Recognition of cancer warning signs and anticipated delay in help-seeking in a population sample of adults in the UK

S L Quaife[1], L J L Forbes[2], A J Ramirez[2], K E Brain[3], C Donnelly[4], A E Simon[5] and J Wardle*,[1]

[1]Health Behaviour Research Centre, Department of Epidemiology and Public Health, University College London, London WC1E 6BT, UK; [2]King's College London Promoting Early Presentation Group, King's College London, London SE1 3QD, UK; [3]Cochrane Institute of Primary Care and Public Health, School of Medicine, Cardiff University, Cardiff CF14 4YS, UK; [4]Centre for Public Health, Queen's University Belfast, Belfast, Northern Ireland BT12 6DP, UK and [5]Health Services Research, School of Health Sciences, City University London, London EC1V 0HB, UK

Background: Not recognising a symptom as suspicious is a common reason given by cancer patients for delayed help-seeking; but inevitably this is retrospective. We therefore investigated associations between recognition of warning signs for breast, colorectal and lung cancer and anticipated time to help-seeking for symptoms of each cancer.

Methods: Computer-assisted telephone interviews were conducted with a population-representative sample ($N = 6965$) of UK adults age $\geqslant 50$ years, using the Awareness and Beliefs about Cancer scale. Anticipated time to help-seeking for persistent cough, rectal bleeding and breast changes was categorised as >2 vs $\leqslant 2$ weeks. Recognition of persistent cough, unexplained bleeding and unexplained lump as cancer warning signs was assessed (yes/no). Associations between recognition and help-seeking were examined for each symptom controlling for demographics and perceived ease of health-care access.

Results: For each symptom, the odds of waiting for >2 weeks were significantly increased in those who did not recognise the related warning sign: breast changes: OR = 2.45, 95% CI 1.47–4.08; rectal bleeding: OR = 1.77, 1.36–2.30; persistent cough: OR = 1.30, 1.17–1.46, independent of demographics and health-care access.

Conclusion: Recognition of warning signs was associated with anticipating faster help-seeking for potential symptoms of cancer. Strategies to improve recognition are likely to facilitate earlier diagnosis.

Evidence that cancer outcomes are better with earlier stage at diagnosis makes minimising delays across the diagnostic pathway a priority in cancer control (Allgar and Neal, 2005; Olesen et al, 2009; Richards, 2009). Delays accumulate from a range of health professional and health system factors (Roetzheim et al, 1999; Macleod et al, 2009; Singh et al, 2010), but there is particular interest in how the public's recognition of cancer warning signs contributes to their decisions to seek medical help.

Many early cancer symptoms (e.g. change in the appearance of a mole, post-menopausal bleeding) do not in themselves cause pain or interfere with functioning; consequently they may not trigger help-seeking unless they are recognised as warning signs of cancer. Not recognising a symptom as suspicious is one of the commonest reasons given by cancer patients for delayed help-seeking (Chapple et al, 2004; Smith et al, 2005), and there is evidence of longer delay with ambiguous rather than classic (e.g. lump) symptoms (Macleod et al, 2009). Systematic reviews have concluded that failure to recognise early warning signs is a key contributor to delayed presentation in clinical populations (Ramirez et al, 1999; Macdonald et al, 2006; Mitchell et al, 2008).

BJC OPEN

The results of these clinical studies have highlighted the need for research into awareness of early warning signs of cancer in the general population. Several surveys have identified low symptom awareness in general population samples (Nichols *et al*, 1996; Grunfeld *et al*, 2002; McCaffery *et al*, 2003; Lockwood-Rayermann *et al*, 2009; Robb *et al*, 2009). There is also evidence that groups from lower socioeconomic status (SES) and ethnic minority background have lower awareness (Yu *et al*, 2001; Waller *et al*, 2009; Forbes *et al*, 2011); the same groups who tend to have cancer diagnosed at a later stage (Palmer and Schneider, 2005; Woods *et al*, 2006; Cuthbertson *et al*, 2009). Just one study has tested the association between awareness and delay in a non-clinical sample. Using data from a population-based survey in the UK, there was a significant negative association between the total number of cancer warning signs recognised from a list of nine (Stubbings *et al*, 2009; CR-UK, 2012a, b), and the number of symptoms (out of the same list of nine) for which respondents said they would delay more than two weeks before seeking medical advice (Robb *et al*, 2009). However, given that recognition and help-seeking vary greatly among warning signs and symptoms (Macleod *et al*, 2009; Robb *et al*, 2009), the use of aggregate scores for awareness (total number of signs) and help-seeking (total number of symptoms with anticipated delay > 2 weeks) may underestimate the strength of the association.

The present study therefore used data from a population-based sample of UK adults to test the hypothesis that anticipated time to help-seeking for potential early symptoms of three common cancers (lung, colorectal, and breast) would be associated with recognition of the warning sign associated with each cancer type. Tracking actual help-seeking for real symptoms would require unfeasibly large samples and study duration, so we therefore used a hypothetical question (how soon would you seek medical help with ….) as a proxy indicator of delay.

MATERIALS AND METHODS

We used data from a survey carried out as part of the International Cancer Benchmarking Partnership (ICBP) which was set up to investigate the causes of international differences in cancer outcomes (CR-UK, 2010). Module 2 of the ICBP assessed awareness of cancer warning signs and anticipated help-seeking for symptoms using computer-assisted telephone interviews with adults age $\geqslant 50$ years in six countries in 2011 (CR-UK, 2010; Forbes *et al*, 2013). For the present analyses, we used data from respondents in three UK nations (England, Wales and Northern Ireland). Random probability sampling was used to achieve population-representative samples of at least 2000 from each nation using electronic telephone directories as sampling frames. The last two digits from each telephone number were substituted with randomly generated digits, to include numbers that were not publicly available. Households were eligible if one or more person was aged 50 or over and spoke English. Where more than one person was eligible, an individual was randomly chosen using the 'Rizzo' method (Rizzo *et al*, 2004).

Awareness of warning signs and anticipated help-seeking were assessed using questions from the internationally validated Awareness and Beliefs about Cancer Measure (ABC) (Simon *et al*, 2012). This had been adapted from the Cancer Awareness Measure (CAM) (Stubbings *et al*, 2009), and pre-existing surveys for use in telephone interviews (Paul *et al*, 2006; Park and Clery, 2010). The ABC has acceptable internal validity (Cronbach's $\alpha > 0.70$), content validity ($> 78\%$), and test–retest reliability ($r \geqslant 0.60$) (Simon *et al*, 2012).

Anticipated time to help-seeking for target symptoms. Help-seeking items from the ABC (Simon *et al*, 2012) assessed anticipated delay for symptoms that could be indicative of each of the three target cancers: (i) persistent cough, (ii) rectal bleeding, and (iii) breast changes. The interview instructions were: 'I'm going to read you out a list of signs and symptoms; for each one can you tell me how long it would take you to go to the doctor from the time you first noticed the symptom'. Responses were categorised by the interviewer into predefined time intervals (as soon as I noticed, up to 1 week, 1–2 weeks, 2–3 weeks, 3–4 weeks, more than a month, and I would not contact a doctor). Responses indicating help-seeking from another health professional (e.g. nurse and pharmacist) were excluded from the analyses (persistent cough: $n = 254$; rectal bleeding: $n = 70$; breast changes: $n = 59$). The primary analyses used a dichotomous anticipated help-seeking variable ($\leqslant 2$ weeks *vs* > 2 weeks) as used in previous analyses (Robb *et al*, 2009). Analyses were repeated using > 4 weeks as a cutoff in a sensitivity analysis.

Recognition of cancer warning signs. Recognition of the three warning signs most closely related to the target symptoms were used in this analysis: (i) persistent cough or hoarseness, (ii) unexplained bleeding, and (iii) unexplained lump or swelling. The interview instructions were: 'I'm now going to list some symptoms that may or may not be warning signs for cancer. For each one can you tell me whether you think it could be a warning sign for cancer'. The order was rotated and answers were recorded as yes, no, don't know, and refused. For the present analysis, 'don't know' responses were combined with 'no', and 'refused' was coded as missing.

Demographic characteristics and health-care access. Data were collected on gender, age, ethnicity (categorised as white *vs* other ethnicity), marital status (categorised as married/cohabiting *vs* single/divorced/separated/widowed), highest level of education (school/further education *vs* university), and UK region (England, Northern Ireland, and Wales). As an indicator of health-care access, respondents were asked: 'How easy or difficult, is it for you to get to see the doctor if you have a symptom that you think might be serious'; with four response options from 'very difficult' to 'very easy'. Responses were dichotomised as difficult *vs* easy for analysis. This item also allowed us to test whether anticipated time to help-seeking was associated predictably with ease of health-care access.

Analysis. Univariate chi-square analyses were used to explore predictors of recognition of warning signs and anticipated time to help-seeking. Multivariable logistic regression analysis was used to test the associations between recognition of each warning sign and anticipated time to help-seeking for each potential cancer symptom controlling for gender, age, marital status, ethnicity, education, and health-care access.

RESULTS

The sample size was 6965; drawn from England ($n = 2360$), Wales ($n = 2298$), and Northern Ireland ($n = 2307$). Of 24 231 households contacted and assessed for eligibility, 10 997 were eligible to take part, of whom 3468 declined and 564 only partially completed the interview. The final response rate was therefore 40% (AAPOR response rate three conventions: The American Association of Public Opinion Research, 2011; Forbes *et al*, 2013; similar to previous household telephone surveys (O'Toole *et al*, 2008). Missing data did not exceed 2.5% for any item. In common with many population surveys, the sample had more women (62.2% *vs* 53.2%), more respondents with university degrees (22.5% *vs* 15.2%), fewer from non-white ethnic backgrounds (1.7% *vs* 7.9%), and fewer aged over 70 (29.7% *vs* 34.2%) than the UK population in this age range (ONS, 2001; NISRA, 2004; ONS, 2005; ONS, 2011).

Anticipating waiting for >2 weeks to seek medical advice was highest for persistent cough (48.1%), whereas for breast changes and rectal bleeding, only 8.2% and 7.4% anticipated waiting for >2 weeks. As an indicator of internal consistency, those who thought it would be difficult to see a doctor anticipated waiting significantly longer for all three warning signs ($P < 0.01$: see Table 1). Table 1 also shows a trend towards greater anticipated time to help-seeking in younger people, and in those from white and more educated backgrounds. The education effect was significant for all three warning signs ($P < 0.05$), the age effect was significant for persistent cough and rectal bleeding ($P < 0.001$), and the ethnicity effect reached statistical significance for persistent cough only ($P < 0.001$).

The warning sign that was most well recognised was 'unexplained lump or swelling' (96.6%), followed by 'unexplained bleeding' (89.7%), and 'persistent cough or hoarseness' (69.5%). Table 2 shows that recognition tended to be lower for men, older people, and those from ethnic minority and less-educated groups. These effects were significant for all three warning signs ($P < 0.05$), although the absolute differences were sometimes small.

Figure 1 shows that for each symptom, anticipating >2 weeks delay was more common in those who did not recognise the associated warning sign (persistent cough: χ^2 (1) = 12.10,

$P = 0.001$; rectal bleeding: χ^2 (1) = 14.66, $P < 0.001$; breast changes: χ^2 (1) = 13.78, $P < 0.001$). We repeated the analyses using anticipated time to help-seeking of >4 weeks, where although the absolute numbers were lower, the patterns were the same (Figure 2).

Multivariable logistic regression analyses (see Table 3) demonstrated that recognition of each warning sign was associated with delay independent of demographic variables and difficulty of access: breast changes (OR = 2.45, 1.47–4.08), rectal bleeding (OR = 1.77, 1.36–2.30), and persistent cough (OR = 1.30, 1.17–1.46). The analyses were repeated using a delay interval of >4 weeks and the odds ratios were similar or higher, and significant in all cases.

DISCUSSION

This is the first large-scale, population-based study to examine associations between anticipated time to help-seeking for a potential cancer symptom and recognition of the related warning sign. For each symptom, individuals who did not recognise the related warning sign were more likely to say they would wait for

Table 1. Demographic and health-care correlates of anticipated time to help-seeking (>2 weeks) for each cancer warning sign

	Anticipated time to help-seeking >2 weeks % (*n*)		
	Persistent cough	**Rectal bleeding**	**Breast changes (women only)**
All respondents (*n* = 6965)	48.1 (3351)	7.4 (515)	8.2 (351)
Gender			
Female (*n* = 4330)	51.2 (2145)[a]	7.1 (306)	8.2 (351)
Male (*n* = 2635)	47.9 (1206)	8.0 (209)	N/A
Age			
50–59 (*n* = 2346)	56.5 (1291)[b]	9.8 (229)[b]	8.6 (123)
60–69 (*n* = 2356)	52.7 (1293)	7.6 (192)	8.6 (133)
70+ (*n* = 2067)	38.6 (757)	4.6 (93)	7.3 (94)
Marital status			
Married/cohabiting (*n* = 3787)	51.9 (1914)[b]	7.5 (283)	7.3 (152)[c]
Single/divorced/separated (*n* = 3144)	47.6 (1424)	7.4 (229)	9.1 (197)
Ethnicity			
White (*n* = 6830)	50.1 (3298)[c]	7.5 (504)	8.2 (346)
Not White (*n* = 117)	38.3 (44)	8.8 (10)	6.5 (4)
Education			
Degree or above (*n* = 1569)	60.3 (921)[b]	8.8 (137)[c]	10.8 (90)[a]
Below degree (*n* = 5224)	47.0 (2363)	7.1 (369)	7.6 (252)
Region			
England (*n* = 2360)	50.7 (1153)[c]	7.1 (165)	6.9 (100)[c]
Wales (*n* = 2298)	51.4 (1142)	7.3 (167)	9.9 (135)
Northern Ireland (*n* = 2307)	47.7 (1056)	8.0 (183)	8.0 (116)
Health-care access			
Easy (*n* = 5785)	49.0 (2739)[a]	7.0 (402)[a]	7.4 (259)[b]
Difficult (*n* = 1101)	54.6 (575)	9.7 (106)	12.0 (87)

Note: Totals vary due to missing data.
[a] χ^2, $P < 0.01$.
[b] χ^2, $P < 0.001$.
[c] χ^2, $P < 0.05$.

Table 2. Recognition that warning signs might indicate cancer			
	Recognition of cancer warning signs % (*n*)		
	Persistent cough or hoarseness	Unexplained bleeding	Unexplained lump or swelling
All respondents (n = 6965)	69.5 (4838)	89.7 (6248)	96.6 (6727)
Gender			
Female (n = 4330)	73.1 (3163)[a]	91.6 (3966)[a]	96.9 (4197)[b]
Male (n = 2635)	63.6 (1675)	86.6 (2282)	96.0 (2530)
Age			
50–59 (n = 2346)	69.3 (1626)[c]	90.2 (2117)[c]	97.5 (2288)[a]
60–69 (n = 2536)	71.5 (1814)	90.6 (2297)	97.1 (2463)
70+ (n = 2067)	67.1 (1387)	88.0 (1818)	94.8 (1960)
Marital status			
Married/cohabiting (n = 3787)	69.5 (2632)	90.2 (3414)	97.0 (3675)[b]
Single/divorced/separated (n = 3144)	69.4 (2181)	89.3 (2805)	96.0 (3019)
Ethnicity			
White (n = 6830)	69.7 (4758)[b]	89.9 (6141)[a]	96.7 (6607)[a]
Not White (n = 117)	59.0 (69)	79.5 (93)	88.9 (104)
Education			
Degree or above (n = 1569)	73.9 (1159)[a]	92.5 (1451)[a]	97.8 (1534)[c]
Below degree (n = 5224)	68.2 (3563)	89.2 (4660)	96.3 (5032)
Region			
England (n = 2360)	68.8 (1623)	89.6 (2113)	96.5 (2277)
Wales (n = 2298)	68.4 (1571)	89.3 (2051)	96.5 (2218)
Northern Ireland (n = 2307)	71.3 (1644)	90.4 (2084)	96.7 (2232)

Note: Totals vary due to missing data.
[a]X^2, $P < 0.001$.
[b]X^2, $P < 0.05$.
[c]X^2, $P < 0.01$.

Figure 1. Recognition and anticipating >2 weeks before help-seeking for each related symptom (persistent cough/hoarseness, unexplained bleeding, and unexplained lump or swelling).
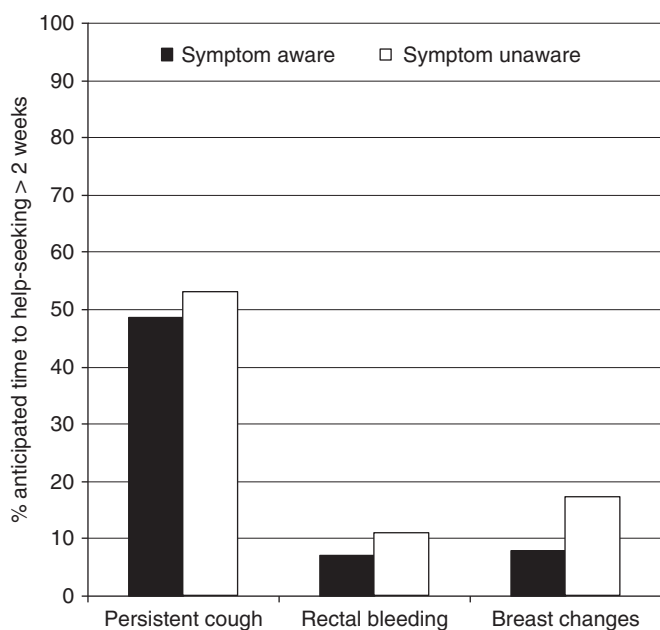
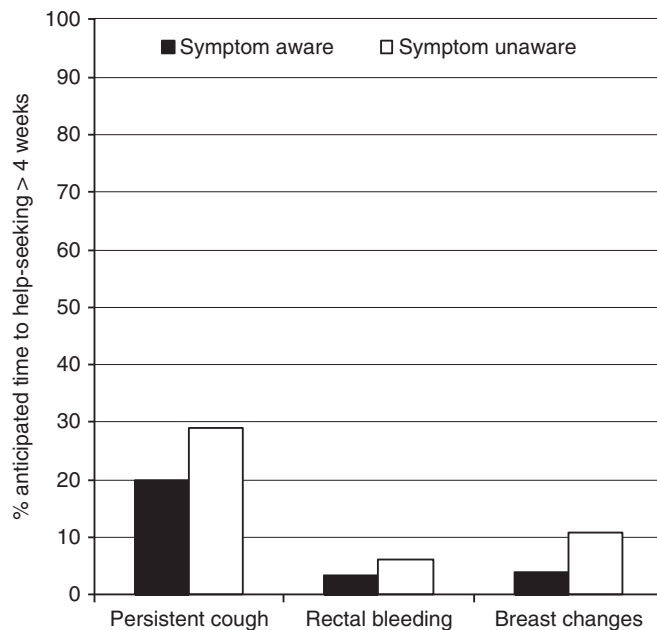

Figure 2. Recognition and anticipating >4 weeks before help-seeking for each related symptom (persistent cough/hoarseness, unexplained bleeding, and unexplained lump or swelling).

	Persistent cough (*n* = 6447)			Rectal bleeding (*n* = 6622)			Breast changes (*n* = 4097)		
	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*
Gender									
Male	1.00	–	–	1.00	–	–	–	–	–
Female	1.24	1.11–1.38	0.000	0.89	0.74–1.08	0.232	–	–	–
Age group									
50–59	1.00	–	–	1.00	–	–	1.00	–	–
60–69	0.90	0.80–1.01	0.076	0.78	0.64–0.96	0.021	1.04	0.80–1.35	0.794
70+	0.52	0.46–0.59	0.000	0.44	0.34–0.58	0.000	0.79	0.58–1.07	0.132
Marital status									
Married/cohabiting	1.00	–	–	1.00	–	–	1.00	–	–
Single/divorced/separated	0.93	0.84–1.03	0.166	1.14	0.94–1.38	0.178	1.27	1.01–1.61	0.044
Ethnicity									
White	1.00	–	–	1.00	–	–	1.00	–	–
Not White	0.44	0.29–0.67	0.000	0.86	0.41–1.80	0.696	0.51	0.16–1.66	0.264
Education									
Degree or above	1.00	–	–	1.00	–	–	1.00	–	–
Below degree	0.61	0.54–0.68	0.000	0.83	0.67–1.03	0.085	0.68	0.52–0.89	0.004
Ease of seeing doctor									
Easy	1.00	–	–	1.00	–	–	1.00	–	–
Difficult	1.20	1.04–1.37	0.010	1.37	1.09–1.72	0.007	1.61	1.24–2.10	0.000
Recognise symptom?									
Yes	1.00	–	–	1.00	–	–	1.00	–	–
No	1.30	1.17–1.46	0.000	1.77	1.36–2.30	0.000	2.45	1.47–4.08	0.001

Table 3. Predictors of anticipating >2 weeks before help-seeking for a potential warning sign of cancer

Abbreviations: OR = odds ratio; 95% CI = 95% confidence interval. The addition of cancer experience (self or close other) did not change the associations.

>2 weeks before visiting the doctor. The association was independent of a range of demographic variables and perceived difficulty of health-care access, and was the same using a longer delay interval as the cutoff. These results confirm findings from an earlier study, using a similar measure (the CAM: Stubbings *et al*, 2009), which found an association between a general awareness score aggregated across nine warning signs and time for help-seeking across symptoms (Robb *et al*, 2009). The observation from clinical samples that recognition of a symptom as possibly a warning sign is related to prompt help-seeking is therefore visible 'in anticipation' in a community sample (Ramirez *et al*, 1999; Smith *et al*, 2005; Macdonald *et al*, 2006; Mitchell *et al*, 2008; Singh *et al*, 2010).

There are methodological issues that limit the interpretation of the results. Associations between warning sign recognition and anticipated time to help-seeking may be artificially inflated owing to shared method variance. The cross-sectional design precludes any assumption of causality: individuals who tend to be rapid help-seekers may know more about cancer warning signs. To unequivocally demonstrate causation requires an intervention design that modifies recognition and shows effects on symptom presentation. There are also limitations with the measures. Using 'recognition' of warning signs as the indicator of awareness (rather than recall of warning signs) may overestimate awareness; but given that in everyday life, the challenge for the individual is to recognise that a symptom they are experiencing may be a sign of

cancer, recognition has been argued to be the most appropriate measure (Waller *et al*, 2004). Awareness is also likely to be more complex than a simple yes/no: a person may 'know' that a lump can indicate cancer but their belief about how a lump should feel, or the broader context such as other symptoms and general health, may contribute to help-seeking decisions (Rauscher *et al*, 2010). This might help to explain why a significant proportion (48%) of those recognising a persistent cough still anticipated waiting over 2 weeks, which was markedly reduced when using a 4-week cutoff (20%). As cough is a common symptom it is unlikely to cause immediate alarm. The key issue is not the symptom itself, but the persistence and this may have been interpreted differently by different respondents. Time to help-seeking was hypothetical (how soon would you visit the doctor if…), and hypothetical intentions do not always translate into action (Sheeran, 2002). However, finding that the rating of difficulty in accessing a doctor was associated with anticipated time to help-seeking gave some reassurance of internal consistency.

Some of the findings associated with the demographic factors were not predicted; in particular, the tendency for people with more education to report greater delay. In a previous study, we found that higher SES respondents were more likely to say that being too busy was a barrier to seeking medical help (Robb *et al*, 2009). Future research to examine the help-seeking decision processes in relation to factors such as age, sex, ethnicity, and SES would be valuable.

In terms of strengths, the level of specificity between warning sign and anticipated help seeking should produce a more accurate estimate of the association than the aggregated scores used in previous community studies, because both awareness and time taken to seek help vary across warning signs (Linsell *et al*, 2008; Macleod *et al*, 2009). The large sample size made it possible to control for multiple confounding variables and therefore produce a more robust result. The older age of the respondents meant that the likelihood of cancer was higher and therefore predictors of earlier diagnosis are more salient.

These results support UK policy initiatives that include awareness-raising as part of the strategy to promote early diagnosis. However, more work is needed to identify the most cost-effective ways to promote recognition of early warning signs, particularly in disadvantaged populations, and to do it without provoking anxiety or increasing inappropriate help-seeking.

CONFLICT OF INTEREST

The opinions, results, and conclusions reported in this paper are those of the authors and are independent from the funding source.

REFERENCES

Allgar VL, Neal RD (2005) Delays in the diagnosis of six cancers: analysis of data from the National Survey of NHS Patients: Cancer. *Br J Cancer* **92**(11): 1959–1970.

Chapple A, Ziebland S, McPherson A (2004) Qualitative study of men's perceptions of why treatment delays occur in the UK for those with testicular cancer. *Br J Gen Pract* **54**(498): 25–32.

CR-UK (2010) International Cancer Benchmarking Partnership. Retrieved 21 March 2013 from http://www.cancerresearchuk.org/cancer-info/spotcancerearly/ICBP.

CR-UK (2012a) Spotting The Signs of Cancer for Men. Retrieved 21 March 2013 from http://publications.cancerresearchuk.org/downloads/product/HM_AP_SCE_Male_July_2013.pdf.

CR-UK (2012b) Spotting The Signs of Cancer for Women. Retrieved 21 March 2013 from http://publications.cancerresearchuk.org/downloads/product/HM_AP_SCE_Female_July_2013.pdf.

Cuthbertson SA, Goyder EC, Poole J (2009) Inequalities in breast cancer stage at diagnosis in the Trent region, and implications for the NHS Breast Screening Programme. *J Public Health (Oxf)* **31**(3): 398–405.

Forbes LJ, Atkins L, Thurnham A, Layburn J, Haste F, Ramirez AJ (2011) Breast cancer awareness and barriers to symptomatic presentation among women from different ethnic groups in East London. *Br J Cancer* **105**(10): 1474–1479.

Forbes LJ, Simon AE, Warburton F, Boniface D, Brain KE, Dessaix A, Donnelly C, Haynes K, Hvidberg L, Lagerlund M, Lockwood G, Tishelman C, Vedsted P, Vigmostad MN, Ramirez AJ, Wardle J (2013) Differences in cancer awareness and beliefs between Australia, Canada, Denmark, Norway, Sweden and the UK (the International Cancer Benchmarking Partnership): do they contribute to differences in cancer survival? *Br J Cancer* **108**(2): 292–300.

Grunfeld EA, Ramirez AJ, Hunter MS, Richards MA (2002) Women's knowledge and beliefs regarding breast cancer. *Br J Cancer* **86**(9): 1373–1378.

Linsell L, Burgess CC, Ramirez AJ (2008) Breast cancer awareness among older women. *Br J Cancer* **99**(8): 1221–1225.

Lockwood-Rayermann S, Donovan HS, Rambo D, Kuo CW (2009) Women's awareness of ovarian cancer risks and symptoms. *Am J Nurs* **109**(9): 36–45.

Macdonald S, Macleod U, Campbell NC, Weller D, Mitchell E (2006) Systematic review of factors influencing patient and practitioner delay in diagnosis of upper gastrointestinal cancer. *Br J Cancer* **94**(9): 1272–1280.

Macleod U, Mitchell ED, Burgess C, Macdonald S, Ramirez AJ (2009) Risk factors for delayed presentation and referral of symptomatic cancer: evidence for common cancers. *Br J Cancer* **101**(Suppl 2): S92–S101.

McCaffery K, Wardle J, Waller J (2003) Knowledge, attitudes, and behavioral intentions in relation to the early detection of colorectal cancer in the United Kingdom. *Prev Med* **36**(5): 525–535.

Mitchell E, Macdonald S, Campbell NC, Weller D, Macleod U (2008) Influences on pre-hospital delay in the diagnosis of colorectal cancer: a systematic review. *Br J Cancer* **98**(1): 60–70.

Nichols BS, Misra R, Alexy B (1996) Cancer detection: how effective is public education? *Cancer Nurs* **19**(2): 98–103.

NISRA (2004) Theme Table 1. Demography: people, family and households. Retrieved 21 March 2013 from http://www.nisra.gov.uk/archive/census/2001/theme/theme_tables.pdf.

O'Toole J, Sinclair M, Leder K (2008) Maximising response rates in household telephone surveys. *BMC Med Res Methodol* **8**: 71.

Olesen F, Hansen RP, Vedsted P (2009) Delay in diagnosis: the experience in Denmark. *Br J Cancer* **101**(Suppl 2): S5–S8.

ONS (2001) Census 2001 National Report for England and Wales Part 1. Retrieved 21 March 2013 from http://www.ons.gov.uk/ons/rel/census-2001-national-report-for-england-and-wales/national-report-for-england-and-wales-part-1/index.html?format=hi-vis.

ONS (2005) Focus on Ethnicity and Identity Data. Retrieved 21 March 2013 from http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-50846.

ONS (2011) Population Estimates for UK, England and Wales, Scotland and Northern Ireland, Mid-2010. Retrieved 21 March 2013 from http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-231847.

Palmer RC, Schneider EC (2005) Social disparities across the continuum of colorectal cancer: a systematic review. *Cancer Causes Control* **16**(1): 55–61.

Park A, Clery E (2010) *British Social Attitudes, 27th Report*. National Centre for Social Research.

Paul C, Girgis A, Wakefield M, Greenbank S, Beckman K, White V, Slevin T, Rogers C, Jalleh G (2006) *Cancer-Related Knowledge & Practices: Recommended Survey Items. Version 1 Newcastle*. The Public Health Committee of The Cancer Council Australia: New South Wales, Australia.

Ramirez AJ, Westcombe AM, Burgess CC, Sutton S, Littlejohns P, Richards MA (1999) Factors predicting delayed presentation of symptomatic breast cancer: a systematic review. *Lancet* **353**(9159): 1127–1131.

Rauscher GH, Ferrans CE, Kaiser K, Campbell RT, Calhoun EE, Warnecke RB (2010) Misconceptions about breast lumps and delayed medical presentation in urban breast cancer patients. *Cancer Epidemiol Biomarkers Prev* **19**(3): 640–647.

Richards MA (2009) The national awareness and early diagnosis initiative in England: assembling the evidence. *Br J Cancer* **101**(Suppl 2): S1–S4.

Rizzo L, Brick JM, Park I (2004) A minimally intrusive method for sampling persons in random digit dial surveys. *Public Opin Quarterly* **68**(2): 267–274.

Robb K, Stubbings S, Ramirez A, Macleod U, Austoker J, Waller J, Hiom S, Wardle J (2009) Public awareness of cancer in Britain: a population-based survey of adults. *Br J Cancer* **101**(Suppl 2): S18–S23.

Roetzheim RG, Pal N, Tennant C, Voti L, Ayanian JZ, Schwabe A, Krischer JP (1999) Effects of health insurance and race on early detection of cancer. *J Natl Cancer Inst* **91**(16): 1409–1415.

Sheeran P (2002) Intention-behavior relations: a conceptual and empirical review. *Eur Rev Soc Psychol* **12**(1): 1–36.

Simon AE, Forbes LJ, Boniface D, Warburton F, Brain KE, Dessaix A, Donnelly M, Haynes K, Hvidberg L, Lagerlund M, Petermann L, Tishelman C, Vedsted P, Vigmostad MN, Wardle J, Ramirez AJ (2012) An international measure of awareness and beliefs about cancer: development and testing of the ABC. *BMJ Open* **2**(6): e001758.

Singh H, De CC, Shu E, Fradette K, Latosinsky S, Pitz M, Cheang M, Turner D (2010) Wait times from presentation to treatment for colorectal cancer: a population-based study. *Can J Gastroenterol* **24**(1): 33–39.

Smith LK, Pope C, Botha JL (2005) Patients' help-seeking experiences and delay in cancer presentation: a qualitative synthesis. *Lancet* **366**(9488): 825–831.

Stubbings S, Robb K, Waller J, Ramirez A, Austoker J, Macleod U, Hiom S, Wardle J (2009) Development of a measurement tool to assess public awareness of cancer. *Br J Cancer* **101**(Suppl 2): S13–S17.

The American Association of Public Opinion Research (2011) Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys.

Waller J, McCaffery K, Wardle J (2004) Measuring cancer knowledge: comparing prompted and unprompted recall. *Br J Psychol* **95**(2): 219–234.

Waller J, Robb K, Stubbings S, Ramirez A, Macleod U, Austoker J, Hiom S, Wardle J (2009) Awareness of cancer symptoms and anticipated help seeking among ethnic minority groups in England. *Br J Cancer* **101**(Suppl 2): S24–S30.

Woods LM, Rachet B, Coleman MP (2006) Origins of socio-economic inequalities in cancer survival: a review. *Ann Oncol* **17**(1): 5–19.

Yu ES, Kim KK, Chen EH, Brintnall RA (2001) Breast and cervical cancer screening among Chinese American women. *Cancer Pract* **9**(2): 81–91.