)	32.1 (350)	45.9 (388)	38.38 (<0.0001)
Any link with sex, STIs or condom use	41.4 (801)	46.3 (505)	35.0 (296)	25.09 (<0.0001)
Sexual activity (specified or unspecified)	35.9 (696)	41.4 (452)	28.8 (244)	32.80 (<0.0001)
Many sexual partners	25.2 (489)	29.7 (324)	19.5 (165)	26.24 (<0.0001)
Early age of first sexual activity	10.5 (204)	12.8 (140)	7.6 (64)	14.03 (<0.0001)
Frequent sexual activity	4.1 (79)	4.7 (51)	3.3 (28)	n.s.
Sexual activity (unspecified)	5.7 (110)	5.7 (62)	5.7 (48)	n.s.
Family history/ heredity/genetics	17.6 (340)	19.9 (217)	14.5 (123)	9.43 (0.002)
Family history of cervical cancer	13.7 (266)	15.5 (169)	11.5 (97)	6.52 (0.01)
Family history of cancer	5.8 (112)	6.2 (68)	5.2 (44)	n.s.
Genetics/heredity	0.6 (11)	0.7 (8)	0.4 (3)	n.s.
Smoking	14.1 (274)	15.3 (167)	12.6 (107)	n.s.
STI or not using condoms	13.5 (262)	14.7 (160)	12.1 (102)	n.s.
Not using condoms	6.3 (122)	7.1 (77)	5.3 (45)	n.s.
Any STI (named or unnamed)	8.5 (165)	9.0 (98)	7.9 (67)	n.s.
STD/STI (unnamed)	5.7 (111)	5.9 (64)	5.6 (47)	n.s.
Named STI (warts, Chl, HSV, HPV, HIV)	4.5 (88)	4.6 (50)	4.5 (38)	n.s.
Genital warts/wart virus	2.4 (47)	2.7 (29)	2.1 (18)	n.s.
Herpes virus	1.2 (23)	0.9 (10)	1.5 (13)	n.s.
Chlamydia	1.3 (25)	1.5 (16)	1.1 (9)	n.s.
HIV/Aids	0.9 (17)	0.7 (8)	1.1 (9)	n.s.
HPV	0.6 (11)	0.9 (10)	0.2 (2)	n.s.
Not attending regular screening	11.9 (230)	15.4 (168)	7.3 (62)	29.66 (<0.0001)
Contraceptive pill	5.6 (109)	7.1 (77)	3.8 (32)	9.63 (0.002)
Dietary factors	3.5 (67)	2.9 (32)	4.1 (35)	n.s.
Misc. dietary factors	1.3 (25)	1.0 (11)	1.7 (14)	n.s.
High fat diet	1.4 (27)	1.1 (12)	1.8 (15)	n.s.
Low fruit/ vegetable diet	1.1 (21)	1.1 (12)	1.1 (9)	n.s.
Low fiber diet	0.6 (11)	0.5 (5)	0.7 (6)	n.s.
Miscellaneous risk factors endorsed by >1%				
Fate/chance/bad luck	3.0 (59)	4.3 (47)	1.4 (12)	13.47 (<0.0001)
A virus/disease/ infection	2.6 (51)	2.1 (23)	3.3 (28)	n.s.
Older age	2.1 (41)	2.1 (23)	2.1 (18)	n.s.
Poor hygiene	2.0 (39)	1.5 (16)	2.7 (23)	n.s.
Stress	1.2 (24)	0.9 (10)	1.7 (14)	n.s.
Misc. risk factors (each endorsed by <1%)[a]	8.3 (161)	9.3 (102)	7.0 (59)	n.s.

[a] Risk factors included are: nothing, immunosuppression, young age, obesity/overweight, tampons, alcohol, childbirth, male hygiene/circumcision, exercise/general health, using contraception, radiation, toxins, carcinogens, talcum powder.

32.1% of women). Women were more aware of the sexual behavioral risk factors: sexual activity (41.4% of women compared with 28.8% of men), sexual activity or STIs (46.3% of women; 35.0% of men), having many partners (29.7% of women; 19.5% of men), and having sex at a young age (12.8% of women; 7.6% of men). Women were also more likely to mention family history of cervical cancer (15.5% of women; 11.5% of men), as well as taking the pill (7.1% of women; 3.8% of men) and not attending regular screening (15.4% of women; 7.3% of men). There were no gender differences in knowledge about sexually transmitted infections, condom use, or smoking.

Age differences

Risk factors for which there was a significant difference by age are shown in Table 3. Awareness of most of the risk factors was lowest in the 16–24 and the 75 and over age groups, with the oldest group most likely to respond that they did not know of any risk factors (56.2% compared with around 30% in the 25–64 age groups). However, the pattern of knowledge across age groups differed considerably between risk factors. Those in the 55–64 age group were most likely to know that sexual activity and having many sexual partners were risk factors (48.2% mentioned sexual activity, compared with only 16% of the youngest age group; 35.1% mentioned many sexual partners, compared with 8% of the youngest group). They were also most likely to mention any kind of sexual activity, or STI, or not using condoms (52.2%, compared with 24.1% of the youngest group). The risk associated with becoming sexually active at a young age was best known by the 45–54 group (15.2%, compared with around 5% of the oldest and youngest groups). This group also had the highest endorsement of dietary factors (5.9%, compared with only 1.1% in the 55- to 64-year-old group).

Those in the 35–44 age group were most aware of the link between STIs and cervical cancer. About 6.8% mentioned a named STI compared with 2–3% in most other groups. About 11.3% mentioned any STI (compared with 4–5% in the youngest and oldest groups) and

Table 3
Risk factors cited by each age group, with chi-squared tests for differences between age groups

Risk factor	Age group							
	16–24 (n = 162); % (n)	25–34 (n = 342); % (n)	35–44 (n = 381); % (n)	45–54 (n = 289); % (n)	55–64 (n = 276); % (n)	65–74 (n = 254); % (n)	75 and over (n = 233); % (n)	χ^2 for age difference (p); df = 6
Any link with sex, STIs or condom use	24.1 (39)	37.4 (128)	47.5 (181)	50.9 (147)	52.2 (144)	36.2 (92)	30.0 (70)	67.22 (<0.0001)
STI or not using condoms	13.0 (21)	14.9 (51)	16.3 (62)	14.9 (43)	14.9 (41)	10.6 (27)	7.3 (17)	13.49 (0.04)
Any STI (named or unnamed)	4.9 (8)	10.5 (36)	11.3 (43)	10.0 (29)	9.1 (25)	5.5 (14)	4.3 (10)	17.42 (0.008)
Named STI	2.5 (4)	6.4 (22)	6.8 (26)	5.2 (15)	3.6 (10)	2.0 (5)	2.6 (6)	15.78 (0.02)
Chlamydia	1.9 (3)	2.6 (9)	2.4 (9)	0.7 (2)	0.4 (1)	0.4 (1)	0	15.99 (0.01)
Sexual activity (specified or unspecified)	16.0 (26)	31.3 (107)	41.5 (158)	43.9 (127)	48.2 (133)	31.9 (81)	27.5 (64)	71.22 (<0.0001)
Many sexual partners	8.0 (13)	19.3 (66)	30.4 (116)	33.2 (96)	35.1 (97)	22.4 (57)	18.9 (44)	67.45 (<0.0001)
Early age of first sexual activity	4.9 (8)	11.1 (38)	13.9 (53)	15.2 (44)	12.0 (33)	6.7 (17)	4.7 (11)	29.79 (<0.0001)
Smoking	18.5 (30)	25.4 (87)	18.1 (69)	13.5 (39)	9.1 (25)	4.3 (11)	5.6 (13)	83.61 (<0.0001)
Not attending regular screening	14.8 (24)	20.8 (71)	14.2 (54)	10.7 (31)	8.7 (24)	6.7 (17)	3.9 (9)	52.91 (<.0001)
Family history/heredity/ genetics	14.2 (23)	24.0 (82)	19.2 (73)	18.3 (53)	16.3 (45)	15.7 (40)	10.3 (24)	21.15 (0.002)
Family history of cervical cancer	9.9 (16)	19.9 (68)	15.7 (60)	14.9 (43)	12.7 (35)	11.4 (29)	6.4 (15)	26.45 (<0.0001)
Dietary factors	1.9 (3)	4.1 (14)	4.2 (16)	5.9 (17)	1.1 (3)	3.1 (8)	2.6 (6)	12.64 (0.05)
Contraceptive pill	3.7 (6)	12.3 (42)	7.1 (27)	3.1 (9)	4.3 (12)	2.4 (6)	3.0 (7)	43.57 (<0.0001)
Don't know	45.1 (73)	29.5 (101)	32.8 (135)	33.6 (97)	32.2 (89)	48.0 (122)	56.2 (131)	68.10 (<0.0001)

Only factors with a significant age effect are shown.

16.3% mentioned any STI or not using condoms, compared with only 7.3% of the oldest group. This group and the 25–34 age group had the highest awareness of chlamydia as a risk factor (around 2.5% in these two groups, compared with fewer than 1% in most other groups).

The 25–34 year olds were most aware of smoking as a risk factor (25.4%, compared with 4–5% in the oldest two groups), of the need to attend regular screening (20.8%, compared with 3.9% in the oldest group), and of the role of the pill (12.3%, compared with 2–4% in most other groups). They were also most likely to believe family history of cervical cancer, and family history or genetics in general to be risk factors. About 19.9% mentioned family history, compared with fewer than 10% in the oldest and youngest groups.

Education differences

Risk factors for which there was a significant education effect are shown in Table 4. Respondents who were under 19 and reported still being in full-time education (n = 23) are excluded from these analyses. It is notable that, with the exception of becoming sexually active at a young age (mentioned by 7.4% of the least educated group, rising to 14.2% in the most educated group), none of the sexual behavioral risk factors showed any differences between education groups, although awareness of the link with STIs increased with increasing education. There were significant differences in most of the other risk factors, with knowledge increasing with higher levels of education. More educated respondents were also more likely to mention incorrect risk factors. The only response to show the opposite pattern was 'don't know'; almost 50% of those who had left full-time education before the age of 16 did not know any risk factors, compared with 29% of those in the most educated group.

Multivariate analyses

Logistic regression analyses were used to establish whether the demographic factors had independent associations with knowledge. Analyses were restricted to those risk factors with significant bivariate associations with gender, age, and education (see Table 5). The odds of mentioning any link with sex, STIs, or condom use, early age of first sexual activity, not attending for regular screening, taking the pill, family history of cervical cancer, and family history or genetics in general, were significantly greater for women

Table 4
Risk factors cited by each education group, with chi-squared tests for differences by age of leaving education

	15 or under (n = 623); % (n)	16 (n = 543); % (n)	17–18 (n = 310); % (n)	19 and over (n = 437); % (n)	χ^2 for education difference (p); df = 3
Any link with sex, STIs, or condom use	36.8 (229)	39.0 (212)	46.1 (143)	48.3 (211)	18.13 (<0.0001)
STI or not using condoms	8.8 (55)	12.2 (66)	16.1 (50)	19.9 (87)	18.13 (<0.0001)
STI (named or unnamed)	5.1 (32)	6.3 (34)	10.3 (32)	14.9 (65)	36.63 (<0.0001)
STI (unnamed)	3.5 (22)	4.6 (25)	7.1 (22)	9.4 (41)	18.65 (<0.0001)
Named STI	1.9 (12)	3.9 (21)	4.8 (15)	8.7 (38)	28.12 (<0.0001)
Genital warts/wart virus	1.0 (6)	2.0 (11)	3.9 (12)	4.1 (18)	13.85 (0.003)
HPV	0	0.6 (3)	0.3 (1)	1.8 (8)	14.60 (0.002)
Herpes virus	0	0.6 (3)	1.0 (3)	3.4 (15)	30.39 (<0.0001)
Chlamydia	0.3 (2)	1.5 (8)	1.3 (4)	2.3 (10)	8.37 (0.04)
Virus/disease/infection	0.8 (5)	2.2 (12)	2.3 (7)	6.2 (27)	29.75 (<0.0001)
Early age of first sexual activity	7.4 (46)	10.9 (59)	11.3 (35)	14.2 (62)	12.97 (0.005)
Smoking	7.4 (46)	16.8 (91)	19.4 (60)	17.2 (75)	36.55 (<0.0001)
Contraceptive pill	2.4 (15)	6.6 (36)	8.7 (27)	6.9 (30)	19.93 (<.0001)
Not attending regular screening	5.3 (33)	14.9 (81)	15.5 (48)	15.6 (68)	39.63 (<0.0001)
Family history/heredity/ genetics	11.4 (71)	16.9 (92)	24.2 (75)	23.3 (102)	35.60 (<0.0001)
Family history of cervical cancer	8.8 (55)	12.5 (68)	18.7 (58)	19.5 (85)	31.48 (<0.0001)
Family history of cancer	2.9 (18)	7.0 (38)	8.7 (27)	6.6 (29)	16.30 (0.001)
Dietary factors	2.4 (15)	2.0 (11)	3.5 (11)	6.9 (30)	20.33 (<0.0001)
High fat diet	0.8 (5)	0.9 (5)	1.0 (3)	3.2 (14)	13.13 (0.004)
Low fruit/vegetable diet	1.0 (6)	0.2 (1)	1.3 (4)	2.3 (10)	10.09 (0.02)
Stress	0.5 (3)	0.7 (4)	2.6 (8)	2.1 (9)	10.87 (0.01)
Don't know	49.3 (307)	36.8 (200)	29.4 (91)	28.6 (125)	60.25 (<0.0001)

Only factors with a significant education effect are shown.
Those still in full-time education are excluded.

than men, after controlling for age and education. Women were significantly less likely not to know of any risk factors.

There were significant age effects for most of the risk factors analyzed. The youngest age group was used as the reference category. Odds of mentioning anything related to sex were significantly greater in all groups compared with the youngest age group, and were greatest for the 55–64 group (OR = 4.59, CI: 2.84–7.43). The 45–54 group had the greatest odds of citing early age of first sexual activity as a risk factor (OR = 4.44, CI: 1.83–1–0.79). Not attending for regular screening was less likely to be mentioned by the oldest age group compared with the youngest (OR = 0.26, CI: 0.11–0.61). The other groups did not differ significantly from the youngest group. There were few differences for knowledge of the contraceptive pill as a risk factor, but those in the 25–34 group were more likely to mention this than those in the youngest group (OR = 3.65, CI: 1.41–9.48). The same pattern was observed for family history of cervical cancer, with the 25–34 group having an odds ratio of 1.88 (CI: 1.04–3.39). There were no significant age effects for mentioning any aspect of family history, genetics, or heredity. Those in the 25–64 groups had smaller odds of not knowing any risk factors than the youngest group.

Education showed a linear association with knowledge of most of the risk factors. The least-educated group was used as the reference category. The most educated group had significantly greater odds of mentioning anything related to sex (OR = 1.91, CI: 1.42–2.57), early age of first sexual activity (OR = 1.91, CI: 1.20–3.04), and family history of cervical cancer (OR = 2.08, CI: 1.36–3.19). Those who left education at age 17–18 were most likely to mention not attending for regular screening (OR = 2.07, CI: 1.22–3.50), taking the pill (OR = 2.51, CI: 1.19–5.26), and anything related to family history, heredity, or genetics (OR = 2.33, CI: 1.56–3.49). The least-educated group was most likely to give a 'don't know' response.

These analyses indicate that the effects of gender, age and education on knowledge of the risk factors were largely independent of each other. Given that there were associations between age, gender, and level of education, we also wanted to see whether these variables had interactive effects on knowledge. Interaction terms were entered into the models shown in Table 5. The only significant interaction was between gender and education for knowledge of any link with sex, STIs, or condom use. It was found that although knowledge increased with education for women, there was no effect of education for men (P = 0.014 for the

Table 5
Logistic regression analyses using demographic variables to predict risk factor knowledge

	OR [95% CI]						
	Any link with sex, STIs or condom use	Early age of first sexual activity	Not attending for regular screening	Contraceptive pill	Family history of cervical cancer	Family history/ heredity/genetics	Don't know
Gender							
Men	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.73 [1.43–2.10]	1.88 [1.37–2.59]	2.34 [1.72–3.20]	1.93 [1.25–2.97]	1.44 [1.10–1.90]	1.48 [1.15–1.89]	0.51 [0.42–0.62]
Age							
16–24	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25–34	1.85 [1.18–2.92]	2.60 [1.07–6.33]	1.17 [0.69–1.96]	3.65 [1.41–9.48]	1.88 [1.04–3.39]	1.56 [0.93–2.61]	0.60 [0.39–0.91]
35–44	3.09 [1.98–4.82]	3.73 [1.56–8.93]	0.79 [0.46–1.35]	2.06 [0.77–5.48]	1.50 [0.83–2.71]	1.23 [0.73–2.07]	0.64 [0.42–0.96]
45–54	3.81 [2.40–6.07]	4.44 [1.83–10.79]	0.66 [0.37–1.19]	1.00 [0.33–3.07]	1.53 [0.82–2.85]	1.32 [0.77–2.29]	0.58 [0.37–0.89]
55–64	4.59 [2.84–7.43]	3.83 [1.53–9.59]	0.62 [0.33–1.18]	1.66 [0.55–4.96]	1.47 [0.76–2.82]	1.35 [0.76–2.40]	0.45 [0.29–0.71]
65–74	2.45 [1.49–4.02]	2.07 [0.77–5.55]	0.50 [0.25–1.01]	0.96 [0.27–3.35]	1.40 [0.70–2.78]	1.42 [0.78–2.58]	0.85 [0.54–1.34]
75 and over	1.74 [1.04–2.90]	1.36 [0.48–3.90]	0.26 [0.11–0.61]	1.16 [0.34–3.93]	0.72 [0.33–1.56]	0.84 [0.44–1.60]	1.28 [0.81–2.04]
Age of leaving education							
15 or under	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	1.21 [0.91–1.60]	1.34 [0.84–2.12]	1.94 [1.19–3.17]	1.75 [0.85–3.59]	1.22 [0.79–1.88]	1.46 [1.00–2.15]	0.69 [0.52–0.91]
17–18	1.59 [1.16–2.19]	1.37 [0.82–2.29]	2.07 [1.22–3.50]	2.51 [1.19–5.26]	2.01 [1.29–3.15]	2.33 [1.56–3.49]	0.49 [0.35–0.68]
19 or over	1.91 [1.42–2.57]	1.91 [1.20–3.04]	2.05 [1.23–3.40]	1.83 [0.87–3.86]	2.08 [1.36–3.19]	2.21 [1.50–3.26]	0.45 [0.33–0.62]

interaction). This effect was not found for knowledge of other risk factors.

Discussion

We used a representative population sample to assess beliefs about the risk factors for cervical cancer in Britain. The study used an open-ended (recall) question format which has been found to provide a more stringent test of knowledge than recognition tasks which provide response options [34,35].

Perhaps the most striking finding was the extremely low knowledge of HPV. Fewer than 1% of respondents named the HPV virus as a risk factor and only 2.6% mentioned an unspecified virus, disease, or infection. This is in contrast to assertions by some authors that the link between HPV and cervical cancer is well-known [36]. The very low awareness of HPV in our study compared with other British research [12–14] may partly be a function of the open-ended question format, but probably also indicates that although a larger number of people may be aware of the virus, few know what it is or about its relationship with cervical cancer.

There was also evidence that only a small proportion of the population is aware of the sexually transmitted nature of cervical cancer. Only about 13% mentioned STIs or not using condoms as risk factors, which indicates that for the vast majority of the population, information about the role of sexual transmission in cervical cancer etiology may be at odds with their current beliefs. A greater number of people were aware of a link with sexual activity in general. Thirty-six percent mentioned some form of sexual activity. However, it is possible that the mechanism may be generally understood in terms of trauma to the cervix caused by sex, rather than the transmission of a virus. This is consistent with the findings of an on-going qualitative study we are conducting, and with other studies [29]. About 60% of the sample did not mention anything related to sexual activity or sexual transmission, indicating that awareness of the link between sexual behavior and cervical cancer is far from universal.

In terms of other risk factors, it is worrying to note that more people believed family history to be a factor (given that there is little evidence for this) than either smoking or not attending for regular screening. This overestimation of the importance of family history is consistent with some other studies [13,25]. It is possible that people have a generic model of cancer etiology, and that publicity about the role of family history in other types of cancer has been generalized to include cervical cancer.

As might be expected for a cancer that only affects women, gender differences in knowledge were found. Women's knowledge of the sexual behavioral risk factors and of the importance of screening attendance was greater than men's, but interestingly there were no gender differences in awareness of the role of sexually transmitted infections.

Age differences in health-related knowledge are well-documented, with people in middle age usually having better knowledge than younger or older people. Interestingly, we found that the pattern of knowledge by age varied between the risk factors. Younger groups were more aware of the risks associated with smoking, not attending for screening and taking the pill, but were also more likely to believe family history to be a risk factor. The 35–44 year olds were most aware of the link with STIs, whereas the older age groups (45–64 years) were most likely to cite sexual behavioral risk factors.

The age patterning of awareness of sexual behavioral risk factors points to a cohort effect. It seems that older people are much more aware of this link, which may be due to changes in health messages over the years. In an attempt to avoid cervical cancer carrying implications of promiscuity, the behavioral risk factors have been underplayed in favor of an emphasis on screening attendance. It is worrying, however, that young people (particularly those in the 16–25 age group) are least aware of a link between cervical cancer and sex, when this is the age at which sexual activity is initiated and numbers of partners are most likely to be high.

It is encouraging the health education messages about smoking and screening appear to be getting through to young women, which may in part be due to contact with health professionals associated with family planning. However, it is concerning that only about 12% of 55- to 64-year-old women cited not attending screening as a risk factor, when women in this age group are still recommended to attend.

The introduction of HPV testing makes it essential that awareness of the virus is raised. Women participating in screening must be fully informed and aware that they may be diagnosed with an STI. One study has indicated that the prospect of being tested for an STI as part of cervical screening is shocking to women unfamiliar with HPV [37], and our findings confirm that the majority of people are unaware of a link between an STI and cervical cancer.

Stigma associated with both testing for, and diagnosis of, STIs is well-documented, for example, [38–42] and care must be taken to ensure that the 'promiscuity' model of cervical cancer which has been so successfully quashed is not resurrected in light of information about HPV. While a 'right to know' discourse has been advocated to enable women to make choices about their sexual behavior [6], sensitive information provision will be necessary to prevent women with cervical abnormalities or cancer being blamed or labeled as promiscuous. This might usefully emphasize the high prevalence of HPV and the fact that the majority of sexually active women are likely to come into contact with it at some point. The role played by men in the spread of the virus is also important; a woman with a single sexual partner can easily contract the virus if her partner has had previous partners. Women's and men's information needs must be taken into account when developing education materials [43].

Although this study uses a representative population sample and should therefore be generalizable to the British population, caution must be exercised in drawing wider conclusions. Educational materials about cervical cancer differ between countries, so public knowledge might vary accordingly. The study is also subject to the usual limitations of self-report data; however, as we were not measuring behavior, for which self-report is notoriously unreliable, there should be minimal systematic bias in the data.

This study is the first to assess knowledge of the risk factors for cervical cancer in a representative population sample, using an open-ended question format. The results indicate that although a significant proportion of the population is aware of a link between sexual activity and cervical cancer, very few seem to hold an etiological model involving sexual transmission. This suggests that the provision of information associated with the introduction of HPV screening has the potential to change radically the way in which the public perceives cervical cancer.

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