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Original Paper

Variations in the Screening History and Appropriateness of Management of Cervical Cancer in South East England

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In seven health districts in southern England, an audit of the management of cervical cancer compared with regionally developed guidelines was undertaken between 1988 and 1991. Four hundred and sixty-nine regional residents were treated in the study district hospitals. 73(15.6%) women were appropriately staged, with increasing likelihood of appropriate staging investigations observed with higher stages ($P < 0.0001$) and type of hospital [Teaching 23(21%), Non-Teaching with oncology support 11(11.5%), Non-teaching 4(7%), $P < 0.0001$] but with no change over the study period. There was no significant trend in the proportion of women treated appropriately over time, with 270(59%) being appropriately treated, 91(20%) under-treated and 98(21%) over-treated overall. Appropriateness of treatment increased with higher stages ($P < 0.0001$) and hospital workload for cancer of the cervix ($P = 0.038$). Multivariable analysis indicated that survival independently and significantly decreased with age and stage, under-treatment and in cases where lymph nodes were involved or not examined. There was no change in the appropriateness of management over the 4 years, with high levels of inappropriate care. Survival was not only influenced by biological and demographic factors, but by inappropriate care.

Key words: cervix neoplasms, survival analysis, practice guidelines, process assessment (health care), delivery of health care

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INTRODUCTION

In England and Wales, cancer of the cervix is the sixth most common cause of cancer in women, representing 4% of female cancer registrations [1]. There have been appreciable declines in the incidence and mortality rates in most countries where organised cervical screening programmes have been introduced [2]. However, mortality rates among young women in some countries, including the U.K., have increased [1]. Macgregor and associates demonstrated, during the time period 1960 to 1991, that cervical screening has been effective in Scotland in reducing the incidence of and mortality from cancer of the cervix. Most cases and deaths occurred in unscreened women (50%) or in those who had had few smears at long intervals.

In the U.K., there is a Health of the Nation target for reducing the incidence rate for cervical cancer [4]. Guidelines have been produced by the national coordinating network of the NHS cervical screening programme for the management of abnormal smears that require adaptation in light of the findings of Macgregor and associates [3, 5]. For women with micro-invasive cervical cancer, Morgan and associates reported that there was no consensus amongst U.K. gynaecologists on methods of diagnosis or management [6]. Although there have been no randomised controlled trials to demonstrate the effectiveness of radiotherapy versus surgery for early invasive cervical cancer, both are generally considered to be equally effective, although the pattern of side-effects varies [7].

There has been debate over the effectiveness of clinical guidelines in improving the outcome of clinical care but arguments for their development for various cancers have been put forward, and in the field of gynaecology the Department of Health in England has issued guidelines for the management of ovarian cancer [8–10].

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(SETRHA), a multidisciplinary group of doctors managing gynaecological cancers drew up guidelines for the management of cervical, ovarian and endometrial cancers. This study reports on the screening history and appropriateness of management of cervical cancer, in relation to these guidelines, in seven district health authorities in SETRHA over a 4-year period between 1988 and 1991.

PATIENTS AND METHODS

Guideline development and dissemination: six gynaecologists, one medical oncologist and four radiotherapists developed the guidelines for the diagnosis, staging and management of cervical cancer by consensus, based on evidence from the literature.

The 15 districts of SETRHA were ranked according to their standardised mortality ratio (SMR) for cervical cancer in women aged under 65 years [11]. Alternate districts from the highest SMR district downwards were selected for the audit and all gynaecological units sited in these seven districts agreed to participate in the study. The guidelines were distributed in 1988 and again in 1990, along with the audit study protocol, to each gynaecologist, medical oncologist and radiotherapist in the relevant units. The authors visited each centre to discuss the study.

Registration of cases

Ascertainment of all incident cases of cervical cancer in the study districts between 1 January 1988 and 31 December 1991 was undertaken by two research associates during 1991/2. The focus of the audit of the guidelines was on regional residents treated in the seven regional districts, for at least one modality. Identical information was also collected on out-of-district referrals to these units to enable the number of women diagnosed and managed in the unit to be estimated. Multiple sources of ascertainment were employed, and included the consultants, their secretaries and medical teams, medical records, histopathology and post-mortem reports. The Thames Cancer Registry provided a list of registrations of those cases treated by the consultants in the study centres during the same time period, which enabled the authors to complete the data on cases missed through study sources of notification. The research associates visited the units regularly and updated the records to include diagnostic and management procedures undertaken in outpatient and inpatient settings, and to record any change in status of the patient. For patients referred out-of-region information was obtained from the relevant departments by correspondence.

Data collection

The age and district of residence (based on postcode) were recorded. Cervical screening history included the date of last normal smear and date and reason for the most recent abnormal smear. A record was made of which investigations were employed for staging (Table 1). The Federation Internationale Gynaecologique Obstetrique (FIGO) stage, if recorded, was noted [12]. If there was no stage recorded in the notes, independent staging was performed by a gynaecological oncologist using the recorded clinical information, results of investigations and histological information available in the notes and from other registration sources. Surgery was classified as: local cervical operations (cone biopsy, LLETZ or laser), hysterectomy (simple or radical; radical hysterectomy includes lymph node dissection) and others (e.g. exenteration). Table 2 outlines the guidelines produced for the management of each stage. Operative details of lymph node involvement, morphological classification of tumour (ICD morphology codes), were recorded and classified as squamous, adenosquamous, adenocarcinoma, clear cell carcinoma, other or not known; for further analyses these were grouped as squamous, other, or not known [13]. The differentiation of the tumour was classified as well, moderate, poor, undifferentiated or not stated.

Postoperative complications recorded included operative and postoperative haemorrhage (>500 ml recorded blood loss), infections of any site with positive microbiological reports, intestinal obstruction and deep vein thrombosis/pulmonary embolus along with late complications, e.g. fistulae.

Details of pre- and postoperative brachy- and external radiotherapy were recorded, along with symptoms and complications of the radiotherapy, for example, radiation bowel damage. If chemotherapy was given, the agent, dose, number of courses and complications were recorded. The inappropriate investigations performed after the initial diagnosis and treatment, without evidence of recurrence or progression, within the first year were recorded.

Details of the date and cause of death as indicated on the death certificate were recorded. A record of whether a woman had died was validated with Thames Cancer Registry records and data censored on 1 June 1994.

Hospitals of surgery were categorised as teaching (T) (hospital with a medical school attached), non-teaching with support (NTS) (a district general hospital with radiotherapy and oncology services in the district), and non-teaching (NT) (district general hospital). Radiotherapy and chemotherapy units by definition were categorised as teaching or non-teaching with support. Hospitals were also categorised by their cervical cancer referral workload, estimated from the number of referrals per year during the study period and divided into teaching (as they treated higher numbers than the NT), and those seeing less than or greater than the regional mean in NT hospitals for the three modalities (surgery, radiotherapy, chemotherapy). Cases were also categorised by district of residence (1–15), and grouped as inner London (IL), outer London (OL) or rural (RUR).

Appropriateness of management

Where the investigations performed and the interventions undertaken were in agreement with the guidelines (Tables 1 and 2), actions were classified as appropriate, and deviations from the guidelines classified as inappropriate, which included under- and over-treatment.

Statistical methods

Comparison between groups was with the chi-squared (χ^2) test and trends over the study period with the chi-squared test for trend. The Cox Proportional Hazards Model [14] was used to examine the factors influencing survival. The variables of interest in relation to survival were: age (continuous), district of residence (IL, OL, RUR), previous smear (yes, no, not known), comorbidity (yes, no, not known), previous births, miscarriage or termination of pregnancy (yes, no, not known), stage (≤IIa, >IIa), histology (squamous, other), differentiation (well, moderate, poor, not known), lymph node involvement (positive, negative, not examined, no surgery), appropriateness of treatment (under-treatment, appropriate,

Table 1. *Patients' characteristics*

Incident cases	493		
Resident and treated in region	469 (95%)		
Treatment			
Surgery	261 (56%)	T	110 (42%)
		NTS	95 (36%)
		NT	56 (21%)
Radiotherapy	286 (61%)	T	124 (43%)
		NTS	162 (57%)
Chemotherapy	27 (6%)	T	16 (59%)
		NTS	11 (41%)
Resident in IL	130 (28%)	Reason for smear known	86 (66%)
OL	170 (36%)		113 (66%)
RUR	169 (36%)		92 (54%)
Had previous smear	269 (57%)		
No previous smear	81 (17%)		
Not known	119 (25%)		
Reason for recent smear known	291 (62%)	Screen	112 (38%)
		Symptoms	123 (42%)
		Previous abnormality	56 (19%)
Stage at presentation known	459 (98%)	Ia	65 (14%)
		Ib/IIa	250 (54%)
		>IIb	144 (31%)
Histology known	462 (99%)	Squamous	377 (82%)
		Adenocarcinoma	57 (12%)
		Adenosquamous	19 (4%)
		Other	9 (2%)
Age known	465 (99%)	Mean 51 (S.D.=17)	Range (23–92)

IL, inner London; OL, outer London; RUR, rural.

Table 2. *The numbers and percentages* (%) *of women having appropriate investigations for staging*

	n	%	Not known
Examination under anaesthesia	414	90	9
Cystoscopy	199	46	33
Intravenous pyelogram	195	42	
Chest X-ray	238	51	
All four investigations	73	15.6	
Total	469		

over-treatment), type of hospital of surgery, radiotherapy, chemotherapy (T, NTS, NT, and by workload T, NT >mean, NT <mean). All these variables were analysed by a multivariable model, and backwards stepwise elimination used to produce a final model where all variables included were significant at the 5% level.

RESULTS

A total of 493 incident cases were referred to units in the seven study districts over the 4-year period. The focus of this audit is on the 469 (95%) who were SETRHA residents treated in these units.

261 (56%) of the women were treated with surgery in the study centres (Table 1). The number of regional cases treated by surgery in each centre ranged from 1 to 43 with a mean of 19 [standard deviation (S.D.)=15] cases per centre and a median of 19.2. There was a significant difference between types of study centre in the mean number of resident women treated per unit [T 36.7 (S.D.=9), NTS 11.9 (S.D.=13.6), NT 9.3 (S.D.=9), P=0.01].

286 (61%) regional women were treated with radiotherapy in the study centres (Table 1). The number treated in each study centre ranged from 23 to 101 cases, with a mean of 57 (S.D.=32) cases per centre and a median of 58. There was no significant difference in the mean number of women treated per centre between the types of radiotherapy centre [T=62 (S.D.=55), NTS 40.5 (S.D.=31.8), P=0.07]. 27 resident women were treated with chemotherapy in study centres (Table 1). The number of regional women treated per centre ranged from 1 to 15 with a mean of 5.4 (S.D.=5.6) cases, and a median of 4.

Of the resident women treated in the study centres, 130 were from inner London (IL), 170 from outer London (OL) and 169 from rural districts (RUR) (Table 1). The average age was 51 (S.D.=17) years (Table 1), with a significantly older population in rural districts (IL 48 years (S.D.=17.4), OL 48.8 years (S.D.=15.6), RUR 55.5 years (S.D.=17), P <0.0001] and a significantly younger population having surgery in Teaching hospitals [T 40.8 (S.D.=12.7), NTS/NT 44.4 (S.D.=12.5), P=0.02].

Cervical screening history and staging investigations

269 (57%) resident women had had a previous smear, 81 (17%) had not had a previous smear, and no record of smear history was available for 119 (25%) (Table 1). There was no significant difference in the proportion of women with no previous smear between types of district (IL 30 (23%), OL 24 (14%), RUR 27 (16%), P=0.15]. Over the 4-year period, the proportion of women with no previous smear did not decline significantly (χ^2 for trend=2.82, P=0.09). Of those women with no previous smear, 7 presented with stage Ia, 35 with stage Ib or IIa and 39 with IIb or more advanced disease.

The reason given for the most recent smear was routine

screen for 112 cases, symptoms for 123 women and follow-up of a previous abnormality in 56 cases (Table 1), with no significant difference in proportions over the 4 years (χ^2 for trend=1.21, P=0.27). Of those giving routine screening as the reason, 92 (82%) had a previous smear, 14 (13%) had no previous smear and for 6 (5%) the smear history was unknown. 68 (55%) of those stating symptoms as the reason for their most recent smear had had a previous smear, 23 (19%) had no previous smear and for 32 (26%) this was not known. Of those with a reason for their most recent smear (Table 1), a significantly lower proportion of those in inner London reported routine screening as the reason than in outer London or rural districts [IL 17 (20%), OL 46 (41%), RUR 49 (53%), P<0.0001].

The proportion of women having the appropriate staging investigations, including intravenous pyelogram (IVP), was 15.6% (Table 2). There were significant differences in the proportion of women undergoing all tests by stage (Ia 1 (1.5%), Ib and IIa 41 (16.5%), ≥IIb 31 (21.5%), P<0.0001] and by type of hospital for surgery [T 23 (21%), NTS 11 (11.5%), NT 4 (7%), P <0.0001]. Over the 4 years, the proportion of women undergoing all the tests did not change significantly [1988 23 (17%), 1991 18 (16%), P = 0.2].

Overall, 317 (69%) of women had stage mentioned in their notes (with this information being unavailable for 8 women) and of those with greater than stage Ia disease, 299 (76%) had stage mentioned. There was no significant difference in proportion with stage mentioned over time [1988 88 (67.2%), 1991 82 (75%)]. For those women undergoing surgery, there was a significant difference in the recording of staging between types of hospitals, teaching hospitals being more likely to mention stage [T 70 (64%), NTS 47 (50%), NT 26 (46%), P = 0.05]. There was no significant difference between types of hospital of radiotherapy. Older women (stage mentioned mean age=53 years, stage not mentioned mean age=46 years, P <0.0001) and women not undergoing surgery [143 (55%) surgery, 174 (87%) other modalities not involving surgery, P=0.0001] were more likely to have stage mentioned in their notes.

65 women (15%) presented with stage Ia disease, 250 (54%) Ib/IIa, 144 (31%) IIb or greater (Table 1). There was no significant difference in the proportion of early or late stage disease over the study period (P = 0.11). There was no difference in stage by type of hospital of surgery. Women with advanced disease were older (stage I mean age = 40 years, stage Ib/IIa mean age = 49 years, stage ≥IIb mean age = 59 years, P <0.0001).

Treatment

The modalities of treatment employed for each stage are displayed in Table 3. The number and proportion of women appropriately managed, under- or over-treated is displayed in Table 4. There was an overall trend in the level of appropriateness of treatment (under-treatment, appropriate treatment, over-appropriate treatment) by year of diagnosis (χ^2 trend=4.97, P = 0.03). Individually, the only significant trend was for under-treatment (χ^2=5.3, P = 0.02), with 20 (15%) being under-treated in 1988 rising to 30 (27%) in 1991. There were no significant differences in the level of appropriateness between T, NTS and NT hospitals for surgery [44 (40%) T, 42 (44%) NTS, 18 (32%) NT, P = 0.3]. There were significant differences in levels of appropriateness with age [45 (53%) <35 years, 115 (53%) 35–59 years, 113 (70%) >60 years, P = 0.0003]. There were differences in the level of appropriateness with stage [Ia 43 (66%), Ib 95 (46%), IIa 32 (74%), IIb 48 (74%), III/IV 52 (66%), P <0.0001]. There were significant differences in the level of appropriateness in relation to workload for cancer of the cervix [44 (40%) T, 54 (44%) NT>mean and 6 (21%) NT<mean, P=0.038, Table 5].

Of the 261 women who had surgery, 149 (57%) had their lymph nodes examined, of whom 25 (17%) had lymph node metastasis. There was a significant difference between the types of hospital of surgery in proportion to women who had pelvic lymphadenectomy [73 (66%) T, 53 (56%) NTS, 23 (41%) NT, P=0.001].

There were 377 (82%) squamous, 57 (12%) adenocarcinoma, 19 (4%) adenosquamous, and 9 (2%) other, with 7 (1.5%) not known (Table 1). The proportion with differentiation of tumour recorded was 242 (52%) with significant differences between types of hospital of surgery [81 (74%) T, 46 (48%) NTS, 29 (52%) NT, P=0.0005].

138 (29%) women had postoperative complications, with significant differences between types of hospital surgery [68 (62%) T, 50 (53%) NTS, 20 (36%) NT, χ^2=10.6, P=0.005]. This could be accounted for by the differences in the proportion of women having radical surgery: [65 (71%) T, 42 (47%) NTS, 20 (38%) NT, P<0.0001]. With regard to cervical cancer surgical workload, there were differences in the complication rates: [68 (62%) T, 60 (49%) NT>mean, 10 (34%) NT<mean, P=0.017], again with an increased radical hysterectomy rate in teaching hospitals (P=0.0002). There was a difference in complication rate between those women undergoing a simple or radical hysterectomy [36 (34%) less than radical and 93 (73%) radical, P<0.0001] but no significant difference between type of hospital of surgery for the two types of operation.

The appropriateness of radiotherapy is displayed in Table 4. There were no differences between centres with regard to appropriateness (P=0.64). The number of women with symptoms of therapy was 150 (55%) with no differences between types of hospital (P=0.5) or between those hospitals treating more or less than the regional mean number of cases (P=0.5).

During the year following the initial treatment, investigations were performed without clinical evidence of progression or recurrence, with 66 (14%) having these investigations, but with no differences between type of hospital. The investigations included: small bowel barium meal (3), abdominal X-ray (3), barium enema (8), cystoscopy (8), intravenous pyelogram (3), lumbar spine (3), vault of vagina biopsies (4).

Survival

Of the 469 patients, 117 (25%) had died when censoring occurred on 1 June 94. For those who were still alive, the time from diagnosis to censoring was a mean of 1640 days (S.D.=420.5) and a median of 1657 days. Those who died had survived for a mean of 497 days (S.D.=477.1, median=345) from diagnosis.

The final Cox Proportional Hazards Model (Table 6) showed that survival decreased with increasing age and stage of disease. There was also reduced survival in those women who were under-treated, in those with lymph node involvement and in those women whose lymph nodes had not been examined (whether this was because they had not had surgery,

Table 3. Modalities of treatment by stage

	n (%)	Ia	Ib/IIa	Stage IIb+	Stage not known
Nil	17 (4)	1	4	10	2
Surgery only	156 (33)	55	99	2	0
Radiotherapy only	182 (39)	4	79	93	6
Surgery + RT	87 (19)	5	58	22	2
Surgery + CT	10 (2)	0	5	5	0
RT+CT	9 (2)	0	2	7	0
Surgery + RT + CT	8 (2)	0	3	5	0
Total	469	65	250	144	10

RT, radiotherapy; CT, chemotherapy.

Table 4. Appropriateness of treatment by stage

Stage	Management	*n* (%)
Ia	Cone biopsy/simple hysterectomy	
	Under-treated	5 (8)
	Appropriately treated	43 (66)
	Over-treated (>simple TAH)	17 (26)
Ib	Well/moderately differentiated squamous: radical hysterectomy	
	Under-treated -(<radical hysterectomy):	18 (33)
	Appropriately treated	32 (58)
	Over-treated	5 (9)
Ib	Poorly differentiated squamous: RT or radical hysterectomy +CT	
	Under-treated	34 (34)
	Appropriately treated	37 (37)
	Over-treated	30 (30)
Ib	Adeno: radical hysterectomy or TAHBSO, RT and/or CT	
	Under-treated	17 (33)
	Appropriately treated	26 (51)
	Over-treated	8 (16)
II, III, IV	RT and/or CT	
	Under-treated (only surgery)	17 (9)
	Appropriately treated	132 (71)
	Over-treated (surgery as well)	38 (20)
All stages	Under-treated	91 (20)
	Appropriately treated	270 (59)
	Over-treated	98 (21)

RT, radiotherapy; CT, chemotherapy; TAHBSO, total abdominal hysterectomy and bilateral salpingo oophorectomy.

Table 5. Appropriateness of management by hospital workload

Treatment	T (%)	NT >mean (%)	NT <mean (%)	Total (%)
Under-treatment	22 (20)	30 (25)	5 (17)	57 (22)
Appropriate treatment	44 (40)	54 (44)	6 (21)	104 (40)
Over-treatment	44 (40)	38 (31)	18 (62)	100 (38)
Total	110	122	29	261

Table 6. Cox Proportional Hazards survival model

Variable	Hazard ratio	95% CI	χ^2	*P*-value
Age	1.04	1.02, 1.06	29.5	<0.0001
Stage <IIa	1.00		40.2	<0.0001
Stage >IIa	5.54	3.07, 9.98		
Under-appropriate	3.98	2.30, 6.89		
Appropriate	1.00		21.1	<0.0001
Over-appropriate	1.71	0.62, 4.73		
Lymph nodes −ve	1.00		15.1	0.0017
Lymph nodes +ve	5.48	0.84, 35.85		
Lymph nodes not examined (surgery)	6.47	1.45, 28.77		
Lymph nodes not examined (no surgery)	10.03	2.18, 46.13		

CI, confidence interval.

or because although surgery was performed lymph node metastases was not assessed).

DISCUSSION

Currently, the only outcome measure that can be routinely used for comparison of cancer care between geographical areas or hospitals is mortality, and in Europe there are significant differences in age standardised mortality ratios between geographical areas that are incompletely understood [15]. These variations could be due to variations in incidence or case-fatality or be artefactual. The aim of this study was to assess the effect of screening and adherence to clinical guidelines on survival. The study population included all cases registered with the Thames Cancer Registry that were resident in the study districts and treated in the region for at least one modality. Those women who were solely treated outside the region were not included, since the hospitals they were referred to were not participating in the audit, and represent only a small proportion of the study population.

In countries where cervical screening is well coordinated, incidence rates have fallen [2, 3]. In the recent Scottish study, over 50% of incident cases were unscreened, and in our seven-district study, 17% of women had never had a smear and in a further 25% there was no record of a smear history, with no improvement in this situation over the 4 years which

encompassed the introduction of the call/recall system in England. Of those women who had never had a smear, over half presented with advanced disease with a reduced chance of survival, indicating the need to develop strategies to encourage these women to avail themselves of the opportunity of having a smear.

For certain cancer sites, survival has been shown to be prolonged in teaching or specialist centres, although the specific reasons for this relationship are not clear. Harding and associates, looking at the management of malignant teratoma, showed that treatment in one tertiary referral centre, as compared with the four other units in a Scottish region, resulted in improved survival, after controlling for other possible factors, and recommended that centralisation of treatment for this condition would improve outcome [16]. A similar study by the same group indicated improved survival for ovarian cancer when treated in a teaching centre [17], although detailed methodologies were not discussed. McArdle and Hole have also demonstrated the effect of surgical expertise on survival from colorectal cancer, and suggested surgery be undertaken by surgeons with a special interest in colorectal surgery or surgical oncology [18]. Apart from the latter study, the specific aspects of the structure and process of care contributing to improved survival have not been determined for cancer care. With the emergence of recommendations for the restructuring of cancer care in the U.K., it is difficult to envisage how these can be executed without further investigation of the 'black box' of cancer care to determine the specific factors that influence outcome and which can be modified [8].

The study by Harding and associates demonstrated that protocol adherence improved the outcome of malignant teratoma [16]. Our findings would also support this for cervical cancer management in southern England. The study involved hospitals in seven districts with a mixture of teaching, non-teaching with support of oncology services and non-teaching centres which are representative of units around the U.K. The levels of appropriateness of staging were extremely low, but with increasing appropriateness with increasing stage, which may indicate understaging in those assigned lower stages because of reduced investigation. There also appeared to be an age effect, younger women being more appropriately staged than older women, which may explain, in part, the reduced survival with age when controlled for stage, as older women may have tended to be understaged. The recording of stage in the notes is an important aspect of documentation required for the planning of treatment, especially by a multidisciplinary team often seeing the patient at different locations and making decisions based on written evidence in the notes. There was no change in the proportion of patients being appropriately staged over time which indicates that guideline dissemination did not affect practice. Guidelines, although useful as one component of a quality assurance programme, do not by themselves appear to change physician behaviour. Grimshaw and Russell, reviewing published guidelines, indicated that the highest probability of being effective is achieved by an internal development strategy, a specific education strategy for dissemination and patient-specific reminder at the time of consultation [19].

The levels of appropriateness of management varied significantly by stage, with the least appropriate treatment being provided for women with the lowest stage disease which should have the highest survival rates [12]. The Expert Advisory Group on Cancer has recommended that expertise be concentrated in cancer centres for the less common cancers, but it is unclear where cancers that fall between the rare and common should be treated [8]. Although this study has only demonstrated an independent effect of appropriate intervention on survival, the levels of appropriateness were higher in teaching hospitals and those treating more than the regional average number of women. This may reflect the expertise of the surgical and oncological teams treating these women, but may also reflect the facilities these units have for the management of cervical cancer. More description of the structure and process of care, including training and specialisation of staff, is required. Younger women who tend to be more adequately staged are less appropriately managed and the reasons for this are not clear from this study.

Traditionally, survival analysis has focused on demographic, biological and clinical variables. In a population-based study, Macleod and associates reported that stage and grade of tumour were the only two independent risk factors for survival [20]. Our study confirmed the effect of stage, but not that of differentiation, probably because of the large proportion in which differentiation was not recorded. The effect of age has previously been reported [21]. This is the first study to report the independent effect of the level of appropriateness on survival which is of importance, as unlike the other factors, it may be possible to improve the levels of appropriate treatment. In a trial addressing the use of guidelines, audit and use of local opinion leaders, Lomas and colleagues found that the use of local opinion leaders to advocate appropriate interventions was the more effective strategy [22]. Our audit did not demonstrate any significant overall change in the levels of appropriateness over time, and in fact the only significant trend was an increase in the proportion of women who were under-treated. The guidelines were principally developed by interested individuals and, although distributed widely and on several occasions, local adaptation and ownership may not have developed adequately enough for the guidelines to be effective at changing practice. The feedback of these results should demonstrate the validity of these guidelines for improving outcome and could be adapted by the local units and incorporated into audit programmes.

This study has highlighted the continual need to adapt the cervical screening programme to enable more women to be screened at regular intervals. There are significant variations in the patterns and appropriateness of practice in southern England and appropriateness of treatment has a strong effect on survival. Guidelines for the management of cervical cancer should be adapted to encourage local ownership by health care professionals and incorporated into audit programmes. Further research is required to investigate the 'black box' of cancer care to determine what aspects of service delivery influence outcome.

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