

# The use, quality and effectiveness of pelvic examination in primary care for the detection of gynaecological cancer: a systematic review

Pelvic examination in primary care to detect gynaecological cancer: a systematic review

Article category: systematic review

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## Key Messages

- Gynaecological cancers are very common in the developed world
- Suspected cancer referral guidelines recommend the use of pelvic examination (PE)
- Existing evidence on PE is sparse and of variable quality
- Deciding to use pre-referral PE is complicated and multifactorial
- High quality research is required



# The use, quality and effectiveness of pelvic examination in primary care for the detection of gynaecological cancer: a systematic review

## **Abstract**

*Background:* Urgent suspected cancer referral (USC) guidelines recommend that women with gynaecological cancer symptoms should have a pelvic examination prior to referral. We do not know to what extent general practitioners (GPs) comply, their competency at pelvic examination (PE), or if PE shortens the diagnostic interval.

*Objectives:* We conducted a systematic review of the use, quality and effectiveness of PE in primary care for women with suspected gynaecological cancer.

*Method:* PRISMA guidelines were followed. Three databases were searched using four terms: pelvic examination; primary care; competency and gynaecological cancer. Citation lists of all identified papers were screened independently for eligibility by two reviewers. Data extraction was performed in duplicate and independently. Paper quality was assessed using the relevant CASP checklist. Emergent themes and contrasting issues were explored in a narrative ecological synthesis.

*Main Findings:* 20 papers met the inclusion criteria. 52% or less of women with suspicious symptoms had a PE. No papers directly explored GPs' competence at performing PE. Pre-referral PE was associated with reduced diagnostic delay and earlier stage diagnosis.

Ecological synthesis demonstrated a complex interplay between patient and practitioner

factors and the environment in which examination is performed. Presenting symptoms are commonly misattributed by patients and practitioners resulting in misdiagnosis and lack of PE.

*Conclusion:* We do not know if pre-referral PE leads to better outcomes for patients. PE is often not performed for women with gynaecological cancer symptoms and evidence that it may result in earlier stage of diagnosis is weak. More research is needed.

*Keywords:* General practitioner, gynaecological cancer, pelvic examination, referral.

## Introduction

Gynaecological cancers are relatively common in the UK affecting over 21,000 women each year<sup>1</sup> and despite recent improvements, UK survival rates for the five main gynaecological cancers, ovarian, endometrial, cervical, vulval and vaginal continue to lag behind those in comparable countries<sup>1</sup>. This may reflect delayed diagnosis of cancer: the primary care interval, the time between patient presentation with symptoms suggestive of cancer and the point of referral by the GP to secondary care has a pivotal role in a patient's diagnostic journey and cancer outcomes may be improved by reducing delays in primary care<sup>2</sup>.

Urgent suspected cancer referral (USC) guidelines have been developed by different agencies as one of a number of strategies to reduce diagnostic delay and improve patient outcomes<sup>3, 4</sup>. The National Institute for Health and Care Excellence (NICE) and the Scottish Referral Guidelines for Suspected Cancer recommend pre referral PE but provide no peer-reviewed evidence. The clinical development group (GDG) for NICE, comprised of non-specialists, predict the value of pelvic examination for suspected cervical, vulval and vaginal cancers, 'based on their clinical experience'. This indicates the divide between available evidence and professional opinion on the role of pre-referral PE to improve patient outcomes. Physical examination is an integral part of patient assessment but the intimate nature of pelvic examination makes learning challenging<sup>5</sup> and subsequent exposure to maintain these skills can be limited; an average GP will see only one case of ovarian cancer every five years<sup>6</sup>. In addition, there may be other factors which influence the decision to perform a PE and to interpret and act on the findings.

We aimed to conduct a systematic review and narrative synthesis of the evidence relating to the use, quality and effectiveness of pelvic examination in primary care in diagnosing gynaecological cancer.

## **Method**

### *Research Questions*

A systematic narrative review was conducted to answer three research questions relating to pelvic examination in primary care and the diagnosis of gynaecological cancer:

- 1) Is PE used by GPs to assess women with symptoms suggestive of a gynaecological cancer?
- 2) What is the quality of PE performed by GPs?
- 3) What is the association between PE and referral outcomes?

The 'Preferred Reporting Items for Systematic reviews and Meta-Analyses' (PRISMA) criteria have been followed. A review protocol was registered and is available at:

[https://www.crd.york.ac.uk/PROSPERO/display\\_record.asp?ID=CRD42016035659](https://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42016035659).

(Supplement 1 Prisma checklist).

### *Search Strategy*

A comprehensive review of the published literature was performed by systematically searching MEDLINE, Embase, CINAHL from 1996 to present and ClinicalTrials.gov and the Cochrane Library from inception to present. The search strategy (Supplement 2 Search strategy) was based around four terms and their synonyms and MeSH terms: pelvic examination; primary care; competency and gynaecological cancer. The grey literature was also reviewed (The New York Academy of Medicine; The Joanna Briggs institute and Google Scholar). Additionally, reference lists from all included papers were hand searched.

The search was limited to English language only. The search strategy was developed with the input of a medical librarian.

### *Inclusion and Exclusion Criteria*

All original research papers of any design were included: controlled and uncontrolled quantitative studies; and qualitative studies. We included studies which involved clinicians who were GPs or trainee GPs and patients over the age of 18. Studies were excluded if they were limited to patients under the age of 18; involved only clinicians who were not GPs or trainee GPs or were non-English language papers. Inclusion and exclusion criteria specific to individual research questions are detailed below:

#### **1) Is PE used by GPs to assess symptoms suggestive of a gynaecological cancer?**

Included studies with women diagnosed with a gynaecological cancer or who had had symptoms potentially suggestive of a gynaecological cancer. Studies examining the facilitators and barriers for performing pelvic examination were also included. Studies were excluded if included non-diagnostic pelvic examination.

#### **2) What is the quality of PE performed by GPs?**

Included studies involved bench top simulators or volunteer patients. Studies involved both diagnostic and screening pelvic examination: skill was assessed in terms of either technique or interpretation of examination findings.

#### **3) What is the association between PE and referral outcomes?**

Studies had to include the referral of women with symptoms suggestive of a gynaecological cancer from primary to secondary care and involve diagnostic pelvic examination.

### *Study selection*

All titles, abstracts and full papers were assessed independently at all stages by two researchers. All titles were screened against the inclusion and exclusion criteria. Following retrieval and removal of duplicates, the remaining abstracts were assessed for eligibility. Any disagreements were resolved by discussion between the two researchers. Full texts were obtained for all abstracts which met the inclusion and exclusion criteria.

### *Data extraction and synthesis*

Data from the full papers selected was extracted independently by both reviewers to a data collection form (Supplement 3 Data collection form).

Previous scoping searches suggested that papers would be heterogeneous in nature. As a result, data synthesis was narrative and followed the recommended sequence described by Popay: themes were developed initially which were then explored within and across included studies<sup>7</sup>.

Thematic analysis was used to identify common threads that extended across extracted data from included studies to answer each research questions, while an ecological approach was used to explore the relationships between common threads within and between the studies and research questions unpicking the mutually interdependent relationships between patients, clinicians and their environments.

### *Assessment of data quality*

Study quality was assessed using the appropriate CASP tool and performed in duplicate by the same researcher. Poor study quality did not affect papers' inclusion.

Patient/public involvement was not included in this systematic review. Funding was from a personal Clinical Academic Training Fellowship, grant reference RG 13111-10, awarded to PW from the Chief Scientist's Office, Scottish Government. The fellowship application was externally peer reviewed. The funder played no part in conducting the research or writing the paper.

## **Results**

PRISMA diagram for each research question is shown in figures S1-S3.

Result summaries can be seen in tables 1-3.

### *Themes*

The initial ecological triangulation identified three main themes. These were: patient factors; practitioner factors; and the context in which the consultation took place. The interdependent relationships between these themes were explored for each research question using an ecological triangulation approach<sup>8</sup>.

### *Research question 1*

#### ***Use of pelvic examination by GP to assess symptoms***

Five papers, one systematic review, three cohort and one mixed methods study, were eligible. No paper looked specifically at the rate of pre-referral pelvic examination in women diagnosed with a gynaecological cancer. Four papers were conducted in countries of high income countries (HIC) and one in low/medium income country (LMIC). Cervical cancer was examined in three papers; one paper looked at ovarian cancer with all gynaecological cancers investigated in another.

Pre-referral PE varied within and between studies. In a cohort of patients with various gynaecological cancers examination rates varied between 52% for women presenting with vaginal bleeding to 18% for abdominal pain and only 4% for abdominal swelling<sup>9</sup>. In a North American survey of women with ovarian cancer, 50% of those who had seen a primary care practitioner as their first contact received a pelvic examination before referral<sup>10</sup>. In a Nigerian study of self-reported practice, rates of examination were lower: only 11.1% of GPs said they would perform a speculum examination on women presenting with post-coital bleeding; this figure dropped to 7.6% of women presenting with post-menopausal bleeding<sup>11</sup>.

### *Research question 2*

#### **Quality of pelvic examination**

Five eligible papers were identified. No paper looked specifically at GPs skill at performing PE. Proxies for skill were used instead: three papers audited the quality of cervical smear tests; there was one RCT evaluating the efficacy of training interventions while one prospective cohort study evaluated the outcome of women referred to a colposcopy clinic with a 'clinically suspicious cervix'. All were conducted in HIC.

Two studies demonstrated no statistically significant differences between family doctors and gynaecologists in obtaining satisfactory cervical smear results<sup>12, 13</sup>. A randomised controlled evaluation comparing smear taking in GPs who had additional training found those doctors who received skills training performed more smears but with no effect on the adequacy of results. However as the rate of poor quality conventional cytology tests taken by GPs in the study was small ranging from 5.3% -7.7%<sup>14</sup>, it was insufficiently powered for

this measure<sup>14</sup>. Knowledge, as demonstrated by multiple choice test results also increased as a result of this hand-on training.

A prospective cohort study of women referred to a colposcopy clinic with the diagnosis of 'clinically suspicious cervix' demonstrated that 80% of the women had either normal or benign pathology such as cervical ectopy or polyps. 81% of the referring clinicians were GPs with no breakdown of clinician type and examination findings<sup>15</sup>.

### *Research question 3*

#### **Pelvic examination and referral**

Two qualitative, three cross-sectional, two cohort, one systematic review and 1 case-note review were identified as meeting the inclusion and exclusion criteria. 9 were from HIC and one from LMIC. Four papers investigated ovarian cancer; 5 investigated cervical cancer and 1 looked at all gynaecological cancers.

Pre-referral PE was associated with early stage (stage I/II) cancer at diagnosis: compared with stage III/IV cancer this difference was significant ( $p\ value=0.001$ )<sup>10</sup>. No examination was associated with long (more than 90 days) delays in diagnosis ( $OR\ 5.36$ )<sup>9</sup>. 21% of patients diagnosed with ovarian cancer had a pre-referral PE: the paper by Kirwan described factors that cause referral delay but there was no investigation of association between pre-referral PE and stage at diagnosis or effect on morbidity/mortality<sup>16</sup>. Abnormal vaginal bleeding at presentation was more common in survivors<sup>16</sup>. Two studies identified lack of knowledge of the significance of symptoms or misattribution of symptoms delayed diagnosis were associated with late diagnosis<sup>17, 18</sup>. Two out of 6 women diagnosed with cervical cancer who experienced provider delay during their diagnostic journey had no pre-referral PE. For the four women who were examined results were documented as normal or benign with only

one patient receiving safety-netting advice; the author suggests pre-referral PE delayed diagnosis<sup>19</sup>. There are two components to the association between PE and referral outcomes:

- Promotion of urgent referral
- Promotion of earlier diagnosis

No evidence was found that suggested an association between pelvic examination and the promotion of urgent referral. There was limited evidence which suggested pre-referral pelvic examination led to better patient outcomes.

### *Ecological Triangulation*

Cross-sectional themes were identified; patient, practitioner and context. The synthesis identified a complex set of mutually interdependent relationships between patient and practitioner factors and the clinical environment where consultations take place. This model is described diagrammatically (*Figure 1*).

*Patient Factors:* Four authors described how patients can misattribute their symptoms<sup>9, 10, 17, and 19</sup>. Symptoms can be misattributed to stress, menopause or previous benign symptoms e.g. bowel problems, IBS, pelvic inflammatory disease<sup>17</sup>. Lack of symptom knowledge can lead to misattribution<sup>9, 10, and 19</sup> along with lack of physical pain or disability as a result of their symptoms<sup>10</sup>. Being too busy to make an appointment, fear about what might be found and embarrassment<sup>9, 10 and 19</sup> were important factors and embarrassment may lead to patients wishing to be examined by female rather than male practitioners<sup>11</sup>.

Age also appears to be a factor in how patients interpret their symptoms; younger patients do not seem to view abnormal vaginal bleeding as seriously as postmenopausal women

leading to patient delay<sup>9</sup>. Additionally, Lim describes a two month delay in presenting in women aged under 25 compared to one month in those aged 25-29 suggesting patient knowledge of symptoms may be important<sup>19</sup>.

*Practitioner Factors:* Pelvic examination was less likely to be performed if patients presented with non-alarm symptoms<sup>9</sup> or with vague symptoms<sup>18</sup>. Vandborg demonstrated a clear relationship between symptom type and pelvic examination rates: rates were higher in those patients with gynaecological symptoms compared to those with abdominal symptoms<sup>9</sup>, while van Schalwyk suggested that lack of symptom knowledge and misattribution of symptoms led to lack of pre-referral PE<sup>18</sup>. Ovarian cancer symptoms were considered to be gastrointestinal (GI) symptoms<sup>16, 17</sup>. Lack of knowledge of the presentation of ovarian cancer with GI symptoms meant irritable bowel syndrome was diagnosed even in women aged over 60: cancer was not considered and examination was not performed<sup>17</sup>. Goff stresses the importance of not labelling the symptoms experienced by patients with ovarian cancer as related to stress, depression or irritable bowel syndrome<sup>10</sup>. Abnormal vaginal bleeding in younger women was attributed to hormonal or intrauterine contraception<sup>19</sup>. Misattribution of abnormal vaginal bleeding in younger women was also observed by Vandborg<sup>9</sup>. This effect was also seen with ovarian cancer: younger patients were more likely to have more symptoms and were more likely to be treated for another condition; diagnosis took longer for younger patients; they were more likely to be diagnosed with late stage disease and were more likely to perceive that the attitude of their clinician was problematic<sup>10</sup>.

Lack of examination or interpretation of examination findings as normal can lead to non-investigation of symptoms<sup>17</sup>. Not only does misattribution of symptoms lead to non-

examination but it can lead to referral to specialities other than gynaecology e.g. gastroenterology<sup>9, 17</sup>. Kirwan demonstrated that misattribution led to less than half of patients referred to gynaecology<sup>16</sup>.

Experience and clinical speciality appear to have some influence with family doctors performing fewer pelvic examinations and diagnosing less stage 1 / 2 ovarian cancers than their specialist colleagues<sup>10</sup>. Male GPs, in particular those with no post graduate qualifications, were less likely to examine older patients and patients new to the practice<sup>21</sup> and avoid performing pelvic examination as they perceive patients' embarrassment as a barrier to examination<sup>11</sup>. Older GPs were more likely to perform pre-referral PE. There was an inverse relationship between age and examination practice observed in female GPs<sup>20</sup>.

There is mixed evidence on specialists and generalists performing adequate cervical cytology<sup>12</sup>. The special cause variation demonstrated within practices in obtaining adequate smear samples may be due to case mix, process or the individual collecting the smear but no evidence is provided to explain these findings<sup>21</sup>.

*Contextual Factors:* Overarching patient and practitioner factors is the context in which the clinician practices, which, in turn, influences the opportunity the clinician has to perform pelvic examination. Milingos highlights the difference in the clinical findings of the referring GP and the specialist but these differences are not explored<sup>15</sup>. Goff demonstrated significant differences between gynaecological specialists and family doctors: specialists were more likely to perform pre-referral and were more likely to diagnose early-stage disease. Specialists also exhibited fewer barriers to diagnosis as perceived by patients and were less likely to make the wrong diagnosis. Significantly more specialists performed pre-referral PE than family physicians<sup>10</sup>.

Rurality and lack of equipment affected GPs' decisions to perform pelvic examination in Nigeria<sup>11</sup>.

### *Summary*

Pre-referral PE is more likely if patients present with bleeding symptoms and are not using hormonal or intra-uterine contraception. Patients can misattribute their symptoms through lack of knowledge or embarrassment. Practitioners are less likely to perform pre-referral PE in patients with vague and non-alarm symptoms. Clinicians can also misattribute symptoms, especially gastro-intestinal symptoms, resulting in non-examination. Lack of PE or misinterpretation of PE results can result in non-investigation of symptoms. Increased levels of experience and higher levels of knowledge lead to higher levels of pre-referral PE.

## **Discussion**

### *Main Findings*

We found substantial gaps in the evidence on the role of PE in primary care for women with gynaecological cancer. There was limited evidence which suggested that PE reduces diagnostic delay and is associated with earlier stage diagnosis. The role of PE in primary care in this context is complex, and involves patient, practitioner and contextual factors.

Evidence is limited both in number and quality of included studies with the majority of papers retrospective observational studies. The evidence suggests that pre-referral PE is not always performed when indicated; that there is no direct evidence to confirm the PE skills of referring GPs although, there appears an association between pre-referral PE and improved patient outcomes.

### *Strengths and limitations*

Our review has been systematically conducted and is the first to examine the role of pelvic examination in diagnosing gynaecological cancer pre-referral. Crucially, it examines the role in primary care where patients usually make their initial presentation in response to their symptoms. These data provide a comprehensive summary of the available evidence as well as highlighting the gaps in knowledge. By breaking the overarching aim of the review into the three component research questions, we build a picture of the role of PE in primary care for suspected gynaecological cancer. The use of narrative synthesis and ecological triangulation identified themes between the papers adding robustness to the results.

The main limitation of the review is the relative lack of evidence and the quality of the identified evidence.

The studies were mostly observational, and while such evidence can inform clinical practice it cannot account for all possible confounders and bias. For the second research question there was no evidence relevant to GPs skills in taking and interpreting the findings of PE. There may be a number of confounders affecting decision to do PE and making a fast track referral to the appropriate speciality. The use of proxies was considered but did not answer the specific research question. The studies were heterogeneous in design involving a variety of different cancer types with various methodologies.

### *Interpretation*

The evidence that suggests PE plays a positive role in the gynaecological cancer diagnostic journey is weak.

Training programme directors, clinicians and medical educationalists need to open up the discussion on the acquisition, maintenance of intimate examination skills and effective

incorporation into clinical practice. We identified various patient and practitioner factors that determine the use of PE, however we need further research into the interplay between them. We know that women's embarrassment of PE, along with lack of symptom knowledge; misattribution of symptoms and difficulty in accessing primary care can act as barriers to presenting to their GP but we need to know if these can be modified. We were not able to fully understand why GPs underperform PE despite the guideline recommendations and undergraduate training. Do GPs lack knowledge; do they lack the skill; is there collusion between GPs and patients to not examine? However, evidence suggests that patients' concerns regarding their symptoms are validated with examination<sup>22</sup>. Research is required to unpick these potentially contradictory behaviours and assess the effect on patient outcomes.

General practice can be a challenging environment in which to perform PE: 10 minute consultations do not lend themselves to PE which is time consuming; the traditional GP consultation couch, placed against a wall; finding chaperones. We do not know if graduates are competent to perform PE or how they can develop or maintain skills in practice and what the facilitators and barriers are to performing PE in primary care.

Timely diagnosis of cervical cancer, as described by Lim, relies on history taking, visualising the cervix and a clear message to re-present if symptoms persist. These requirements are common to the other gynaecological cancers<sup>19</sup>. The foundations for history taking and examination are established in undergraduate training, but exposure to PE can be limited especially for male students<sup>20</sup>. Interpersonal skills required for intimate examination can be difficult to teach<sup>21</sup> while van Schalwyk highlights the role of poor history taking<sup>18</sup>.

Postgraduate requirement for GPs during training in the UK is the demonstration of one PE

which can be performed either in primary care or secondary care. There are no requirements following qualification and no guidance on how skills should be maintained<sup>23</sup>.

National and international guidelines on management of suspected gynaecological cancers are clear in their recommendation to perform pelvic examination (abdominal palpation, bimanual palpation +/- visualisation of the cervix) when women present with symptoms suggestive of a gynaecological cancer but there is little evidence offered to support this recommendation<sup>3, 4 and 24</sup>. Pre-referral visualisation of the cervix by GPs had low sensitivity and may lead to delayed diagnosis due to incorrect interpretation of examination findings<sup>19, 25</sup>. In the diagnosis of ovarian cancer, bimanual examination was found to have marked limitations when examining adnexal masses, regardless whether the clinician was a specialist or a generalist<sup>26</sup>. These findings are not a reflection of the role that pelvic examination has in patient outcomes, but they demonstrate the complexity of its use. However in a changing clinical environment there is increased emphasis on the use of technology and some clinicians advocate that physical examination is unnecessary<sup>27</sup>. Earlier cancer stage at diagnosis improves patient outcomes<sup>28</sup>. While there is weak evidence suggesting an association between pre-referral PE and reduced interval to cancer diagnosis, it cannot be determined whether this is an effect of the examination or a well informed practitioner who has considered that gynaecological cancer is a possibility: research is required to determine the extent and nature of any association.

## **Conclusion**

We do not know if pre-referral PE leads to better outcomes for patients. PE is often not performed in primary care for women with gynaecological cancer symptoms and evidence that it may result in earlier stage of diagnosis is weak. More research is needed.

**Acknowledgements**

None.

**Disclosure of interests**

There were no conflicts of interest.

**Contribution to authorship**

PW, PM, CMB and CDB contributed to the conception and design of the work, acquired and interpreted the data for the work, drafted the manuscript and revised it for important intellectual content, provided final approval for publication and agreed to be accountable for all aspects of the work. MEC interpreted the data for the work, drafted the manuscript and revised it for important intellectual content, provided final approval for publication and agreed to be accountable for all aspects of the work.

**Details of ethics approval**

Ethical approvals were not required for this work.

**Funding**

Dr Pauline Williams completed this work during a clinical academic fellowship funded by the Chief Scientist's Office of the Scottish Government, grant reference RG13111-10.

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## Figure Legend

**Figure 1** Ecological model of relationships between patient and practitioner factors and the clinical environment in which they were observed.

## Table Legend

**Table 1** Characteristics of RQ1 included papers

**Table 2** Characteristics of RQ2 research included papers

**Table 3** Characteristics of RQ3 included papers

Supporting Information

**Supplement 1** PRISMA Checklist

**Supplement 2** Search strategy

**Supplement 3** Data collection tool

**Figures S1-S3** PRISMA flow diagrams

**Table 1** Characteristics of RQ1 included papers

Author and year of publication	Country of Origin	Method	Number and nature of subjects	Summary of key results	Comments
Anorlu 2007 <sup>11</sup>	Nigeria	Cohort. Survey of cervical screening practices by GPs	540 GPs; 31.6% worked in rural and 68.4% in urban practices. 68% were male and 32% female	Post coital and post menopausal bleeding were the most common indicators for selective screening of patients, conducted by 25% and 21.6% respectively. Speculum/visualisation of the cervix would be used by 11% and 7.6% respectively.	Self reported methodologically sourced paper
Goff 2000 <sup>10</sup>	USA	Cohort. Survey of women diagnosed with ovarian cancer	1725 patients with ovarian cancer completed the surveys; from 46 US states and 4 Canadian provinces	34% of respondents presented to a GP; 50% of GPs performed a pre-referral pelvic examination at the first consultation compared with 94% of gynaecologists.	Specialists described fewer perceived barriers to performing pelvic examination than family doctors. Poor quality study as it was impossible to verify the respondent's diagnosis and it was a highly selected population.
Lim 2014 <sup>19</sup>	UK	Interview study with additional analysis of patient records and cervical screening results.	128 patients <30 years of age diagnosed with cervical cancer	6 patients had primary care provider delay: there was no visualisation of the cervix for 2 while 4 did have their cervixes visualised prior to diagnosis; 2 were recorded as normal; 1 recorded as cervical polyp and 1 as cervical bleeding on contact. Advice to reattend was documented in only 1 of these patients' notes.	The most important factor for GP delayed diagnosis was the use of hormonal or uterine contraception. Suggestion that for at least 2 patients pelvic examination delayed diagnosis. Good quality paper.
Macleod 2009 <sup>29</sup>	USA	Systematic review	2 papers: 97 women with cervical cancer and 1725 patients with ovarian cancer	Inadequate examination causes diagnostic delay. While Goff quantifies the percentage of GPs who performed pre-referral pelvic examination, Fruchter did not.	Robust systematic review
Vandborg 2011 <sup>9</sup>	Denmark	Mixed methods cohort	161 patients with gynaecological cancer; ovarian (63); endometrial (50); cervical (34) and vulva (14)	Pre-referral pelvic examination rates varied depending on presenting symptom: 52% for women presenting with vaginal bleeding; 18% in those with abdominal pain and 4% with abdominal swelling.	Misattribution of symptoms more likely if 'non-alarm' symptoms or non gynaecological. Good quality paper although some self-reporting.

**Table 2** Characteristics of RQ2 research included papers

Author and year of publication	Country of Origin	Method	Number and nature of subjects	Summary of key results	Comments
Curtis 1999 <sup>12</sup>	USA	Audit of smears test samples and the clinicians who obtained them	176 clinicians who took 21, 833 smears, obtained over a 7 month period	There were differences in the performance of obtaining smear tests between specialities: O&G specialists performed better than family physicians who performed better than interns. These differences were statistically significant.	
Jansen 2000 <sup>14</sup>	The Netherlands	RCT to evaluate the efficacy of a short course of technical skills to change performance in general practice	59 GPs; 31 in the intervention group and 28 in the control group	In this self selected group of participants, an educational intervention led to increased knowledge of and taking of cervical smear test. There was no statistically significant increase in the quality of smears taken however	
Harrison 2004 <sup>21</sup>	UK	Audit of cervical cytology data and the clinicians who obtained it	Cervical cytology data from 100 general practices over a 2 year period	23% of practices exhibit 'special cause' variation in cervical cytology samples which cannot be explained by chance.	Special cause is described in the Walter Shewhart theory of variation: it occurs as a result of unusual practice that is not an inherent part of the smear taking process e.g. the process; the resource; or the clinician taking the sample.
Fiscella 1999 <sup>13</sup>	USA	Audit of smears test samples and the clinicians who obtained them	218 clinicians who obtained 34, 916 smears over a 2 year period	No statistically significant differences between obstetrician-gynaecologists and family physicians (FPs), although FPs had higher rates of absent endocervical cells, a marker of quality	
Milingos 2000 <sup>15</sup>	UK	Prospective cohort study	86 women attending colposcopy clinic for 'clinically suspicious' cervix	39% no abnormality; 41% benign cervical condition; 16% CIN and 4% invasive cancer	92% referred by their GP; 8% by O&G trainees. The paper did not look at the speciality difference in results.

**Table 3** Characteristics of RQ3 included papers

Author and year of publication	Country of Origin	Method	Number and nature of subjects	Summary of key results	Comments
Evans 2006 <sup>17</sup>	UK	Qualitative semi-structured interviews	43 patients who had been diagnosed with ovarian cancer	Patient delays: appraisal; illness; behavioural and scheduling. Treatment delays attributable at least in part to a doctor or health care system: non-investigation of symptoms; treatment for non-cancer causes; lack of follow-up; referral delays and system delays.	Symptom pattern at presentation could lead to misattribution; lack of examination and investigation and referral to a non-gynaecological speciality, often gastroenterology.
Goff 2000 <sup>10</sup>	USA	Cohort. Survey of women diagnosed with ovarian cancer	1725 patients with ovarian cancer completed the surveys; from 46 US states and 4 Canadian provinces	70% of patients had stage III or IV cancer; 77% presented with abdominal symptoms and 26% with pelvic; only 3% of stage III or IV cancer were symptomatic. Factors significantly associated with late, stage III or IV cancer, were no pelvic examination at first visit; not initially being investigated and being diagnosed initially with depression, stress, irritable bowel or gastritis.	Poor quality study as it was impossible to verify the respondent's diagnosis and it was a highly selected population.
Kirwan 2002 <sup>16</sup>	UK	Retrospective review of patient notes	135 patients with epithelial ovarian cancer	Only 21% had pre-referral pelvic examination; vaginal bleeding was significantly more common ( $p=0.025$ ) in those women who survived their diagnosis. Older age; late stage diagnosis (stage III or IV); and non specific symptoms were identified as significant variables affecting survival.	Low rates of pelvic examination and high rates of misattribution of symptoms: did this effect stage at diagnosis? Did not look at effect of pre-referral pelvic examination on survival outcomes.
Lim 2014 <sup>19</sup>	UK	Interview study with additional analysis of patient records and cervical screening results.	128 patients <30 years of age with cervical cancer	31% presented symptomatically; 28% had delayed presentation. Symptoms dictate readiness to perform pre-referral pelvic examination and if contraception use could be the cause of symptoms this reduced the likelihood of examination.	6 patients had primary care provider delay: there was no visualisation of the cervix for 2 while 4 did have their cervixes visualised prior to diagnosis; 2 were recorded as normal; 1 recorded as cervical polyp and 1 as cervical bleeding on contact. Advice to reattend was documented in only 1 of these patients' notes.

Lim 2016 <sup>24</sup>	UK	Cross sectional: patient interviews and retrospective data collection from patient records	128 women <30 years of age diagnosed with cervical cancer. 107 had their records searched in addition to the interviews.	52% (56 of 107) patients had symptoms recorded in their primary care records; 89% reported symptoms at interview. 39% (22/56) had a documented cervical examination at presentation; only 4 were referred. Visualisation identified 1/8 stage 1A and 3/14 Stage 1B or worse cervical cancers.	Visual inspection has low sensitivity when used by GPs. High risk of measurement bias as what is recorded in notes is not always an accurate description of what took place during the consultation
MacLeod 2009 <sup>28</sup>	UK	Systematic review	2 papers: 97 women with cervical cancer and 1725 patients with ovarian cancer	The ovarian paper, Goff 2000, has already been discussed as part of this review. The additional paper, Fruchter, gave no figures to defend the statement that inadequate examination led to diagnostic delay.	
Reid 1997 <sup>20</sup>	Australia	Secondary analysis of retrospective cohort	473 GPs	GPs were less likely to examine if they were less experience; had no post graduate qualifications; worked in a metropolitan practice; if the patient was older or new to them.	
van Schalwyk 2008 <sup>18</sup>	South Africa	Qualitative semi-structured interviews	15 women with advanced cervical cancer (data saturation was achieved after 12 interviews)	Lack of knowledge and awareness among health professionals resulted in low suspicion and misdiagnosis	Qualitative evidence that lack of examination contributed to delays
Vandborg 2011 <sup>9</sup>	Denmark	Mixed methods cohort	161 patients with gynaecological cancer; ovarian (63); endometrial (50); cervical (34) and vulva ((14)	Diagnosis was delayed if no pre-referral pelvic examination was performed (OR 5.36, p=0.044). Pelvic examination was less likely to be performed if the woman did not present with vaginal bleeding.	Misattribution of symptoms more likely if 'non-alarm' symptoms or non-gynaecological.
Yu 2005 <sup>29</sup>	UK	Retrospective cohort	105 women diagnosed with cervical cancer; 22<35 years of age	Median time to diagnosis significantly longer in those patients <35 years of age: 9 months vs 2 months (p=0.0009). Delay was due to a lack of cervical visualisation at initial presentation for the majority of women.	Poor quality study. No quantification of extent of failure to visualise the cervix at initial presentation. However, confirmation as in other studies that abnormal vaginal bleeding in younger women is often attributed to hormonal causes leading to changes in oral contraception rather than cervical examination.