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ORIGINAL ARTICLE

Perceived risk of cervical cancer among pre-screening age women (18–24 years): the impact of information about cervical cancer risk factors and the causal role of HPV

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► Additional materials are published online only. To view these files please visit the journal online (http://dx.doi.org/10.1136/sextrans-2012-050482).

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Accepted 25 March 2012

Published Online First 19 April 2012

ABSTRACT

Objectives Current National Health Service cervical screening information does not explain that the cause of cervical cancer is a sexually transmitted infection (human papillomavirus (HPV)). This study aimed to consider the impact that providing this information, in addition to risk factor information, might have on women's perceived risk of cervical cancer.

Methods Female students aged 18–24 years (n=606) completed a web-based survey and were randomised to receive (1) control information about cervical cancer; (2) details of the link between HPV and cervical cancer; (3) risk factor information or (4) details about the link with HPV + risk factor information. Risk perceptions for cervical cancer were assessed before and after reading the information.

Results There was a significant difference in perceived risk of cervical cancer between the four groups following information exposure (p=0.002). Compared with the control group, risk perceptions were significantly lower among women given risk factor information but not among those informed about HPV. There were significant group by risk factor interactions for smoking status (p<0.001), age of first sex (p=0.018) and number of sexual partners (p<0.001). Risk perceptions were lower among women considered at low risk and given risk factor information, but there was no association between information group and perceived risk for high-risk women.

Conclusions Providing risk factor information appears to reduce cervical cancer risk perceptions, but learning about the aetiological role of HPV appears to have no impact on risk perceptions. Incorporating brief information about HPV as the cause of cervical cancer should be in addition to, rather than in place of, risk factor information.

INTRODUCTION

Human papillomavirus (HPV) is a common sexually transmitted infection (STI). In a large sample of 20–29-year-olds in England, 27% had a high-risk HPV infection.[1] Persistent infection with high-risk HPV could potentially lead to cervical cancer,[2] but there are two highly effective ways to prevent this carcinogenic process available to women in England. First, prophylactic vaccination against the most common high-risk HPV types is available for girls aged 12–13 years. Second, women aged 25–64 years are invited for cervical screening, which aims to detect pre-cancerous cell changes that can be treated before cancer develops.

The majority of women have not heard of HPV and are unaware that cervical cancer is caused by an STI.[3–5] Theoretical models of illness perceptions suggest that lay understanding of the cause of an illness contributes to perceptions of threat from the illness.[6] It could therefore be expected that understanding the link between cervical cancer and an STI might influence perceptions of cervical cancer risk. Risk perceptions (also known as perceived susceptibility or perceived vulnerability) relate to an individual's perception of the likelihood that a disease will develop. Risk perceptions are a key component of many health behaviour theories[7–10] and have been shown to predict cancer screening attendance[11–13] and may also be associated with HPV vaccination uptake.[14]

In general, women perceive their risk of cervical cancer to be below average.[15] This tendency to perceive invulnerability compared with others is known as optimistic bias and has been observed across different cancers.[16–19] A few studies have also explored the accuracy of women's cervical cancer risk perceptions. In one study of women in the USA, those considered to be at higher risk of cervical cancer (because they had been diagnosed with an STI, had a partner with an STI, were smokers, were <18 years the first time they had sex or had had more than four sexual partners) were more likely to perceive their risk of cervical cancer as being above average than those at lower risk (22% vs 6%, respectively), but the majority of the higher risk group still thought their risk was average or below average.[20] In another study, there were no differences in comparative perceived risk of cervical cancer among smokers and non-smokers, suggesting a lack of awareness that smoking can increase risk of cervical cancer.[21]

Similar findings have been reported for perceived risk of contracting an STI. In a recent population-based survey of 18–30-year-olds in Sweden, only 12% of women felt that they had a fairly large or large risk of contracting an STI but perceived risk was associated with sexual behaviour suggesting some degree of accuracy.[22] However, there is evidence of an optimistic bias even in those considered to be at higher risk.[23] These studies did not explore the role of knowledge in perceived risk

judgements so it is not possible to extrapolate whether those making more accurate judgements were doing so because they were more knowledgeable about the relevant risk factors and those making inaccurate judgements were not.

Knowledge of cervical cancer risk factors has been shown to inform risk judgements.[24–26] For example, previous research has shown that explaining the link between smoking and cervical cancer to women who smoke increases their perceived vulnerability to cervical cancer and their intention to stop smoking.[26] In a population-based study of women aged 16–75 years,[27] we showed that providing information about HPV increased cervical cancer risk perceptions among younger women (16–25 years) and decreased them among older women (65–75 years). We suggested that the differential effects of information could be attributed to differences in sexual behaviour among these two age groups, but as sexual behaviour was not measured, it was not possible to test this hypothesis. In addition, the information provided to women in this study included several details about HPV (sexually transmitted nature, cause of cervical cancer, high prevalence and asymptomatic nature, limited protection afforded by condoms), as well as incidence/mortality figures for cervical cancer and the role of cervical screening in preventing cancer. Therefore, it was not possible to pinpoint whether informing women that cervical cancer is caused by an STI (ie, HPV) was the piece of information that resulted in changes to risk perceptions.

In England, the current National Health Service (NHS) cervical screening information leaflet does not explain the link between cervical cancer and an STI, instead notifying women of behavioural risk factors that put them at increased risk of cervical cancer including multiple sexual partners, younger age of first sexual intercourse and smoking.[28] We were interested in answering the following research questions:

(i) Are cervical cancer risk perceptions associated with actual risk behaviour?
(ii) Does informing women that cervical cancer is caused by an STI increase perceived risk of cervical cancer over and above information about cervical cancer risk factors (as currently provided)?
(iii) Does informing women that cervical cancer is caused by HPV an STI encourage more accurate risk perceptions (ie, are increases in risk perceptions restricted to women who are actually at higher risk of cervical cancer)?
(iv) Do any changes in risk remain one week after reading the information?

We explored these research questions among women in the pre-screening age group (18–24 years) because previous research has shown that information about HPV increased perceived risk in this age range,[27] and as women in England are not invited for cervical screening until 25 years, there should have been limited exposure to the standard cervical screening information in this age group.

METHODS

Participants

In May and June 2011, an email was sent to all students at two London universities inviting women aged 18–24 years to click on a link directing them to a web-based survey. Entry into a prize draw to win £50 was offered as a thank you for taking part. The study received ethical approval from the University College London Research Ethics Committee.

Procedure

Participants who clicked on the link were asked to confirm their gender and age. Eligible participants (females, 18–24 years) were then presented with an information page and a consent page before beginning the study. After an initial perceived risk question, participants read a paragraph of information about cervical cancer before responding to additional questions (assessing perceived risk, risk behaviours, demographics and HPV knowledge). The questionnaire took approximately 10 min to complete. Participants were invited to complete a second shorter survey 1 week later. Their responses were matched using their email address.

Measures

Information conditions

Participants were randomised to receive one of four pieces of information: (1) control, which provided a basic description of cervical cancer; (2) control + HPV, which included the same basic information plus a description of the causal role of HPV in cervical cancer; (3) controls + risk factor, which included the basic information plus information about cervical cancer risk factors and (4) control + HPV + risk factor, which included all pieces of information (see table 1 for the information provided and details of how it was developed).

Dependent variable

Perceived risk of cervical cancer was assessed at three time points: baseline (time 1), directly after exposure to the information (time 2) and 1 week later (time 3). The 1-week follow-up was designed to examine sustained short-term impact within a time period that would minimise attrition. A single-item comparative risk measure was used: 'Compared to other women

Table 1 Information provided to women in each group*

Control	Cervical cancer is cancer of the cervix. The cervix connects a woman's womb and her vagina. It is also known as the neck of the womb. Cervical cancer can affect women of all ages but is most common in women between 30–45 years of age. It is very rare in women under 25.
Control + HPV	Cervical cancer is cancer of the cervix. The cervix connects a woman's womb and her vagina. It is also known as the neck of the womb. Cervical cancer can affect women of all ages but is most common in women between 30–45 years of age. It is very rare in women under 25. Nearly all cervical cancers are caused by a common sexually transmitted infection (STI) called human papillomavirus (HPV).†
Control + risk factors	Cervical cancer is cancer of the cervix. The cervix connects a woman's womb and her vagina. It is also known as the neck of the womb. Cervical cancer can affect women of all ages but is most common in women between 30–45 years of age. It is very rare in women under 25. Cervical cancer is more common if you smoke, first had sex at an early age or have had several sexual partners or have had a sexual partner who has had several other partners.‡
Control + HPV + risk factors	Cervical cancer is cancer of the cervix. The cervix connects a woman's womb and her vagina. It is also known as the neck of the womb. Cervical cancer can affect women of all ages but is most common in women between 30–45 years of age. It is very rare in women under 25. Nearly all cervical cancers are caused by a common STI called HPV. Cervical cancer is more common if you smoke, first had sex at an early age or have had several sexual partners or have had a sexual partner who has had several other partners.

*The information was developed from publicly available cervical cancer leaflets.
†Details about HPV as the cause of cervical cancer were taken from Cancer Research UK's 'Preventing cervical cancer' leaflet.
‡The risk factor information was taken from the National Health Service cervical screening programme leaflet 'Cervical Cancer: The Facts' which is sent as standard to all women invited for screening.[28]

your age, what do you think your chances of getting cervical cancer are?' with five possible options 'Much below average', 'Below average', 'Average', 'Above average' and 'Much above average' (scored −2, −1, 0, +1 and +2, respectively). This item was adapted from previous studies.[27 29]

Independent variables

After exposure to the information and reporting perceived risk of cervical cancer at time 2, women were asked to report behavioural risk factors for cervical cancer. All women were asked their smoking status, whether they had been vaccinated against HPV, whether they had been for cervical screening in the past and if they had ever had sexual intercourse. Sexually active women were also asked to indicate age of first sexual intercourse, number of lifetime sexual partners, frequency of condom use and whether they had ever been diagnosed with an STI. These questions were adapted from previous studies, see online data supplement.[30] Women also reported their age, ethnicity, religious participation and relationship status. At the end of the survey, women were asked whether they had heard of HPV before taking part in the study (yes/no/not sure) and those who responded *yes* answered a 16-item true/false/don't know questionnaire assessing knowledge of HPV (developed by the research team, available on request). Women were given a point for each correct answer, resulting in a score from 0–16 which was recoded as none/poor (had not heard of HPV or a score of <9), moderate (a score of 9–12) or good (a score of 13–16).

Analysis

A 'rather not say' option was offered for questions assessing sexual behaviour. Very few participants selected this response (<3% for all variables). These responses were treated as missing data using pairwise deletion. To test whether cervical cancer risk perceptions were associated with actual risk behaviour at baseline, we used independent samples t-tests and one-way analyses of variance. To test the effect of information condition on perceived risk of cervical cancer at time 2, we first used a univariate analysis of covariance (ANCOVA) (controlling for perceived risk at baseline). A series of multivariate ANCOVAs were then run to explore the moderating effects of behavioural risk factors and knowledge. A repeated-measures ANCOVA compared perceived risk between time 2 and time 3 to explore whether changes in perceived risk remained stable over time.

RESULTS

Sample characteristics

The survey was completed by 606 participants. Sample characteristics are shown in table 2. Mean age was 21 years (SD=1.8 years), and the majority of participants were single/dating casually (48%) or dating one person (37%). Most were from white ethnic backgrounds (75%) and rarely or never participated in religious activities (60%). A fifth of women were current or past smokers, around a third had received the HPV vaccine (30%) and 22% had had cervical screening in the past. Three-quarters had some sexual experience, among whom mean age of first debut was 17.3 years (SD=1.95 years) and just over half reported having three or more sexual partners (57%). The majority of sexually active women used a condom at least half the time (63%) and 8% had been diagnosed with an STI in the past. At the end of the survey, 87% reported having heard of HPV before taking part with a mean knowledge score among those who had heard of it was 10.81 of 16 (SD=3.56).

Perceived risk of cervical cancer at baseline (time 1)

At time 1 (before reading any information), mean perceived risk of cervical cancer was −0.42 (SD=0.79) (possible range: −2 to 2), reflecting the typical comparative optimism bias with the mean deviating significantly below average risk (score=0; $t=13.05$ (605), $p<0.001$). Perceived risk of cervical cancer at baseline was higher for women who had ever smoked (t (604)=3.59, $p<0.001$), had not received HPV vaccination (t (604)=1.98, $p=0.048$), had had a smear test (t (604)=3.29, $p<0.001$) and had more than five sexual partners (F (2,582)=19.89, $p<0.001$). In the sexually active subgroup, perceived risk was higher among those who had had sex below the age of 17 (t (441)=2.13, $p=0.034$), did not use condoms every time (F (2,452)=3.80, $p=0.023$) and who had been diagnosed with an STI (t (454)=4.29, $p<0.001$) (see table 2). There was no association between perceived risk at baseline and participants' age, but those who were dating casually had higher perceived risk than those who were single (F (3,602)=3.81, $p=0.010$), participants from Asian backgrounds had lower perceived risk than those from white or mixed backgrounds (F (3,602)=12.55, $p<0.001$), and those who participated in religious activities at least once a month had lower perceived risk than those who attended rarely or a few times a year (F (2,603)=11.43, $p<0.001$). There was no association between perceived risk and HPV awareness or knowledge score.

The immediate impact of information on perceived risk

There were no differences in demographic characteristics, behavioural risk factors, HPV knowledge or perceived risk at baseline between the four information groups, suggesting that the randomisation procedure was successful. At time 2 (after information exposure), the mean perceived risk of cervical cancer was −0.64 (SD=0.86), again showing comparative optimism and significantly deviating below the midpoint (t (605)=18.21, $p<0.001$). Mean perceived risk was significantly lower at time 2 than at baseline (t (605)=8.42, $p<0.001$).

There was a significant difference in perceived risk of cervical cancer between the four groups after information exposure (F (3, 601)=5.16, $p=0.002$—adjusting for perceived risk at baseline). Contrasts showed that participants in the control + risk factor and the control + HPV + risk factor groups had significantly lower perceived risk than the control group ($p=0.004$ and $p>0.001$, respectively, see figure 1). Those in the control + HPV group had slightly lower perceived risk than the control group, but the difference was not significant ($p=0.080$). Those in the control + HPV group had slightly higher perceived risk than participants in the control + HPV + risk factor group (bordering on significant, $p=0.054$), but there was no difference between the control + HPV + risk factor and the control + risk factor groups ($p=0.605$).

Moderators of the impact of information on perceived risk

There were significant group by risk factor interactions for smoking status (F (3,597)=8.74, $p<0.001$), age of first sex (F (3,566)=3.39, $p=0.018$) and number of sexual partners (F (3,573)=5.14, $p<0.001$) (see table 3). For participants with lower risk behaviours (ie, those who were never-smokers, not sexually active or only sexually active >16 years old and not sexually active or less than three sexual partners), providing brief information about HPV as the cause of cervical cancer or about cervical cancer risk factors resulted in lower perceived risk of cervical cancer. Conversely, there were no significant information group differences in mean perceived risk of cervical cancer for those with higher risk behaviours (ie, those who were smokers/ex-smokers, had sex at 16 years or younger and who had had more than five sexual partners), although there appeared to be

Table 2 Sample characteristics and associations between demographic characteristics and comparative perceived risk of cervical cancer (N=606)

Variables	N (%) or (mean, SD)	Perceived risk of cervical cancer at baseline (range: −2 to 2) (mean, SD)	Significance of between-group differences
Socio-demographic characteristics			
Age in years	(21.4, 1.8)	–	–
Relationship status			
Single	230 (38)	−0.51 (0.86)	F (3602)=3.81, p=0.010
Dating casually	59 (10)	−0.19 (0.71)	
Dating one person	225 (37)	−0.44 (0.75)	
Married/cohabiting	92 (15)	−0.28 (0.70)	
Ethnic origin			
White	454 (75)	−0.33 (0.75)	F (3,602)=12.55, p<0.001
Asian	93 (15)	−0.86 (0.80)	
Black	18 (3)	−0.50 (0.92)	
Other	41 (7)	−0.29 (0.81)	
Religious participation			
Rarely or never	366 (60)	−0.31 (0.74)	F (2,603)=11.43, p<0.001
Few times a year	133 (22)	−0.47 (0.83)	
At least once a month	107 (18)	−0.71 (0.82)	
Risk factors			
Ever been a smoker	112 (19)	−0.18 (0.86)	t (604)=3.59, p<0.001
Never been a smoker	494 (82)	−0.47 (0.76)	
Received HPV vaccination	183 (30)	−0.51 (0.82)	t (604)=1.98, p=0.048
Not received HPV vaccination	423 (70)	−0.38 (0.77)	
Had a smear test in the past	135 (22)	−0.22 (0.80)	t (604)=3.29, p<0.001
Not had a smear in the past	471 (78)	−0.47 (0.78)	
Number of sexual partners			
None	132 (22)	−0.74 (0.84)	F (2,582)=19.89, p<0.001
1–2	196 (32)	−0.46 (0.71)	
3–4	103 (17)	−0.39 (0.70)	
5+	155 (26)	−0.06 (0.75)	
First sexual intercourse 16 years or below*	150 (25)	−0.20 (0.75)	t (441)=2.13, p=0.034
First sexual intercourse over 16 years	293 (48)	−0.36 (0.73)	
Consistency of condom use*			
Every time	118 (26)	−0.27 (0.68)	F (2,452)=3.80, p=0.023
Most times	134 (30)	−0.25 (0.79)	
Half the time or less	203 (45)	−0.48 (0.79)	
Past diagnosis of an STI*	46 (8)	0.13 (0.78)	t (454)=4.29, p<0.001
No past diagnosis of an STI	410 (68)	−0.36 (0.73)	
Knowledge			
Heard of HPV before	529 (87)	−0.41 (0.78)	t (604)=0.91, p=0.365
Not heard of HPV	77 (13)	−0.49 (0.82)	
HPV knowledge score	(10.81, 3.56)	–	–

*Only sexually active women were included in these analyses.
HPV, human papillomavirus; STI, sexually transmitted infection.

a trend towards increased perceived risk among those given risk factor information. Having had HPV vaccination, having had cervical screening in the past, frequency of condom use, diagnosis of an STI and previous HPV knowledge did not moderate the effect of information on perceived risk of cervical cancer.

The stability of perceived risk

A short follow-up survey was completed a week after the initial questionnaire by 441 women, with 410 cases successfully matched (68% of the original sample). Mean perceived risk of cervical cancer at time 3 was −0.58 (SD=0.79), and there was no significant overall difference in risk perceptions between time 2 (post-information) and time 3 (1-week follow-up) (F (1,406)= 2.20, p=0.139).

DISCUSSION

The majority of women in this study perceived themselves to be at average or below average risk of cervical cancer, which is consistent with other studies measuring comparative risk perceptions for cervical cancer, other cancers and STIs.[15–19 22 23] Women who could be considered at higher risk (had ever smoked, had more than five sexual partners, had sex below the age of 17, used condoms infrequently and who had been diagnosed with an STI) had slightly higher perceived risk of cervical cancer at baseline than those who could be considered at lower risk, suggesting some level of accuracy. These findings are consistent with some previous studies exploring variation in perceived risk of cervical cancer and STIs among women with different behavioural risk factors.[20 22]

We found that women who were presented with information about cervical cancer risk factors (as currently included in the NHS cervical screening leaflet) had lower perceived risk of cervical cancer than those presented with control information. Explaining that cervical cancer is caused by an STI without additional risk factor information did not influence risk perceptions. What is also interesting is that the risk factor information explicitly stated that cervical cancer is more common in women who smoke, have sex at an early age and have several sexual

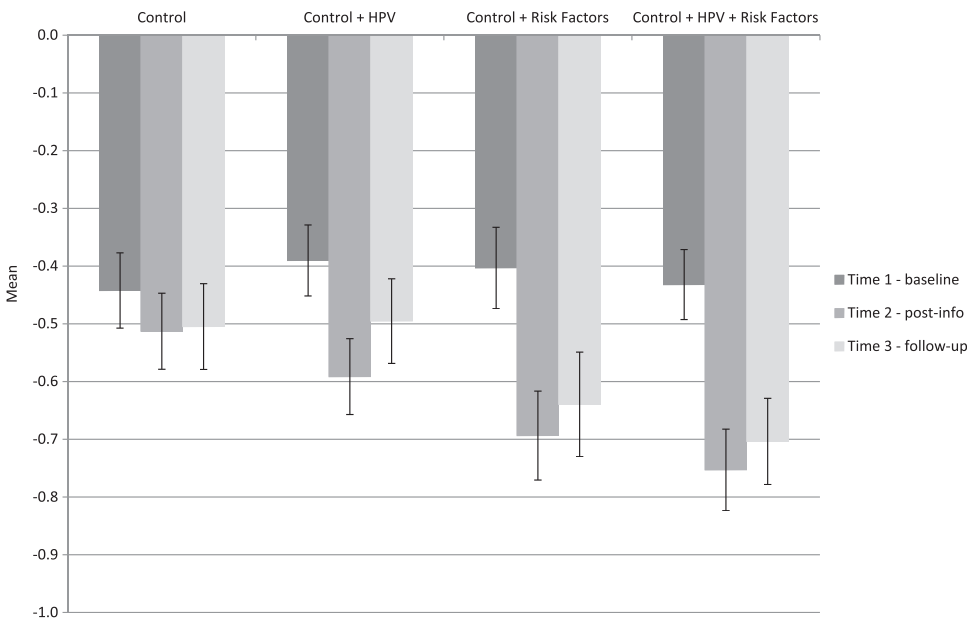

Figure 1 Perceived risk of cervical cancer by information group.

partners and it was these three behavioural risk factors that moderated the effects of the information on perceived risk. Condom use, HPV vaccine status and previous diagnosis of an STI were not mentioned in the information and were not significant moderators of the impact of the information.

Interestingly, we found that presenting information about cervical cancer risk factors resulted in lower cervical cancer risk perceptions, which is of concern because reductions in risk perceptions could potentially result in lower uptake of cervical screening.[11–13] The present study's finding of a reduction in perceived risk is in contrast to our previous work, which showed that information about HPV and cervical cancer increased risk perceptions among women aged 16–24 years.[27] There are two possible explanations for the difference in findings between this study and previous studies: the sample used and the information provided. Marlow *et al* used a population representative sample, while the current study used a student population and participants reported fewer risk behaviours than estimated in the

Table 3 Mean perceived risk of cervical cancer at time 2 (adjusted for time 1 response)

	Control	Control + HPV	Control + risk factors	Control + HPV + risk factors	Group by risk factor interaction
Smoking status					
Never smoked (n=494)	−0.50	−0.61	−0.80	−0.88	F (3,597)=8.74, p<0.001
Smoker/ex-smoker (n=112)	−0.49	−0.61	−0.28	−0.19	
Age of sexual debut					
17+ years or not sexually active (n=425)	−0.47	−0.65	−0.78	−0.87	F (3,566)=3.39, p=0.018
16 years and below (n=150)	−0.46	−0.42	−0.41	−0.37	
Number of sexual partners					
None/1−2 (n=328)	−0.49	−0.70	−0.92	−1.02	F (6,573)=5.14, p<0.001
3−4 (n=103)	−0.48	−0.45	−0.61	−0.52	
5+ (n=155)	−0.44	−0.42	−0.27	−0.25	
Condom use*					
Every time/most times (n=252)	−0.39	−0.54	−0.55	−0.55	F (3,446)=0.41, p=0.748
Half the time or less (n=203)	−0.45	−0.44	−0.57	−0.52	
History of STI*					
Never diagnosed (n=410)	−0.41	−0.51	−0.59	−0.56	F (3,447)=0.47, p=0.703
Diagnosed (n=46)	−0.39	−0.29	−0.38	−0.25	
Received HPV vaccination					
Yes (n=183)	−0.50	−0.60	−0.75	−0.72	F (3,597)=0.11, p=0.954
No (n=423)	−0.49	−0.62	−0.69	−0.75	
Had a smear test					
Yes (n=135)	−0.52	−0.48	−0.63	−0.70	F (3,597)=0.61, p=0.610
No (n=471)	−0.48	−0.65	−0.73	−0.75	
HPV knowledge					
None/poor (n=153)	−0.45	−0.80	−0.81	−0.94	F (6,593)=1.77, p=0.103
Moderate (n=235)	−0.52	−0.62	−0.68	−0.83	
Good (n=218)	−0.51	−0.49	−0.67	−0.52	

*Only sexually active women were included in these analyses.
HPV, human papillomavirus; STI, sexually transmitted infection.

general population.[30 31] There was also higher previous awareness of HPV in the present study (87% compared with 15% of 16–24-year-olds in our previous study[27]) and this means for some women the information we provided was not new. The second potential reason why the present study saw a decrease in perceived risk in contrast to other studies could be the information presented. In the Marlow *et al* study, women were given several pieces of information including cervical cancer incidence and mortality figures and details of the high prevalence of HPV. In contrast, the present study included a sentence that stated cervical cancer is very rare in women under 25 (provided to all groups). It is possible that these additional pieces of information could have influenced the direction of the changes in perceived risk after information exposure.

In this study, details about HPV were limited to explaining its role in cervical cancer aetiology and its sexually transmitted cause. Additional details about HPV are likely to be important for helping women to make accurate judgements about their risk of cervical cancer. For example, a woman who is aware of HPV, its sexual transmission and its link with cervical cancer may feel at low risk if she uses condoms consistently and believes that condoms offer full protection against HPV. In this scenario, providing further detail that condoms are not fully protective against HPV could have an influence on perceived risk.

Explaining the link between cervical cancer and HPV did not influence risk perceptions, but risk factor information did. One possible explanation could be that the sentence about HPV was in the third person, while the risk factors sentence was phrased in a more personally relevant way: 'cervical cancer is more common if you…', and this could have influenced the salience of the information.

Further exploration showed that this decrease was moderated by behavioural risk factors. Providing risk factor information had no significant impact on women who would be considered at higher risk of cervical cancer (ever-smokers, those with more sexual partners and those who had sex at an earlier age), but it decreased perceived risk in women at lower risk of cervical cancer (never-smokers, those with fewer sexual partners and those who had first sex at an older age). It seems that while the low behavioural risk group used the information provided to further increase their optimistic perceptions, which is perhaps appropriate, those at higher risk did not apply this new information to decrease their optimistic beliefs about their chances of developing cervical cancer, which is perhaps inappropriate given their behaviour. It could be that the higher risk women were making downward social comparisons, comparing their perceived risk to women their age that would be higher risk than them, for example, heavy smokers or those with more sexual partners. Alternatively, research suggests that people often defensively process health messages that are threatening to them.[32] Closer inspection of the means suggested that although not significant, there was a tendency towards increased risk perceptions among some higher risk groups, for example, smokers and women with more than five sexual partners. The study may have lacked sufficient power to detect significant differences here, as the higher risk groups were comparatively small so we also had to combine higher risk groups with participants who may be considered at moderate risk in order to ensure large enough groups for analyses, for example, the high-risk smoking group included current and ever-smokers; the more than five sexual partners group included women with 5–9, 10–20 and 20+ sexual partners. Collapsing these variables may have reduced our ability to detect changes in perceived risk in the highest risk women. Future work might consider repeating this study with high-risk populations (eg, recruited through GUM clinics) to see if providing information about cervical cancer risk factors increases perceived risk in very high-risk groups.

Key messages

- Women who could be considered at high risk (based on their behaviour) accurately perceived their risk of cervical cancer to be higher than other women.
- Exposure to information about cervical cancer risk factors lowers risk perceptions among women at low risk of cervical cancer but has no influence on high-risk women.
- Informing women that HPV, an STI, is the cause of cervical cancer does not influence cervical cancer risk perceptions.

There are a number of limitations to the current study. As mentioned earlier, the study was carried out in a student population, which means it is not representative of the general population and further research needs to explore the impact of details about HPV as the cause of cervical cancer and cervical cancer risk factor information in other groups. In addition, the recruitment method used meant we could not determine an appropriate denominator for a response rate calculation. The lack of response rate makes it difficult to determine how representative the sample is of female university students aged 18–24 years. The sample met a specific age range that should not have been exposed to the cervical screening programme information, although some women had been screened before and there was also high awareness of HPV. We were interested in pin-pointing whether learning that HPV, an STI, is the cause of cervical cancer changes risk perceptions, so women were given a very small amount of information which lacks ecological validity; the NHS cervical screening leaflet includes lots of information including the incidence of cervical cancer and the efficacy of cervical screening. It is possible that while providing risk factor information changes risk perceptions, there is additional information in the leaflet that would counteract this.

In conclusion, the present study suggests that incorporating brief information about HPV as the cause of cervical cancer has little effect on perceptions of cervical cancer risk, at least in the short term. It is possible that explaining that an STI is the mechanism through which sexual behaviour increases risk of cervical cancer could have longer term benefits by providing a more coherent explanation which can be incorporated into lay perceptions of cervical cancer, but this would need to be explored further. Providing risk factor information appeared to reduce cervical cancer risk perceptions, and although these changes are small, they remained a week later, suggesting a sustained effect.

Contributors LAVM conceived the study. LAVM and TN analysed the data. All authors contributed to the design of the study and drafting of the manuscript.

Funding JW, KAR and LAVM are funded by Cancer Research UK.

Competing interests None.

Ethics approval Ethics approval was provided by UCL Research Ethics Committee.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement We will consider requests for access to the data set.

REFERENCES

1. **Sargent A,** Bailey A, Almonte M, *et al*. Prevalence of type-specific HPV infection by age and grade of cervical cytology: data from the ARTISTIC trial. *Br J Cancer* 2008;**98**:1704—9.
2. **Moscicki AB,** Schiffman M, Kjaer S, *et al*. Chapter 5: updating the natural history of HPV and anogenital cancer. *Vaccine* 2006;**24**(Suppl 3):S42—51.
3. **Pitts M,** Clarke T. Human papillomavirus infections and risks of cervical cancer: what do women know? *Health Educ Res* 2002;**17**:706—14.
4. **Waller J,** McCaffery K, Forrest S, *et al*. Awareness of human papillomavirus among women attending a well woman clinic. *Sex Transm Infect* 2003;**79**:320—2.
5. **Marlow LA,** Waller J, Wardle J. Public awareness that HPV is a risk factor for cervical cancer. *Br J Cancer* 2007;**97**:691—4.
6. **Leventhal H,** Benyamini Y, Brownlee S, *et al*. *Illness Representations: Theoretical Foundations*. Amsterdam: Harwood Academic Publishers, 1997.
7. **Rosenstock IM.** Historical origins of the health belief model. *Health Educ Monogr* 1974;**2**:1—8.
8. **Rogers RW.** A protection motivation theory of fear appeals and attitude change. *J Psychol* 1975;**91**:93—114.
9. **Weinstein ND.** The precaution adoption process. *Health Psychol* 1988;**7**:355—86.
10. **Witte K.** Putting the fear back into fear appeals: the extended parallel process model. *Commun Monogr* 1992;**59**:329—49.
11. **Mccaul KD,** Branstetter AD, Schroeder DM, *et al*. What is the relationship between breast cancer risk and mammography screening? A meta-analytic review. *Health Psychol* 1996;**15**:423—9.
12. **Orbell S,** Sheeran P. 'Inclined abstainers': a problem for predicting health-related behaviour. *Br J Soc Psychol* 1998;**37**:151—65.
13. **Codori AM,** Petersen GM, Miglioretti DL, *et al*. Health beliefs and endoscopic screening for colorectal cancer: potential for cancer prevention. *Prev Med* 2001;**33**:128—36.
14. **Brewer NT,** Fazekas KI. Predictors of HPV vaccine acceptability: a theory-informed, systematic review. *Prev Med* 2008;**45**:107—14.
15. **Eiser JR,** Cole N. Participation in cervical screening as a function of perceived risk, barriers and need for cognitive closure. *J Health Psychol* 2002;**7**:99—105.
16. **Woloshin S,** Schwartz LM, Black WC, *et al*. Women's perceptions of breast cancer risk: how you ask matters. *Med Decis Making* 1999;**19**:221—9.
17. **Hay JL,** Ostroff JS, Cruz GD, *et al*. Oral cancer risk perception among participants in an oral cancer screening program. *Cancer Epidemiol Biomarkers Prev* 2002;**11**:155—8.
18. **Grunfeld EA,** Ramirez AJ, Hunter MS, *et al*. Women's knowledge and beliefs regarding breast cancer. *Br J Cancer* 2002;**86**:1373—8.
19. **Robb KA,** Miles A, Wardle J. Subjective and objective risk of colorectal cancer (UK). *Cancer Causes Control* 2004;**15**:21—5.
20. **McAlearney AS,** Song PH, Rhoda DA, *et al*. Ohio Appalachian women's perceptions of the cost of cervical cancer screening. *Cancer* 2010;**116**:4727—34.
21. **Marteau TM,** Hankins M, Collins B. Perceptions of risk of cervical cancer and attitudes towards cervical screening: a comparison of smokers and non-smokers. *Fam Pract* 2002;**19**:18—22.
22. **Leval A,** Sundstrom K, Ploner A, *et al*. Assessing perceived risk and STI prevention behavior: a national population-based study with special reference to HPV. *PLoS One* 2011;**6**:e20624.
23. **Wolfers M,** de Zwart O, Kok G. Adolescents in the Netherlands underestimate risk for sexually transmitted infections and deny the need for sexually transmitted infection testing. *AIDS Patient Care STDS* 2011;**25**:311—19.
24. **Garces-Palacio IC,** Scarinci IC. Factors associated with perceived susceptibility to cervical cancer among Latino immigrants in Alabama. *Matern Child Health J* 2012;**16**:242—8.
25. **Katapodi MC,** Dodd MJ, Facione NC, *et al*. Why some women have an optimistic or a pessimistic bias about their breast cancer risk: experiences, heuristics, and knowledge of risk factors. *Cancer Nurs* 2010;**33**:64—73.
26. **Hall S,** Weinman J, Marteau TM. The motivating impact of informing women smokers of a link between smoking and cervical cancer: the role of coherence. *Health Psychol* 2004;**23**:419—24.
27. **Marlow LA,** Waller J, Wardle J. The impact of human papillomavirus information on perceived risk of cervical cancer. *Cancer Epidemiol Biomark Prev* 2009;**18**:373—6.
28. **NHS.** *Cervical Screening: The Facts*. 2009. http://www.cancerscreening.nhs.uk/cervical/publications/nhscsp-the-facts.pdf
29. **Lipkus IM,** Kuchibhatla M, McBride CM, *et al*. Relationships among breast cancer perceived absolute risk, comparative risk, and worries. *Cancer Epidemiol Biomark Prev* 2000;**9**:973—5.
30. **Johnson AM,** Mercer CH, Erens B, *et al*. Sexual behaviour in Britain: partnerships, practices, and HIV risk behaviours. *Lancet* 2001;**358**:1835—42.
31. **Wellings K,** Nanchahal K, Macdowall W, *et al*. Sexual behaviour in Britain: early heterosexual experience. *Lancet* 2001;**358**:1843—50.
32. **Witte K,** Allen M. A meta-analysis of fear appeals: implications for effective public health campaigns. *Health Educ Behav* 2000;**27**:591—615.

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Sex Transm Infect 2012 88: 400-406 originally published online April 19, 2012
doi: 10.1136/sextrans-2012-050482

Notes