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Variation in promptness of presentation among 10,297 patients subsequently diagnosed with one of 18 cancers: Evidence from a National Audit of Cancer Diagnosis in Primary Care

Stuart Keeble[1], Gary A. Abel[1], Catherine L. Saunders[1], Sean McPhail[2], Fiona M. Walter[3], Richard D. Neal[4], Gregory P. Rubin[5] and Georgios Lyratzopoulos[1]

[1] Cambridge Centre for Health Services Research, University of Cambridge, Cambridge, United Kingdom
[2] National Cancer Intelligence Network (NCIN), Public Health England, London, United Kingdom
[3] Primary Care Unit, University of Cambridge, Cambridge, United Kingdom
[4] North Wales Centre for Primary Care Research, College of Health and Behavioural Sciences, Bangor University, Wrexham, United Kingdom
[5] Wolfson Research Institute, School of Medicine and Health, University of Durham, Queen's Campus, University Boulevard, Stockton-on-Tees, United Kingdom

Cancer awareness public campaigns aim to shorten the interval between symptom onset and presentation to a doctor (the 'patient interval'). Appreciating variation in promptness of presentation can help to better target awareness campaigns. We explored variation in patient intervals recorded in consultations with general practitioners among 10,297 English patients subsequently diagnosed with one of 18 cancers (bladder, brain, breast, colorectal, endometrial, leukaemia, lung, lymphoma, melanoma, multiple myeloma, oesophageal, oro-pharyngeal, ovarian, pancreatic, prostate, renal, stomach, and unknown primary) using data from of the National Audit of Cancer Diagnosis in Primary Care (2009–2010). Proportions of patients with 'prompt'/'non-prompt' presentation (0–14 or 15+ days from symptom onset, respectively) were described and respective odds ratios were calculated by multivariable logistic regression. The overall median recorded patient interval was 10 days (IQR 0–38). Of all patients, 56% presented promptly. Prompt presentation was more frequent among older or housebound patients ($p < 0.001$). Prompt presentation was most frequent for bladder and renal cancer (74% and 70%, respectively); and least frequent for oro-pharyngeal and oesophageal cancer (34% and 39%, respectively, $p < .001$). Using lung cancer as reference, the adjusted odds ratios of non-prompt presentation were 2.26 (95% confidence interval 1.57–3.25) and 0.42 (0.34–0.52) for oro-pharyngeal and bladder cancer, respectively. Sensitivity analyses produced similar findings. Routinely recorded patient interval data reveal considerable variation in the promptness of presentation. These findings can help to prioritise public awareness initiatives and research focusing on symptoms of cancers associated with greater risk of non-prompt presentation, such as oro-pharyngeal and oesophageal cancer.

Epidemiology

Key words: cancer, patient interval, promptness, presentation, delay, oro-pharyngeal, oesophageal, bladder, renal, variation.
Additional Supporting Information may be found in the online version of this article.

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Correspondence to: Georgios Lyratzopoulos, Strangeways Research Laboratory, Worts' Causeway, Cambridge CB1 8RN, United Kingdom, Tel.: +44-1223-330326, E-mail: gl290@medschl.cam.ac.uk

Diagnosing cancer promptly in symptomatic patients is a key aspect of contemporary cancer control policies in different countries.[1–5] After symptom onset, delays in establishing the diagnosis may occur both before a patient presents to a doctor and post-presentation.[6] In most cancer patients, initial symptoms have low specificity, as they are also associated with benign diseases.[7] Appropriate appraisal and interpretation of symptoms that may be related to cancer by both patients (pre-presentation) and their doctor (post-presentation) are critical for timely diagnosis.[6,8] There is large variation between different patient groups in the promptness with which general practitioners suspect the diagnosis of cancer and refer patients to specialists (*i.e.* in the 'primary care interval').[9,10] It is also plausible that there is variation in the promptness with which cancer patients seek medical help (*i.e.* in the 'patient interval', defined as the period between first symptom onset and first relevant presentation to a doctor[6]). Variation in the patient interval may exist both between patients with different socio-demographic characteristics (since cancer awareness, beliefs and attitudes vary between socio-demographic groups or

What's new?

A critical aspect of cancer diagnosis is how promptly patients consult a doctor after they first notice initial symptoms. Here, the authors examine differences in this so-called patient interval in English patients subsequently diagnosed with one of 18 cancers. On average, patients with bladder and renal cancer as well as older and housebound patients consulted a doctor relatively promptly while patients with oro-pharyngeal and oesophageal cancer took the longest until first presenting to a general practitioner. The authors point out that cancer awareness campaigns should encompass symptoms of oro-pharyngeal and oesophageal cancer aiming to shorten the patient interval for these cancers.

country populations[11–16]; and between patients with different cancers (given wide variability in the nature of symptoms of different tumours). Understanding variation in the patient interval can help to identify patient groups at higher risk of non-prompt presentation, enabling better targeting of public health awareness interventions.[17]

Evidence about patient interval variation is however limited, partly because accurate measurement is known to be challenging.[6,18] Determining the date of onset of symptoms or bodily changes (the start of the patient interval) is difficult, given the potential for inaccurate or biased patient recall, and the gradual onset of many symptoms.[6,18] The date of first presentation to a doctor with symptoms caused by cancer (the end of the patient interval) is often easy to identify, but there can be difficulties in determining the first relevant consultation in patients with multi-morbidity. Acknowledging these difficulties, broadly, patient interval information can be obtained either from the patients themselves (through interviews or questionnaire surveys[19–22] or from their medical consultation records.[23,24] Either approach has advantages and disadvantages (Box). Although elicitation of symptom duration typically forms a key part of medical consultations, medical records studies assume accurate elicitation and recording of this information. On the other hand, patient interview or questionnaire studies can provide detailed information but may lack representativeness (as, by their nature, cancer patients who die early or are too sick soon after diagnosis are typically not included in such studies).

Appreciating both the strengths and the limitations of patient interval studies that are based on information from medical records, we conducted a secondary analysis of data from the National Audit of Cancer Diagnosis in Primary Care, 2009–2010.[25] Our aim was to explore variation in the routinely recorded (*i.e.* during general practice consultations) patient interval of patients subsequently diagnosed with cancer. We were particularly interested in exploring likely variation by socio-demographic characteristic and cancer diagnosis.

Material and Methods

Data

We analysed data from the (English) National Audit of Cancer Diagnosis in Primary Care (2009–2010).[25] Information from patient records on different aspects of the diagnostic process was collected by general practitioners or other primary care professionals in an estimated total of 1,170 general practices (~14% of all practices in England).[25,26] Audited patients were incident cases of cancer within the audit period and were representative of the age and diagnosis case-mix of English cancer patients.[25] Although participation to the audit was voluntary, the organisational characteristics and care quality of participating and non-participating practices were similar.[27] Screening-detected cases were excluded from the audit. The patient interval was defined as the number of days from first symptom onset to first presentation to a general practitioner with relevant symptoms based on information in the patients' records.[6,25] Patients were categorised as housebound if primary care encounters usually occurred at home – we included information on housebound status in the analysis as a marker of severe co-morbidity, because of theoretical concerns that patients with higher levels of co-morbidity may be disadvantaged in respect of the timeliness of cancer diagnosis. The analysis was *a priori* restricted to patients who first presented to a general practitioner with any of 18 cancers for

Box. Principal advantages and limitations of the two main approaches to measuring the patient interval

	Strengths	Limitations
Patient interview (or questionnaire) studies	*Potentially highly accurate and detailed* Can allow for detailed ('in-depth') appreciation of relevant symptoms and their time of onset.	*Limited representativeness (generalisability)* Patients dying soon after symptom onset/ diagnosis and those 'too ill to take part' are unlikely to be included.
Studies of medical consultation records	*High representativeness (generalisability)* Information about all cancer patients can be included, even for those with poor prognosis/ only short-term survival.	*Potential limitations in completeness and accuracy* Rely on doctors appropriately eliciting the timing of symptom onset as part of history taking and accurately interpreting and recording this information. Patient interval information may be missing.

which variation in respect of the primary care interval was previously explored and were aged 15 or older.[25,26] Analysis was restricted to records with patient interval values of up to two years, and complete information on outcome and exposure variables of interest (Fig. 1).

Analysis

We aimed to profile variation in promptness of presentation to a general practitioner after symptom onset. There is no uniform approach to analysing patient interval data, which tend to be zero-inflated and right-skewed. Therefore, we first described the key patient interval statistics (median and other relevant centile values) by patient group. Subsequently, we analysed variation in respect of a binary form of the patient interval (0–14 *vs* 15 or more days – hereafter, we use the terms prompt/non-prompt to denote either category, respectively). Our choice of binary cut-off was pragmatic – choosing a short-term period during which it could be reasonably assumed that most patients who did decide to see their doctor would have been able to do so. Additional short-term binary cut-off values were explored in sensitivity analysis (see below).

In univariable analysis, we examined crude differences between different patient groups in respect of the median patient interval, the proportion of non-prompt presenters and respective crude odds ratios. Subsequently, multivariable logistic regression was used to explore independent associations between patient characteristics or cancer diagnosis and prompt/non-prompt presentation. Further, interactions between cancer diagnosis and age and cancer diagnosis and gender were explored. Robust estimation of standard errors was used to account for potential clustering of observations.

Sensitivity analysis

We first repeated the multivariable regression model using alternative binary categories of the patient interval (0–7 *vs* 8+, 0–21 *vs* 22+ and 0–30 *vs* 31+ days, respectively). Complete case analysis pre-supposes that missing information is Missing Completely At Random which is a strong assumption. We, therefore, used extreme-case scenario analysis (assuming data are Missing Not At Random) by repeating the multivariable analysis assuming patients with missing interval values were either 'all non-prompt' or 'all prompt' presenters – these analyses do not intend to represent a real situation but are useful to illustrate the largest possible bias that could be introduced by missing patient interval information. We used further sensitivity analyses to explore potential confounding by ethnic group among patients with known ethnicity and the impact of only including patients with interval values of up to a year. Analysis was undertaken using Stata 11 (Stata Corporation, Texas).

Results

Of an initial 14,320 patients with one of the 18 cancers examined, 10,297 (72%) were included in complete case analysis (Fig. 1). The main single source of sample attrition was missing patient interval (3,004 or 21% of initially eligible patients). Patients with missing patient interval were more likely to be older and men ($p < 0.001$ for both) without evidence for an association with housebound status ($p = 0.342$). Missing patient interval also varied by cancer ($p < 0.001$), being most common among patients with leukaemia, prostate cancer, melanoma and multiple myeloma (41%, 40%, 36% and 28%, respectively, Supporting Information Appendix 1). Hereafter, results related to complete case analysis except were otherwise noted. Characteristics of included patients are shown in Table 1.

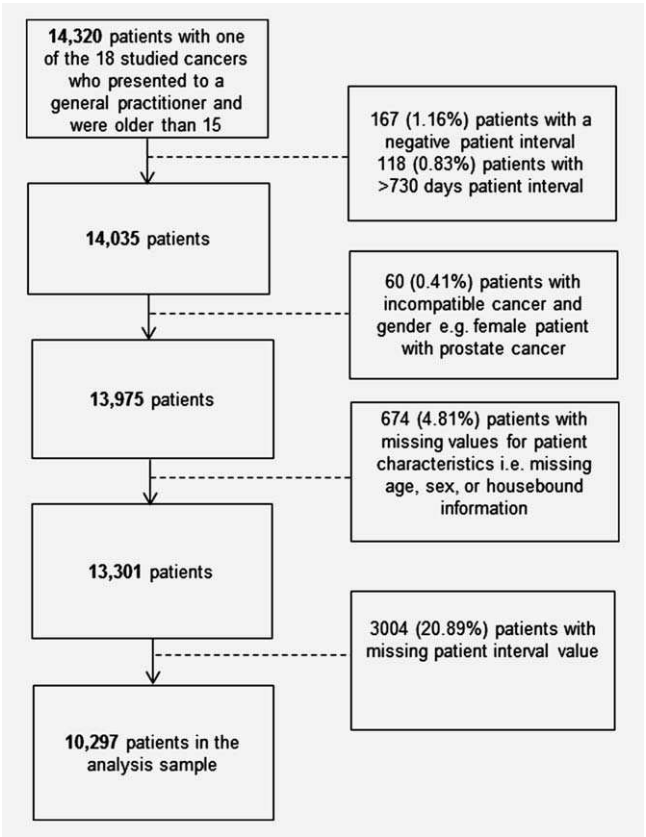

Figure 1. Derivation of the analysis sample. Percentage values relate to the initial sample of 14,320 patients with one of the 18 studied cancers.

The overall median patient interval was 10 days (interquartile range 0–38 days); about half of all patients (5,789, or 56%) had an interval of up to 14 days, *i.e.* were prompt presenters by our definition (Table 1). There was substantial variation in promptness of presentation by age, housebound status and cancer diagnosis ($p < 0.001$ for all). Prompt presentation was more frequent among older patients; and those who were housebound (66% *vs* 56% among those non-housebound). These differences were also apparent when examining various centiles of the patient interval which tended to be shorter for older and housebound patients (Table 1). Prompt presentation was most frequent

Table 1. Sample characteristics and descriptive statistics for patient interval by patient characteristic and cancer (n = 10,297)

	Patient interval (days)							Patient interval binary category				
								Prompt (0–14 days)		Non-prompt (15+ days)		
	N	25th Centile	Median	75th Centile	90th Centile	95th Centile	*p*-Value[1]	*N*	%	*N*	%	*p*-Value[2]
Age												
15–44	784	1	13	42	120	242	$p < 0.0001$	439	56.0	345	44.0	$p < 0.0001$
45–54	1,220	1	14	45	108	187		649	53.2	571	46.8	
55–64	2,170	0	12	41	102	191		1,186	54.7	984	45.3	
65–74	2,807	0	11	43	112	185		1,526	54.4	1,281	45.6	
75–84	2,459	0	7	31	92	183		1,463	59.5	996	40.5	
85+	857	0	7	31	95	188		526	61.4	331	38.6	
Sex												
Male	5,028	0	11	43	116	200	$p = 0.37$	2,742	54.5	2,286	45.5	$p = 0.0008$
Female	5,269	0	10	33	92	182		3,047	57.8	2,222	42.2	
Cancer												
Bladder	601	0	2	16	67	141	$p < 0.0001$	446	74.2	155	25.8	$p < 0.0001$
Renal	209	0	3	19	74	184		146	69.9	63	30.1	
Brain	125	1	7	26	96	154		81	64.8	44	35.2	
Breast	2,124	1	7	27	77	164		1371	64.5	753	35.5	
Unknown primary	110	0	7	23	64.5	104		69	62.7	41	37.3	
Leukaemia	239	0	7	30	86	140		144	60.3	95	39.7	
Prostate	1,386	0	6	42	151	283		813	58.7	573	41.3	
Pancreatic	272	1	9.5	31	73	97		162	59.6	110	40.4	
Stomach	187	0	9	33	125	205		104	55.6	83	44.4	
Lung	1,126	0	12	33	87	138		622	55.2	504	44.8	
Myeloma	127	0	14	40	95	193		69	54.3	58	45.7	
Endometrial	311	1	14	57	152	259		165	53.1	146	46.9	
Ovarian	270	2	14	51	113.5	172		144	53.3	126	46.7	
Lymphoma	482	1	14	43	92	183		243	50.4	239	49.6	
Melanoma	477	0	20	69	241	366		216	45.3	261	54.7	
Colorectal	1,697	1	19	60	131	203		786	46.3	911	53.7	
Oesophageal	407	7	22	46	99	152		158	38.8	249	61.2	
Oro-pharyngeal	147	7	30	62	122	212		50	34.0	97	66.0	
Housebound status												
No	9,707	0	11	39	103	188	$p < 0.0001$	5399	55.6	4308	44.4	$p < 0.0001$
Yes	590	0	5	28	91	200		390	66.1	200	33.9	
Total	10,297	0	10	38	103	189		5,789	56.2	4,508	43.8	

[1]Kruskal–Wallis test.
[2]Chi-squared test.

among patients with bladder and renal cancer (74% and 70%, respectively). Conversely, oro-pharyngeal and oesophageal cancer had the lowest proportions of prompt presenters (34% and 39%, respectively).

Table 2 and Figures 2 and 3 describe odds ratios of non-prompt presentation derived by both univariable and multivariable logistic regression. Except for gender for which there was no evidence of variation in the multivariable analysis (p = 0.17), these analyses produced similar findings, indicating only a limited degree of confounding between exposure variables. The largest degree of variation (>5-fold) in the odds of prompt presentation is seen between patients with different

Table 2. Proportion of patients with non-prompt presentation and respective unadjusted and adjusted odds ratios (n = 10,297)

	% Non-prompt (15+ days) presentation[1]	Unadjusted odds ratios for non-prompt (15+ days) presentation		Adjusted odds ratios for non-prompt presentation (15+ days) by patient characteristic and cancer diagnosis	
Age					
15–44 (N = 784)	44.0	0.94 (0.80–1.10)	$p < 0.0001$	0.99 (0.84–1.17)	$p = 0.0003$
45–54 (N = 1,220)	46.8	1.05 (0.92–1.20)		1.12 (0.98–1.30)	
55–64 (N = 2,170)	45.3	0.99 (0.88–1.11)		0.98 (0.87–1.10)	
65–74 (N = 2,807)	45.6	Baseline		Baseline	
75–84 (N = 2,459)	40.5	0.81 (0.73–0.90)		0.83 (0.74–0.93)	
85+ (N = 857)	38.6	0.75 (0.64–0.88)		0.83 (0.70–0.98)	
Gender					
Male (N = 5,028)	45.5	Baseline	$p = 0.0008$	Baseline	$p = 0.17$
Female (N = 5,269)	42.2	0.87 (0.81–0.95)		0.93 (0.84–1.03)	
Cancer type					
Bladder (N = 601)	25.8	0.43 (0.35–0.53)	$p < 0.0001$	0.42 (0.34–0.52)	$p < 0.0001$
Renal (N = 209)	30.1	0.53 (0.39–0.73)		0.51 (0.37–0.71)	
Brain (N = 125)	35.2	0.67 (0.46–0.99)		0.66 (0.45–0.98)	
Breast (N = 2,124)	35.5	0.68 (0.58–0.79)		0.67 (0.57–0.78)	
Unknown primary (N = 110)	37.3	0.73 (0.49–1.10)		0.75 (0.50–1.12)	
Leukaemia (N = 239)	39.7	0.81 (0.61–1.08)		0.78 (0.58–1.03)	
Prostate (N = 1,386)	41.3	0.87 (0.74–1.02)		0.83 (0.70–0.98)	
Pancreatic (N = 272)	40.4	0.84 (0.64–1.10)		0.85 (0.65–1.11)	
Stomach (N = 187)	44.4	0.98 (0.72–1.34)		0.99 (0.73–1.35)	
Lung (N = 1,126)	44.8	Baseline		Baseline	
Myeloma (N = 127)	45.7	1.04 (0.72–1.50)		1.01 (0.70–1.47)	
Endometrial (N = 311)	46.9	1.09 (0.85–1.40)		1.08 (0.84–1.40)	
Ovarian (N = 270)	46.7	1.08 (0.83–1.41)		1.09 (0.83–1.43)	
Lymphoma (N = 482)	49.6	1.21 (0.98–1.50)		1.15 (0.93 - 1.43)	
Melanoma (N = 477)	54.7	1.49 (1.20–1.85)		1.41 (1.13–1.75)	
Colorectal (N = 1,697)	53.7	1.43 (1.23–1.66)		1.43 (1.23–1.67)	
Oesophageal (N = 407)	61.2	1.94 (1.54–2.45)		1.94 (1.54–2.45)	
Oropharynheal (N = 147)	66.0	2.39 (1.67–3.43)		2.26 (1.57–3.25)	
Housebound					
No (N = 9,707)	44.4	Baseline	$p < 0.0001$	Baseline	$p < 0.0001$
Yes (N = 590)	33.9	0.64 (0.54–0.77)		0.67 (0.56–0.81)	

[1]This column repeats information presented in Table 1, for ease of reference regarding crude proportions.

cancers. Specifically, using patients with lung cancer as the reference group, the odds ratios of non-prompt presentation were 2.26 (95% confidence interval 1.57–3.25) and 0.42 (0.34–0.52) for patients with oro-pharyngeal and bladder cancer, respectively. There was no evidence of interaction between cancer diagnosis and either age or sex (p = 0.29 for both).

Sensitivity analysis

Using different binary categories of patient interval produced similar findings (Supporting Information Appendix 2). Assuming patients with missing data were either 'all non-prompt' or 'all prompt' presenters did either attenuate or accentuate patterns of variation observed in the main analysis, respectively, particularly by age and the four cancers with relatively high proportions of missing interval data (leukaemia, prostate, melanoma and myeloma) (Supporting Information Appendix 3). The degree of confounding by ethnicity was very limited (Supporting Information Appendix 4). Only including patients with interval values of up to a year produced highly concordant findings (results not shown).

Discussion

In this study, among patients with any of the 18 cancers prompt presentation was most frequent among those with

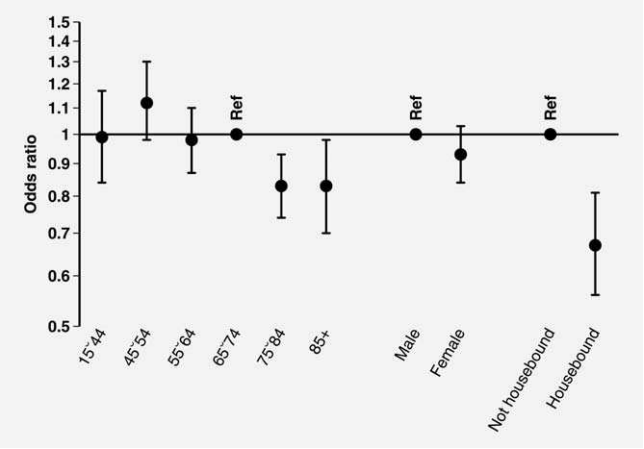

Figure 2. Multivariable logistic regression outputs (adjusted odds ratios and 95% confidence intervals) for non-prompt presentation by sociodemographic characteristic (n = 10,297).

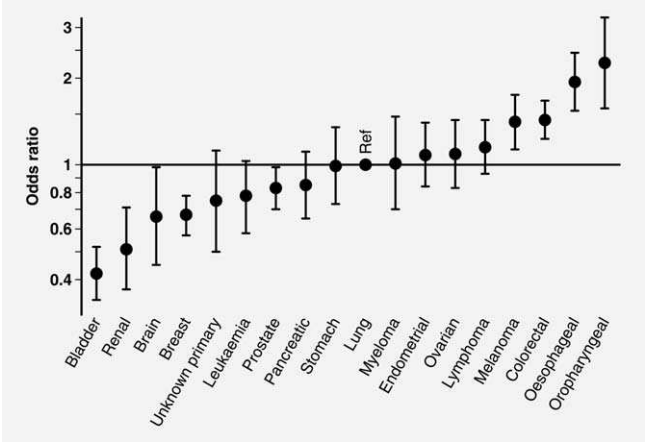

Figure 3. Multivariable logistic regression outputs (adjusted odds ratios and 95% confidence intervals) for non-prompt presentation by cancer diagnosis (n = 10,297).

bladder and renal cancer, and least frequent among patients with oro-pharyngeal and oesophageal cancer. Prompt presentation was also more frequent in older and housebound patients.

Of the 18 cancers included in our study, 12 were also examined previously by an audit (medical record) study of Scottish patients[23]; and 10 by a similar Danish study.[24] Among Scottish cancer patients, those with 'head and neck' (including oro-pharyngeal) cancer presented least promptly, whilst those with bladder and 'other urological' (including renal) cancers did so most promptly.[23] In general, median reported patient interval values for Scottish patients were similar to those reported here; however, those reported for Danish patients were longer – potentially reflecting differences in patient populations or in methods of data recording and collection (Supporting Information Appendix 5).[23,24] However, the Spearman rank correlation coefficient for pairwise comparisons of median patient interval values by cancer is 0.87 (p = 0.0002) and 0.59 (p = 0.071) between the present and the Scottish or the Danish study, respectively – indicating an overall high degree of rank concordance.[23,24] Similarly, most Finnish patients with pharyngeal cancer have patient intervals longer than a month.[28]

Prior evidence is inconsistent regarding the presence and direction of associations between age and patient interval for different cancers.[22,28–32] We are unaware of previous descriptions of variation in patient interval by housebound status. Housebound patients may be more prone to seeking help promptly, or are monitored more frequently and, therefore, assessed more promptly. Disability may confer paradoxical benefits in respect of stage at diagnosis of cancer.[33]

One of the strengths of our study is that it included patients with many different cancers. The representativeness of the patient population and of participating practices was good.[25,27] Because of continuous sampling, the study population can be assumed to be a relatively unbiased sample of incident cases first presenting to general practitioners, also including patients with poor prognosis. The robustness of the findings was explored by a range of sensitivity analyses, which generally provided similar findings. Although patient interval data were missing for between a fifth and a quarter of patients, sensitivity analyses using extreme-case assumptions indicated that this factor might have biased the findings regarding patients with four cancers with a relatively high proportion of missing data (leukaemia, prostate cancer, melanoma and myeloma); in contrast, patterns of variation for patients with all other cancers, and particularly for those with bladder, renal, oesophageal and oro-pharyngeal cancer, remained similar. Two of the cancers with higher than average proportion of missing patient interval data were prostate cancer and leukaemia. For those cancers, diagnostic suspicion is sometimes first raised at an asymptomatic stage or incidentally, based on the findings of relatively simple-to-perform blood tests (such as Prostate Specific Antigen testing or Full Blood Count). In such circumstances, the diagnosis is not symptom-driven and, therefore, measurement of the patient interval is *a priori* not applicable. These factors may explain the higher proportion of missing interval information for those cancers.

There are several limitations. The validity of patient interval data is contingent on several factors: patients need to have been able to accurately appreciate the onset of their symptoms and recall relevant dates; their doctors need to have been able to elicit and appropriately interpret information about the patient interval during consultations, and to have accurately entered it in the patient records. Although elicitation of information on symptom duration is a key aspect of a medical consultation, inaccuracies and omissions may occur in any of the above steps. However, previous research indicates that inaccurate patient recall of diagnostic intervals is unlikely to be systematic (*e.g.* biased towards either over- or under-estimation of patient interval).[34] It is

also unreasonable to assume that recall inaccuracies will be grossly differential between patients with different cancers – for example, between patients with bladder and oro-pharyngeal cancer, given the large size of the observed variation between these cancers (~5-fold difference in odds ratios). Although we believe this assertion to be reasonable, there is no direct evidence for it, and future evidence from relevant clinical psychology studies would be useful. It is important to also consider that non-systematic errors of this kind would result in under-estimation of true variation; therefore, our reported estimates of socio-demographic or cancer diagnosis differences may be conservative. We were not able to examine variation in the patient interval of patients with cancer whose first presentation did not involve previous contact with their general practitioner. Some patients have long or very long patient intervals, *e.g.* 90 or 180 days (Table 1) and the predictors of very long patient intervals may be different to the predictors of delay in respect of shorter intervals. We plan to explore variation in the patient interval amongst these patients in the future. Our findings relate to a population of English cancer patients, and extrapolations to other populations should therefore be cautious. Although at least some of the observed findings may be relevant, research questions about variation in the patient interval in other country populations are best addressed by new empirical evidence.

Promptness of presentation is a concept also applicable to a larger group of patients who experience symptoms but do not necessarily have cancer (or any other formal diagnosis). For example, even among patients with 'alarm' symptoms mandating specialist referral for investigation of suspected cancer, only one in nine are found to have cancer, whereas eight in nine patients with relevant symptoms will have another diagnosis.[35] Therefore, future research should also explore variation in the timeliness of presentation among the broader population of patients with symptoms likely to be related to cancer, and not only among cancer cases. Although clearly important, exploring variation in patient interval among patients with symptoms (not simply among cancer patients) was impossible given our data.[14]

Measuring patient interval is challenging as it cannot be 'objectively' measured.[6,18,36] Additional difficulties arise in the context of co-morbidity. Both patient interviews/surveys and medical record studies have strengths and limitations (Box). Patient interview/questionnaire studies can be subject to survivorship bias (differential attrition) as those who die early do not contribute information and their intervals may be different to those of survivors. In contrast, studies based on medical records information can provide for relatively large samples (including patients with rarer cancers) whilst limiting the potential for survivorship bias (as continuous sampling of all incident cases is possible). Ideally studies should encompass both approaches, and also measure patient intervals of patients with relevant symptoms who do not necessarily have cancer, as in the DISCOVERY programme's SYMPTOM study, due to report 2014 (http://discovery-programme.org/symptom_study.php).

Variation in the promptness of presentation by cancer is likely to reflect differences in how patients appreciate and appraise typical symptoms of different cancers. Symptoms with abrupt and unexplained onset such as bleeding are associated with shorter patient intervals.[22,29–31] As patients with bladder and renal cancer often present with haematuria, this may explain why patients with these two cancers seem to present more promptly than patients with any other examined cancer.[23] Other factors, such as symptom frequency, duration and intensity may also matter. Familiarity with signs and symptoms in the context of previous self-limiting illness (*e.g.* oral ulcerations) has been judged responsible for non-prompt presentation of patients with oro-pharyngeal cancer.[37,38]

Whilst there is very strong evidence of variation in prompt presentation between patients with different cancers we cannot reliably distinguish between all individual cancers, particularly for cancers in the middle of the spectrum. We suggest that interpretation considers the general pattern of variation, particularly focusing on comparisons of the extremes (*e.g.* oro-pharyngeal or oesophageal *vs* bladder or renal cancer). We specifically draw attention to oro-pharyngeal and oesophageal cancer – the two cancers with the highest proportions of non-prompt presenters and longest median patient intervals. Oro-pharyngeal cancer has relatively poor 5-year relative survival (typically <50% for most sub-sites except lip). Together with our own findings, these considerations can support the development of awareness campaigns for oro-pharyngeal cancer.[39] Oesophageal cancer also has poor prognosis (5-year relative survival <20%). Although dysphagia is a common cardinal symptom of oesophageal cancer (and one with relatively high specificity[40], the findings indicate that patients with oesophageal cancer do not present promptly. These findings concord with prior evidence indicating that awareness of 'difficulty swallowing' as a potential sign of cancer is particularly poor among members of the British public (lowest compared with other eight cancer symptoms).[11] Specifically, only about 1 in 20 respondents would immediately recall dysphagia as a symptom of cancer – in contrast lump/swelling (the symptom with the highest spontaneous recall) would be recalled by two thirds of respondents.[11] These findings would therefore support the development of awareness campaigns about the importance of dysphagia. The clinical and population health outcomes of awareness campaigns nevertheless need to be evaluated, ideally using controlled designs.[41]

As the aim of public awareness interventions is to decrease patient intervals,[17] we strongly advocate the conduct of regular surveys of patient interval in representative samples of cancer patients to help monitor the impact of such interventions and progress towards improving the timeliness of presentation in the population. Appreciating variation in promptness of presentation can help to better target and

tailor such interventions. Given the findings, prioritising public awareness interventions for symptoms of oro-pharyngeal and oesophageal cancer is particularly justified.

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Contributors

The study was initiated by SK and GL in the context of SK's MPhil in Public Health studies (University of Cambridge) supervised by GL. Material and Methods were further developed and modified in discussions with GAA and all other authors. CLS and SK performed most analyses. GPR and SMcP led different aspects of the National Audit project and data collation. RDN and FMW commented on the methods and findings alongside all other authors. All authors commented on initial drafts and saw and approved the final draft of the paper.

Ethical Approval

Not required. An integral part of the National Audit of Cancer Diagnosis in Primary Care project was that anonymous data may subsequently be used for purposes of early diagnosis research, and access to these data was granted by the Audit oversight group.

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