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# The launch of Cancer Research UK's 'Reduce the Risk' campaign: Baseline measurements of public awareness of cancer risk factors in 2004

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## ABSTRACT

**Aim:** This national survey sought to establish levels of awareness of cancer risk factors and awareness of what individuals could do to reduce their own risk status.

**Method:** Cross-sectional interview data comprising a national representative sample of 4233 individuals aged 15 years or over across Great Britain.

**Results:** There were high levels of awareness of the role of smoking in the development of cancer, but only modest awareness of alcohol intake, being overweight, physical inactivity and older age. Recognition of the role of viral infection in cancer risk was very poor. Although two-thirds of respondents thought that cancer risk could be modified through lifestyle changes, those most in need of making lifestyle changes were less likely to be aware of what they could do to reduce their cancer risk.

**Conclusion:** This survey highlights the need to increase awareness of overweight, alcohol, infections and exercise in the development of cancer, particularly amongst younger people and those from more socio-economically deprived backgrounds.

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## 1. Introduction

Cancer is a major public health problem<sup>1,2</sup> with up to 40% of Europeans being diagnosed with cancer during their lifetime.<sup>3</sup> Moreover, cancer incidence has increased considerably in recent years, rising from 2.9 million in 2004 to 3.2 million in 2006 in Europe,<sup>1</sup> and the situation is set to worsen as a consequence of the aging population.<sup>1,4,5</sup> However, it has been estimated that around half of 11 major cancer types are potentially avoidable.<sup>6–9</sup> Thus, primary prevention (tackling modifiable causes) and secondary prevention (increasing participation in cancer screening programmes) are central to reducing cancer incidence and mortality. Both of these have been designated as priority areas in the EU public health pol-

icy.<sup>10</sup> The European Code Against Cancer has set out 11 scientifically founded guidelines related to tobacco and alcohol consumption, nutrition and physical activity, to help citizens to avoid certain cancers, which will also serve to reduce the risk of other chronic illnesses such as heart disease and diabetes.<sup>11</sup> However, for the effective promotion of healthy lifestyles on a national and European level, it is important to increase public awareness in conjunction with structural changes such as legal actions, tax and living conditions.<sup>12</sup>

Few data exist on awareness of cancer risk factors in the general population. Some studies have shown that, despite the scientific evidence, the public is not well informed about the link between cancer and lifestyle.<sup>13–17</sup> For example, excess bodyweight (overweight or obesity) is an important risk factor

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for endometrial, gallbladder and renal cancers for women and for thyroid, colon and renal cancers in men,<sup>18–20</sup> and the prevalence of obesity in most European countries has increased rapidly over the years,<sup>11,21</sup> yet awareness of the association between increased BMI (body mass index) and cancer is very low.<sup>14,16,22</sup> Another important issue is the association between risk factor awareness and risk status. One United Kingdom (UK) study found that awareness of tobacco as a risk factor for mouth cancer was lower among smokers than non-smokers,<sup>23</sup> but it is unclear whether similar results will be found for other modifiable risk factors such as obesity, diet and physical activity, and whether people will recognise what they could do to reduce their personal risk of developing cancer.

The present survey was carried out in the context of Cancer Research UK's 'Reduce the Risk' campaign. The campaign was launched in 2005 and its aim was to highlight ways to reduce the risk of cancer. Risk factors targeted in the campaign are in line with the recommendations of the Europe Against Cancer Programme and these include smoking, unhealthy diet, physical inactivity, excess alcohol intake, overweight and obesity, non-attendance at routine cancer screening tests and sun exposure. The purpose of this national survey was to establish baseline levels of awareness of cancer risk factors prior to the campaign, and to examine associations between individual risk factor status and awareness of what steps they could take to reduce their own cancer risk.

## 2. Method

The survey was commissioned by Cancer Research UK through the British Market Research Bureau International (BMRB).

### 2.1. Design and sampling procedures

Data collection took place in September 2004, as a part of BMRB's weekly ACCESS Face-to-Face Omnibus survey. A total of 4233 in-home interviews with adults aged 15 years or over across Great Britain were carried out. Interviews were conducted by trained members of BMRB's field force, who were working under supervision.

ACCESS uses a random location sampling technique to ensure a correct distribution across all area types within each standard region of the UK (England, Wales, Scotland and Northern Ireland). The sampling frame includes all Enumeration Districts (EDs) in Great Britain. EDs defined by the 2001 Census were selected for the survey with probabilities proportional to their population. Within each standard region, EDs are chosen to give a correct distribution by socio-economic status (SES), and therefore conventional quota sampling was not deemed necessary for SES. But at each sampling point, quotas were set for sex and age groups (15–34, 34–54 and 55 and over). Quota controls are designed to correct for variation in the likelihood of being at home at the time of the interview. Age, gender, number of children and employment status were recorded. Socio-economic grade was based on employment and was categorised into groups A to E. People categorised in group A had higher managerial or professional occupa-

tions, group B intermediate managerial or professional occupations, group C1 supervisory or junior managerial occupations, group C2 were skilled manual workers, group D semi and unskilled manual workers and group E were state pensioners or lowest grade workers. No information was kept on those who refused to participate.

### 2.2. Measures

In addition to demographic details, the survey incorporated the following measures:

*Awareness of cancer risk factors* was assessed by presenting respondents with a list created by CRUK (see Table 1) and asking 'Which of these things do you think increase a person's chance of developing some types of cancer?' The list included well-established risk factors as well as some with no established link to cancer (e.g. using underarm deodorant). Respondents could choose as many items as they wished.

*Beliefs about the impact of lifestyle changes on risk of cancer* were assessed with the question: 'How likely do you think it is that a person can reduce their chances of getting cancer sometime in their life by making changes to their lifestyle?' Response categories were 'very likely', 'quite likely', 'neither likely nor unlikely', 'quite unlikely', 'very unlikely' and 'don't know'.

*Beliefs about personal cancer risk-reducing behaviour* were assessed by asking respondents to name steps they personally could take to reduce their cancer risk. No prompts were offered, and all responses were recorded.

*Health behaviours* were assessed with the following questions: For smoking the question was: 'Do you smoke at all?'. Response categories were 'Yes', 'No' and 'Don't Know'. Individual perception of weight was assessed with the question: 'Do you think you are underweight, normal weight, overweight or obese?' Responses were entered accordingly. For fruit and vegetable intake the question asked was 'Thinking about last week, how many portions of fruits and vegetables did you eat each day on an average?' Responses were 'None', 'One', 'Two', 'Three', 'Four', 'Five or more' and 'Don't know'. For the data analyses, the responses were reduced to 'Less than 5 a day' and 'More than 5 a day'. The question regarding exercise was phrased: 'How many times a week do you usually exercise, at least moderately, for 30 min or more (e.g. brisk walking, swimming, cycling, dancing)?' Response were 'Once a week' continued to 'Seven times a week or more', 'Less often than once a week', 'I do not exercise' and 'Don't Know'. The response categories were reduced to '5 times a

**Table 1 – List of cancer risk factors.**

Smoking	Being overweight
Getting sunburnt	Stress
Close relative with cancer	Low fruit and vegetable intake
Drinking alcohol frequently	Getting older
Taking hormone treatment like HRT	Being physically inactive
Infection with certain bacteria or viruses	Living near power lines
Using underarm deodorant	Do not know
Having many sexual partners	None of these

week or more' and 'Less than 5 times a week' for data analyses purposes. The tendency to sunburn was assessed with the question: 'Thinking back over the years, during sunny hot spells of weather how often does your skin tend to 'go red' or get sunburnt?' Response categories were 'Always', 'Usually', 'Sometimes', 'Rarely', 'Never' and 'Don't Know'.

### 2.3. Analysis

Analyses were carried out using Statistical Package for the Social Sciences (SPSS) for Windows version 14. Statistical analyses were performed on unweighted data. Chi-square analysis was used to analyse categorical data, with logistic regression to determine associations between demographic variables and awareness and between health behaviours and awareness. Odds ratios (ORs) with 95% confidence intervals (CIs) are reported.

**Table 2 – Demographic details of respondents.**

	Sample (unweighted) compared with (United Kingdom) UK-demographics		p-Value
	Sample (%)	UK demographics (%)	
Gender			n.s.
Male	44.6	48.4	
Female	55.4	51.6	
Age			n.s.
15–24	14.3	15.5	
25–34	17.6	16.2	
35–44	19.3	18.8	
45–54	14.4	15.6	
55–64	14.2	14.2	
65 and over	20.3	19.6	
Social grade			n.s.
AB	14.1	25.0	
C1	27.5	29.1	
C2	24.5	21.0	
D	14.8	16.2	
E	19.1	8.8	

## 3. Results

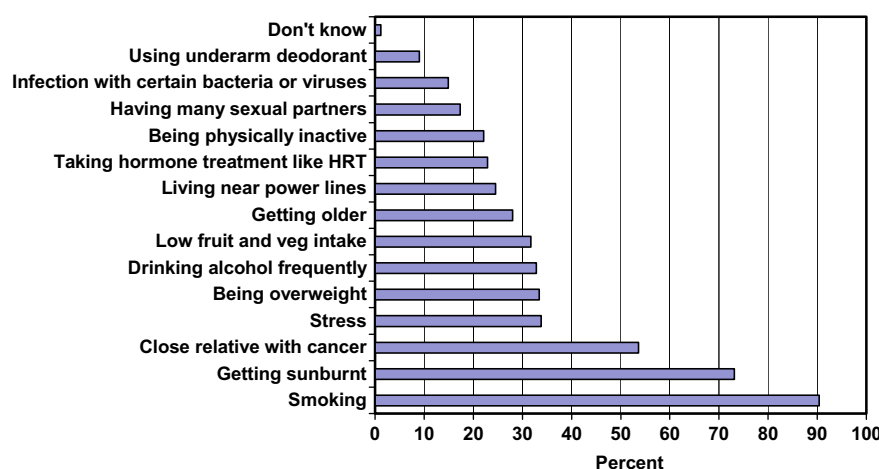
Demographic details of respondents are presented in Table 2. Overall, 55% of respondents were female. The sample distribution was not significantly different from the UK population.

### 3.1. Knowledge of risk factors

The proportion of respondents identifying each factor as increasing cancer risk are presented in Fig. 1. The majority endorsed smoking as a risk factor (90%) and 73% identified getting sunburnt, but only a third of respondents endorsed being overweight (33%) and alcohol intake (33%) as risk factors. Older age was identified by only 28% and physical inactivity by 22%. Stress was endorsed as a risk factor for cancer by 34%, and using underarm deodorant by 9% despite there being limited evidence to support either as aetiological factors in the development of cancer. Living near power lines – a risk factor with equivocal risk status – was endorsed by a quarter (25%).

Univariate and multivariate associations between age, gender, SES and knowledge of cancer risk factors are shown in Table 3. Only associations that were significant in both the univariate and the multivariate analyses are discussed. The relationship between gender and knowledge was inconsistent. Women were more aware of the established risk factors of getting sunburnt, having a close relative with cancer, having many sexual partners and hormone treatment, but they were also more likely to endorse power lines and underarm deodorants. Men were more likely to endorse two of the risk factors: getting older and physical inactivity. There were no gender differences for smoking, weight, fruit and vegetable intake, alcohol consumption, infection or stress.

For a number of the established risk factors, awareness was higher among the older people than the youngest age group. The odds of mentioning low fruit and vegetable intake were significantly higher in all age groups compared to the youngest group, whilst the odds of endorsing hormone treatment were higher in all age groups except those aged 65 and over. Similarly, the odds of mentioning a relative with cancer were higher in all age groups except those aged 55 and over.



**Fig. 1 – Knowledge of cancer risk factors (prompted) (unweighted).**

**Table 3 – Univariate and multivariate logistic regression analyses of demographic variables as predictors of knowledge of cancer risk factors (prompted) and proportion of people citing each risk factor (odd ratios (ORs) and confidence intervals (CIs) are from the univariate analysis).**

	%	OR	%	OR	%	OR	%	OR	%	OR	%	OR	%	OR
	Smoking		Getting sunburnt		Close relative with cancer		Being overweight		Low fruit and veg intake		Drinking alcohol frequently		Being physically inactive	
<i>Gender</i>														
Male	90	(1.0)	68	(1.0)	44	(1.0)	34	(1.0)	32	(1.0)	33	(1.0)	24	(1.0)
Female	91	1.12 [.91–1.37]	77	1.55 <sup>cf</sup> [1.36–1.78]	61	1.97 <sup>cf</sup> [1.74–2.23]	33	.99 [.87–1.12]	32	1.02 [.89–1.16]	33	.98 [.86–1.12]	20	.80 <sup>be</sup> [.69–.93]
<i>Age</i>														
15–24	90	(1.0)	71	(1.0)	49	(1.0)	32	(1.0)	24	(1.0)	37	(1.0)	21	(1.0)
25–34	92	1.33 [.91–1.94]	73	1.15 [.91–1.46]	60	1.60 <sup>cf</sup> [1.29–1.99]	32	1.02 [.81–1.28]	32	1.50 <sup>ce</sup> [1.18–1.91]	34	.87 [.69–1.08]	26	1.29 <sup>d</sup> [1.00–1.66]
35–44	91	1.18 [.82–1.69]	75	1.25 [.99–1.59]	58	1.43 <sup>cd</sup> [1.15–1.76]	31	.99 [.79–1.24]	34	1.63 <sup>cf</sup> [1.29–2.07]	32	.80 <sup>ad</sup> [.64–.99]	21	.98 [.76–1.27]
45–54	93	1.51 <sup>a</sup> [1.01–2.28]	78	1.46 <sup>bd</sup> [1.13–1.90]	60	1.58 <sup>ce</sup> [1.26–1.99]	36	1.20 [.95–1.52]	36	1.78 <sup>cf</sup> [1.38–2.28]	34	.89 [.70–1.12]	25	1.22 [.93–1.59]
55–64	89	.88 [.61–1.27]	74	1.20 [.93–1.54]	52	1.14 [.91–1.43]	35	1.16 [.91–1.47]	34	1.65 <sup>cf</sup> [1.28–2.13]	30	.72 <sup>be</sup> [.56–.91]	20	.95 [.72–1.26]
65+	88	.80 [.57–1.12]	69	.92 [.74–1.16]	44	.84 [.68–1.04]	35	1.18 [.94–1.47]	31	1.45 <sup>bf</sup> [1.15–1.84]	31	.76 <sup>ad</sup> [.61–.94]	20	.94 [.72–1.21]
<i>Social grade</i>														
AB	96	(1.0)	82	(1.0)	65	(1.0)	42	(1.0)	46	(1.0)	36	(1.0)	28	(1.0)
C1	92	.48 <sup>be</sup> [.30–.76]	76	.73 <sup>ae</sup> [.57–.93]	57	.71 <sup>cf</sup> [.58–.86]	35	.73 <sup>be</sup> [.60–.90]	36	.66 <sup>cf</sup> [.54–.80]	33	.89 [.73–1.11]	23	.77 <sup>ad</sup> [.62–.96]
C2	90	.37 <sup>cf</sup> [.23–.58]	74	.64 <sup>cf</sup> [.50–.82]	53	.62 <sup>cf</sup> [.50–.76]	33	.66 <sup>cf</sup> [.53–.81]	29	.47 <sup>cf</sup> [.38–.58]	33	.89 [.72–1.10]	21	.66 <sup>cf</sup> [.52–.84]
D	89	.35 <sup>cf</sup> [.22–.57]	69	.51 <sup>cf</sup> [.39–.66]	50	.53 <sup>cf</sup> [.42–.67]	28	.54 <sup>cf</sup> [.42–.68]	25	.39 <sup>cf</sup> [.30–.49]	31	.78 <sup>ad</sup> [.62–.99]	21	.66 <sup>be</sup> [.51–.86]
E	86	.25 <sup>cf</sup> [.16–.39]	64	.40 <sup>cf</sup> [.31–.52]	45	.44 <sup>cf</sup> [.35–.54]	30	.58 <sup>cf</sup> [.47–.73]	23	.36 <sup>cf</sup> [.28–.45]	31	.79 <sup>a</sup> [.63–.99]	19	.59 <sup>cf</sup> [.46–.76]
	Sexual partners		Getting older		Hormone treatment		Infection with certain viruses		Power lines		Stress		Deodorants	
<i>Gender</i>														
Male	12	(1.00)	30	(1.0)	16	(1.0)	16	(1.0)	22	(1.0)	33	(1.0)	7	(1.0)
Female	22	2.12 <sup>cf</sup> [1.78–2.51]	27	.87 <sup>ad</sup> [.76–.99]	28	2.03 <sup>cf</sup> [1.74–2.36]	14	.90 [.76–1.07]	26	1.23 <sup>be</sup> [1.07–1.42]	35	1.11 [0.97–1.26]	11	1.78 <sup>cf</sup> [1.42–2.23]
<i>Age</i>														
15–24	12	(1.0)	25	(1.0)	16	(1.0)	19	(1.0)	18	(1.0)	21	(1.0)	8	(1.0)
25–34	17	1.48 <sup>a</sup> [1.08–2.01]	27	1.11 [.87–1.42]	22	1.48 <sup>bd</sup> [1.12–1.95]	16	.78 [.58–1.03]	26	1.64 <sup>cf</sup> [1.26–2.14]	30	1.54 <sup>cf</sup> [1.20–1.98]	10	1.38 [0.94–2.02]
35–44	18	1.55 <sup>bd</sup> [1.15–2.09]	24	.97 [.76–1.24]	27	1.89 <sup>cf</sup> [1.45–2.47]	14	.68 <sup>be</sup> [.52–.91]	27	1.75 <sup>cf</sup> [1.35–2.26]	34	1.88 <sup>cf</sup> [1.48–2.40]	10	1.39 [0.96–2.03]
45–54	22	1.96 <sup>cf</sup> [1.44–2.67]	34	1.56 <sup>cf</sup> [1.22–2.01]	28	2.02 <sup>cf</sup> [1.53–2.67]	18	.93 [.70–1.24]	31	2.13 <sup>cf</sup> [1.62–2.79]	40	2.44 <sup>cf</sup> [1.89–3.14]	10	1.38 [0.92–2.05]
55–64	22	1.94 <sup>cf</sup> [1.42–2.64]	30	1.28 [.99–1.65]	29	2.10 <sup>cf</sup> [1.59–2.77]	14	.67 <sup>be</sup> [.49–.91]	24	1.44 <sup>be</sup> [1.09–1.91]	41	2.53 <sup>cf</sup> [1.96–3.26]	10	1.30 [0.87–1.95]
65+	14	1.14 [.84–1.56]	29	1.25 <sup>d</sup> [.99–1.58]	17	1.03 [.78–1.36]	11	.50 <sup>cf</sup> [.38–.68]	21	1.21 [0.93–1.58]	37	2.19 <sup>cf</sup> [1.73–2.78]	6	.80 [0.53–1.20]
<i>Social grade</i>														
AB	24	(1.0)	37	(1.0)	29	(1.0)	21	(1.0)	23	(1.0)	38	(1.0)	11	(1.0)
C1	18	.72 <sup>be</sup> [.57–.92]	32	.80 <sup>a</sup> [.65–.98]	24	.78 <sup>ad</sup> [.63–.98]	15	.65 <sup>cf</sup> [.50–.83]	28	1.30 <sup>ad</sup> [1.03–1.64]	36	.92 [0.75–1.13]	11	.94 [0.68–1.28]
C2	16	.62 <sup>cf</sup> [.48–.80]	24	.53 <sup>cf</sup> [.43–.66]	22	.71 <sup>be</sup> [.56–.89]	14	.58 <sup>cf</sup> [.45–.76]	25	1.12 [0.88–1.42]	32	.76 <sup>ad</sup> [0.62–0.94]	9	.76 [0.55–1.07]
D	15	.55 <sup>cf</sup> [.41–.74]	23	.51 <sup>cf</sup> [.40–.66]	22	.71 <sup>bd</sup> [.55–.91]	14	.60 <sup>cf</sup> [.45–.81]	25	1.16 [0.89–1.50]	32	.75 <sup>a</sup> [0.59–0.95]	6	.53 <sup>be</sup> [0.35–0.79]
E	14	.54 <sup>cf</sup> [.41–.71]	25	.57 <sup>cf</sup> [.45–.71]	18	.56 <sup>cf</sup> [.44–.72]	12	.51 <sup>cf</sup> [.38–.68]	21	.91 [0.70–1.17]	31	.74 <sup>be</sup> [0.59–0.92]	7	.62 <sup>ad</sup> [0.46–0.90]

Univariate analysis: a =  $p < 0.05$ ; b =  $p < 0.01$ ; c =  $p < 0.001$ .

Multivariate analysis (controlling for the two other socio-demographic variables): d =  $p < 0.05$ ; e =  $p < 0.01$ ; f =  $p < 0.001$ .

Sunburn, older age and sexual partners were more likely to be endorsed by people in the mid-age range (sexual partners awareness was higher among people aged 35–64, while recognition of sunburn and older age was only higher in people aged 45–54).

Two risk factors showed a negative association between age and awareness: knowledge of infections and alcohol intake were lower for the 35–44 and the 55 and over age groups. There was no relationship between age and awareness of smoking, physical inactivity or overweight. Older respondents were more likely to endorse risk factors with a weaker evidence base, with all age groups more likely to endorse stress as a risk factor compared to the youngest group and all age groups except the 65 and over endorsing power lines. Belief that deodorants were a risk factor for cancer showed no relationship with age.

Strong socio-economic gradients were evident for all the established risk factors, with lower awareness in the lower SES groups. The odds of endorsing smoking, sunburn, close relative with cancer, fruit and vegetable intake and having many sexual partners showed a linear trend, decreasing from the highest to the lowest SES group. Similar patterns of decreasing awareness with lower SES were also evident for being overweight, being physically active, getting older, hormone treatment and infection with certain viruses, although the effect was not linear. SES effects on awareness for drinking alcohol were weaker, with only social group D showing lower levels of awareness than social group AB.

For non-established risk factors, there were lower levels of endorsement of stress for social groups C2 and E, and lower levels of endorsement of deodorants for groups D and E. For power lines, there were higher levels of endorsement among social group C1 compared to the reference group.

### 3.2. Beliefs about the impact of lifestyle changes on risk of cancer

Overall, 79% of respondents thought that cancer risk could be modified via lifestyle changes, with 28% believing it very likely and 51% believing it quite likely that lifestyle changes could reduce cancer risk. Again, only associations that were significant in both univariate and multivariate analyses (controlling for the other socio-demographic factors) are discussed here. Men were more likely to believe that cancer

risk was modifiable than women ( $t = 3.61$ ,  $p < 0.001$ ). More affluent groups were also more likely to endorse the belief that cancer risk could be modified ( $t = 5.27$ ,  $p < 0.001$ ). Age was unrelated to belief in the impact of lifestyles change.

Smokers and people with lower fruit and vegetable intake were less likely to endorse the view that lifestyle changes could reduce the risk of cancer ( $t = 5.44$ ,  $p < 0.001$ ;  $t = 2.79$ ,  $p = 0.005$ , respectively), but no such associations were observed for weight, exercise and skin type.

### 3.3. Endorsement of behavioural factors that could reduce personal cancer risk

Responses to the question of what they could do to personally reduce their cancer risk were coded by the BMRB researcher. People were most likely to say stop smoking/do not smoke (72%), and more than half named consuming a healthy balanced diet (63%), but only 25% mentioned maintaining a healthy body weight or losing weight (see Fig. 2). Unproven factors such as taking vitamin supplements and eating organic food were mentioned by less than 10%. A very small proportion considered that nothing could be done to reduce their cancer risk.

Only associations that were significant in both univariate and multivariate analyses (controlling for the other socio-demographic factors) are discussed here. Women were more likely to mention taking care in the sun (OR: 1.20, CI: 1.06–1.35), go for screening (OR: 1.83, CI: 1.62–2.07), checking early warning signs (OR: 1.42, CI: 1.25–1.60) and maintaining a healthy weight (OR: 1.27, CI: 1.11–1.47) as things they could do to reduce their own cancer risk, but they were less likely to mention stop smoking/do not smoke (OR: 0.85, CI: 0.74–0.97). There were no gender differences in the remaining responses.

Awareness of smoking, warning signs and exercise as ways to reduce risk showed an inverse relationship with age. Smoking was less likely to be mentioned across all age groups compared with the youngest group, whilst exercise (OR: 0.73, CI: 0.59–0.90) and warning signs (OR: 0.76, CI: 0.61–0.94) were less likely to be mentioned by just the oldest group (65 and over). In addition, the view that nothing could be done to alter cancer risk was more likely to be mentioned by people aged 55–64 (OR: 2.30, CI: 1.21–4.37) and by people aged 65 and over (OR: 4.38, CI: 2.46–7.81).

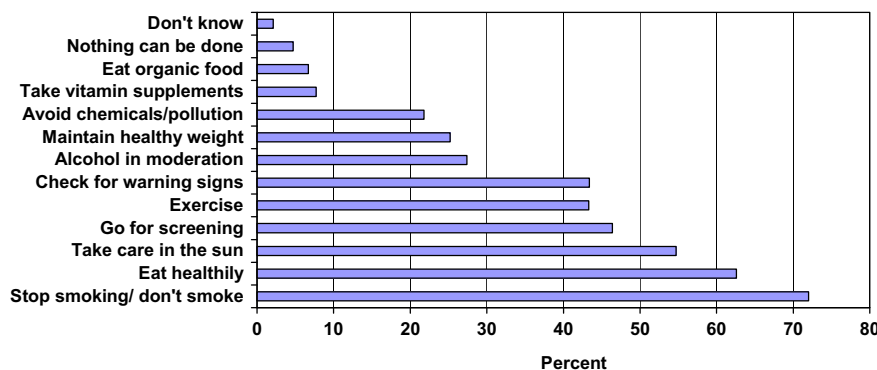


Fig. 2 – Behavioural factors endorsed.

**Table 4 – Relationship between risk status and actions that could be taken to reduce cancer risk and proportion of the sample currently in each of the behavioural risk factor categories.**

	%	Stop smoking do not smoke	Eat healthily	Take care in sun	Go for screening	Exercise	Check for warning signs	Alcohol in moderation	Maintain healthy weight
<i>Smoking</i>									
No	69	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Yes	31	4.01 <sup>cf</sup> [3.34–4.81]	.68 <sup>cf</sup> [.59–.78]	.89 [.78–1.01]	.82 <sup>be</sup> [.72–.93]	.78 <sup>cf</sup> [.68–.89]	.93 [.81–1.06]	.78 <sup>ce</sup> [.67–.90]	.74 <sup>cd</sup> [.64–.87]
<i>Self-reported BMI<sup>A</sup></i>									
Normal	47	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Underweight	5	1.03 [.75–1.42]	.71 <sup>ad</sup> [.53–.94]	.84 [.63–1.11]	1.04 [.78–1.38]	.91 [.68–1.21]	.94 [.71–1.26]	.78 [.56–1.09]	.98 [.70–1.37]
Overweight	29	1.05 [.89–1.23]	1.04 [.90–1.21]	1.04 [.90–1.20]	1.11 <sup>e</sup> [.96–1.28]	.98 [.85–1.13]	1.08 [.94–1.25]	.91 [.77–1.06]	1.07 [.91–1.26]
Obese	19	.80 <sup>b</sup> [.67–.95]	.95 [.80–1.13]	.96 [.82–1.14]	1.01 [.86–1.19]	.89 [.76–1.05]	1.07 [.91–1.26]	.89 [.74–1.06]	1.14 [.95–1.38]
<i>Fruit &amp; veg intake</i>									
5 a day or more	26	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Less than 5 a day	74	1.12 [.96–1.30]	.76 <sup>ce</sup> [.66–.88]	.81 <sup>bd</sup> [.71–.93]	.85 <sup>a</sup> [.74–.97]	.76 <sup>cf</sup> [.66–.87]	.84 <sup>a</sup> [.73–.97]	.82 <sup>bd</sup> [.70–.95]	.70 <sup>ce</sup> [.60–.82]
<i>Exercise</i>									
5 times a week or more of moderate	33	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Less than 5 times a week	67	.75 <sup>cf</sup> [.64–.86]	.94 [.82–1.07]	.89 <sup>d</sup> [.78–1.01]	.92 [.81–1.04]	.87 <sup>ad</sup> [.76–.99]	.76 <sup>cf</sup> [.67–.87]	.88 <sup>d</sup> [.77–1.02]	.95 [.82–1.10]
<i>Tendency to sunburn</i>									
Never	20	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Rarely	31	1.00 [.83–1.21]	1.59 <sup>cf</sup> [1.34–1.90]	1.67 <sup>cf</sup> [1.41–1.99]	1.12 [0.94–1.33]	1.43 <sup>cf</sup> [1.20–1.70]	1.50 <sup>cf</sup> [1.26–1.79]	1.16 [0.95–1.41]	1.52 <sup>cf</sup> [1.24–1.86]
Sometimes	24	1.04 [.85–1.27]	1.58 <sup>cf</sup> [1.31–1.90]	1.76 <sup>cf</sup> [1.46–2.11]	1.20 [0.99–1.43]	1.38 <sup>ce</sup> [1.15–1.66]	1.57 <sup>cf</sup> [1.30–1.89]	1.14 [0.93–1.40]	1.40 <sup>bd</sup> [1.13–1.74]
Usually	13	1.10 [.87–1.39]	1.30 <sup>ad</sup> [1.05–1.62]	1.48 <sup>cf</sup> [1.20–1.83]	1.06 [0.86–1.32]	1.33 <sup>bd</sup> [1.07–1.65]	1.38 <sup>be</sup> [1.11–1.71]	1.07 [0.84–1.36]	1.31 <sup>a</sup> [1.02–1.68]
Always	11	1.17 [.91–1.52]	1.22 [0.97–1.54]	1.83 <sup>cf</sup> [1.45–2.31]	1.17 [0.93–1.47]	1.01 [0.80–1.28]	1.55 <sup>cf</sup> [1.23–1.95]	1.02 [0.79–1.32]	1.11 [0.84–1.46]

Univariate analysis: a =  $p < 0.05$ ; b =  $p < 0.01$ ; c =  $p < 0.001$ .Multivariate analysis (controlling for age, gender and SES): d =  $p < 0.05$ ; e =  $p < 0.01$ ; f =  $p < 0.001$ .

A BMI (body mass index).



Older age was also associated with a lower likelihood of mentioning take care in the sun (OR: 0.80, CI: 0.65–0.98), but take care in the sun (OR: 1.35, CI: 1.09–1.68), go for screening (OR: 1.64, CI: 1.32–2.03), avoid chemicals/pollution (OR: 1.31, CI: 1.01–1.71) and maintain a healthy body weight (OR: 1.67, CI: 1.29–2.17) were all more likely to be mentioned by people aged 25–34. Eating healthily was more likely to be mentioned by people aged 35–44 (OR: 1.44, CI: 1.16–1.79) and by people aged 45–54 (OR: 1.62, CI: 1.28–2.05). The latter group was also more likely to mention maintaining a healthy body weight as a risk-reducing strategy (OR: 1.96, CI: 1.50–2.56).

No age differences were observed in relation to drinking alcohol in moderation, taking vitamin supplements and eating organic food.

Lower levels of awareness of what to do to reduce personal cancer risk were observed across all SES groups compared with the AB group (the reference group). Exceptions were awareness of screening, which was significantly lower only in SES groups D and E (OR: 0.67, CI: 0.53–0.84; OR: 0.68, CI: 0.55–0.84, respectively), and taking vitamin supplements which was significantly lower in SES group C2 (OR: 0.60, CI: 0.42–0.87). Awareness of smoking, and the belief that nothing could be done to reduce personal cancer risk showed no association with SES, although the response do not know was more likely to be mentioned by people in SES group E (OR: 2.44, CI: 1.15–5.19).

### 3.4. Risk status and perceptions of cancer risk reduction

The relationship between personal risk status and awareness of steps that could be taken to reduce individual cancer risk were assessed using univariate and multivariate regression. The univariate odds ratios and confidence intervals are shown in Table 4. The correlations between risk status variables are shown in Table 5.

Only the results that are related to established risk factors and that were significant in both univariate and multivariate analyses (controlling for age, gender and SES) are discussed here.

### 3.5. Smokers

Smokers were more likely to mention stopping smoking, but they were less likely to mention healthy eating, going for screening, exercising, reducing alcohol or maintaining a healthy weight. Because smokers differed from non-smokers in self-reported BMI, fruit and vegetable intake and exercise,

these variables were entered as covariates in the above analysis. Smokers were still more likely to mention stopping smoking (OR: 3.77, CI: 3.13–4.55), and less likely to mention following a healthy diet (OR: 0.75, CI: 0.65–0.86), going for screening (OR: 0.82, CI: 0.71–0.94), taking regular exercise (OR: 0.80, CI: 0.70–0.92), drinking alcohol in moderation (OR: 0.81, CI: 0.69–0.95) or maintaining a healthy weight (OR: 0.84, CI: 0.71–0.99) than non-smokers.

### 3.6. BMI

Self-reported BMI was significantly associated only with mentioning healthy eating: the underweights were less likely to state healthy eating, but this association became non-significant once the other behavioural risk factors associated with BMI were added into the analysis (smoking status, fruit and vegetable consumption and skin type).

### 3.7. Low fruit and vegetable intake

People with low fruit and vegetable intake were less likely to mention healthy eating. They were also less likely to mention take care in the sun, exercise, drink alcohol in moderation or maintain a healthy weight. People reporting a low fruit and vegetable intake were more likely to smoke, self-report a higher BMI and were less likely to exercise. However, controlling for these factors in addition to the demographic variables still meant people with low fruit and vegetable intake were less likely to mention healthy eating (OR: 0.84, CI: 0.72–0.98), take care in the sun (OR: 0.85, CI: 0.74–0.98), exercise (OR: 0.78, CI: 0.68–0.91) and maintain a healthy weight (OR: 0.79, CI: 0.68–0.94), but the association with alcohol became non-significant.

### 3.8. Exercise less than 5 times a week

People who reported exercising less than 5 times a week were less likely to mention exercise as something they could do to reduce their chances of getting cancer. They were also less likely to mention stop smoking and check for warning signs. Controlling for behavioural risk factors that correlated with self-reported exercise (smoking status and fruit and vegetable intake), people who reported doing fewer than the recommended 5 sessions of exercise per week were less likely to mention take regular exercise (OR: 0.86, CI: 0.75–0.97), smoking (OR: 0.78, CI: 0.67–0.91) or check for warning signs (OR: 0.74, CI: 0.65–0.84).

**Table 5 – Univariate correlations between behavioural risk factors.**

	Smoke	BMI (body mass index)	Low fruit and vegetable intake	Being physically inactive	Tendency to sunburn
Smoke	1				
BMI	-.05 <sup>b</sup>	1			
Fruit and vegetables	-.10 <sup>c</sup>	.04 <sup>a</sup>	1		
Being physically inactive	.05 <sup>c</sup>	-.03	.05 <sup>b</sup>	1	
Tendency to sunburn	-.01	.03 <sup>a</sup>	-.03	.01	1
Univariate analysis: a = $p < 0.05$ ; b = $p < 0.01$ ; c = $p < 0.001$ .					

### 3.9. Skin type

Respondents who reported a tendency to burn in the sun were significantly more likely to report taking care in the sun and checking their body for warning signs. These associations remained significant after controlling for BMI (the only behavioural risk factor that correlated significantly with skin type) (OR: 1.12, CI: 1.06–1.17 and OR: 1.08, CI: 1.03–1.13, respectively). People who reported rarely, sometimes or usually burning in the sun (but not those who reported always burning in the sun) were more likely to mention healthy eating (OR: 1.59, CI: 1.34–1.90; OR: 1.58, CI: 1.31–1.90 and OR: 1.30, CI: 1.05–1.62, respectively) and exercise (OR: 1.43, CI: 1.20–1.70; OR: 1.38, CI: 1.15–1.66; OR: 1.33, CI: 1.07–1.65, respectively), both of which remained significant in controlling for the above factors in the multivariate analysis.

## 4. Discussion

Awareness of cancer risk factors varied widely across different risk factors in this population-based survey. There were high levels of awareness of the role of smoking, sunburn and family history in the development of cancer, but only modest levels of awareness of overweight, fruit and vegetable intake, and older age. Recognition of the role of viral infection in cancer risk was very poor. With the exception of stress, endorsement of unproven factors in cancer aetiology was fairly low (under 10%). The present results are in concordance with the previous findings<sup>14,16,24,25</sup> indicating ‘awareness deficiencies’ for some cancer risk factors amongst adults. In particular, awareness of overweight, alcohol, exercise and infections in the development of cancer needs to be increased, particularly among the younger people and those from more socio-economically deprived backgrounds.

Encouragingly, over three quarters of respondents thought that cancer risk could be modified by lifestyle changes, but this was graded by socio-economic status. Somewhat surprisingly, men were more likely to believe that cancer risk was modifiable than women. A higher proportion of male cancers are in fact caused by lifestyle factors,<sup>26</sup> so this result could reflect men’s greater potential to prevent cancer, but given that recognition of the main lifestyle contributors to male cancers (alcohol and smoking) was lower for men than for women, this suggests that they do not have an accurate understanding of what they could usefully do to reduce their cancer risk.<sup>26</sup>

Of particular interest is whether people are aware of the changes they personally need to make to reduce their risk, given their own risk factor profile. People with a tendency to burn in the sun and smokers were more likely to identify appropriate strategies to reduce their cancer risk, though these were the two most widely recognised cancer risk factors in the sample as a whole. However, although smokers were more likely to say that quitting smoking was something they could do to reduce their personal cancer risk, they showed lower levels of awareness of other lifestyle changes they could make, such as eating healthily, going for screening and reducing alcohol intake. The latter is of particular concern given that smoking and alcohol in combination can dra-

matically increase the risk of oral and certain other (i.e. oesophageal) cancers.

For a number of the other risk factors, people most in need of behaviour change showed lower levels of awareness of what they could do to reduce their risk. Those with low levels of fruit and vegetable intake were less likely to mention healthy eating, and those who reported doing fewer than the recommended five sessions of exercise a week were less likely to mention regular exercise. This is in line with the results from the 2003 Health Information National Trends Survey (HINTS), where it was found that people with lower levels of awareness of cancer risk-reducing strategies (such as exercising, eating fruit and vegetables and not smoking) were also less likely to engage in these behaviours.<sup>14</sup>

Additionally, there is evidence that sometimes people judge risk factors as more important for others than for themselves. For instance, a large (United States) US study with 670 breast, colorectal and prostate cancer survivors investigated beliefs concerning the cause of their own cancer. Cancer survivors were more likely to attribute other people’s cancer diagnosis to behavioural risk factors than their own cancer. For example, even current smokers thought that smoking was more of a risk factor for others than for themselves. Similarly, only 13% of cancer survivors believed that obesity or being overweight was a cause of their own cancer, compared with 43% who thought that it might be a cause for the same type of cancer in others.<sup>27</sup>

Across the sample as a whole, there was little recognition of the role of weight in cancer, and people who self-reported BMI in the overweight or obese range were no more likely to be aware that losing weight was something they could do to reduce their personal cancer risk than people of a normal weight. Currently, 65% of men and 56% of women in the UK are overweight or obese. This is predicted to rise to 75% and 58% by 2010, and it has been suggested that excess bodyweight could become the dominant lifestyle factor contributing to cancer occurrence.<sup>19</sup> This indicates that efforts to raise awareness of the role of weight in cancer aetiology are urgently required.

Our results indicate that socially disadvantaged groups are less aware of cancer risk factors and have reported poorer health practices; consistent with other findings in the UK and Europe.<sup>28–30</sup> The results highlight that consideration must be given to inequalities in awareness of cancer risk factors and these need to be addressed in future health campaigns. Bostock, for example, offers recommendations on how comprehensive tobacco control policies that address smoking-related inequalities can be developed.<sup>28</sup> Moreno and colleagues suggest that strategies such as pricing and taxations, regulation of products and restrictions of advertising will also play a very important role besides awareness in achieving behaviour change.<sup>12</sup> On a European level, the Eurocadet project aims to develop measures and collect data on health inequalities indicators in participating countries and to provide estimations of the effectiveness of policies and interventions to tackle the determinants of health inequalities.<sup>3</sup> This will help to identify the most effective preventive strategies.



The results suggest that messages about sun exposure and smoking have been successfully communicated to the general population including those at high risk. The same cannot be said of other modifiable cancer risk factors such as weight, exercise, or fruit and vegetable intake. Public health promotion campaigns may have a role in informing the public about cancer prevention strategies, but this needs to be combined with studies of trends in public awareness in relation to such campaigns in order to gain a better understanding of their effectiveness. Of course, awareness does not automatically translate into behaviour change, but it is an important first step and one that is both desirable in terms of informing the public about the developments in science and relatively neutral in terms of the ethical issues that are associated with more intrusive approaches to behaviour change.<sup>31</sup>

### Conflict of interest statement

None declared.

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### Appendix 1. Structure of the survey

1. Demographic details (gender, age, social grade and standard region).
2. Can you please name up to three things that people can do about their lifestyles to reduce their risk of cancer (any cancer)?
3. Which of these things do you think increase a person's chance of developing some type of cancer? (complete list shown as Table 2)
4. How likely do you think it is that a person can reduce their chances of getting cancer sometime in their life by making changes to their lifestyle?
5. Of every 100 people in Britain, how many do you think will get cancer at some point in their life?
6. Of every 100 people in Britain, how many do you think will die of cancer?
7. Are you aware of any type of cancer that the NHS screens for?
8. What do you think you can personally do to reduce your risk of developing cancer in the future?
9. Do you smoke at all?
10. Do you want to give up smoking?
11. Thinking about the last week, how many portions of fruits and vegetables did you eat each day on an average?
12. How many times a week do you usually exercise, at least moderately, for 30 min or more (e.g. brisk walking, swimming, cycling, dancing)?
13. Thinking back over the years, during sunny and hot spells of weather how often does your skin tend to 'go red' or get sunburnt?

14. What do you think 'Cancer Research UK' is involved with?
15. Do you go for regular cervical screening?
16. Do you go for regular breast screening?
17. How tall are you?
18. How much do you weigh?
19. Do you think you are underweight, normal weight, overweight or obese?
20. Have you ever been diagnosed with cancer?

### REFERENCES

1. Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. Estimates of the cancer incidence and mortality in Europe in 2006. *Ann Oncol* 2007;**18**:581–92.
2. Jemal A, Siegel R, Ward E, et al. Cancer Statistics, 2008. *CA Cancer J Clin* 2008;**58**(2):71–96.
3. The Eurocadet project: towards less cancer in Europe. <<http://www.eurocadet.org/index.php?nav>> [accessed 24.09.2008].
4. Quinn MJ, d'Onofrio A, Moller B, et al. Cancer mortality trends in the EU and acceding countries up to 2015. *Ann Oncol* 2003;**14**(7):1148–52.
5. Moller H, Fairley L, Coupland V, et al. The future burden of cancer in England: incidence and numbers of new patients in 2020. *Br J Cancer* 2007;**96**(9):1484–8.
6. Soerjomataram I, de Vries E, Pukkala E, Coebergh JW. Excess of cancers in Europe: a study of eleven major cancers amenable to lifestyle change. *Int J Cancer* 2007;**120**(6):1336–43.
7. Bianchini F, Kaaks R, Vainio H. Weight control and physical activity in cancer prevention. *Obes Rev* 2002;**3**(1):5–8.
8. Glade MJ. World Cancer Research Fund/American Institute for Cancer Research, Food, Nutrition, Physical Activity and the Prevention of Cancer: A Global Perspective, American Institute for Cancer Research, Washington, DC (2007). *Nutrition* 2008;**24**(4):393–8.
9. Kanavos P. The rising burden of cancer in the developing world. *Ann Oncol* 2006;**17**:15–23.
10. Public Health: Prevention of cancer. <<http://www.ec.europa.eu/health/>> [accessed 24.09.2008].
11. Boyle P, Autier P, Bartelink H, et al. European code against cancer and scientific justification: third version (2003). *Ann Oncol* 2003;**14**(7):973–1005.
12. Martin-Moreno JM, Soerjomataram I, Magnusson G. Cancer causes and prevention: a condensed appraisal in Europe in 2008. *Eur J Cancer* 2008;**44**(10):1390–403.
13. de Vries E, Doré JF, Autier P, Eggermont AMM, Coebergh JWW. Patients' perception of the cause of their melanoma differs from that of epidemiologists. *Br J Dermatol* 2002;**147**:385–410.
14. Hawkins NA, Berkowitz Z, Peipins LA. What Does The Public Know About Preventing Cancer? Results From The Health Information National Trends Survey (HINTS). *Health Educ Behav* [published online ahead of print May 2007] <<http://heb.sagepub.com/cgi/rapidpdf/1090198106296770v1>> [accessed October 2008].
15. Reeder A, Trevena J. Adults' perception of the causes and primary prevention of common fatal cancers in New Zealand. *J New Zeal Med Assoc* 2003;**116**(1182):U600.
16. Wardle J, Waller J, Brunswick N, Jarvis MJ. Awareness of risk factors for cancer among British adults. *Public Health* 2001;**115**(3):173–4.
17. Peacey V, Steptoe A, Davidsdottir S, Baban A, Wardle J. Low levels of breast cancer risk awareness in young women: An international survey. *Eur J Cancer* 2006;**42**(15):2585–9.

18. WHO Technical Report Series 916. Diet, Nutrition and the Prevention of Chronic Diseases. <[http://whqlibdoc.who.int/trs/WHO\\_TRS\\_916.pdf](http://whqlibdoc.who.int/trs/WHO_TRS_916.pdf)> [accessed 24.09.2008].
19. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet* 2008;**371**(9612):569–78.
20. Vainio H, Kaaks R, Bianchini F. Weight control and physical activity in cancer prevention: international evaluation of the evidence. *Eur J Cancer Prev* 2002;**11**(Suppl. 2):S94–100.
21. Paul C, Tzelepis F, Walsh RA, Girgis A, King L, McKenzie J. Has the investment in public cancer education delivered observable changes in knowledge over the past 10 years? *Cancer* 2003;**97**(12):2931–9.
22. Consedine NS, Magai C, Conway F, Neugut AI. Obesity and awareness of obesity as risk factors for breast cancer in six ethnic groups. *Obes Res* 2004;**12**(10):1680–9.
23. West R, Alkhatib MN, McNeill A, Bedi R. Awareness of mouth cancer in Great Britain. *Brit Dent J* 2006;**11**;200(3):167–9.
24. Keighley MRB, O'Morain C, Giacosa A, et al. Public awareness of risk factors and screening for colorectal cancer in Europe. *Eur J Cancer Prev* 2004;**13**(4):257–62.
25. Marlow LAV, Waller J, Wardle J. Public awareness that HPV is a risk factor for cervical cancer. *Brit J Cancer* 2007;**97**(5):691–4.
26. Bray F, Atkin W. International cancer patterns in men: geographical and temporal variations in cancer risk and the role of gender. *J Mens Health Gend* 2004;**1**(1):38–46.
27. Wold KS, Byers T, Crane LA, Ahnen D. What do cancer survivors believe causes cancer? (United States). *Cancer Cause Control* 2005;**16**(2):115–23.
28. Bostock Y. *International network of women against tobacco – Europe. Searching for the solution: women, smoking and inequalities in Europe*. London: Health Development Agency; 2003.
29. Karim-Kos HE, de Vries E, Soerjomataram I, Lemmens V, Siesling S, Coebergh JWW. Recent trends of cancer in Europe: a combined approach of incidence, survival and mortality for 17 cancer sites since the 1990s. *Eur J Cancer* 2008;**44**(10):1345–89.
30. Zatonski W, Didkowska J. Closing the gap: Cancer in Central and Eastern Europe (CEE). *Eur J Cancer* 2008;**44**(10):1425–37.
31. Nuffield Council on Bioethics. *Public health: ethical issues*. <[http://www.nuffieldbioethics.org/fileLibrary/pdf/Public\\_health\\_-ethical\\_issues.pdf](http://www.nuffieldbioethics.org/fileLibrary/pdf/Public_health_-ethical_issues.pdf)> [accessed 24.09.08].