LABORATORY ORGANISATION

A Guide for Laboratories Participating in the
NHS Cervical Screening Programme

NHSCSP Publication No 14
January 2003

First published by:

NHS Cancer Screening Programmes
The Manor House
260 Ecclesall Road South
Sheffield S11 9PS

Tel: 0114 271 1060
Fax: 0114 271 1089
Email: nhs.screening@sheffield-ha.nhs.uk
Web site: www.cancerscreening.nhs.uk

ISBN 1 871 997 59 3

Further copies of this publication are available from:

NHS Responseline
Tel: 08701 555 455
Fax: 01623 724 524
Email: doh@prolog.uk.com

Typeset by Prepress Projects Ltd, Perth (www.prepress-projects.co.uk)
Printed by Streamline Offset, Hoddesdon, Herts

CONTENTS

PREFACE

The purpose of this publication is to assist the managers of laboratories to make the best use of the resources at their disposal in order to improve productivity and reduce backlogs. It brings together existing guidance and makes new recommendations for laboratories working in the NHS Cervical Screening Programme. It includes examples of proven good practice and refers to the latest guidance on ergonomic and health and safety issues. In this way, it allows managers to examine the working practices in their laboratory and adapt the guidance in this publication to their own circumstances.

The new guidance and recommendations to be found in this publication are that:

- the recommended mode of rapid screening is the step technique at 60 seconds
- screeners can undertake cervical screening microscopy for at least 4 hours in a normal working day; current evidence suggests that this can be up to 5 hours in total, provided that the laboratory manager operates a system of continuous performance monitoring
- a complete break from microscopy work should be taken after no more than 2 hours at the microscope
- this break should be of 20 minutes' duration and ideally should be taken away from the screening room
- it is considered good practice that these time periods should apply to a 24-hour period
- the working environment should comply with the ergonomic standards recommended by the Medical Devices Agency (MDA).

MEMBERSHIP OF THE WORKING GROUP

Mr Peter Briggs (Chairman)	Consultant to the National Coordination Team, NHS Cancer Screening Programmes
Dr Paul Cross	Consultant Pathologist, Queen Elizabeth Hospital, Gateshead Chairman, National Laboratory Quality Assurance Group
Mr Nick Dudding	Manager, Northern & Yorkshire Cytology Training School
Mrs Eileen Hewer	Assistant Director of Cervical Screening Quality Assurance, Trent Region
Dr John Kershaw	Consultant Pathologist, Path Links, Lincoln County Hospital
Ms Sarah May	Head of Communications, Institute of Biomedical Science (Previously, Laboratory Manager and Head of Cellular Pathology, Farnborough Hospital)
Dr Peter Smith	Consultant Cytopathologist, Royal Liverpool University Hospital
Mrs Julietta Patnick	National Coordinator, NHS Cancer Screening Programmes
Mr Richard Winder	Deputy National Coordinator, NHS Cancer Screening Programmes

The working group would like to thank Professor Alastair Gale and his staff at the Applied Vision and Research Unit, University of Derby, for their involvement on the working time at the microscope and other ergonomic issues. The group would also like to thank the management and staff of the laboratories that participated in the studies which form part of the findings of this report. We also wish to thank Mrs Susan Gray for her editorial advice on the production of this report.

1. INTRODUCTION

1.1 Existing guidance

It is acknowledged by managers and ministers alike that there are problems with turn round times for cervical smears in many parts of the NHS Cervical Screening Programme (NHSCSP). These times often fall outside the four-week target for the time between the receipt of slides and the issue of reports. This project has sought to examine and address issues of organisation, smear throughput, staff scheduling and so on in order to assist laboratory managers in the day to day running of their services.

There are a number of factors which influence smear turn round times. Various pieces of work, either published or in progress, include guidance that is relevant to the operational arrangements in laboratories.

This work includes:

- *The Second Survey of Non-medical Laboratory Staff Working within the NHSCSP*[1]
- *Achievable Standards, Benchmarks for Reporting and Criteria for Evaluating Cervical Cytopathology*[2]
- *Guidelines for Clinical Practice and Programme Management*[3]
- *Minimum Ergonomic Working Standards for Personnel Engaged in the Preparation, Scanning and Reporting of Cervical Screening Slides*[4]
- *Ergonomic Working Standards for Personnel Engaged in the Preparation, Scanning and Reporting of Cervical Screening Slides*[5]
- *Recommended Code of Practice for Laboratories Providing a Cytopathology Service*.[6]

In addition, the examination of screener productivity and working patterns in a particular laboratory has led to further recommendations.

Ministers suggested that the application of industrial principles might be useful in investigating laboratory practice. This report has considered such approaches and at the same time, in liaison with clinical directors and laboratory managers on the working group, has identified areas of good practice.

1.2 Definition of terms

The following definitions are used throughout this guide and build on and develop the definitions in *Qualifications and Training for Non-medical Staff in the UK Cervical Screening Programme*.[7]

Cervical smear	A cervical smear is a sample of cells taken from the cervix and transferred to a glass slide.
Primary screening	An initial full screen of a conventional cervical smear.

Full screen		A systematic examination of the entire cervical smear, ie all the material on the slide using a minimum 100× magnification and overlapping sweeps.
Rapid screen	either	A re-examination of all cervical smears identified as negative or inadequate at primary screening, as part of the quality control process. This is also known as rapid review. In rapid review, smears are not fully screened.
	or	A rapid screen of all smears prior to a full primary screen. This is also known as rapid prescreening. In rapid prescreening, smears are not fully screened.
Double screen		The process of carrying out two full screens, the second full screen of the cervical smear being required by laboratory protocols.
Second screen		A second screen is always required if the primary screening was carried out by a member of staff in training or under supervision.
Checking		A second full screen of a cervical smear by a checker when the primary screening result was abnormal or indeterminate.The checker must either report the smear as negative or inadequate, or refer it for a final opinion.
Screener		A screener is a trained individual who is employed to undertake the primary screening, double screening and rapid screening of cervical smears. A screener may sign out and report negative or inadequate smears that have undergone primary screening and rapid screening. The qualifications required by the NHSCSP to work as a cytology screener are completion of the training programme for trainee cytology screeners and the NHSCSP Certificate in Cervical Cytology. A biomedical scientist who undertakes the same duties as a cytology screener may have a wider role in the laboratory both within and outside the NHSCSP.
Screening rate		The mean number of slides which are primary screened per hour by an individual screener or group of screeners when all other duties and breaks are excluded.
Screening throughput		The mean throughput of primary screened cervical slides from a laboratory calculated over any representative period of time, which must be specified and which includes all other NHSCSP duties and breaks. Throughput per hour is known as the rate per hour.

Rate per attendance hour worked for the NHSCSP	The mean number of slides primary screened per hour by an individual screener or group of screeners when all other NHSCSP duties are included.
Working period	The hours of attendance at work in a 24-hour day.

2. EXISTING GUIDANCE AND NEW RECOMMENDATIONS

2.1 Screening protocols

In the course of developing this guidance, a number of different screening protocols were found to be in operation in laboratories. In some instances, the words used to describe the protocols differed from laboratory to laboratory, but on closer analysis the protocols themselves were the same. The time taken to process a given batch of slides depends on the protocol used. The increase in time over that taken using the recommended protocol ranges from 0.8% to 71% (see section 3.3). Any possible sensitivity and specificity differences between protocols are not discussed in this report.

The protocols commonly found were described as:

- all smears are primary screened; all negative and inadequate smears are rapid reviewed. All smears considered to be potentially abnormal are then checked prior to reporting (the recommended NHSCSP protocol)
- primary screening and rapid review of all negative and inadequate slides and a full rescreen of suspect slides (the British Society of Clinical Cytology (BSCC) protocol)[6]
- primary screening (sometimes described as 'full screen') and rapid review of all slides and the partial rescreen of selected slides. In this instance, the laboratory would describe this partial rescreen as a check
- rapid prescreening and primary screening of all slides and checking (not defined) of selected slides
- primary screening and second full screen (double screening) of all slides
- primary screening and rapid review of negative and inadequate slides and two full rescreens of suspect slides
- primary screening and second full screen of suspect slides and rapid review of negative slides.

Current recommendations for screening protocols and screening practice are summarised in Table 1.

2.2 Screening frequency

The taking of smears outside the three or five yearly interval and the taking of additional smears will increase the workload of the laboratory. Therefore, it is important to ensure that such additional work is kept to the necessary minimum commensurate with the needs of the women and national screening protocols.

The recommendations for screening frequency are shown in Table 2.

Table 1 Recommendations for screening protocols

Protocol or practice	Guidance	Source(s)
Screening protocol	The recommended protocol is:	Reference 2
	All smears are primary screened; all negative and inadequate smears are rapid reviewed. All smears considered to be potentially abnormal are then checked prior to reporting	
Efficiency of rapid screening	The recommended mode of rapid screening is the step technique at 60 seconds	Reference 8
	The rapid screening workload for an individual screener should be limited to a maximum of 50 slides in any working day	
	Rapid review of all smears initially reported as non-positive (ie negative or inadequate) is a more effective and a more cost-effective quality control measure than full rescreening of a 10% random sample	Reference 9
Selective double screening	There is no evidence to demonstrate that selective double screening is any more effective in preventing false negatives than rapid review	Reference 2
	(With reference to selected rescreening) 'as no significant difference is detected when re-screening selected "high risk" patients, the need to continue this practice is questioned'	Reference 10

Table 2 Recommendations for screening frequency

Protocol or practice	Guidance	Source(s)
Screening interval	In practice, the screening interval between screening smears in the UK is approximately four years; it is strongly recommended that the recall invitations be issued no sooner than three years and no later than four and half years after a previous routine negative smear	Reference 3
Unscheduled smear taking	Opportunistic screening and taking smears from women under the age of 20 can increase workload by 6.7% and 3.6% respectively	Reference 11
Additional smears within the screening interval	Provided the woman is in the age group to be screened and has had a smear within the previous three to five years, additional smears are not justified in any of the following situations:	Reference 12 See also reference 13
	• on taking or starting to take an oral contraceptive	Reference 3
	• on the insertion of an intrauterine contraceptive device (IUCD)	
	• on taking or starting to take hormone replacement therapy (HRT)	
	• in association with pregnancy – neither antenatally nor postnatally, nor after termination	
	• in women with genital warts	
	• in women with vaginal discharge	
	• in women with infection	
	• in women who have had multiple sexual partners	
	• in women who are heavy cigarette smokers	
	Annual screening is not therefore recommended at present beyond the initial five years of negative follow-up of previous abnormalities	
Screening interval after treatment	Studies are taking place to determine whether annual screening is more effective in preventing invasive cervical cancer in women treated for high grade CIN and CGIN than screening three yearly after five years of negative follow-up	National colposcopy QA group
	After treatment of CIN2 and CIN3, smears should be repeated annually for five years before the woman is returned to normal recall. Two smears should be taken in the first year	Reference 2

2.3 Number of slides

2.3.1 Slides per smear

In the same way that additional smears increase workload, so does the practice of using more than one slide per smear. One slide per woman per test is routine for the NHSCSP and it should rarely be necessary to submit two slides.

The mean percentage of smears that present as dual samples (two slides) is 3.2%, the range is 0.13%–12.6% (based on an ad hoc survey of laboratories in one region).

2.3.2 Smear taking

Samples should usually be taken using the extended tip spatula. Cervex type samplers are acceptable and are equivalent to extended tip spatulas.

If a smear taker is using an endocervical brush, it should only be used in conjunction with a spatula and should only be considered:[12]

- where there is difficulty in inserting the spatula into the external os
- when a woman is being followed up for previous borderline nuclear changes in endocervical cells
- for follow-up of a previously treated endocervical glandular abnormality (usually CGIN when the woman has not had a hysterectomy or radiotherapy) when the previous smear was judged inadequate because of the absence of endocervical cells (ie when an endocervical abnormality is being followed up).

2.4 Working period

2.4.1 Introduction

In 1997, the BSCC recognised the problem for cytology screeners of maintaining performance over a period of time.[6] It described the need for vigilance as 'a state of readiness to detect and respond to certain specific small changes occurring at random intervals' and went on to say that the laboratory day should be organised such that a decrease in this vigilance (vigilance decrement) is minimised.

Ongoing experimental studies[14,15] of cervical cytology microscopy have confirmed that extended daily time at the microscope can result in a decrease of visual competence and an increase in fatigue and discomfort on the part of the screener. These latest studies have shown that:

- screening is an intensive visual task that produces self reports of fatigue in both visual and other muscle groups; these reports increase with overall time spent screening
- regular breaks can positively affect subsequent self reports of fatigue
- the rate of screening slides decreases with time on task, although breaks can affect this positively.

Further evidence[16] suggests that 'If, as seems likely, fatigue, low arousal and divided attention are major causes of false negative cytology, then it

is perhaps remiss of our profession not to specifically address these. We should investigate whether the task of screening can be better structured to maintain sufficient arousal in on-task mental activity. Meanwhile, individual screeners can better structure their own work, such as taking breaks including physical activity, setting up the workstation so you have to reach for things, adding complexity to the task, e.g. by recording comments, and can choose appropriate secondary arousal activities … .'

2.4.2 Hours of work

In order to create a safe working period and to optimise the performance of cytology screeners, current evidence from the relevant studies indicates that working arrangements and hours of work should take account of the following:

- screeners can be safely and effectively utilised on cervical cytology microscopy for 4 hours in a normal working day. Current evidence suggests that this can be up to 5 hours in total, provided that the laboratory manager operates a system of continuous performance monitoring
- the working day should be organised such that a break in continuous screening should be of at least 20 minutes' duration and ideally should be taken away from the screening room
- this break should be taken after no more than 2 hours at the microscope
- regular micro-breaks of several seconds should be taken every 10–15 minutes
- the other duties required of screeners can act as breaks from microscopy (see below).

Non-microscope duties both within and outside the screening programme may account for additional hours worked per day.

A review of staffing and working practices in one laboratory suggests that a working day of 5–6 hours would allow for up to 4 hours of primary screening, rapid screening, natural breaks and other duties to be carried out (see section 3.1).

Based on the available evidence that fatigue and discomfort increase over time, it is considered good practice that the above time periods should apply to a 24-hour period.

Managers must be vigilant in their application of these working arrangements and in the monitoring of individual and laboratory performance. Managers should also be alert to the ergonomic aspects of microscopy work and to screener self reports of fatigue.

2.4.3 Health and safety regulations

The *Health and Safety (Display Screen Equipment) Regulations (1992)*[17] came into force in the UK on 1 January 1993. Although relating to work at a visual display unit (VDU), these regulations are pertinent to work in screening laboratories.

Although they do not specifically state a maximum number of hours of work nor the exact nature and timing of breaks, the regulations do include important guidance on breaks and the organisation of work:

- breaks should be taken before the onset of fatigue
- breaks (or changes of activity) should be included in working time
- breaks, where possible, should be taken away from the screen
- informal breaks (ie doing other work tasks) can be more effective in relieving visual fatigue than formal rests
- short, frequent breaks are more satisfactory than longer occasional ones.

Breaks can be described in a number of ways and a useful classification is:[4]

- micro-breaks of about 15 seconds every 10–15 minutes
- mini-breaks of 1–2 minutes approximately every 30 minutes
- maxi-breaks of 15–20 minutes every 2 hours.

The other duties required of screeners can be incorporated into the working period so that they act as breaks from microscopy. In practice, most laboratories adopt working patterns that introduce non-microscope activities into the working period for screening.

The organisation of working patterns within the laboratory must vary the duties of screeners and adhere to the recommended breaks in all their forms.

Further information on breaks can be found in Appendix 1.

2.5 Ergonomic standards

'Scanning of slides for the identification of precancerous changes of the uterine cervix is amongst the most difficult of diagnostic tasks as it requires the continual undivided attention of the screener. The task becomes even more difficult if the screener is fatigued or distracted giving rise to the consequent risk of errors.'

This quote is from the Medical Devices Agency report MDA/97/31.[4] The work was commissioned and facilitated by the NHSCSP and is currently being updated and will be published as Medical Devices Agency standards document 02104.[5] It contains standards which must be adhered to in order to meet minimum requirements and those which it is recommended should be adhered to in order to establish an efficient and effective working environment. The working environment should therefore comply with MDA 02104, the relevant sections of which are shown in Table 3.

Table 3 Aspects of screening work in MDA 02104

Aspect of screening work	Section(s) in MDA 02104	Appendix in MDA 02104
Posture	2	17.2
Screening workstation furniture	6.1, 6.2 and 6.3	17.3
Screening work microscope	6.4	17.4
Screening workstation computer	2.1.2 and 7.4	
Environmental conditions	8.1, 8.2, 8.3 and 8.4	
Lighting	8.6	
Noise	8.7	
Flooring	9	
Hygiene facilities	10	
Waste facilities	11	
Protective equipment	12	
Storage	13	
Relaxation facilities	14	

2.6 Rates of working

2.6.1 Introduction

We know that the rate of working of screeners varies hour by hour, screener by screener and slide by slide. This variation is to be expected as the complexity of the slides being examined varies and the performance of the screener changes over time. The other duties expected of screeners will also determine how many slides are screened over a given period as will the recommendation requiring that screeners examine a minimum of 3000 slides per annum for skill maintenance.

This section brings together up to date information regarding the number of slides processed by screeners. It provides for managers of laboratories rates of working that are clearly defined, that have been derived from a range of studies and have been proven in practice.

2.6.2 Defining the terms

Before recommending rates of working that would be of use to managers of laboratories, it is important to differentiate between two different rates and to define them:

1. The mean time that a screener takes to primary screen a slide, ie the time examining the slide down the microscope. We define the **screening rate** as the rate at which slides are primary screened when all other duties and breaks are **excluded.**

   The BSCC's recommendation of eight slides per hour is a reasonable expectation for this rate.[6]
2. The rate of working expressed as the number of slides per hour at work for the NHSCSP. We define the **rate per attendance hour** as the rate for primary screening when all other duties and breaks are **included**.

   There are two sources of evidence for the rate per attendance hour: the laboratory workforce survey[1] and a case study based on the actual findings of a laboratory.

From the workforce survey, it is possible to calculate for each laboratory the mean number of slides that are primary screened per hour allocated to the NHSCSP. The range is large, but when obvious outliers are excluded and the data aggregated on a regional basis the range becomes 4.55–5.62 slides per attendance hour, with a mean of 5.16 slides per hour. This suggests that a figure of five slides per attendance hour would be useful in terms of managing a laboratory.

Section 3.1 describes the findings of a particular laboratory with regard to the rate per attendance hour. The laboratory found that five primary screens per screener attendance hour were achieved on a consistent basis as a measure of screening throughput for the laboratory as a whole.

In addition, a recent Italian study[18] concluded that 'a reasonable cytoscreener workload would range from six slides per hour to four slides per hour.' The authors conclude 'that professional attention must be given to determine appropriate workloads in order to minimise suboptimal performance and improve the cost effectiveness of laboratory activities.'

These results lead to the recommendations on screener output shown in Table 4.

Laboratory managers and quality assurance (QA) directors may find it useful to look at variations in screening rates between laboratories as a basis for questioning the practices and organisation of some laboratories, for example:

- why does one laboratory process more or fewer slides than another?
- are there elements of good practice that can be used elsewhere?
- are there elements of bad or outdated practice that should be changed?

The workforce survey[1] shows no statistically significant link between the size of the laboratory, as measured by the number of slides primary screened per annum, and the rate of slides screened per attendance hour.

Table 4 Recommendations for rates of working

Protocol or practice	Guidance	Source
Slides screened per attendance hour for the NHSCSP	Five slides per hour	This publication
Primary screening rate	Eight slides per hour	Reference 6
Minimum number of slides per annum	A reasonable minimum target for skill maintenance would be 3000 slides per annum	Reference 19
	The number of screening programme slides processed/reviewed annually by each individual screener, whether part time or not, must be greater than 3000 slides	Reference 20

2.7 Non-microscope duties

It is recognised that other duties are required of screeners. These include quality assurance and quality control procedures and duties such as receipt of specimens, slide preparation and data entry.[7]

Other tasks may include, for example, the validation of reports, review of cases sent for checking and weekly slide meetings. Allowance should also be made for time spent assisting trainees and attending update courses. Planning of working time for staff should also take into account other occasional interruptions in the working day, such as fire practices. Essential natural breaks should not be forgotten: the recommended personal allowance is 7% for female employees and 4% for male employees (*Introduction to Work Study*[21] and other publications on work measurement).

2.8 Allowances for leave

Allowance must be made for absences for annual leave and sick leave in any calculation of staffing levels and working periods. Estimates are shown in Table 5.

Table 5 Estimates of allowances for absences

Absence	Estimates	Comment
Holidays	20 days on commencement of employment, rising to 23 days after five years and 25 days after ten years	Dependent upon grade and length of service
Bank holidays	8–10 days per annum	Dependent on local policy
Sickness	9 days per annum	Based on an actual sickness rate of 3.39% for one large NHS Trust
Total expected absences	37–44 days per annum	

From this we can expect a working year to be:

365 days – 104 weekend days = 261 gross available days – 37 to 44 days absent = 224 to 217 net available days

For calculation purposes in this report, this is rounded to 220 days or 44 weeks.

2.9 Summary

2.9.1 Screening protocol

The recommended screening protocol is that all smears are primary screened. All negative and inadequate smears are rapid reviewed and, of these, all smears considered to be potentially abnormal are then checked prior to reporting.

There is no evidence that selective double screening is any more effective in preventing false negatives than rapid review. Therefore, the practice of selective double screening cannot be recommended.

The recommended mode of rapid screening is the step technique at 60 seconds.

The rapid screening workload for an individual screener should be limited to a maximum of 50 slides in any working day.

Rapid review of all smears initially reported as non-positive (ie negative or inadequate) is a more effective and a more cost-effective quality control measure than full rescreening of a 10% random sample.

In rapid screening, smears should not be fully screened.

2.9.2 Frequency of screening and screening intervals

It is recommended that the recall invitations be issued no sooner than three years and no later than four and a half years after a previous routine negative smear.

At present, annual screening is not recommended beyond the initial five years' negative follow-up of previous abnormalities.

2.9.3 Workload

Number of slides
One slide per woman per test is normal, and it should rarely be necessary to use two slides if a single sampling device is used.

Method of smear taking
Samples should usually be taken using the extended tip spatula. Cervex type samplers are acceptable and are equivalent to extended tip spatulas. An endocervical brush should only be used in specific circumstances, and then only in conjunction with a spatula.

2.9.4 Rates of working and screener output

The recommended screening rate at which slides are primary screened when all other duties and breaks are excluded is eight slides per hour.

The recommended screening rate per attendance hour (the rate at which slides are primary screened per attendance hour for the NHSCSP when all other duties and breaks are included) is a mean of five slides per hour.

The number of screening programme slides processed or reviewed annually by each individual primary screener, whether part time or not, must be greater than 3000 slides for skill maintenance.

2.9.5 Working period

The working period is the hours of attendance at work in a 24-hour day.

Screeners can be safely and effectively utilised on cervical cytology microscopy for 4 hours in a normal working day. Current evidence suggests that this can be up to 5 hours in total, provided that the laboratory manager operates a system of continuous performance monitoring.

A break in continuous screening of at least 20 minutes should be taken after no more than 2 hours at the microscope and ideally should be taken away from the screening room.

Duties both inside and outside the screening programme may account for additional hours worked per day.

2.9.6 Working year and allowances for leave

Allowance must be made for annual and sick leave in any calculation of staffing levels and working periods.

2.9.7 Breaks and non-microscope duties

Activities should be planned to allow breaks from microscopy. These breaks can take a number of forms and other duties can constitute a break.

A number of non-microscope activities are essential to the screening process and allowances should be made for these.

2.9.8 Ergonomic standards

The working environment should comply with the standards contained in MDA 02104.

3. APPLYING THE GUIDANCE

3.1 Laboratory staffing study and working patterns in a 5.5-hour period

This study describes the methods used by one laboratory to determine the number of screeners required to undertake a given screening workload.

3.1.1 Background

The unplanned loss of a significant number of screeners over a short period of time necessitated an urgent review of staffing. The aims of the review were:

- to produce a rational, efficient and acceptable staffing plan
- to develop a robust system of costing to support bids to ensure a suitable staff establishment.

It was recognised that a laboratory undertaking cervical cytology screening within the NHSCSP is a complex organisation. There are many tasks to be undertaken. Some of these can be observed and measured. Others are difficult to quantify and can only be estimated. It was decided to analyse staffing based upon primary screening and the tasks closely related to it. The number of supervisory staff is mainly related to the number of screeners and the number of trainees within the laboratory. The study therefore concentrated on determining the number of screeners required for the primary screening of cervical smears and how best they should be deployed. The rationale for this approach was based on the fact that, although all of the other tasks required of a screener are carried out (internal and external quality assessment schemes, educational activities and the regular routine laboratory tasks), the laboratory achieves the standards set by the NHSCSP within acceptable ranges.

3.1.2 Scope of the review

It is common practice in the NHSCSP for screeners to undertake various other duties in addition to primary screening. These include regular routine tasks such as slide preparation, computer data entry and slide filing. In the laboratory in question, screeners undertake rapid review. They are also required to participate in external quality assessment (EQA) exercises and continuous professional development (CPD). An analysis of the time spent on all of the activities undertaken by this group of staff would have been difficult and of dubious value.

It was decided, therefore, to base the study on data which could be measured easily, namely the average number of primary screened smears passing through the laboratory per unit of time. An achievable and sustainable figure for the productivity of an individual screener could be derived from this.

3.1.3 Rates of working

Individual screeners work at different rates, and screening rates of an individual screener vary from day to day. Observations in this laboratory showed that, despite these variations, there was a consistent relationship between the laboratory throughput of primary smears per week and the number of hours of primary screening undertaken during that time.

The laboratory in question consistently achieved a rate of five primary screened slides per attendance hour allocated to the NHSCSP. In this laboratory, screeners have time allocated for primary screening each working day. Most, but not all, of that time is spent on primary screening. Some time is spent on other tasks. The proportions vary from day to day and from screener to screener. The rate of primary screening slides by screeners while they are actually sitting at the microscope is usually higher than five smears per hour but varies considerably. The average laboratory throughput of five primary screens per screener hour varies only slightly.

3.1.4 Staffing plan

The staffing plan for screeners had to recognise other factors or constraints and was based on the following:

1. the average primary screening rate per screener attendance hour for the laboratory
2. the number of screening hours allowed per day
3. the required minimum number of primary screened slides per screener per year, as required by the NHSCSP for skill maintenance
4. the number of smears received by the laboratory per year
5. the average number of weeks worked per screener per year in this laboratory.

3.1.5 Working period

New members of staff have been employed on a working pattern in which 4 hours of the working period is allocated to primary screening. Most, but not all, of this time is spent on primary screening. The screener also undertakes other regular duties. Occasionally, no screening is performed during this period. Activities such as EQA and training sessions are undertaken instead.

The daily working pattern includes time when the screener undertakes rapid review. Screeners usually review a similar number of slides, but not the same slides, during this period as they would primary screen in 4 hours. This ensures a smooth workflow through the laboratory. The basic daily working period for new staff is 5 hours, to which a further half-hour is added to accommodate rest breaks. Existing members of staff are gradually moving to this 5.5-hour daily working pattern. The laboratory has found this to be an efficient pattern of work.

This approach enabled the laboratory to develop an understandable and evidence based staffing plan, and to have factual and productive discussions on resource issues. The daily working pattern allows for a sufficient degree of flexibility so that working arrangements can be tailored to the requirements of individual screeners. It is appreciated that this pattern may not be universally applicable because not all laboratories will follow this pattern of primary screening and rapid rescreening.

The calculation of the laboratory staffing requirements for cytology screening for this laboratory is therefore:

5 hours in attendance for the NHSCSP at five slides per attendance hour

Output per screener per day = 25 slides

Number of screening days per annum = Number of days worked per week × number of weeks worked per annum = 5 × 44 = 220

Maximum number of slides screened per screener per year = 25 × 220 = 5500

Minimum number of screeners required = Laboratory annual workload/5500

Maximum number of screeners allowed = Laboratory annual workload/3000*

*The minimum number of slides per screener per annum for skill maintenance.

3.1.6 An illustration of the working patterns in the 5.5-hour period

Please refer to Figure 1. Microscopy activities are shown in shaded cells and other activities are shown in open cells. In this example, the activity 'case review' is not a microscope activity.

It should be noted that many laboratories prefer to undertake rapid screening activity at the start of the working day.

<table>
<tr><th>From/to</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th></tr>
<tr><td>08.00</td><td rowspan="7">Primary screen</td><td rowspan="2">Preparation</td><td rowspan="3">Primary screen</td><td>Preparation</td><td rowspan="2">Booking out</td></tr>
<tr><td>08.15</td><td rowspan="2">Primary screen</td></tr>
<tr><td>08.30</td><td rowspan="6">Primary screen</td></tr>
<tr><td>08.45</td><td>Booking out</td><td rowspan="2">Booking out</td><td rowspan="6">Primary screen</td></tr>
<tr><td>09.00</td><td rowspan="5">Primary screen</td></tr>
<tr><td>09.15</td><td rowspan="3">Primary screen</td></tr>
<tr><td>09.30</td><td rowspan="2">Preparation and histories</td></tr>
<tr><td>09.45</td></tr>
<tr><td>10.00</td><td rowspan="2">Primary screen</td><td rowspan="4">Primary screen</td></tr>
<tr><td>10.15</td></tr>
<tr><td>10.30</td><td rowspan="2">Break</td><td rowspan="2">Break</td><td rowspan="2">Break</td></tr>
<tr><td>10.45</td><td rowspan="2">Break</td><td>Break</td></tr>
<tr><td>11.00</td><td rowspan="4">Primary screen</td><td rowspan="2">Primary screen</td><td rowspan="6">Case review</td><td rowspan="4">Primary screen</td></tr>
<tr><td>11.15</td></tr>
<tr><td>11.30</td><td>Queries</td><td rowspan="3">Primary screen</td></tr>
<tr><td>11.45</td><td>Booking out</td></tr>
<tr><td>12.00</td><td rowspan="4">Rapid review</td><td>Case review</td><td>Preparation</td></tr>
<tr><td>12.15</td><td rowspan="2">Rapid review</td><td rowspan="5">Rapid review</td><td rowspan="3">Preparation</td></tr>
<tr><td>12.30</td></tr>
<tr><td>12.45</td><td>Case review</td><td rowspan="3">Rapid review</td></tr>
<tr><td>13.00</td><td rowspan="2">Preparation and histories</td><td rowspan="2">Booking out</td><td rowspan="3">Rapid review</td></tr>
<tr><td>13.15</td></tr>
<tr><td>13.30</td><td>End</td><td>End</td><td>End</td><td>End</td><td>End</td></tr>
</table>

Figure 1 An illustration of the working patterns in the 5.5-hour period.

3.1.7 A comparison of activities with the guidance

The analysis in Figure 2 compares the activities described above with the guidance in this report. It can be seen that, apart from the short break on Friday, it conforms in every respect.

Activity	Guidance	Monday	Tuesday	Wednesday	Thursday	Friday	Week
Number of slides primary screened		32	27	28	27	27	141
Hours spent primary screening		3.00	2.50	2.25	2.50	3.25	13.50
Primary screening rate	Eight slides per hour is a reasonable expectation for this rate	10.67	10.80	12.44	10.80	8.31	10.44
Rate per attendance hour (NHSCSP hours=5.5 per day)	A mean rate is five slides per hour	5.82	4.91	5.09	4.91	4.91	5.13
Total hours of microscopy	Must be no more than 4 hours per day	4.00	3.00	3.00	3.75	3.75	
Maximum hours of microscopy without break or change of duties	No more than 2 hours should be spent at the microscope without a break	2.00	2.00	1.50	1.25	2.00	
Length of break (minutes)	A break of at least 20 minutes should be taken after no more than 2 hours at the microscope	30	30	30	30	15	

Figure 2 A comparison of activities with the guidance.

3.2 Workload implications of different screening protocols

The models below show the staff hours required to primary screen and rescreen a given laboratory workload depending on the protocol used.

For the purposes of comparison, the assumptions shown below are used. It is accepted that these will vary from laboratory to laboratory. The number of slides referred for checking will vary between individual screeners and between laboratories. It is recognised that in practice this may be in excess of the figure used as an example of equivocal slides in the following protocols.

The assumptions used in the models are:

- Workload = 100 slides per day (equating to a workload of 22 000 slides over a working year of 220 days)

  of which

  83% are negative*
  17% are non-negative*

  of which

  9% are inadequate*
  8% are abnormal*

  Although 5% of the workload is carried out by trainees† the effect of this will be constant throughout all protocols and is therefore excluded from the calculations in each case

- Time to screen

  Primary screen = five slides per hour (12 minutes per slide)

  Rapid rescreening (rapid review and rapid prescreening) = 41.4 slides per hour (1.45 minutes per slide)‡

  Checking = five slides per hour (12 minutes per slide), assuming that the check is a second full screen

- Further assumptions are made within the models where necessary

The different protocols found to be in use in the NHSCSP are described below.

*Taken from *Cervical Screening Programme 1998–99*, Table 10.[22] Local performance may vary from these means.

†Survey of non-medical staff within the NHSCSP.[1]

‡Taken from a work study survey.[23]

Protocol 1 The recommended protocol

All smears are primary screened; all negative and inadequate smears are rapid reviewed, and of these all deemed suspect are then checked.

Throughput of 100 slides

For every 100 slides	Slides	×	Minutes per slide	=	Total minutes
100 are primary screened	100		12.00		1200.00
Of these, 83 (83%) are negative and will go to rapid review	83		1.45		120.35
and nine (9%) are inadequate and will go to rapid review	9		1.45		13.05
The remaining eight (8%) are abnormal and will be rescreened and passed to a pathologist for reporting	8		12.00		96.00
After rapid review, 1%* of total slides show a discrepancy between the review and the primary screen and therefore require a further full screen	1		12.00		12.00
Furthermore, 2%* of the slides at primary screening will be equivocal and therefore require a further full screen by a checker (2% of 92 slides = 1.84 slides) (say two slides)	2		12.00		24.00
	Total staff minutes			=	1465.40
	Total staff hours			=	24.42

*These assumptions are based on experience in one laboratory.

Protocol 2 Rapid review of all slides

Primary screening (sometimes described as 'full screen') and rapid review of all slides and the partial rescreen of selected slides. In this instance, the laboratory would describe this partial rescreen as a check. This protocol shows a 0.8% increase in time for 100 slides above that of the recommended protocol.

Throughput of 100 slides

For every 100 slides	Slides	×	Minutes per slide	=	Total minutes
100 are primary screened	100		12.00		1200.00
100 are rapid reviewed	100		1.45		145.00
Of these, eight (8%) are abnormal and will be rescreened (checked) and passed to a pathologist for reporting	8		12.00		96.00
After rapid review, 1%* of total slides show a discrepancy between the review and the primary screen and therefore require a further full screen	1		12.00		12.00
Furthermore, 2%* of the slides at primary screening will be equivocal and therefore require a further full screen by a checker (2% of 92 slides = 1.84 slides) (say two slides)	2		12.00		24.00
		Total staff minutes		=	1477.00
		Total staff hours		=	24.62

Percentage increase on recommended protocol = 0.8%

*These assumptions are based on experience in one laboratory.

Protocol 3 Rapid prescreening

Rapid prescreening and primary screening of all slides and checking (not defined) of selected slides. A 0.8% increase in time for 100 slides is shown.

Throughput of 100 slides

For every 100 slides	Slides ×	Minutes per slide =	Total minutes
100 are rapid prescreened	100	1.45	145.00
100 will be primary screened	100	12.00	1200.00
Of which, 92 (92%) are negative and therefore require no further screening and one (1%) shows a discrepancy between the prescreen and the full screen and will require a further full screen	1	12.00	12.00
Of these, eight (8%) are abnormal and will be rescreened (checked) and passed to a pathologist for reporting	8	12.00	96.00
Furthermore, 2%* of the slides at primary screening will be equivocal and therefore require a further full screen by a checker (2% of 92 slides = 1.84 slides) (say two slides)	2	12.00	24.00
		Total staff minutes =	1477.00
		Total staff hours =	24.62

Percentage increase on recommended protocol = 0.8%

*This assumption is based on experience in one laboratory.

Protocol 4 Double screening

Primary screening of all slides and second full screen (double screening) of all slides. An increase in time of 71.2% is shown for 100 slides.

Throughput of 100 slides

For every 100 slides	Slides ×	Minutes per slide =	Total minutes
100 are primary screened	100	12.00	1200.00
100 are given second primary (full) screen	100	12.00	1200.00
One (1%*) shows a discrepancy between the first and second full screen and requires a further full screen	1	12.00	12.00
Of these, eight (8%) are abnormal and will be rescreened (checked) and passed to a pathologist for reporting	8	12.00	96.00
		Total staff minutes =	2508.00
		Total staff hours =	41.80

Percentage increase on recommended protocol = 71.2%

*This assumption is based on experience in one laboratory.

Protocol 5 Second full screen of suspect and inadequate slides

Primary screening of all slides, rapid review of negative slides and second full screen of suspect and inadequate slides. A 6.5% increase in time for 100 slides is shown.

Throughput of 100 slides

For every 100 slides	Slides ×	Minutes per slide =	Total minutes
100 are primary screened	100	12.00	1200.00
Eighty-three negative slides (83%) are rapid reviewed	83	1.45	120.35
Seventeen inadequate and abnormal slides (17%) are rescreened (checked) and passed to a pathologist for reporting	17	12.00	204.00
After rapid review, one slide (1%*) shows a discrepancy between the review and the primary screen and therefore require a further full screen	1	12.00	12.00
Furthermore, 2%* of the slides at primary screening will be equivocal and therefore require a further full screen by a checker (2% of 92 slides = 1.84 slides) (say two slides)	2	12.00	24.00
	Total staff minutes	=	1560.35
	Total staff hours	=	26.00

Percentage increase on recommended protocol = 6.5%

*These assumptions are based on experience in one laboratory.

APPENDIX 1: FURTHER INFORMATION ON BREAKS

The following are taken from a number of sources and provide additional information about breaks in working activity.

A worker is entitled to an uninterrupted break of 20 minutes when daily working time is more than 6 hours. It should be a break in working time and should not be taken either at the start or end of a working day.

Work breaks are essential in order to ensure that a screener's mental, visual and physical ability are not affected significantly by the duration of time spent on that task. If work breaks are not taken regularly and screeners continue to work, they will gradually become fatigued, both mentally and physically. Muscular and visual discomfort will develop and concentration may lapse.

Short breaks must be built into the work pattern to prevent this visual strain, fatigue and muscular discomfort. These breaks do not necessarily need to be taken as a complete break from work but can be taken as changes in duties.

Breaks can be in three forms: a complete rest from work, a change in work task and a 'micro' break.

- *Complete break from work* – cessation of work, such as for coffee breaks, enables the screener to take a complete break from imposed activities. It is an opportunity to relax both mentally and physically and to move around, so dispelling any muscular tension in the body.
- *Changes in task* – changes in task require the screener to keep working but also to change their position or posture, so relaxing and stretching muscles. These breaks are intended to incorporate a change in the intensity of concentration required for the work task and to give the screener some change of visual focus.
- *Micro-breaks* – micro-breaks are when the screener shifts their position or posture briefly. This constitutes small but important changes in work posture that relax and stretch the muscles and give the screener time to rest before continuing work. These can be taken at the workplace and do not necessarily disrupt the screener's flow of work. Screeners should be encouraged to take these micro-breaks approximately every 15 minutes.

Examples of micro-breaks are:

- rotating the neck to help to ease the neck muscles
- looking away from work to relax the eyes
- arching the back to help stretch the back muscles and adjust the posture, which may have slumped into the chair

- shrugging the shoulders to help release any tension building up in the neck and shoulders
- relaxing the arms to the side and letting the shoulders fall to release any tension
- stretching the legs out to relax the muscles
- stretching the arms to release tension in the arms, neck, shoulders and back
- closing the eyes or looking at a distant object for a few seconds will help if eyes feel tired.

REFERENCES

1. *The Second Survey of Non-medical Laboratory Staff Working within the NHSCSP*. NHS Cancer Screening Programmes, 1999 (unpublished report).
2. *Achievable Standards, Benchmarks for Reporting and Criteria for Evaluating Cervical Cytopathology*, 2nd edn. NHS Cancer Screening Programmes, 2000 (NHSCSP Publication No 1).
3. Duncan ID (ed). *Guidelines for Clinical Practice and Programme Management*. NHS Cancer Screening Programmes, 1998 (NHSCSP Publication No 8).
4. *Minimum Ergonomic Working Standards for Personnel Engaged in the Preparation, Scanning and Reporting of Cervical Screening Slides*. Medical Devices Agency, 1997 (MDA Evaluation Report MDA/97/31 and addendum MDA/97/31S).
5. *Ergonomic Working Standards for Personnel Engaged in the Preparation, Scanning and Reporting of Cervical Screening Slides*. Medical Devices Agency (MDA 02104) (in preparation and will supersede MDA/97/31 above).
6. *Recommended Code of Practice for Laboratories Providing a Cytopathology Service*, revised edition. British Society of Clinical Cytology, 1997.
7. *Qualifications and Training for Non-medical Staff in the UK Cervical Screening Programme*. NHS Cancer Screening Programmes, 2000 (NHSCSP Publication No 12).
8. Dudding N, Hewer E, Lancucki L. Rapid screening: a comparative study. *Cytopathology* 2001; 12: 235–248.
9. Arbyn M, Schenck U. Detection of false negative Pap smears by rapid reviewing. *Acta Cytologica* 2000; 44: 949–957.
10. Baker A, Melchar D, Smith R. Role of re-screening of cervical smears in internal quality control. *Journal of Clinical Pathology* 1995; 48: 1002–1004.
11. *The Performance of the Cervical Screening Programme in England*. National Audit Office, 1998.
12. *Resource Pack for the Training of Smear Takers*. NHS Cervical Screening Programme, 1998 (NHSCSP Publication No 9).
13. Woodman CBB, Richardson J, Spence M. Why do we continue to take unnecessary smears? *British Journal of General Practice* 1997; 47: 645–646.
14. *Cervical Screeners and their Working Hours*. Applied Vision and Research Unit, University of Derby, 1999 (unpublished report).
15. *Working Hours – Effect on Quantity of Work, Visual Performance and Fatigue*. Applied Vision and Research Unit, University of Derby, 2000 (unpublished report).
16. Bowditch R. False negative cytology due to the failure to identify abnormal microscopic appearances. *SCAN* 1998; 9: 17–18.
17. *Health and Safety (Display Screen Equipment) Regulations (1992)*. Health and Safety Executive, 1992.
18. Andrion A, Dalla Palma P. The cervico-vaginal cytology workload. A complex task in planning. *Pathologica* 2000; 92: 177–184.
19. *Report of the Working Party on Internal Quality Control*. The Scottish Office, 1995.
20. *Quality Assurance Guidelines for the Cervical Screening Programme*. NHS Cervical Screening Programme, 1996 (NHSCSP Publication No 3).
21. *Introduction to Work Study*, 3rd edn. International Labour Office, 1979.
22. *Cervical Screening Programme*. Department of Health Statistical Bulletin, 1998–99.
23. *Cytology Workflow Study*. Argent Consulting Services, 1999.