NHSCSP AUDIT OF INVASIVE CERVICAL CANCER: NATIONAL REPORT 2009-2013

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PREFACE

Since April 2007, the regional Quality Assurance Reference Centres (QARCs) in England have adopted a standardised protocol for capturing screening data on all cases of cervical cancer. The data are aggregated in a national database for the purpose of audit, with the aim of monitoring and improving the service.

The first national audit report analysing these data appeared in July 2011, and covered cases of invasive cervical cancer diagnosed between April 2007 and March 2010. The second national audit report updated the data presented in the first, extended the period under scrutiny to March 2011, and covered both cytology and histology review data. The third national report included cases diagnosed between April 2009 and March 2012presenting data on the most recently diagnosed cases only. The third report was the first to cover colposcopy data in details, but did not include data on cytology and histology review. This, the fourth national report extends the period of scrutiny to March 2013, and includes an data on cytology and histology review under the new audit guidelines implemented in 2012.

This report prioritises timeliness over data completeness, and readers should take note of the caveats attached to this approach.

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EXECUTIVE SUMMARY

The NHS Cervical Screening Programme (NHS CSP) in England provides high-quality cervical screening to a target population of about 14 million women. The NHS CSP is highly effective in preventing cervical cancer, and still more effective in preventing death from the disease.

- The NHS CSP audit comprises 13,190 women with confirmed diagnoses of cervical cancer (an estimated 90% of all cervical cancers diagnosed between January 2007 and December 2010 in England).
- This report focuses on 8,784 women who had a confirmed diagnosis of cervical cancer between April 2009 and March 2013. They are compared to 17,270 women without cervical cancer.
- The proportion of missing staging data continues to decrease (from 13.3% in the May 2012 publication to 10.7%). Missing treatment data has decreased from 33.7% to 28.5%.
- Almost half (47%) of all the cases diagnosed in women aged 25-49 are micro-invasive cancers (stage 1A). 36% are stage 1B. However, in women aged 50 to 64, 49% of cancers are stage 2 or worse.
- Over 76% of stage 1A1 cancers were treated conservatively (by cone biopsy, loop excision or trachelectomy). In comparison, only 48% of stage 1A2 cases were treated conservatively.
- Since October 2009, 20.8% of all women diagnosed between the ages of 25 and 34 were diagnosed at the age of 25. Between April 2007 and September 2009, just 8.2% of women within this same age range were diagnosed at 25. Sending women their first invitation to cervical screening at the age of 25 instead of 20 has therefore resulted in an increase in diagnoses of early stage cancer (1A) at age 25.
- Despite improvements in histopathological reporting, women diagnosed with squamous carcinoma are more likely to be diagnosed when the cancer is at an early stage (39% of all squamous carcinoma was stage 1A) when compared to those diagnosed with adenocarcinoma (24% were diagnosed as stage 1A).
- Under the new guidelines (implemented in July 2012) the cytology review workload has been reduced by 68% and the histology review by 78%. An estimated 523 cytology slides will need to be reviewed in England a year (roughly between 30-70 slides per QARC, depending on the size of the region).
- Concordance between original result and review result was 59% for cytology and 90.2% for histological samples.

1. CONTEXT

1.1 The burden of cervical cancer in England

Cervical cancer is a malignant neoplasm of the cervix uteri. In 2011, 2,511 cases were registered in England, with an incidence rate of 9.3 per 100,000 women (calculated using corresponding mid-year resident population).[1] The highest incidence was among women aged 25-29 (19.3 per 100,000 women), followed by women aged 35–39 (17.5 per 100,000 women). According to Globocan, the estimated cervical cancer age-standardised incidence rate (world) for England in 2012 was 7.1 per 100,000, in 1975 it was 11.0[2] and for sub-Saharan Africa it was 34.8 per 100,000 in 2012.[3] Thus it is reasonable to suggest that, in the absence of cervical screening, the age standardised incidence rate (world) would be between 11 and 34 cases per 100,000 women.

Mortality from cervical cancer is substantially lower than incidence, with 786 deaths reported in 2012.[4] Age-standardised net survival for patients diagnosed in 2006 was 82.6% at 1 year and 66.0% at 5 years.[5]

1.2 Epidemiology of HPV and cervical cancer

Human papillomavirus (HPV) is a common, sexually transmitted infection. A small proportion of women who are infected with high-risk forms of this virus can go on to develop cervical cancer.

There is consistent evidence from across the world that high-risk HPV (HR-HPV) infection is a necessary cause of cervical cancer, and optimal testing systems have identified the virus in all invasive specimens.[6] HR-HPV is implicated in both squamous cell carcinoma (SCC) and adenocarcinoma (ADC), as well in over 95% cases of cervical intraepithelial neoplasia grade 3 (CIN3), which can subsequently develop into cancer.

Cofactors that appear to increase the risk of developing cervical cancer in HPV-infected women include the use of oral contraceptives, smoking, high parity, unidentified genetic factors (possibly related to immunity), and previous exposure to other sexually transmitted diseases, such as *Chlamydia trachomatis* and herpes virus type 2. Women exposed to human immunodeficiency virus (HIV) are at elevated risk of HPV infection, HPV persistence, and cervical cancer.

Cervical screening and treatment of high-grade CIN have the potential to prevent the development of cervical cancer in HPV-infected women, and screening programmes have therefore had a substantial impact on cervical cancer incidence in many countries.[7]

1.3 Cervical screening

Cervical screening is not a test for cancer, but a means of preventing it. The English cervical screening programme uses cervical cytology and HPV testing to detect abnormalities which could lead to cancer if left untreated. Early treatment can prevent the development of almost 100% of cervical cancers.[7]

Though cervical screening sometimes does not detect an abnormality before the onset of cancer, it increases the chance of detecting asymptomatic disease at an early stage, which means that treatment is more straightforward and more likely to be successful. Virtually all micro-invasive (stage 1A) cancers are diagnosed by screening; these can often be treated with fertility-sparing surgery[8], and can usually be cured (5 year survival >98%).

The cytological screening test involves the collection, staining, and microscopic examination of cells from the cervix. Between 1988 and 2003, conventional smears were used to screen women: samples were taken from around the cervix and wiped onto a glass slide, which was then sent to the laboratory for examination. Between 2003 and 2008, a new way of preparing samples, known as liquid-based cytology (LBC) was introduced nationwide. Here, cells are brushed from the neck of the womb and placed into a small vial of preservative fluid. This is then sent to the laboratory, where a glass slide is prepared. The introduction of LBC has decreased the proportion of samples that are inadequate for evaluation, producing more representative specimens with less of the distracting background material that was found in conventional smears.[9]

1.4 HR-HPV DNA testing

There are over 100 types of HPV, most of which do not cause significant disease in humans. However, around 15 types of HPV have been implicated in cervical cancer, notably types 16 and 18, which together give rise to some 70% of all cases. Research has shown that women with no evidence of HR-HPV infection are extremely unlikely to have concurrent precursor disease or cervical cancer, or to develop either for the following 6 years. [10]

HR-HPV testing detects high-risk forms of HPV. Over the last few years, different uses for such tests have been under evaluation in England:

- to triage women whose cytology shows borderline changes or low-grade dyskaryosis, so that only those who are positive for HR-HPV are sent for further investigation.
- as a 'test of cure', to reduce the duration of surveillance following treatment for CIN by safely returning women to routine recall at an earlier date.
- to replace cytology as the primary screening test.

As of April 2012, HR-HPV testing was introduced in England for triage and test of cure, following successful use at six sentinel sites within the NHSCSP.As of May 2013, primary screening for HR-HPV positivity with cytology triage is being piloted in six screening laboratories in England.

1.5 Eligible age range and intervals for screening within the NHSCSP

The NHSCSP aims to reduce the incidence of, and mortality from, invasive cervical cancer. It does this by regularly screening all women at risk, so that abnormalities that might otherwise develop into invasive cancer can be identified and treated.

Cervical screening was introduced in England in the mid-1960s. By the mid-1980s, many women were undergoing regular cervical cytology, but there was concern that those at greatest risk were not being tested, and that those who had positive results were not being effectively followed up and treated. In response, the NHSCSP was established in 1988, after the Department of Health introduced quality standards for screening services and instructed all health authorities to introduce computerised 'call and recall' systems to manage invitations and results.

Between 1988 and 2003, women were invited for cervical screening at least every five years (and not more frequently than once every three years) from the age of 20 to the age of 64. In October 2003, it was announced that women would receive their first invitation five years later, at the age of 25, and that the interval between screening episodes would be three years up to the age of 49. Thereafter, women would be recalled every five years until the age of 64 (Table A). This remains current policy.

However, while this alteration was announced in 2003, it was designed to take effect from the date of a woman's next screening invitation. This meant that a woman screened prior to 2003 at the age of 20 had already been allocated a three-year recall, and could therefore have been invited again in 2006, despite the fact that she was still not 25. Similarly, a 61-year old women screened in 2003 could have been invited again three years later if her screening due date had been entered on the call and recall system before the change in policy. Moreover, in some parts of England, the policy change to a minimum age of 25 was not implemented until October 2005. It was therefore not until November 2010 that routine invitations to those aged 20-24 ceased.

Today, all women between the ages of 25 and 64 are eligible for free cervical screening. However, because first invitations are sent out a few months before a woman's 25th birthday, some women will still be screened at the age of 24. Cervical screening is not offered to women who have no cervix, or to those who have made an informed choice to opt out of the programme.

Table A Cervical screening intervals since October 2003

Age group (years)	Frequency of screening
25	First invitation.
25–49	Every 3 years.
50–64	Every 5 years.
65+	Routine screening for women who have not been screened since the age of 50, or who have had recent abnormal test results.

1.5.1 NHAIS

All women aged between 25 and 64 and registered with a GP in England are eligible for cervical screening, including migrants. The process of calling and recalling women for screening is managed by a computer database called the National Health Authority Information System, or NHAIS (also known as 'the Exeter system'). NHAIS manages the invitation process, keeps a record of test results, and, if all is well, recalls the woman for her next routine appointment in three or five years, depending on her age.

The programme screens almost four million women in England each year. In total, almost four and a half million samples per annum are examined by pathology laboratories (some women have more than one test, for clinical reasons or because a sample has proven to be inadequate).

While no cervical screening test can be 100% effective, cervical screening programmes greatly reduce the incidence of this cancer in the screened population. Since the establishment of the NHSCSP, the number of cervical cancer diagnoses has halved from 16 per 100,000 women in 1988 to 8 per 100,000 women in 2005, despite increasing rates of HPV infection. Another measure of the programme's effectiveness is its coverage, defined as the percentage of women in the target age group (25–64) who have been adequately screened in the last five years. In 2012/2013, screening coverage of eligible women was 78.3%.[11]

1.6 Cervical screening and HPV vaccination

Two prophylactic HPV vaccines are known to be effective at preventing both persistent HR-HPV infection, and the high-grade cellular abnormality (CIN3) that it can cause. In September 2008, a national HR-HPV immunisation programme was introduced to vaccinate girls against HPV 16 and 18. It covers young women aged 12–13, but also includes a catch-up programme for those born between 1990 and 1995.

Despite this vaccination programme, the NHSCSP will continue to play an important role in the fight against cervical cancer. It will screen those women who have not been vaccinated, and it will also play a role in monitoring the vaccinated population because they are at risk of carrying non-vaccine HPV types and because vaccination in women that are already infected can fail. The role of the screening programme in these women can be better defined once clearer data are available about the cross-protection given by the vaccine for other HPV types, and the duration of the protection provided. Interim studies are needed to explore the impact of HPV vaccination, and to determine the best course of action for the cervical screening programme in future.

A woman's HPV vaccination status should be recorded on the call and recall computer system, so that her future screening interval can be determined. Unfortunately, the completeness with which this information is recorded is very variable, though ongoing work aims to simplify the process and improve the completeness and accuracy of the data.

2. AUDIT OF INVASIVE CERVICAL CANCERS

2.1 Introduction

Unfortunately, despite the effectiveness of population-based screening, women continue to develop cervical cancer. The reasons for this were recognised before the NHSCSP was established in 1988, and have been taken into account in previous recommendations emerging from this audit.[12]

Five-year cervical screening coverage has been around 80% since 1993, so the majority of cancers in England are probably occurring in women who have been screened at some point in their lives. Monitoring incidence and mortality rates in this population can determine whether the programme is achieving its objectives. It does not give a complete picture, however; nor does it indicate the effectiveness of the screening programme under optimal conditions.

2.2 Purpose of the audit

The purpose of the NHSCSP audit of invasive cervical cancer (hereafter, 'the audit') is to monitor the effectiveness of the cervical screening programme, to identify areas of good practice and indicate where improvements might be made, and to monitor cases where the programme fails to prevent cervical cancer. The audit can also monitor whether alterations to the programme (for example, changes to the screening technologies employed, to the age range over which women are called for testing, and to the frequency of screening at different ages) are affecting the incidence of cervical cancer in the screened population.

All cervical cancers are included in this audit, irrespective of their clinical stage, or the age of the woman at the time of diagnosis. The audit thus provides an early indicator of the pattern of disease incidence, using cases which have not necessarily been fully abstracted by the cancer registries. It allows the proportion of screen-detected cases to be determined, and explains why some cases occurred (e.g. diagnoses of cervical cancer in previously unscreened women, or cases that result from a failure of colposcopic treatment).

Monitoring the effectiveness of the NHSCSP requires accurate data about the incidence of, prognosis for, and mortality from cervical cancer. Additionally, these data need to be linked to individual-level information about screening uptake and outcome. In order to obtain consistently reported information for this purpose, all parties in the NHSCSP were asked to follow the same national protocol for auditing cases of invasive cervical cancer.[11]

2.3 Audit Protocol

Although there are minor differences in the procedure employed by different regions, the broad principles of the audit, including the allocation of key roles, are the same nationwide. These were first outlined in the document *Audit of Invasive Cervical Cancers (*NHSCSP publication no 28)[12] and subsequently updated in April 2012[13] A further update was introduced in April 2013[14]. These guidelines are currently being incorporated into an updated version of NHSCSP publication no 28, which will be published shortly.

The NHSCSP Audit Management Group is the steering committee for the audit. Based on its data and findings, the Group approves updates and makes recommendations.

In brief, when a case of histologically confirmed invasive cervical cancer has been identified, the clinician treating the woman must ensure that the Hospital-Based Programme

Coordinator (HBPC) and the regional Quality Assurance Reference Centre (QARC) are informed. This will initiate a cascade of audit activities. The role of the HBPC is to organise audit activities locally (i.e. within each Trust). The role of the QARC is to ensure that local cytology, histology, and colposcopy review processes are coordinated according to the national audit protocol, and to liaise with Cancer Registries to ascertain that the information captured includes a record of the diagnostic status of each cancer case (though the extent of this cooperation varies between regions). The QARC also assembles all the data for a region, ready for national collation.

2.3.1 Ethical approval

Anonymised data are routinely collected for women who have developed cervical cancer (known as 'cases') and for women of the same age who have not (known as 'controls'). Since collection of these data is regarded as part of the NHSCSP's service evaluation, the process is exempt from research ethics review by the National Research Ethics Service.[15]

2.3.2 Selection of controls

To permit rigorous evaluation of the programme, cases of cervical cancer are compared to controls of the same age. Controls are identified using bespoke software within NHAIS.

All controls are registered with a GP in the same administrative district as the case, and women who are known to have had a hysterectomy are excluded. Additionally, controls fall into the following groups, based on their similarity with cases:

- GP controls, from the same group practice as the case.
- District controls, who share the same first half of a postcode with the case, but who are registered with a different GP.
- Screened controls, who underwent cytological tests over roughly the same period as the case (used where the case may have been diagnosed as a result of screening).
- Abnormal controls, who received an abnormal cytology test report during roughly the same period as the case.

Each case is assigned two population controls (one GP control and one district control). In addition, some cases are assigned controls to match the woman's screening history. This allows the audit of both cases that are detected by screening (known as 'screen-detected cancers'), and cases where a woman received an abnormal screening result and was referred to a colposcopist some time before her actual diagnosis (see section 4.1).

Population controls are used to study the importance of coverage and the efficacy of the screening programme. Screened controls are used to explore the impact of the screening interval on the incidence of screen-detected cancers. Abnormal controls are used to compare the way in which cases and controls are managed by the screening programme after a cytological test is reported as abnormal.

2.3.3 Databases and other data sources

The audit is designed to collect data from a number of sources on a woman's age, stage, and call and recall status, as well as on her cytology, colposcopy, and histology results. Information on a woman's screening invitations and results, and laboratory data on her

cytology, are drawn from NHAIS via Open Exeter.* Coordination between the HBPC and the QARCs is needed to obtain all other records, due to variability in the availability of data and level of access to the different databases. Colposcopy clinics are contacted for records of all appointments (e.g. information on patient attendance, details of the examiner, data on the colposcopic impression, account of any procedures performed). Histology results are also collated to produce a fuller picture, and to facilitate slide review.

An audit database has been created to aggregate all data collected by regional QARCs for epidemiological analysis.

2.3.3.1 Essential fields

To generate a minimum dataset, information about each case of cervical cancer is entered into the database via a number of essential fields (see Appendix A).

2.3.3.2 Cytology screening history

Before 2003, cytology samples took the form of conventional smears, but between 2004 and 2008, laboratories converted to liquid-based cytology (LBC). To reflect the use of both technologies during the audit period, this document refers to cytology 'tests' or 'samples', not to 'smears'.

Details of every recorded cytology test for both cases and controls were downloaded from NHAIS. The dataset included a large number of privately-taken samples, as well as information on all NHSCSP tests. The following information was obtained:

- the date on which the test was taken.
- the result of the test.
- the action code resulting from the test.

(The action code is the national code used to define the woman's recall type, the type of notifications required, and the period of time between recalls. It determines the management action for each woman in the light of her latest test result, and records any additional clinical input).

Additionally, from April 2012, the following information is included in the NHAIS download:

- the interval between tests.
- the date in which the woman's next test is due.
- the HR-HPV test result (where was an HR-HPV test was performed).
- the reason a woman postponed screening (where appropriate).
- the reason a woman was ceased from screening (where appropriate).

The following additional information is collected from NHAIS for cases:

- date of birth.
- date of cancer diagnosis.
- the FIGO stage of the tumour.
- histology of the tumour.
- treatment received (now an essential field).
- the woman's score according to an Index of Multiple Deprivation (now an essential field).

* Open Exeter is a portal that allows bodies such as NHS trusts, GP practices, and laboratories to access the Exeter (NHAIS) system.

For controls, date of birth and Index of Multiple Deprivation score were collected.

2.3.3.3 Colposcopy

Colposcopy data were obtained for cases, including:

- date of appointment.
- attendance at appointment.
- whether the examination was satisfactory.
- information on any surgical procedure(s) performed.

Non-essential additional fields included:

- colposcopic impression.
- pathological diagnosis.
- whether the woman was pregnant.
- time to next follow-up appointment.

Colposcopy review guidelines and data collection forms were rolled out in April 2013. Results from this review should provide insight into colposcopic management in women who go on to be diagnosed with cervical cancer.

2.3.3.4 Cytology and histology reviews

Audit guidelines covering the period of this report mandate that when a case of cervical cancer is confirmed, all cytology samples and histology specimens obtained over the 10 years preceding diagnosis, including those that led to diagnosis, must be reviewed. The primary purpose of this slide review is educational, and collated national results from this exercise, with detailed analysis and commentary, have been published separately.[16] While some of these data are summarized here, those interested in obtaining a more detailed picture should refer to the published document.

Data obtained from the review process include:

- date of the original sample or specimen.
- date of the review.
- type of reviewer (screener, checker, advanced practitioner, consultant).
- original sample or specimen result.
- result of the review/consensus.

Following the implementation of revised guidelines in April 2012, fewer slides need to be reviewed and, in the case of cytology, fewer reviews per slide as required. The introduction of the new audit guidelines was followed by a 3 month period (April to June 2012) where reviews of cytology and histology samples from women diagnosed with cervical cancer as part of audit were suspended. Since July 2012 the cytology review workload has been reduced by 68% and the histology review by 78%. However, it takes close to a year after a diagnosis of cervical cancer is made before full slide review data is entered into the database. Currently about 34.7% of eligible cytology samples and 59% of eligible histology samples have a review recorded in the audit. Results to date are presented in section 4.6 and 4.7.

2.3.3.5 GP notes

Following a recent review by the West Midlands QARC, the Evaluation Committee has agreed that, in most cases, it is not possible systematically to collect useful information from this source. Consequently, information derived from GP notes is no longer required as part of this audit.

However, it may be of interest to collect information from GP notes where a woman's screening history is unclear. This may yield additional information on her symptoms (if the cancer is symptomatic), and may also explain any non-attendance at appointments (e.g. where there is evidence of pregnancy, travel, co-morbidity, or private treatment). There are currently several other projects exploring the possibility of obtaining information from GP notes. The Evaluation Committee will evaluate the results from these projects and assess whether there is a feasible way to obtain data from this source before revising the audit protocol.

2.3.3.6 HR-HPV tests

HR-HPV DNA is currently being introduced nationally as part of the NHSCSP, following evaluation at three pilot and six Sentinel Sites. It is used for two purposes:

1. To triage of women with low-grade or borderline cytology reports. Where HR-HPV is found, these women are referred immediately to colposcopy, but where women are HR-HPV-negative, they are returned to routine (three- or five-yearly) recall.
2. As a 'test of cure' for women who have been treated for cervical intraepithelial neoplasia (CIN). If a cytology test, taken six months after treatment, is reported as normal, borderline, or low-grade, an HR-HPV test is performed. Women who are HR-HPV-negative are returned to routine recall, but those who are HR-HPV-positive are referred to colposcopy. (Women with high-grade cytology six months after treatment are referred immediately to colposcopy, without this additional HR-HPV test).

HR-HPV test results are currently recorded on NHAIS and have been added to the list of essential fields.

2.3.3.7 Index of Multiple Deprivation

The Office of the Deputy Prime Minister produces the English Indices of Deprivation, from which the Index of Multiple Deprivation, utilized by this audit, is derived.*

For the purpose of this exercise, the index of deprivation has been divided into deciles, from the most deprived (0) to the least (9). The Index of Multiple Deprivation score is derived from each woman's postcode. To facilitate the collection of this field, the woman's home postcode is now captured as part of the NHAIS download and converted automatically by the audit database into a deciles. Only the deprivation deciles are collected nationally.

However, because this data field is currently not essential, it has not been reported consistently across QARCs. The data received to date, while quite revealing, are therefore incomplete (see Appendix B, Table 1a). Since 2012 this field is essential and more detailed analysis will be possible in future.

* For more information see https://www.gov.uk/government/publications/english-indices-of-deprivation-2010-technical-report.

2.3.4 Data aggregation

Names, addresses, and unique identifiers (such as NHS numbers) are deleted before data are transferred to the national audit database. The only data that might be considered "person-identifiable" received by the audit is date of birth. However, since there are 750 women in England between the ages of 20 and 65 with any given date of birth, this information is considered insufficient to identify a particular individual, effectively making the data anonymous.

3. DATA COMPLETENESS AND LIMITATIONS

The findings presented in this report should be approached in light of the available information's varying degree of completeness (see Appendix B). The difficulties involved in ensuring the completeness of essential data fields are described below.

It is rare for data to be reported as missing, but missing data should be distinguished from incompleteness of record. Missing data may be unavailable (e.g. where a death certificate, which does not provide information about cancer staging, has been used), or may not yet have been recorded as part of the audit. For this reason, the term 'none recorded' has been used to cover both scenarios, although reference is also made to 'missing values'.

Other cases may be subject to reporting delays, having been submitted to the audit before all essential fields could be completed. In these instances, missing fields are updated as and when data become available, with the result that complete information may not be received for some months after the case has been registered. An additional challenge, which can create further delay, is the need to coordinate between the various aspects of the audit process when a case of cervical cancer is diagnosed. In future, as the completeness of the audit for each case will be monitored, it will be possible to distinguish between data that are not available (after reasonable efforts have been made to collect them) and data that have not yet been collected (see Appendix B).

3.1 Cancers and population controls

Cases of cervical cancer are identified by NHS hospital staff (primarily via gynae-oncology), and confirmed by histology. A small proportion of cancers will be missed by the audit, and a very small proportion will be excluded because the patients are not registered with an NHS GP. Table D (Section 4.1) illustrates the limited extent of this problem, comparing the number of registrations for cervical cancer in a given calendar year with the number of cases picked up by the audit over the same period of time.

Controls are selected randomly (subject to matching) from women registered with an NHS GP. All those selected are included in the audit.

3.2 Dealing with missing values

Cases reported by the MB1 series (Cancer registration statistics in England) between 2008 and 2010 were compared to those recorded in the audit for the same period by age at diagnosis to explore whether missing values (in particular those for FIGO stage) are related to the age at which the cancer is diagnosed or the FIGO stage at diagnosis. The aim was to ascertain whether there is a subset of women for whom a delay in the inclusion of the cancer in the audit is more likely (see Table C). The number of cases in the audit for 2008-2010 is 92% of the number of cervical cancer registrations in England over the same three years. However, the data are more likely to include cases diagnosed in women between the ages of 25 and 64 (97% of all registered cancers), than in women over the age of 65 (76% of registered cancers).

We also assessed the completeness of the data for FIGO stage by comparing the distribution of staged cancers diagnosed between April 2008 and March 2009 across four audit years (Table D). Women with a cancer of unknown stage and those whose case was not registered into the audit straight away were more likely to have been diagnosed with stage 2 or worse cancer. For instance, looking at cancers diagnosed in April 2008 to March 2009, 23% of those registered by October 2009 were stage 2 or worse, but by October 2012

30% were stage 2 or worse. By October 2013 the proportions appear to have stabilized with negligible changes when compared to October 2012.

In the July 2011 and May 2012 reports, we assumed that data for FIGO staging was missing at random. In recent audits, this has led to an overestimation of the proportion of stage 1A cancers and an underestimation of the proportion of stage 2+ cancers. This bias applies to figures that present stage distribution over time. However, results shown in Table D (Section 4.1) suggest that, in recent years, cancers have been registered into the audit in a timelier manner. If this trend continues, the bias in the stage distribution should diminish year on year.

For this report (and the previous report) we have used a more complicated model that takes into account the differential delays in obtaining stage[1].

3.3 Cytology

Since data for cytological tests are downloaded directly from NHAIS, completeness is assumed for all cases and controls. This is because cytological test results are recorded for all women who participate in the NHSCSP, and for some of those who are tested privately. The audit does not attempt to capture screening events that take place outside the UK.

3.4 Colposcopy

The quality and completeness of the colposcopic data are variable. This is principally because there is no central database to act as a repository for this information (indeed, most colposcopy records were not computerised until 2001). It is therefore difficult to determine where a woman attended for colposcopy, particularly if she visited more than one clinic.

The best indicator of whether a woman is likely to have had colposcopy is the presence of a 'suspend' code in her cytology record (see Table 19). Similarly, a record from the histology laboratory would suggest that a sample was taken at colposcopy. However, neither the cytology nor the histology record provides conclusive information regarding colposcopic examination.

3.5 Histology

The quality and completeness of the data on histology in this audit are also variable, as there is no national link between histology laboratories. The proportion of histological samples reviewed in the audit is based on the total number of samples recorded in the database, rather than the total number of histological samples taken within the NHSCSP.

3.6 HR-HPV DNA

Data on HR-HPV testing are now being collected directly from NHAIS in conjunction with the cytology data. We expect to be able to report on this in coming years.

3.7 Treatment

[1] For each QARC, a multinomial logistic regression model was fitted with outcome 'stage at diagnosis' and explanatory variables age group, treatment type and year of diagnosis. Using the results of this model, the probability of each stage category was then predicted for each individual with missing stage

Data on treatment are obtained by the HBPC from patient notes or from the meeting notes of the multidisciplinary team (MDT). These fields tend to be provided as data become available, which may mean that the information is missing for a few months after cases are first entered in the audit. Obtaining treatment data can be especially challenging where women are diagnosed in one centre and treated in another.

There has been some confusion over the use of the category 'none' to report treatment. The intended meaning is that the treating hospital has given only palliative care, but at least one QARC interpreted the category as 'no treatment was reported'. Additionally, some HBPCs used 'none' when micro-invasive cancers were treated solely with the diagnostic LLETZ/cone biopsy. While efforts have been made to correct this miscommunication for the future, some cases classified as 'none' in the audit may, in fact, have received treatment. From 2011 onwards, we are able to distinguish between 'palliative care' and 'no treatment'.

Table B Cancers reported nationally compared to those reported in the Audit between January 2008 and December 2010.

Total cases reported	<20	20-24	25-29	30-34	35-39	40-44	45-49	50-55	55-59	60-64	65-69	70-74	75-79	80-84	85 and over	Total	Aged 25-64
MB1 series 2008/10	2	147	963	980	1006	841	609	465	432	418	300	319	306	294	304	7386	5714
Audit 2008/10	1	140	1003	966	996	829	582	405	381	361	269	247	232	220	182	6814	5523
Proportion	50.0%	95.2%	104.2%	98.6%	99.0%	98.6%	95.6%	87.1%	88.2%	86.4%	89.7%	77.4%	75.8%	74.8%	59.9%	92.3%	96.7%
Difference	1	7	-40	14	10	12	27	60	51	57	31	72	74	74	122	572	191

Table C Cancers in women aged 20-64 diagnosed between April 2008 and March 2009

	Observed stage by year of audit data							Proportion assuming missing at random		
Date received as of	1A	1B	2	3+	1B+	None recorded	Total	% 1A	%1B	%2+
Oct-09	463	380	130	109	67	419	**1568**	40.3%	36.7%	23.1%
Oct-10	646	598	239	201	82	398	**2164**	36.6%	36.5%	26.9%
Oct-11	665	651	275	241	90	283	**2205**	34.6%	36.5%	28.9%
Oct-12	669	659	295	259	93	277	**2252**	33.9%	35.9%	30.2%
Oct-13	670	666	301	268	92	265	**2262**	33.6%	35.8%	30.6%

4. ANALYSIS AND COMMENTARY

This section analyses and discusses the audit's key findings. Detailed data tables are presented in Appendix C.

4.1 Invasive cervical cancer

Over the period 2007–2013, 13,190 cases of invasive cervical cancer and 25,992 controls were included in the audit. Table D (see also Table B, section 3.2) provides a broad assessment of the audit's coverage, comparing the number of cases of invasive cervical cancer included in each audit year (corresponding to the financial year) with the number reported nationally in each calendar year. Although some cases included in the audit are not included in Cancer Registry data, and vice versa, the number of cancers reported to registries is only around 10% greater than the number included here. Updated estimates from the Office for National Statistics (ONS) report 2,346 diagnoses of invasive cervical cancer during 2010 and 2,511 during 2011[1], whereas the audit comprises 2,099 cases during 2010-11 and 2,191 during 2011-12. All QARCs are working to minimise these discrepancies and to make both data sources more directly comparable.

Table D also presents a recent history of the number of cervical cancers included in each audit year. We have included this to illustrate the amount of new data received each year. Compared to national registrations, 72% of cancers diagnosed between April 2009 and March 2010 had been reported into the audit by October 2010, rising to 85% by October 2011 and 89% by October 2012. By comparison, 80% of cancers diagnosed between April 2010 and March 2011 had been reported into the audit by October 2011 and 89% by October 2012. These numbers suggest that data are being entered into the audit in an increasingly timely manner.

There is a trade-off between presenting data in a timely manner and the completeness of that same data. We have emphasized timeliness, and this year's report includes a great deal of detail on when we receive the data and how this timing affects our estimates of FIGO stage and age at diagnosis (see Section 3.1). Additionally, we focus only on the most recently diagnosed cervical cancers by restricting the data in this report to 8,784 cases diagnosed between April 2009 and March 2013 and their 17,270 controls (see table E). However where relevant, we have used all cancers reported to the audit.

Table D Number of cases of cervical cancer included in each Audit report compared with those reported nationally

Audit Year	Calendar year	Cases included in 2010 report	Cases included in 2011 report	Cases included in 2012 report	**No of cases in this Audit report**	Cancer Registrations£
2007-2008	2007	2,089	2,136	2,158	2,144	2,337
2008-2009	2008	2,164	2,205	2,254	2,262	2,409
2009-2010	2009	1,978	2,349	2,452	2,474	2,766
2010-2011	2010	0	1,876	2,087	2,099	2,346
2011-2012	2011	0	0	1,969	2,191	2,511
2012-2013	2012	0	0	0	2,020	NP
Total					**13,190**	

£ Source: Table 8 of the Office for National Statistics MB1 publication 42 (2011). As with the audit, ONS receive notification of a few extra cancers after they have published their yearly statistics.

Most cases submitted to the audit have at least two age-matched population controls (GP and district). However, for a small number of cases (36), only one of these controls was identified (see Table E), while 131 cases were submitted with no population control. For a defined subset of cases, up to two further controls were selected, resulting in 4,120 screened controls and 5,043 abnormal controls (see section 2.4.3.1.)

Table E Number of cases of invasive cervical cancer and controls submitted to the 2009–2013 audit by QARC region[a]

QARC	Case	Two Population Controls (GP and District)	One Population Control (GP or District)	No Population Controls
East of England	824	822	0	2
East Midlands	867	855	9	3
London	865	736	6	123
North East	570	567	3	0
Yorkshire	1025	1019	6	0
North West	1120	1114	6	0
South Central	650	649	1	0
South East Coast	651	650	1	0
South West	1009	1007	2	0
West Midlands	1203	1198	2	3
Total	**8784**	**8617**	**36**	**131**

*Cancers diagnosed 01/04/09 to 31/03/2013

4.2 Age at which invasive cervical cancer is diagnosed

Figure 1 shows the percentage distribution of cases of cervical cancer by age in the 2009–2013 audit, compared to the numbers reported nationally for 2008-2011. The peak number of cases is observed in the 25–29 year old age group (1,406 or 16.0%), followed closely by cases in women aged 30-34 (1208 or 13.8%), and aged 35-39 (1171 or 13.3%). Nationally, for the first time, the peak incidence is observed in those aged 25-29, followed by those aged 35-39. The underreporting of cases to the audit increases with the age of diagnosis, so that we are missing more cases for women over the age of 65 than for those under age 65.

82% of all cases of invasive cervical cancer in this audit fell within the age group eligible for cervical screening (25-64 years, see Table 3, Appendix C). In 2011, women in this age group made up 79% of all cervical cancer registrations in England.[1] As a proportion of all cancers, invasive cervical cancer at FIGO stage 2 or worse was more likely to be diagnosed in women over the age of 50 than in those under 50, with stage 1A disease becoming increasingly infrequent with age. By contrast, between the ages of 25 and 49, the majority of women diagnosed with cervical cancer were found to have stage 1A disease (see Table 6a, Appendix C).

The difference in the stage at diagnosis by age is even more apparent when looking at rates of cervical cancer (Figure 2). We used the observed rates of cervical cancer by age group reported in the MB1 series[1] in 2011 and applied the FIGO stage distribution observed in the audit dataset.

From October 2009, a quarter 20.8% (455/2191) of all women diagnosed between the ages of 25 and 34 were diagnosed at the age of 25. Between April 2007 and September 2009, just 8.2% (130/1590) of women within this same age range were diagnosed at 25. In terms of stage, before October 2009 57% of cases age 25-34 were stage 1A, 34% 1B and 9% 2+.

From October 2009 the distribution changed to 62% stage 1A, 29% 1B and 9% 2+. At age 25, the increase in the proportion of stage 1A cancers was even more striking it went from 68% before October 2009 to 75% from October 2009 with decreases both in stage 1B (27% to 20%) and stage 2 or worse cancer (5% to 4%). Sending women their first invitation to cervical screening at the age of 25 instead of 20 has therefore resulted in an increase in diagnoses of early stage cancer (1A) at age 25. However, there is no evidence to suggest that women who attend screening for the first time at the age of 25 have an increased risk of being diagnosed with stage 1B or worse cervical cancer.

We are keen to identify any changes in the FIGO stage of cancers diagnosed aged 25-29 as a result of the change in screening policy. We have published a detailed analysis of 1,800 women aged 20-29 with cervical cancer in Castanon et al, BJC 2013.[17] It remains too early to study the full impact of the change in policy on rates of cervical cancer because the first cohort of women invited for screening at age 25 are still to reach the age of 30 (which will happen around 2015). However it is reassuring to note that 65% of all women (with known stage) age 25-29 are diagnosed with stage 1A cancer.

Figure 1 FIGO stage of cervical cancer cases: estimated percentage distribution, by age

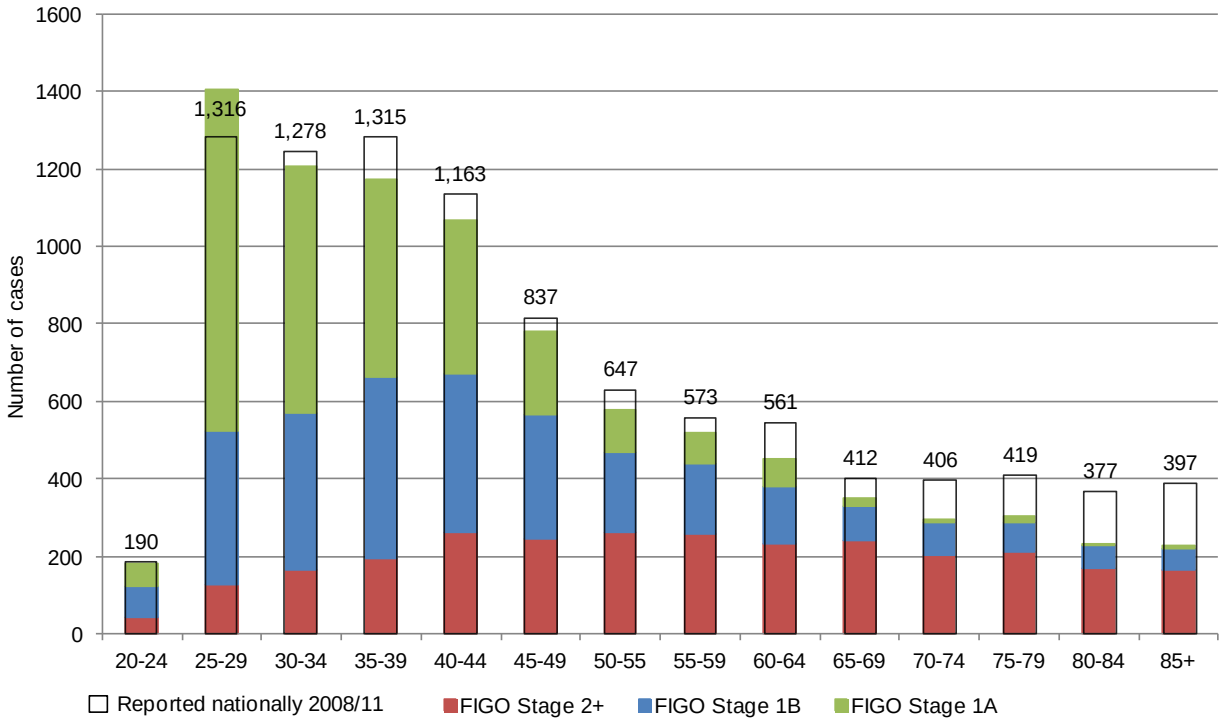
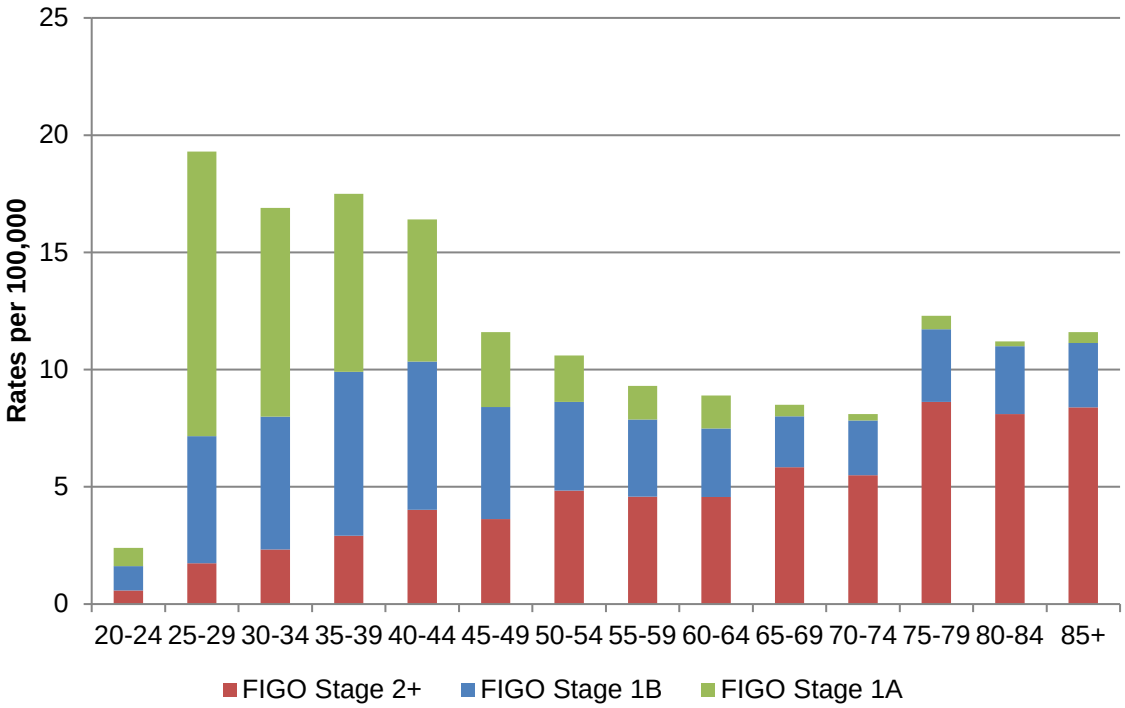


Figure 2 Observed 2011 rates per 100,000 women: by FIGO stage of cervical cancer cases and age



4.3 FIGO stage of invasive cervical cancers

Table F shows the observed number of cervical cancer cases by FIGO stage for each QARC region. FIGO stage information is missing for 8.91% of cases and clinical staging was not possible for 1.79% of women, therefore no staging data is available for 10.7% of cases (see Appendix B, Table 1b). The distinction between cases with missing stage data and cases where clinical staging was not possible is a recent one. It is difficult to determine the true proportion of cancers where staging is not possible, but we could speculate that it is similar to the proportion with missing histological data on type, i.e. 3.8% of cases (see Table 8, Appendix C).

The proportion of cases with missing stage has been reduced by a third since the first audit report was published (from 17% to 11% in this report), but we now know that those cancers where the FIGO stage is unknown tend to be higher stage than those with known stage. Therefore, we estimate that had all the cancers been staged, 34% of cancers in the audit would be stage 1A, 34% stage 1B, and 32% stage 2 or worse (Table G).

In 1,894 out of 2,834 cases of 1A cancer, further details were provided, and these suggest that 92% are 1A1 and only 8% 1A2 (see Table 4, Appendix C). 90% of women with stage 1A1 cancer were aged between 25 and 49, while only 1.0% were over the age of 65. Similarly in 1,390 out of 2,527 cases of 1B cancer, further details were provided, and these suggest that 88% are 1B1 and 12% are 1B2.

Table F Number of cervical cancer cases by FIGO stage in 2009-2013 audit, by QARC region

QARC Region	1A		1B		2+		1B(NOS)*		None recorded		Total	
East of England	253	31%	270	33%	232	28%	3	0%	66	8%	824	100%
East Midlands	307	35%	256	30%	156	18%	3	0%	145	17%	867	100%
London	278	32%	234	27%	264	31%	62	7%	27	3%	865	100%
North East	181	32%	175	31%	73	13%	89	16%	52	9%	570	100%
Yorkshire and the Humber	402	39%	241	24%	163	16%	27	3%	192	19%	1,025	100%
North West	348	31%	330	29%	185	17%	106	9%	151	13%	1,120	100%
South Central	227	35%	203	31%	174	27%	2	0%	44	7%	650	100%
South East Coast	221	34%	203	31%	170	26%	13	2%	44	7%	651	100%
South West	328	33%	320	32%	312	31%	31	3%	18	2%	1,009	100%
West Midlands	289	24%	295	25%	418	35%	0	0%	201	17%	1,203	100%
Total	**2,834**	**32%**	**2,527**	**29%**	**2,147**	**24%**	**336**	**4%**	**940**	**10.7%**	**8,784**	**100%**

* Cases reported as 1B(NOS) (are known to be stage 1B or worse but detailed stage is not known)

Table G Estimated percent distribution of cervical cancer cases by FIGO stage in 2009-2013 audit, by QARC region

QARC Region	1A	1B	2+	Total
East of England	31%	36%	33%	100%
East Midlands	37%	33%	30%	100%
London	34%	30%	36%	100%
North East	35%	42%	23%	100%
Yorkshire and the Humber	44%	32%	24%	100%
North West	33%	40%	27%	100%
South Central	35%	33%	32%	100%
South East Coast	36%	34%	31%	100%
South West	33%	33%	34%	100%
West Midlands	27%	30%	43%	100%
Total	**34%**	**34%**	**32%**	**100%**

Figure 3 shows the percentage distribution of invasive cervical cancer by FIGO stage and by age group in those women with a known FIGO stage. As the age of women increases, the proportion of cases diagnosed as FIGO stage 1A decreases, and the proportion of women diagnosed at FIGO stage 2+ increases. Stage 1A cancer is often screen-detected, and treatment generally has fewer side effects and is more likely to be curative. The large proportion of cervical cancer cases diagnosed at stage 1A (particularly those at stage 1A1) in women under the age of 50 can be regarded as a benefit of the screening programme. The exception is women aged <25. As fewer women under the age of 25 attend screening due to the raising of the lower age limit for the programme, the likelihood of screen-detected cancer in this group decreases. Therefore, it is mostly those women who are investigated because of symptoms who are likely to be diagnosed at this age.

Figure 4 shows the estimated percentage distribution of cervical cancer cases by FIGO stage, year of diagnosis, and age. Estimates for the last two years of data included in the audit are dotted, as this more recent data is less complete and we are less certain of the accuracy of the results. The effect of raising the age at which women are first invited for screening from 20 to 25 can be clearly seen from 2009 onwards (Figure 4a).

58% of women in the audit were diagnosed between the age of 25 and 39. 55% of these women are diagnosed with stage 1A cancer and a further 34% with stage 1B cancer. The 'Jade Goody effect' (a rise in the number of younger women attending cervical screening appointments following the diagnosis and untimely death of the reality TV star) can be seen in an increase in the number of stage 1A and stage 1B cancers diagnosed in women aged 25-39 in 2009/10 (Figure 5). No increase was observed in stage 2 or worse cancers.

Women over the age of 50 at diagnosis, and particularly those diagnosed after the age of 65, are more likely to be diagnosed with advanced stage cancer than younger women. There has been an increase in the proportion of cancers diagnosed as stage 2 or worse in women aged 65+ from 62% in 2007/08 to 72% in 2011/12 (Figure 4d). However the absolute number of cancers diagnosed in this age group has fallen from 419 in 2007/08 to 343 in 2011/12. It is worth noting that women aged 80+ at diagnosis (between 2007 and 2012) will have been aged between 56 and 61 when screening was introduced in 1988. Therefore they are unlikely to have participated in the screening programme (as can be seen in Table 15, Appendix C). Furthermore only 40% of women diagnosed aged 65-79 were screened between the ages of 60-64, compared to 72% of the controls. They were also much more likely to have never been screened (33%) than controls (13%).

Figure 3 FIGO stage of cervical cancer cases: percentage distribution, by age-group

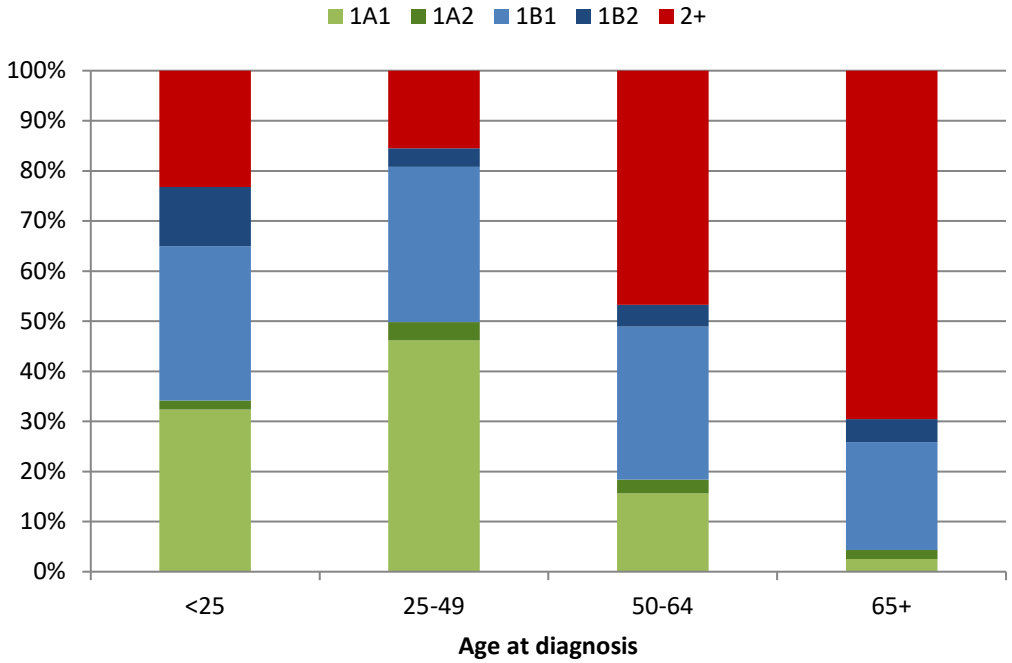


Figure 4 FIGO stage of cervical cancers cases: estimated percentage distribution by financial year

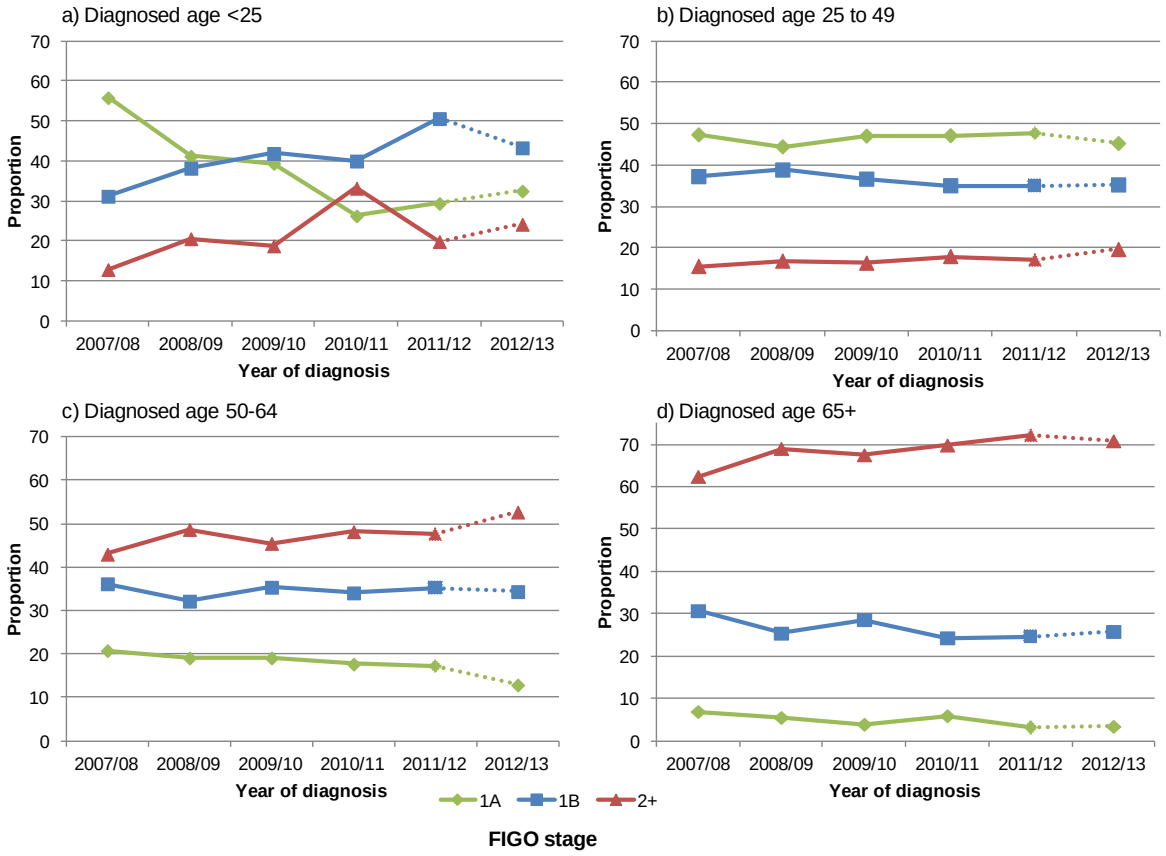
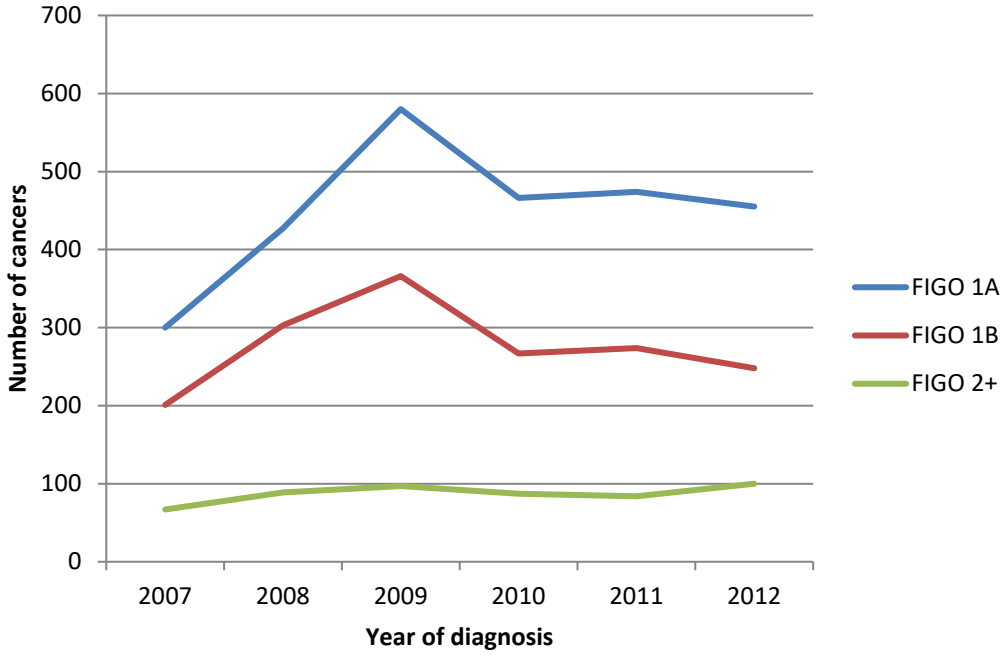


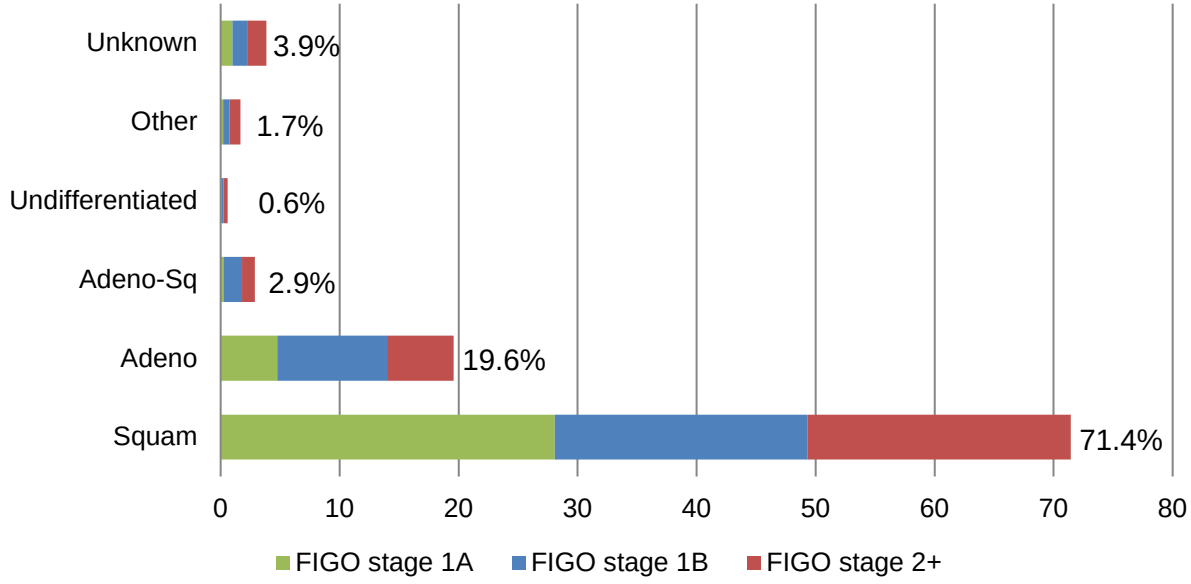
Figure 5 FIGO stage of cervical cancer cases aged 25-39: number, by year of diagnosis



4.4 Histology of invasive cervical cancers

Figure 6 shows the distribution of invasive cervical cancer cases by histological type. Most of the cases of cervical cancer show squamous histology (71%), while 20% are adenocarcinomas. Adenosquamous types are significantly rarer. Squamous carcinoma is more likely to be diagnosed as stage 1A cancer than the other histological types: 39% were stage 1A compared to 24% of adenocarcinoma and 9% of adenosquamous cases. Over half of the cases with undifferentiated or other histological types were diagnosed as stage 2 or worse.

Figure 6 Percentage of all cervical cancer cases, by histology and stage



4.5 Treatment of invasive cervical cancers

Figure 7 shows the distribution of treatment for cervical cancers, according to age (see also Table 12). The most aggressive treatment employed in each case has been captured. Treatment was recorded in 6,283 cases (71.5%) (Table 11), and out of those, the most common treatment was cone biopsy/loop excision/trachelectomy (33.1%), followed by simple or radical hysterectomy (24.3%), and radiotherapy plus chemotherapy ± hysterectomy (25.5%). Only 2.4% of those treated by cone biopsy/loop excision/trachelectomy had a trachelectomy. 5% of known treatments were recorded as 'none'.

Filtering the results by age reveals that for women aged 50 to 64, the most common treatment was chemotherapy plus radiotherapy ± hysterectomy (43%), followed by hysterectomy alone (25%). By contrast, 46% of women under 50 had fertility-sparing treatment (cone biospy/loop excision or trachelectomy) with only 28% undergoing a hysterectomy (simple or radical). For those aged 65 to 79, chemotherapy plus radiotherapy ± hysterectomy (42%) was the most common treatment, followed by radiotherapy ± hysterectomy (24%). However, 13% of women in this age group reportedly received no treatment, other than perhaps palliative care. Given the substantially poorer relative survival of elderly cervical cancer patients nationally,[18] this appears to warrant further investigation. It should be borne in mind, however, that some regions may have recorded 'no treatment' because they were unable to find a record of treatment, rather than because the patient was not treated (see section 3.7).

Figure 7 Percentage treatment of cervical cancer cases, by age at diagnosis

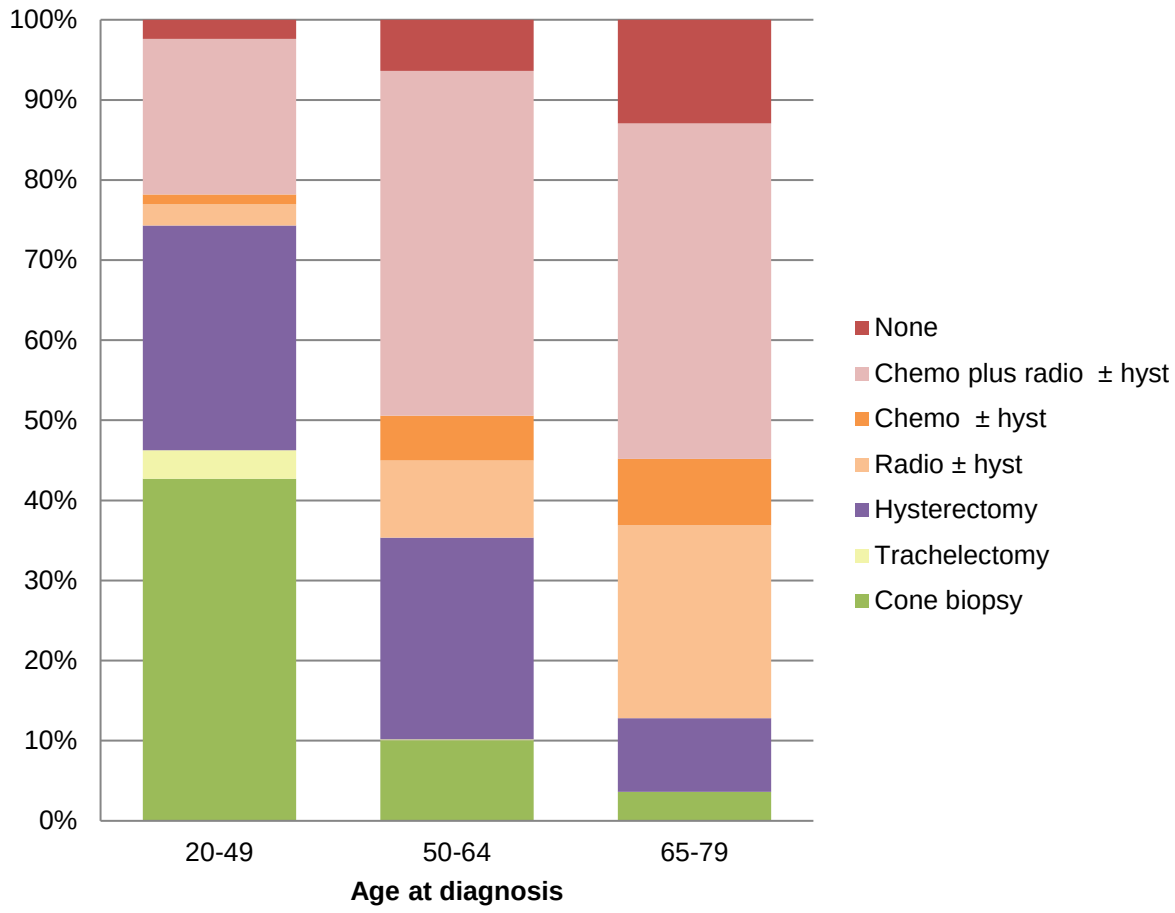
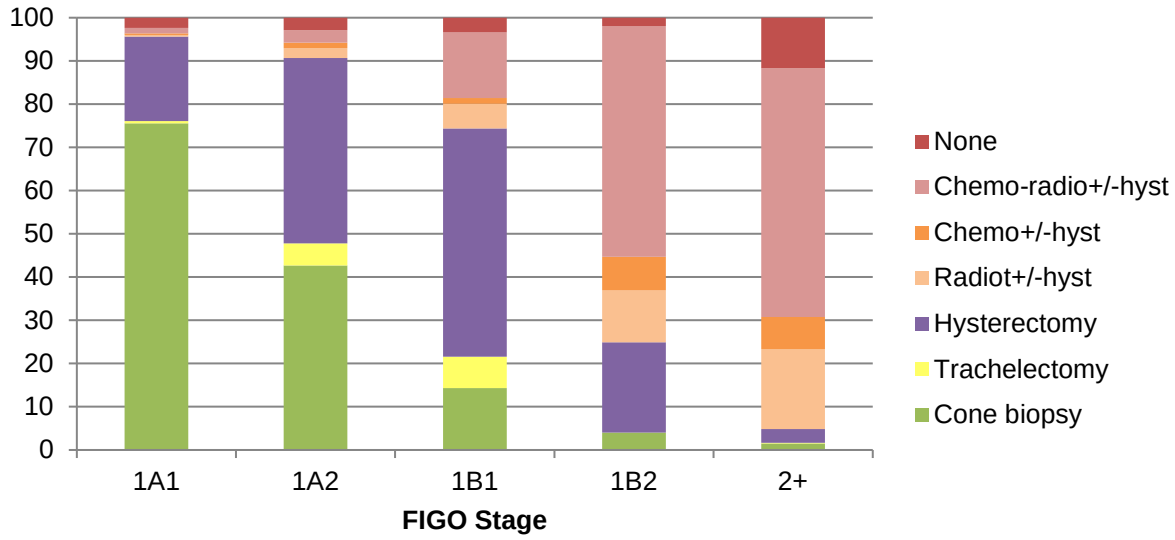


Figure 8 shows the distribution of treatment for invasive cervical cancer by stage of disease. The graph reveals that the majority of women diagnosed with FIGO stage 1A1 cancer received cone biopsy/loop excision (76%), whereas those with stage 1A2 are more likely to have non-fertility preserving treatment (52%). Women with stage 1B1 cancer were most likely to have had a simple or radical hysterectomy (53%), whereas those with stage 1B2 were more likely to have chemotherapy plus radiotherapy ± hysterectomy (53%). The majority of those with stage 2 or worse (58%) cancer received chemotherapy plus radiotherapy ± hysterectomy. Note that a very small proportion (1%) of cancers diagnosed at stage 1A1 are recorded as having been treated with chemotherapy plus radiotherapy ± hysterectomy. Similarly, 1% of stage 2 or worse cancers are recorded as having a cone biopsy. These are clearly misclassifications of stage and/or treatment which we are endeavouring to correct for the future.

Figure 8 Percentage treatment of cervical cancer cases by FIGO stage



4.6 Cytology review

The introduction of revised cytology review audit guidelines (under Addendum 2, to Publication No 28) in April 2012 saw a 3 month period (April to June 2012) where reviews of cytology and histology samples from women diagnosed with cervical cancer as part of audit were suspended. From the 1st of July 2012 onwards cytology review, under the new guidelines, are mandatory. In this report we focus on those cytology reviews among women diagnosed from the 1st of July 2012 onwards. Despite new guidance coming into effect a few reviews were still carried out by more than one person locally and by a panel externally. In these circumstances the review result reported is that of the reviewer with the highest qualification, except where a consensus result was provided.

Out of 8784 cases included in the report, 1490 were diagnosed on or after 01 July 2012. These women had a total of 6,156 cytology tests taken before the date of diagnosis.

To establish which slides were eligible for **local review** under addendum 2, to Publication No28 we excluded the following tests.

- Anything more than 10 years before diagnosis does not need review – **3,204** tests were taken more than 10years before diagnosis and are not eligible.
- Slides taken with conventional cytology need not be reviewed – **472** slides are known to be conventional cytology. However the type of cytology was missing for 1,668

slides (57% of slides within 10years). 1,026 (61.5%) of these were taken on or after April 2008 when LBC was fully rolled out. Nevertheless some of these slides may not have been eligible and have been included as eligible in this report.
- Samples within three months of diagnosis with a result of moderate or worse need not be reviewed – a total of **699** slides meet these criteria and were excluded.

Revised guidelines (under Addendum 2, to Publication No 28) indicate that the following slides need **external cytology review** (at the training centre):

- Slides taken within 2 years of diagnosis originally reported as negative or inadequate (irrespective of review diagnosis) need external review – a total of **22 inadequate** and **115 negative** need external review.
- Negative or inadequate slides upgraded to high-grade (mod or worse) at local review (excluding those within 2 years) - **58 slides** need external review.
- Borderline or low-grade upgraded to high grade (severe or worse) at local review – **27 slides** need external review

This means that only 28.9% (1,781/6,156) of slides were eligible for local review. A review result was recorded for 618 (34.7%) of eligible slides. Additionally 222 slides required external review; results were recorded for 79 (35.6%). Readers should note that many more external reviews have been carried out than are evident in this report (the data in this report is affected by the timeliness in which data is entered into the audit database).

Concordance between original cytology test and local review test can be found in table H. The sample size is much smaller than in the 2012 publication,[16] however concordance between original and review result is much higher overall (55% vs. 59% here) and in particular for those samples initially reported as negative (45% vs. 61% here). A total of 65 negative or inadequate tests within 2 years of diagnosis were reviewed, concordance was 41.5% (results not shown). 13 (27.5%) were upgraded to low-grade cytology and 20 (30.8%) to moderate or worse.

Concordance between local and external review among the 79 samples reviewed by both was 73%. Only 8% of samples (N=6) reviewed locally as moderate or less were upgraded by external reviewers to severe or worse.

Table H. Original cytology result by review result in those women diagnosed from 01 July 2012 onwards

Original test result	Review result: Negative	Inadequate	Borderline	Mild	Moderate	Severe	?Invasive	?Glandular	Total	Concordance	% Upgraded to Severe+
Negative	273	14	81	7	7	42	4	21	449	60.8%	14.9%
Inadequate	4	10	5	1	1	2	2	2	27	37.0%	22.2%
Borderline	3	0	33	5	6	21	3	10	81	40.7%	42.0%
Mild	0	0	6	12	4	2	1	0	25	48.0%	12.0%
Mod	0	0	0	0	3	1	0	0	4	75.0%	25.0%
Severe	0	0	0	0	0	20	1	0	21	95.2%	4.8%
?Invasive	0	0	0	0	0	0	3	0	3	100.0%	
?Glandular	0	0	0	0	0	0	0	8	8	100.0%	
Total	280	24	125	25	21	88	14	41	618	58.6%	

4.7 Histology review

Out of 8,784 women with cervical cancer included in this report 7,507 (85.5%) have at least on histology sample recorded in the database. A total of 9,822 histological samples are included in the dataset. In total 5,630 samples have been reviewed of which 4,134 (73%) were diagnostic samples.

Since the 01 of July 2012 a total of 1,243 samples have been recorded in the database, of these 78% (975) were diagnostic samples. Therefore only 268 (21.6%) of histological samples were eligible for review and 60.4% (162) of these have a review result recorded.

Although review of diagnostic samples is no longer required 101 diagnostic samples were reviewed (97 of these samples were taken within a month of diagnosis). 18 samples were reviewed by more than one person, the reviewers disagreed in 3 (16.6%) of the reviews.

Original histological result and review results are presented in Table L. Concordance between results was 90.2%, which is slightly less than that in the peer reviewed publication (94%). Concordance with invasive cancer was 99% in the publication and 100% here.

Table L. Original histological diagnosis by review diagnosis for women diagnosed from 01 July 2012 onwards

				Review result							Concordance	Percent upgraded
Original result	Normal	Inadequate	CIN	CIN1	CIN2	CIN3	CGIN	hCGIN	Cancer	Total		
Normal	22	1	0	2	0	0	0	1	0	26	84.6%	3.8%
Inadequate	0	6	1	0	0	0	0	0	0	7	85.7%	0.0%
CIN	0	0	1	0	2	0	0	0	0	3	33.3%	66.7%
CIN1	2	0	0	10	0	0	0	0	0	12	83.3%	0.0%
CIN2	0	0	0	2	10	4	0	0	1	17	58.8%	-
CIN3	0	0	0	0	0	72	0	1	6	79	91.1%	-
CGIN	0	0	0	0	0	0	2	1	0	3	66.7%	-
hCGIN	0	0	0	0	0	0	1	14	1	16	87.5%	-
Cancer	0	0	0	0	0	0	0	0	101	101	100.0%	
Total	24	8	3	13	12	83	3	18	109	264	90.2%	

5. FUTURE DEVELOPMENTS/ ONGOING WORK

Results from this audit are presented to the Advisory Group, and changes will be implemented as part of the screening programme where appropriate.

This audit forms the basis for a number of peer-reviewed articles. The following manuscripts have recently been published and maybe of interest to the reader:

Characteristics and screening history of women diagnosed with cervical cancer aged 20-29 years. (2013) Castanon A, Leung VMW, Landy R, Lim AWW, Sasieni P. BJC, 1-7. Doi:10.1038/bjc.2013.322

How much could primary human papillomavirus testing reduce cervical cancer incidence and morbidity? (2013) Castanon A, Landy R, Sasieni P. Journal of Medical Screening. doi:10.1177/0969141313492313

Cervical screening at age 50-64 years and the risk of cervical cancer at age 65 years and older: population-based case control study. (2014) Castañón A, Landy R, Cuzick J, Sasieni P. PLoS Med. 2014 Jan;11(1):e1001585. doi: 10.1371/journal.pmed.1001585.

Benefits and harms of cervical screening from age 20 compared with screening from age 25 years. (2014). Landy R, Birke H, Castanon A, Sasieni P. Br J Cancer. 2014 Feb 11. doi: 10.1038/bjc.2014.65

Going forward we will use the data to analyse: (i) comparison of different screening history classifications and (ii) the use of cytology as diagnostic test among symptomatic women.

The audit management group have updated the audit guidelines in order to make the review process more efficient and to enhance its educational focus. It is too soon to report on the outcomes of these changes but we continue to monitor the situation. The colposcopy review process will continue to be improved as part of future audit protocol documents.

In the longer term, the audit database will be integrated into the new national cancer registry for England, which will increase capacity to store and manage information on each registration. This will enable screening history to be related to mortality allowing us to study survival.

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GLOSSARY

Action code	This field (downloaded as part of the screening history from NHAIS) denotes the action to be taken in response to the result of each cytology test. The codes are: A. Routine screening/call and recall. H. Result recorded, but no change in current action code. (This code is normally used when privately-taken cytology tests are entered into the system). R. Early recall at an interval specified by the laboratory. S. Suspend recall pending referral.
Cases	Women diagnosed with invasive cervical cancer in England.
Controls	Women who have not been diagnosed with cervical cancer, who are registered with a GP in England. They are matched by age and place of residence with a case.
Cervical Screening Evaluation Group /Audit Management Group	The group charged with evaluating developments in the NHS Cervical Screening Programme. The CSEG oversaw the NHS CSP national audit until February 2011, when an Audit Management Group was established, consisting of a subgroup of individuals from the Evaluation Group. The new Audit Management Group is charged with coordinating the development of audit protocols, and with gathering and disseminating recommendations for best practice
Confidence Interval	Confidence interval is a term used in inferential statistics that measures the probability that a population parameter will fall between two set values. The confidence interval can take any number of probabilities, with the most common being 95% or 99%.
Exeter call and recall system	The system used to invite women for screening. Since 1988, it has stored screening records for all women registered with a GP
FIGO stage	The cancer staging classification developed by the International Federation of Gynaecological Oncologists (I, IA, IA1, IA2, IB, IB1, IB2,III, IIIA, IIIA, IV, IVA, IVB).
Hospital Based Programme Coordinators (HBPC)	The named individual within each NHS trust who is responsible for collating cases of invasive cervical cancer and initiating the audit process.
Quality Assurance Reference Centres (QARC)	The nine Quality Assurance Reference Centres (QARCs) in England are responsible for the quality of the screening programme in their area. With the exception of the North East and Yorkshire and The Humber QARCs, each covers one region of the country.

APPENDIX A: ESSENTIAL FIELDS

SECTION A & A1	**Personal details**	NHS number (to be held locally) Date of birth For cases only: Date of diagnosis Stage of tumour (FIGO) Histology Treatment Index of Multiple Deprivation
SECTION B	**Cytology**	Reason for no cytology Date test was taken Result of cytology test HPV result
SECTION C	**Colposcopy**	For cases only: Number of colposcopic appointments Date of colposcopy Attendance type Colposcopist Surgical procedure
SECTION C2	**Colposcopy review**	All fields should be completed
SECTION D1	**Histology cancer diagnosis**	For cases only: Date of specimen Type of specimen Pathological diagnosis FIGO stage
SECTION D2	**Specimen history**	Date of specimen Type of specimen Pathological diagnosis Excision status
SECTION E Cytology Review of cases	**E1. Original slide**	Slide ID Cytology type Date of original test Original test result
	E2. Review results	Reviewed location Review result Original result NFR (no further review)
SECTION F Histology Review of cases	**F1. Original specimen**	Specimen ID Date of original specimen Pathological diagnosis Evidence of TZ sampling
	F2. Review results	Reviewed at Review pathological diagnosis Excision status

APPENDIX B: COMPLETION OF DATA (ESSENTIAL FIELDS)

NHS Number is not received nationally

B-1 Proportion of essential data collected for cases in **Section A. Personal and cancer details**

		Section A: Essential fields							
		Date of Birth		Date of Diagnosis		Stage*		Histology*	
QARC Region	**Case**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
East of England	824	824	100	824	100	777	94.3	820	99.5
East Midlands	867	867	100	867	100	737	85.0	834	96.2
London	865	865	100	865	100	838	96.9	845	97.7
North East	570	570	100	570	100	526	92.3	557	97.7
Yorkshire and the Humber	1025	1025	100	1025	100	861	84.0	972	94.8
North West	1120	1120	100	1120	100	973	86.9	1117	99.7
South Central	650	650	100	650	100	617	94.9	629	96.8
South East Coast	651	651	100	651	100	620	95.2	621	95.4
South West	1009	1009	100	1009	100	1005	99.6	1008	99.9
West Midlands	1203	1203	100	1203	100	1060	88.1	1140	94.8
Total	**8784**	**8784**	**100**	**8784**	**100**	**8014**	**91.2**	**8543**	**97.3**

*Cases where data collection is complete and stage is missing are considered to be staged as a reasonable amount of effort has been made to collect the data. Incomplete cases with a stage recorded as X (or missing) are considered not to have stage. Please refer to section 6 for full details regarding missing data

B-1a Proportion of non-essential data collected for cases in **Section A. Personal and cancer details**

		Section A: Non-essential fields								
		Treatment (in those with known tx, **excluding** those reported as none*)		Treatment (in those with tx recorded **including** those recorded as none)		Index of Multiple Deprivation			Index of Multiple Deprivation	
QARC Region	**Case**	n	%	n	%	n	%	**All Controls**	n	%
East of England	824	652	79.1	680	82.5	815	98.9	1644	557	33.9
East Midlands	867	575	66.3	592	68.3	0	0.0	1719	0	0.0
London	865	571	66.0	648	74.9	209	24.2	1478	350	23.7
North East	570	182	31.9	184	32.3	569	99.8	1137	337	29.6
Yorkshire and the Humber	1025	671	65.5	682	66.5	994	97.0	2044	661	32.3
North West	1120	454	40.5	499	44.6	1079	96.3	2234	930	41.6
South Central	650	557	85.7	589	90.6	648	99.7	1299	1275	98.2
South East Coast	651	547	84.0	563	86.5	641	98.5	1301	1240	95.3
South West	1009	910	90.2	847	83.9	994	98.5	2016	1995	99.0
West Midlands	1203	851	70.7	899	74.7	894	74.3	2398	0	0.0
Total	**8784**	**5970**	**68.0**	**6183**	**70.4**	**6843**	**77.9**	**17270**	**7345**	**42.5**

B-1b Proportion of cases with FIGO stage reported as none available, none recorded,* or '1B+' (1B or worse), by QARC region, age, and audit year

QARC Region	None recorded	None available	1B+ (NOS)	Total
East of England	5.7	2.3	0.4	824
East Midlands	15.0	1.7	0.4	867
London	3.1	0.0	7.2	865
North East	7.7	1.4	15.6	570
Yorkshire and the Humber	16.0	2.7	2.6	1025
North West	13.1	0.4	9.5	1120
South Central	5.1	1.7	0.3	650
South East Coast	4.8	2.0	2.0	651
South West	0.4	1.4	3.1	1009
West Midlands	11.9	4.8	0.0	1203
Age				
<25	11.3	2.2	3.2	186
25-49	7.1	0.8	3.0	5,634
50-64	10.5	2.8	5.6	1,550
65+	13.4	5.6	5.4	1,414
Audit Year				
2009-2010	8.5	1.3	4.1	2474
2010-2011	8.0	1.6	4.5	2,099
2011-2012	6.9	1.8	4.0	2,191
2012-2013	12.1	3.3	2.6	2,020
Total	**8.8**	**1.9**	**3.8**	**8784**

*where stage is reported as none available instead of none recorded a reasonable amount of effort has been made to find the stage, but none has been available. This is derived from cases recorded as "Audit complete" which means that no further details are being sought for these women. The option to report cases as "none available" has only been available to all QARCs since April 2012.

B-2 Proportion of data collected for cases in **Section B. Cytology**

Section B: Cytology								
			Completeness of data among recorded cytology tests					
		Total No. of tests on cases[a]	Date test was taken		Result of Test		Action Code	
QARC Region	Case		n	%	n	%	n	%
East of England	824	3,537	3,537	100	3,537	100	3,537	100
East Midlands	867	3,933	3,933	100	3,933	100	3,933	100
London	865	2,151	2,151	100	2,150	100	2,150	100
North East	570	2,189	2,189	100	2,188	100	2,185	100
Yorkshire and the Humber	1025	4,301	4,301	100	4,301	100	4,297	99.9
North West	1120	4,765	4,765	100	4,765	100	4,762	99.9
South Central	650	2,975	2,975	100	2,975	100	2,962	99.6
South East Coast	651	2,831	2,831	100	2,831	100	2,829	99.9
South West	1009	3,999	3,999	100	3,999	100	3,998	100
West Midlands	1203	5,129	5,129	100	5,124	100	5,128	100
Total	**8784**	**35,810**	**35,810**	**100**	**35,803**	**100**	**35781**	**99.9**[b]

[a] Cytology tests known to the Audit and taken before diagnosis

[b] Cytology data obtained directly from Open Exeter should have all three data fields complete. Missing data, we believe, is the result of inclusion into the audit of cytology tests taken before the programme started in 1988 and a few slides that were found in the laboratory, but not recorded on Exeter. These tests will not have “Action Code” as this field is generated by Exeter.

B-3 Proportion of data collected for cases in **Section C: Colposcopy**

	Section C: Colposcopy									
	No. of cases with an Action Code of suspend	No. of cases with a suspend and a colposcopy		Additional cases with a colp but no suspend (n)	No. of Colp appts	Date of colp		Satisfactory exam or DNA		Colposcopic procedure
QARC Region		n	%		n	n	%	n	%	n
East of England	558	422	75.6	62	686	686	100	686	100	580
East Midlands	600	247	41.2	29	433	433	100	433	100	347
London[1]	615	360	58.5	49	535	535	100	535	100	535
North East	419	222	53.0	39	385	385	100	385	100	329
Yorkshire and the Humber	750	479	63.9	68	832	832	100	832	100	667
North West	795	473	59.5	49	812	812	100	812	100	631
South Central	457	357	78.1	33	597	597	100	597	100	485
South East Coast	463	357	77.1	35	667	667	100	667	100	510
South West	653	569	87.1	80	1062	1062	100	1062	100	878
West Midlands	763	477	62.5	50	814	814	100	814	100	517
Total	**6073**	**3963**	**65.3**	**494**	**6823**	**6823**	**100**	**6823**	**100**	**5479**

[1] London reports the diagnostic sample for every cancer, this has been taken as a colposcopy appointment making the results look complete. However cases very rarely have any other colposcopy recorded

APPENDIX CI: LIST OF DATA TABLES

APPENDIX CII: DATA TABLES

Table 1. Number of cases of invasive cervical cancer, 2009-2013, by audit year and QARC*

QARC Region	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	Total
East of England	181	224	225	219	212	168	1229
East Midlands	200	195	234	220	213	200	1262
London	226	225	272	211	231	151	1316
North East	132	160	171	134	136	129	862
Yorkshire and the Humber	268	245	269	234	276	246	1538
North West	315	303	344	273	260	243	1738
South Central	169	165	189	159	165	137	984
South East Coast	145	158	192	163	163	133	954
South West	261	288	285	246	240	238	1558
West Midlands	247	299	293	240	295	375	1749
Total	**2144**	**2262**	**2474**	**2099**	**2191**	**2020**	**13190**

*Audit year between 1 April and the 31 March

Table 2. Number and percentage of invasive cervical cancer in 2009-2013 audit in five-year age groups, by year of diagnosis

Audit Year[1]	<20*	20-24	25-29	30-34	35-39	40-44	45-49	50-55	55-59	60-64	65-69	70-74	75-79
2009-2010	0	52	392	370	361	299	213	143	128	122	91	92	76
2010-2011	0	45	322	268	280	251	194	145	126	120	92	64	70
2011-2012	1	34	351	276	288	298	212	146	125	117	78	70	84
2012-2013	1	53	341	294	242	219	163	145	142	91	89	72	74
Total	**1**	**184**	**1406**	**1208**	**1171**	**1067**	**782**	**579**	**521**	**450**	**350**	**298**	**304**
Percent													
2009-2010	0.0	2.1	15.8	15.0	14.6	12.1	8.6	5.8	5.2	4.9	3.7	3.7	3.1
2010-2011	0.0	2.1	15.3	12.8	13.3	12.0	9.2	6.9	6.0	5.7	4.4	3.0	3.3
2011-2012	0.0	1.6	16.0	12.6	13.1	13.6	9.7	6.7	5.7	5.3	3.6	3.2	3.8
2012-2013	0.0	2.6	16.9	14.6	12.0	10.8	8.1	7.2	7.0	4.5	4.4	3.6	3.7
Total	**0.0**	**2.1**	**16.0**	**13.8**	**13.3**	**12.1**	**8.9**	**6.6**	**5.9**	**5.1**	**4.0**	**3.4**	**3.5**

[1]Audit year runs 1 April to 31 March

*Both cases are aged 19

Table 3. Number and percentage of invasive cervical cancer cases in 2009-2013 audit for each QARC region, by age

QARC Region	<25	25-49	50-64	65+	Total
East of England	16	495	172	141	824
East Midlands	22	591	123	131	867
London	15	553	168	129	865
North East	18	375	105	72	570
Yorkshire and the Humber	20	694	179	132	1025
North West	33	727	181	179	1120
South Central	7	430	109	104	650
South East Coast	12	427	119	93	651
South West	24	619	173	193	1009
West Midlands	19	723	221	240	1203
Total	**186**	**5634**	**1550**	**1414**	**8784**
Percent					
East of England	1.9	60.1	20.9	17.1	100
East Midlands	2.5	68.2	14.2	15.1	100
London	1.7	63.9	19.4	14.9	100
North East	3.2	65.8	18.4	12.6	100
Yorkshire and the Humber	2.0	67.7	17.5	12.9	100
North West	2.9	64.9	16.2	16.0	100
South Central	1.1	66.2	16.8	16.0	100
South East Coast	1.8	65.6	18.3	14.3	100
South West	2.4	61.3	17.1	19.1	100
West Midlands	1.6	60.1	18.4	20.0	100
Total	**2.1**	**64.1**	**17.6**	**16.1**	**100**

*Table 4. Number and percentage of invasive cervical cancer cases in 2009-2013 audit, by FIGO Stage**

FIGO Stage	Number	Percentage
1A NOS	940	10.7
1A1	1,735	19.8
1A2	159	1.8
1B+ NOS	336	3.8
1B NOS	1,137	12.9
1B1	1224	13.9
1B2	166	1.9
2 NOS	55	0.6
2A	163	1.9
2B	933	10.6
3 NOS	79	0.9
3A	82	0.9
3B	363	4.1
4 NOS	192	2.2
4A	136	1.5
4B	144	1.6
None available	157	1.8
None recorded	783	8.9
Total	**8784**	**100**

*NOS= not otherwise specified (or not further specified)

Table 5. Number of invasive cervical cancer cases in 2009-2013 audit for each QARC region, by FIGO stage

QARC Region	1A	1B	2	3	4	1B+	None recorded	Total
East of England	253	270	114	64	54	3	66	824
East Midlands	307	256	91	33	32	3	145	867
London	278	234	146	65	53	62	27	865
North East	181	175	40	17	16	89	52	570
Yorkshire and the Humber	402	241	88	40	35	27	192	1025
North West	348	330	96	47	42	106	151	1120
South Central	227	203	83	49	42	2	44	650
South East Coast	221	203	100	39	31	13	44	651
South West	328	320	164	71	77	31	18	1009
West Midlands	289	295	229	99	90	0	201	1203
Total	**2834**	**2527**	**1151**	**524**	**472**	**336**	**940**	**8784**

Table 5a. FIGO stage of invasive cervical cancer cases in 2009-2013: estimated percent distribution, by QARC region

QARC Region	1A	1B	2+	Total
East of England	31.5%	35.9%	32.7%	100
East Midlands	37.0%	33.0%	30.0%	100
London	34.3%	29.8%	35.9%	100
North East	34.6%	42.2%	23.2%	100
Yorkshire and the Humber	43.7%	32.1%	24.1%	100
North West	33.4%	40.1%	26.6%	100
South Central	35.4%	32.6%	32.0%	100
South East Coast	35.6%	33.5%	30.9%	100
South West	33.1%	33.0%	33.9%	100
West Midlands	26.9%	30.4%	42.6%	100
England	**34.3%**	**34.0%**	**31.7%**	**100**

Table 6. Number of invasive cervical cancer cases in 2009-2013 audit, by age and FIGO stage

Age	1A	1B	2	3	4	1B+(NOS)	None Recorded	Total
<25	53	66	25	8	3	6	25	186
25-49	2,504	1,742	489	164	126	168	441	5634
50-64	231	439	307	146	135	86	206	1550
65+	46	280	330	206	208	76	268	1414
All ages	**2834**	**2527**	**1151**	**524**	**472**	**336**	**940**	**8784**

Table 6a. FIGO stage of invasive cervical cancer cases in 2009–2013 audit: estimated percentage distribution, by age-group

Age	1A	1B	2	Total	Total
<25	32.3	43.6	24.1	100	186
25-49	46.8	35.5	17.6	100	5634
50-64	16.8	34.8	48.5	100	1550
65+	4.1	25.9	70.0	100	1414
All ages	**34.3**	**34.0**	**31.7**	**100**	**8784**

Table 7. Number of invasive cervical cancer cases in 2009-2013 audit, by FIGO stage and year of diagnosis

Year	1A	1B	2	3	4	1B+(NOS)	None Recorded	Total
2009-2010	824	740	293	149	127	101	240	2,474
2010-2011	678	589	296	133	108	95	200	2,099
2011-2012	734	643	272	129	137	87	189	2,191
2012-2013	598	555	290	113	100	53	311	2,020
Total	**3134**	**2527**	**1151**	**524**	**472**	**336**	**940**	**8784**

Table 7a. FIGO stage of invasive cervical cancer cases: estimated percentage distribution, by year of diagnosis

Year	1A	1B	2	Total
2009-2010	35.6	35.3	29.2	100
2010-2011	34.4	33.2	32.5	100
2011-2012	35.1	33.6	31.3	100
2012-2013	32.0	33.8	34.3	100
Total	**34.3**	**34.0**	**31.7**	**100**

Table 8. Number and percentage of invasive cervical cancer cases in 2009-2013 audit, by histology

Year	Squamous	Adenocarcinoma	Adeno-Squamous	Undifferentiated	Other	None recorded
2009-2010	1,763	499	73	16	35	88
2010-2011	1,533	384	58	7	44	73
2011-2012	1,579	429	62	17	37	67
2012-2013	1,400	408	60	11	31	110
Total	**6275**	**1720**	**253**	**51**	**147**	**338**
Percent						
2009-2010	71.3	20.2	3.0	0.6	1.4	3.6
2010-2011	73.0	18.3	2.8	0.3	2.1	3.5
2011-2012	72.1	19.6	2.8	0.8	1.7	3.1
2012-2013	69.3	20.2	3.0	0.5	1.5	5.4
Total	**71.4**	**19.6**	**2.9**	**0.6**	**1.7**	**3.8**

Table 9. Number and percentage of invasive cervical cancer cases in 2009-2013 audit, by age at diagnosis and histology

Age	Squamous	Adenocarcinoma	Adeno-Squamous	Other (incl undiff)	None recorded	Total
<25	136	25	7	11	7	186
25-49	4074	1124	159	95	182	5634
50-64	1084	322	52	34	58	1550
65+	981	249	35	58	91	1414
Total	**6275**	**1720**	**253**	**198**	**338**	**8784**
Percent						
<25	73.1	13.4	3.8	5.9	3.8	100
25-49	72.3	20.0	2.8	1.7	3.2	100
50-64	69.9	20.8	3.4	2.2	3.7	100
65+	69.4	17.6	2.5	4.1	6.4	100
All ages	**71.4**	**19.6**	**2.9**	**2.3**	**3.8**	**100**

Table 10. Percentage of invasive cervical cancer cases in 2009-2013 audit, by FIGO Stage and histology

Stage	Squamous	Adenocarcinoma	Adeno-Squamous	Other (incl undiff)	None recorded	Total
1A	37.6	22.0	6.7	8.6	18.9	32.3
1B+	53.7	67.0	84.6	72.7	38.5	57.0
None recorded	8.8	10.9	8.7	18.7	42.6	10.7
Total	**100**	**100**	**100**	**100**	**100**	**100**

Table 11. Number of invasive cervical cancer in 2009-2013 audit for each QARC region, by treatment

QARC Region	None	Cone biopsy/ Loop excision	Trachelectomy	Simple hysterectomy	Radical hysterectomy	Hysterectomy/ Radiotherapy	Hysterectomy/ chemotherapy	Hysterectomy/ Radio/Chemo	Radiotherapy	Chemotherapy	Radiothearpy/ Chemotherapy	Palliative care	Other	None recorded
East of England	28	202	28	37	130	8	5	15	33	17	173	4	0	144
East Midlands	17	168	6	53	126	4	3	11	40	18	146	0	0	275
London	77	136	17	59	89	7	2	8	57	23	151	0	22	217
North East	2	53	4	8	56	1	2	1	10	5	41	1	0	386
Yorkshire and the Humber	11	258	6	39	101	15	2	13	54	17	162	4	0	343
North West	45	228	11	22	76	4	2	7	34	8	61	1	0	621
South Central	32	212	12	31	98	14	5	14	29	13	125	4	0	61
South East Coast	16	219	13	41	90	10	1	18	33	19	97	6	0	88
South West	37	263	27	58	194	16	3	28	69	26	222	4	0	62
West Midlands	48	186	26	153	63	9	3	45	68	26	257	15	0	304
Total	**313**	**1925**	**150**	**501**	**1023**	**88**	**28**	**160**	**427**	**172**	**1435**	**39**	**22**	**2501**

Table 11a. Percentage of invasive cervical cancer cases in 2009–2013 audit for each QARC region, by treatment

QARC Region	None	Cone biopsy/ Loop excision	Trachelectomy	Simple hysterectomy	Radical hysterectomy	Hysterectomy/ Radiotherapy	Hysterectomy/ chemotherapy	Hysterectomy/ Radio/ Chemo	Radiotherapy	Chemotherapy	Radiothearpy/ Chemotherapy	Palliative care	Other	None recorded
East of England	3.4	24.5	3.4	4.5	15.8	1.0	0.6	1.8	4.0	2.1	21.0	0.5	0.0	17.5
East Midlands	2.0	19.4	0.7	6.1	14.5	0.5	0.3	1.3	4.6	2.1	16.8	0.0	0.0	31.7
London	8.9	15.7	2.0	6.8	10.3	0.8	0.2	0.9	6.6	2.7	17.5	0.0	2.5	25.1
North East	0.4	9.3	0.7	1.4	9.8	0.2	0.4	0.2	1.8	0.9	7.2	0.2	0.0	67.7
Yorkshire and the Humber	1.1	25.2	0.6	3.8	9.9	1.5	0.2	1.3	5.3	1.7	15.8	0.4	0.0	33.5
North West	4.0	20.4	1.0	2.0	6.8	0.4	0.2	0.6	3.0	0.7	5.4	0.1	0.0	55.4
South Central	4.9	32.6	1.8	4.8	15.1	2.2	0.8	2.2	4.5	2.0	19.2	0.6	0.0	9.4
South East Coast	2.5	33.6	2.0	6.3	13.8	1.5	0.2	2.8	5.1	2.9	14.9	0.9	0.0	13.5
South West	3.7	26.1	2.7	5.7	19.2	1.6	0.3	2.8	6.8	2.6	22.0	0.4	0.0	6.1
West Midlands	4.0	15.5	2.2	12.7	5.2	0.7	0.2	3.7	5.7	2.2	21.4	1.2	0.0	25.3
Total	**3.6**	**21.9**	**1.7**	**5.7**	**11.6**	**1.0**	**0.3**	**1.8**	**4.9**	**2.0**	**16.3**	**0.4**	**0.3**	**28.5**

Table 12. Number and percentage of invasive cervical cancer cases in 2009–2013 audit, by age at diagnosis and treatment

Treatment	<50	50-64	65-79	80+	Total
None(palliative)	98	70	86	98	352
Cone biopsy/ Loop excision	1783	110	24	8	1925
Trachelectomy	148	1	0	1	150
Hysterectomy only (simple or radical)	1170	275	61	18	1524
Radiotherapy (+/- hysterectomy)	113	105	160	137	515
Chemotherapy (+/- hysterectomy)	76	61	55	8	200
Chemo-radiotherapy (+/- hysterectomy)	811	470	278	36	1595
Not recorded (Other)	1621	458	288	156	2523
Total	**5820**	**1550**	**952**	**462**	**8784**
Percent					
None(palliative)	1.7	4.5	9.0	21.2	4.0
Cone biopsy/ Loop excision	30.6	7.1	2.5	1.7	21.9
Trachelectomy	2.5	0.1	0.0	0.2	1.7
Hysterectomy only (simple or radical)	20.1	17.7	6.4	3.9	17.3
Radiotherapy (+/- hysterectomy)	1.9	6.8	16.8	29.7	5.9
Chemotherapy (+/- hysterectomy)	1.3	3.9	5.8	1.7	2.3
Chemo-radiotherapy (+/- hysterectomy)	13.9	30.3	29.2	7.8	18.2
Not recorded (Other)	27.9	29.5	30.3	33.8	28.7
Total	**100**	**100**	**100**	**100**	**100**

Table 13. Number of invasive cervical cancer cases in 2009-2013 audit, by FIGO Stage and treatment

Treatment	1A	1B	2	3	4	1B+(NOS)	None recorded	Total
None(palliative)	43	47	33	50	88	21	70	352
Cone biopsy/ Loop excision	1581	240	20	2	5	15	62	1925
Trachelectomy	20	118	3	0	0	5	4	150
Hysterectomy only (simple or radical)	466	940	46	11	5	19	37	1524
Radiotherapy (+/- hysterectomy)	11	117	150	96	79	12	50	515
Chemotherapy (+/- hysterectomy)	8	41	40	27	67	3	14	200
Chemo-radiotherapy (+/- hysterectomy)	30	380	657	252	146	46	84	1595
Not recorded (Other)	675	644	202	86	82	215	619	2523
Total	**2834**	**2527**	**1151**	**524**	**472**	**336**	**940**	**8784**

Table 13a. FIGO stage of invasive cervical cancer cases: estimated percentage distribution in 2009–2013 audit, by treatment

Treatment	1A	1B	2	Total
None(palliative)	13.3	19.5	67.2	100
Cone biopsy/ Loop excision	84.3	13.9	1.8	100
Trachelectomy	13.3	84.7	2.0	100
Hysterectomy only (simple or radical)	31.4	64.2	4.4	100
Radiotherapy (+/- hysterectomy)	2.3	24.4	73.3	100
Chemotherapy (+/- hysterectomy)	4.2	21.4	74.4	100
Chemo-radiotherapy (+/- hysterectomy)	1.9	25.3	72.7	100
Not recorded (Other)	31.6	38.6	29.8	100
Total	**34.3**	**34.0**	**31.7**	**100**

Table 14. Cervical screening status of invasive cervical cancer cases and controls aged 25-64, up to six months prior to diagnosis (percentages)

Cervical screening status up to six months prior to diagnosis	Population Controls		Cases Stage 1A		Cases Stage 1B+		Cases Stage not recorded	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
No cytology test (except within 6 months of diagnosis)	1,901	13.7	783	28.6	1011	26.6	168	26.0
Last smear routine and								
Up to date	8,410	60.6	532	19.5	957	25.2	164	25.3
Lapsed	2,264	16.3	734	26.8	1041	27.4	178	27.5
Last smear early repeat								
Up to date	611	4.4	188	6.9	181	4.8	37	5.7
Lapsed	492	3.5	188	6.9	338	8.9	48	7.4
Last smear suspend (not followed by any negative(s))	103	0.7	290	10.6	252	6.6	48	7.4
Last smear suspend (followed by at least one negative)	99	0.7	20	0.7	22	0.6	4	0.6
Total	**13,880**	**100**	**2735**	**100**	**3802**	**100**	**647**	**100**

We have used the action code provided by Exeter to determine whether the last cytology test lead to a routine recall, early recall or suspend from the recall programme. After a routine recall interval we consider the screening to be up to date when the diagnosis occurred within 3.5 years (or 5.5 years for older women) from the routine cytology test. After an action code of early repeat we consider the screening to be up to date when the diagnosis occurred within 1.25 years (or .25 years if the test was inadequate) of the early repeat test. When the last test (six month before diagnosis) was suspend and was followed by at least one negative test, women were up to date if the diagnosis was made within 1.5 years of the test leading to the suspend code. Those that were suspended more than 6 months before diagnosis and are not followed by any negative tests are considered to be lapsed.

Table 15. Cervical screening status of invasive cervical cancer cases and controls up to six months prior to diagnosis (numbers and percentages), by age

Cervical screening status up to six months prior to diagnosis	All Cases					Controls				
	20-24	**25-49**	**50-64**	**65-79**	**80+**	**20-24**	**20-49**	**50-64**	**65-79**	**80+**
No cytology test (except within six months of diagnosis)	169	1,558	404	311	274	547	1,737	164	238	473
Last smear routine and										
Up to date	4	1208	445	378	162	25	6,203	2,207	1342	411
Lapsed	2	1,569	384	157	8	11	1,752	512	231	12
Last smear early repeat and										
Up to date	4	346	60	9	7	8	563	48	4	6
Lapsed	0	443	131	72	9	1	413	79	52	13
Last smear suspend*	5	510	126	25	2	1	178	24	5	3
Total	**184**	**5,634**	**1,550**	**952**	**462**	**593**	**10,846**	**3,034**	**1,872**	**918**
Percent										
No cytology test (except within six months of diagnosis)	91.8	27.7	26.1	32.7	59.3	92.2	16.0	5.4	12.7	51.5
Last smear routine and										
Up to date	2.2	21.4	28.7	39.7	35.1	4.2	57.2	72.7	71.7	44.8
Lapsed	1.1	27.8	24.8	16.5	1.7	1.9	16.2	16.9	12.3	1.3
Last smear early repeat and										
Up to date	2.2	6.1	3.9	0.9	1.5	1.3	5.2	1.6	0.2	0.7
Lapsed	0.0	7.9	8.5	7.6	1.9	0.2	3.8	2.6	2.8	1.4
Last smear suspend*	2.7	9.1	8.1	2.6	0.4	0.2	1.6	0.8	0.3	0.3
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

* The categories "last smear suspend (not followed by any negative)" and "last smear suspend (followed by al least one negative)" found in table 14 are combined due to small numbers

Table 16. Number and percentage of population controls (GP plus district controls) screened in the 3-5 year interval preceding the date of diagnosis of their matched case, by age

Age		Total	Not screened in previous interval	Screened once in previous interval	Screened twice in previous interval	Screened ≥3 times in previous interval
20-24		598	551	34	6	7
25-29		2558	993	1331	118	116
30-34		2351	755	1314	134	148
35-39		2301	683	1400	117	101
40-44		2105	566	1370	82	87
45-49		1531	435	1003	44	49
50-54		1141	225	536	316	64
55-59		1022	258	701	40	23
60-64		871	254	582	22	13
65-69		695	162	422	96	15
70-74		577	148	282	123	24
75-79		600	194	261	128	17
80+		918	505	301	97	15
Total		17268	5729	9537	1323	679
Percent	National Coverage reported in 2011/12*	Coverage (>=1 test in interval)	%	%	%	%
20-24	3.6	7.9†	92.1	5.7	1.0	1.2
25-29	63.0	61.2	38.8	52.0	4.6	4.5
30-34	72.7	67.9	32.1	55.9	5.7	6.3
35-39	76.1	70.3	29.7	60.8	5.1	4.4
40-44	78.1	73.1	26.9	65.1	3.9	4.1
45-49	78.3	71.6	28.4	65.5	2.9	3.2
50-54	82.8	80.3	19.7	47.0	27.7	5.6
55-59	76.6	74.8	25.2	68.6	3.9	2.3
60-64	72.7	70.8	29.2	66.8	2.5	1.5
65-69	-	76.7	23.3	60.7	13.8	2.2
70-74	-	74.4	25.6	48.9	21.3	4.2
75-79	-	67.7	32.3	43.5	21.3	2.8
80+	-	45.0	55.0	32.8	10.6	1.6
Total			**33.2**	**55.2**	**7.7**	**3.9**

* Source: NHS Cervical Screening Programme in England in 2011-12. **Note:** we have used the 3 yearly coverage for women aged 20-49 and the 5 yearly coverage for women aged 50-64 using table 2 (see reference 9)

† Note: 71.8% of controls aged 20-24 are aged 24, only 4.5% are aged 20 or 21. Thus this age group is a reflection of the age at which their matched cases were diagnosed and not of the distribution of women aged 20-24 nationally. This explains the difference in coverage nationally and in the audit.

Table 16a. Number and percentage of population controls (GP plus district controls) screened in the 3-5 year interval preceding the date of diagnosis of their matched case (aged 25-64), by QARC region

QARC	Total	Not screened in previous interval	Screened once in previous interval	Screened twice in previous interval	Screened ≥ times in previous interval
East of England	1310	341	820	97	52
East Midlands	1386	381	875	72	58
London	1221	418	654	94	55
North East	924	275	551	59	39
Yorkshire and the Humber	1700	511	1035	95	59
North West	1795	546	1042	118	89
South Central	1070	330	613	86	41
South East Coast	1066	335	627	61	43
South West	1557	459	939	87	72
West Midlands	1851	573	1081	104	93
Total	**13880**	**4169**	**8237**	**873**	**601**
Percent	**Coverage** (>=1 test in interval)				
East of England	74.0	26.0	62.6	7.4	4.0
East Midlands	72.5	27.5	63.1	5.2	4.2
London	65.8	34.2	53.6	7.7	4.5
North East	70.2	29.8	59.6	6.4	4.2
Yorkshire and the Humber	69.9	30.1	60.9	5.6	3.5
North West	69.6	30.4	58.1	6.6	5.0
South Central	69.2	30.8	57.3	8.0	3.8
South East Coast	68.6	31.4	58.8	5.7	4.0
South West	70.5	29.5	60.3	5.6	4.6
West Midlands	69.0	31.0	58.4	5.6	5.0
Total		**30.0**	**59.3**	**6.3**	**4.3**

Table 17. Time to previous cytology among screened controls

	Time to previous screen						
Age	**<2.75 yrs**	**2.75-3.5 yrs**	**3.5-4.75 yrs**	**4.75-5.5 yrs**	**5.5-9.5 yrs**	**No previous cytology within 9.5 years**	**Total**
25-29	18	124	37	20	49	548	796
30-34	12	228	88	30	63	134	555
35-39	21	218	79	26	59	69	472
40-44	10	224	48	21	38	31	372
45-49	8	148	32	6	27	15	236
50-54	7	65	21	10	14	12	129
55-59	3	8	7	76	15	9	118
60-64	0	4	9	50	8	12	83
Total	**79**	**1019**	**321**	**239**	**273**	**830**	**2761**
Percent							
25-29	2.3	15.6	4.6	2.5	6.2	68.8	100
30-34	2.2	41.1	15.9	5.4	11.4	24.1	100
35-39	4.4	46.2	16.7	5.5	12.5	14.6	100
40-44	2.7	60.2	12.9	5.6	10.2	8.3	100
45-49	3.4	62.7	13.6	2.5	11.4	6.4	100
50-54	5.4	50.4	16.3	7.8	10.9	9.3	100
55-59	2.5	6.8	5.9	64.4	12.7	7.6	100
60-64	0.0	4.8	10.8	60.2	9.6	14.5	100
Total	**2.9**	**36.9**	**11.6**	**8.7**	**9.9**	**30.1**	**100**

Table 17a. Time to previous cytology test among potentially screen-detected cases of cervical cancer and their screened controls*

	Time to previous screen													
Age	**<3.5 yrs**		**3.5-4.75 yrs**		**4.75-5.5 yrs**		**5.5-9.5 yrs**		**No previous cytology within 9.5 yrs**		**Total**		**<5.5 yrs**	
	Cases	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**
25-34	307	382	128	125	50	50	144	112	740	682	1369	1351	485	557
35-49	370	629	115	159	46	53	162	124	384	115	1077	1080	531	841
50-64	36	87	23	37	68	136	30	37	168	33	325	330	127	260
Total	**713**	**1098**	**266**	**321**	**164**	**239**	**336**	**273**	**1292**	**830**	**2771**	**2761**	**1143**	**1658**
Percent														
	Cases	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**
25-34	22.4	28.3	9.3	9.3	3.7	3.7	10.5	8.3	54.1	50.5	100	100	35.4	41.2
35-49	34.4	58.2	10.7	14.7	4.3	4.9	15.0	11.5	35.7	10.6	100	100	49.3	77.9
50-64	11.1	26.4	7.1	11.2	20.9	41.2	9.2	11.2	51.7	10.0	100	100	39.1	78.8
Total	**25.7**	**39.8**	**9.6**	**11.6**	**5.9**	**8.7**	**12.1**	**9.9**	**46.6**	**30.1**	**100**	**100**	**41.2**	**60.1**

*A potentially screen-detected case is one in which cytology results are consistent with screen detection; there is no national record of whether the cytology was in response to screening or to symptoms

Table 18. Maximum interval between cytology tests (over the previous 8 years) among cases with FIGO stage 1B+ and their population controls

	Maximum Interval between cytology tests											
Age	**<3.5 yrs**		**3.5-4.75 yrs**		**4.75-5.5 yrs**		**5.5-7yrs**		**>7 yrs or no cytology**		**Total**	
	Cases	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**	**Cases**	**Controls**
28-34	124	470	156	341	82	152	79	194	338	373	779	1530
35-49	347	1429	295	817	113	272	166	306	797	547	1718	3371
50-64	116	490	148	621	149	471	74	210	626	365	1113	2157
Total	**587**	**2389**	**599**	**1779**	**344**	**895**	**319**	**710**	**1761**	**1285**	**3610**	**7058**
Percent												
28-34	15.9	30.7	20.0	22.3	10.5	9.9	10.1	12.7	43.4	24.4	100	100
35-49	20.2	42.4	17.2	24.2	6.6	8.1	9.7	9.1	46.4	16.2	100	100
50-64	10.4	22.7	13.3	28.8	13.4	21.8	6.6	9.7	56.2	16.9	100	100
Total	**16.3**	**33.8**	**16.6**	**25.2**	**9.5**	**12.7**	**8.8**	**10.1**	**48.8**	**18.2**	**100**	**100**

Table 19. Number and percentage of invasive cervical cancer cases in 2009-2013 audit with colposcopic appointment recorded, by QARC region

QARC region	Number of cases	Cases with a recorded colposcopy		Cases with an action code "suspend"		Cases with a "suspend" code >4 months before diagnosis		Cases with "Suspend" >4 months before diagnosis + colposcopy		Cases with "Suspend" >4 months before diagnosis + colposcopy (excluding colposcopy within 2 months of diagnosis)	
		n	%	n	%	n	%	n	%	n	%
East of England	824	484	58.7	558	67.7	141	17.1	100	70.9	64	45.4
East Midlands	867	276	31.8	600	69.2	162	18.7	77	47.5	41	25.3
London	865	409	47.3	615	71.1	175	20.2	108	61.7	59	33.7
North East	570	261	45.8	419	73.5	75	13.2	36	48.0	23	30.7
Yorkshire and the Humber	1025	547	53.4	750	73.2	184	18.0	122	66.3	77	41.8
North West	1120	522	46.6	795	71.0	247	22.1	135	54.7	84	34.0
South Central	650	390	60.0	457	70.3	98	15.1	79	80.6	55	56.1
South East Coast	651	392	60.2	463	71.1	114	17.5	82	71.9	61	53.5
South West	1009	649	64.3	653	64.7	173	17.1	143	82.7	97	56.1
West Midlands	1203	527	43.8	763	63.4	219	18.2	104	47.5	76	34.7
Total	**8784**	**4457**	**50.7**	**6073**	**69.1**	**1588**	**18.1**	**986**	**62.1**	**637**	**40.1**

Table 20. Original cytology result by review result[1]

Original result	Review Result																	
	Negative		Inadequate		Borderline		Low-grade (mild)		Low-grade (Mod)		High-grade (severe)		?Invasive		?Glandular		Total	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Negative	2,800	51.1	506	9.2	997	18.2	135	2.5	181	3.3	572	10.4	29	0.5	260	4.7	5,480	100
Inadequate	58	8.2	417	59.1	93	13.2	15	2.1	12	1.7	72	10.2	11	1.6	27	3.8	705	100
Borderline	22	2.3	10	1.0	424	43.4	69	7.1	64	6.6	234	24.0	20	2.0	134	13.7	977	100
Low-grade (mild)	4	1.1	1	0.3	35	9.5	152	41.3	78	21.2	88	23.9	5	1.4	5	1.4	368	100
High-grade (moderate)	1	0.2	0	0.0	6	1.5	4	1.0	138	33.9	229	56.3	19	4.7	10	2.5	407	100
High-grade (severe)	9	0.4	3	0.1	5	0.2	0	0.0	9	0.4	1,788	85.1	204	9.7	84	4.0	2,102	100
?Invasive	1	0.1	0	0.0	0	0.0	0	0.0	1	0.1	41	6.1	621	91.9	12	1.8	676	100
?Glandular	2	0.4	0	0.0	3	0.6	0	0.0	0	0.0	30	5.7	13	2.5	479	90.9	527	100
Total	2,897	25.8	937	8.3	1,563	13.9	375	3.3	483	4.3	3,054	27.2	922	8.2	1,011	9.0	11,242	100

[1] Updated version of Table 1 in Castanon et al[14]