

**AUDIT OF PHYSICS
SERVICES TO THE
NHSBSP IN 2003**

**NHSBSP Equipment Report 0404
July 2004**

Enquiries

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1. INTRODUCTION

Purpose	The purpose of this audit is to monitor the provision of physics services to the NHSBSP on behalf of the National Coordinating Group for Breast Screening Physics. The audit checks whether physics services are complying with the standards defined in the <i>Quality Assurance Guidelines for Medical Physics Services</i> (NHSBSP Publication Number 33) ¹ . The audit also checks for organisational changes in service provision.
Method	This report has been produced by Dr J M Oduko and Dr K C Young of the National Co-ordinating Centre for the Physics of Mammography (NCCPM), and is an update of a previous audit conducted on behalf of the National Physics Group in 2000 ² . The audit was carried out by sending a questionnaire to each of the physics services working for the NHSBSP in July 2003, and these were returned to NCCPM. The audit returns are maintained on a database at NCCPM for future reference. Each of the physics services is identified by a physics service code on the graphs and tables in this report. Each service has been informed of its own code, and regional QA physicists are aware of the codes in their region. It is currently planned to repeat this audit procedure every 2 years.
Layout	For convenience the subject headings in the <i>QA Guidelines</i> (NHSBSP Publication 33) are used in section 2 to summarise the broad conclusions. The responses to the questionnaire under the various headings are detailed in tables and figures in sections 3 to 11.

2. SUMMARY OF CONCLUSIONS

Overview	All the mammography systems (465) used by the NHSBSP are routinely monitored by one of 31 physics services.
Organisation	<p>Wales, Scotland and Northern Ireland each have a single physics service covering all the programmes in their regions. In England each region is covered by more than one service. The data is presented in relation to the old regional boundaries and names. A consortium of six physics services provides the service for London.</p> <p>All services are kept informed by their representative on the National Co-ordinating Group for Breast Screening Physics</p> <p>All services participate in national reviews by NCCPM; however the answers from four of them are a qualified 'yes', eg 'when practicable'.</p>
Qualifications	All services except one are supervised by a physicist who holds corporate membership of IPEM (as required in the <i>QA Guidelines</i>). The physicist supervising the other service is a corporate member of 'other physics organisations'.
Training	<p>All the services involve physicists who have received basic training in general diagnostic radiological physics and radiation protection.</p> <p>Sixty six of the 79 physicists involved in these services have attended the IPEM Basic Mammography Training Course. For one service, the single physicist had not attended the basic training course at the time of the audit, but he/she had attended the update course.</p>
Experience	<p>The requirement in the Guidelines for the minimum number of QA tests conducted by staff (ie for 6 units per year or 2 units per year with extensive experience of general radiological work) was met by all the services.</p> <p>All services but one participate in a review of QA data on at least 6 systems at least once a year.</p> <p>In the last two years 'buddy' visits have been made by at least one physicist from approximately half of the services.</p>

Level of service	<p>All except two of the services operate under a written service agreement.</p> <p>All the services conduct acceptance testing and routine monitoring of the x-ray set following the procedures in <i>Commissioning and Routine Testing of Mammographic X-ray Systems</i>³ (IPEM 59/2), with a few minor exceptions. Most services now test ultrasound systems.</p> <p>All services check that image quality and dose (to the standard breast) complies with NHSBSP guidelines.</p> <p>Thirty of the 31 services also periodically measure doses to samples of screened women.</p> <p>Most services now test ultrasound systems, while the finding that not all services test digital or analogue stereo systems simply reflects the fact that some have only analogue or only digital systems in their areas. About 30% to 50% of services test processors and viewing boxes, while a much smaller proportion test films, screens and cassettes.</p>
Frequency	<p>The interval between routine tests was 6 months for all the services, which meets the national guidelines.</p>
Test equipment	<p>Most services had all the basic test equipment with only minor omissions (see Appendix 2 for details).</p>

3. REGIONAL ORGANISATION

London is covered by a consortium of five services, acting as one entity, but all the other regions in England are covered by more than one physics service, as shown in Table 1. Five physics departments provide services to more than one region. Only Wales, Scotland and Northern Ireland have single physics services.

Table 1: Physics services per region

NHS Region	Number of Physics Services in 2003
Eastern	3
North West	2
London	1
South East	5
Northern	4
Trent	2
South West	8
West Midlands	3
Wales	1
Scotland	1
Northern Ireland	1

At the time of the audit every NHSBSP programme was attended by an appointed physics service. Replies were received from three services covering West Midlands, which had just resumed service provision after a period of inactivity due to administrative difficulties.

The number of x-ray systems monitored by each of the physics services is shown in Figure 1.

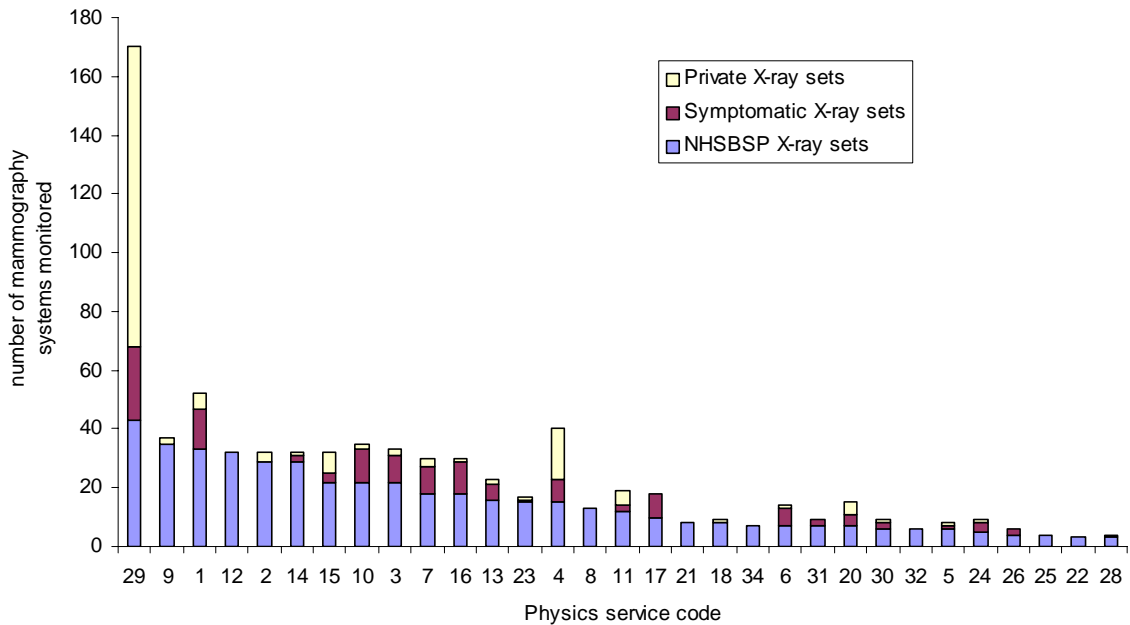


Figure 1: Number of mammography systems monitored by each physics service

One of the main methods by which quality assurance is organised at the regional level is by multi-disciplinary quality assurance visits. It is NHSBSP policy in England that a medical physicist should participate in these visits, and this was the case for all English regions as shown in Table 2. Other arrangements apply in Scotland, Wales and Northern Ireland.

Table 2: Participation of physicists in multi-disciplinary quality assurance visits to screening centres

NHS Region	Do physics services participate in multi-disciplinary QA visits?
Eastern	Yes
London	Yes
North West	Yes
Northern	Yes
South East	Yes
South West	Yes
Trent	Yes
West Midlands	Yes
Wales	No
Scotland	Yes
Northern Ireland	No

4. SERVICE AGREEMENTS

Two of the 31 services operate without a written service agreement for the provision of routine physics quality assurance. For two others there is no specific written agreement for mammography physics QA, but it is defined as part of a broader agreement.

Eleven services fulfil a regional or sub-regional co-ordinating role and ten of them have a written agreement for this role. The exception is Wales, for which regional operation is a defined part of its service provision, so that a separate written agreement would be inappropriate.

5. EQUIPMENT

The total numbers of each type of equipment monitored by the physics services in the NHSBSP are shown in Table 3. The sets listed as “assessment X-ray sets” may also be used part-time for screening, whereas the “mobile” and “static” X-ray screening systems are generally only used for screening.

Table 3: Total numbers of equipment monitored by physics services

Type of Equipment	Number monitored by physics services			
	1996	1998	2000/2001	2003
Mobile screening x-ray systems	110	116	141	187
Static screening x-ray systems	38.5	62	62	123
Assessment x-ray systems	134	139	168	145
Prone biopsy unit			9	10
Total of all x-ray systems	287.5	317	380	465
Processors	183	188	163	206
Ultrasound	112	114	123	160
Stereo accessory (film)	116	118	89	62
Stereo accessory (digital)			41	80
Specimen cabinet	39	43	51	54
Roller viewers		84	104	122

6. LEVEL OF SERVICE

6.1 Routine surveys

All the services conducted routine surveys according to IPEM 59/2.³ All services are monitoring image quality and dose to the standard breast. Variations in some additional procedures are shown in Table 4.

Most services now test ultrasound systems, which was not the case in previous surveys. The finding that not all services test digital or analogue stereo systems simply reflects the fact that some have only analogue or only digital systems in their areas. About 30% to 50% of services test processors and viewing boxes, while much smaller numbers test films, screens and cassettes.

Table 4: Level of service

	Yes in 1996 (of 31)	Yes in 1998 (of 35)	Yes in 2000/1 (of 34)	Yes in 2003 (of 31)
Is advice on equipment selection provided?	23	28	21	21
Is advice on the use of equipment given?			33	30
Does your service provide RPA cover?			29	24
Acceptance testing on x-ray sets	31	33	34	31
Acceptance testing on analogue stereo attachments		13	24	26
Acceptance testing on digital stereo attachments				29
Acceptance testing on processors	9	11	13	13
Acceptance testing on screens	9	11	9	4
Acceptance testing on film	5	6	7	4
Acceptance testing on viewing box	11	11	12	11
Acceptance testing on cassettes	5	6	8	4
Routine testing on x-ray sets			34	31
Routine testing on analogue stereo attachments	16	21	22	22
Routine testing on digital stereo attachments				30
Routine testing on processors			17	19
Routine testing on screens			5	1
Routine testing on film			4	1
Routine testing on viewing box			13	10
Routine testing on cassettes			5	4
Image quality tested for compliance with NHSBSP stds	31	35	34	31
MGD to standard breast measured	31	35	34	31
Participates in drafting QA manual	28	35	30	25
Conducts patient dose measurement		31	29	30
Ultrasound tested routinely	24	28	24	27

6.2 Patient dose surveys

Only one of the 31 physics services does not conduct patient dose surveys. This service is about to re-start, having stopped earlier because of the lack of clarity over the funding for such work. Where dose surveys are conducted, the majority of services (22) collect data for 50 women, while three collect data for 100 and six for '50 or more'. Eighteen services conduct annual surveys, while others conduct them at intervals of 2 or 3 years or on request.

7. INTERVAL BETWEEN PHYSICS SURVEYS

The QA Guidelines for Medical Physics Services require a physics survey at intervals of no more than 6 months. All 31 services carried out surveys at 6 monthly intervals, which complies with this requirement.

8. QUALIFICATIONS, EXPERIENCE AND TRAINING

A summary of the replies to questions about qualifications, experience and training are give in Table 5. Answers for each service are given in Appendix 1.

All services except one are supervised by a physicist who holds corporate membership of IPPEM (as required in the *QA Guidelines*). The physicist supervising the other service is a corporate member of 'other physics organisations'.

Out of the 79 physicists involved in services to NHSBSP, 66 have attended the IPPEM basic mammography training course and 65 the update training. Out of the 39 technical officers involved in services to the NHSBSP, 30 have attended the IPPEM basic mammography training course and 29 the update training.

In the last two years 'buddy' visits have been made by least one physicist from approximately half of the services.

Table 5: Qualifications, experience and training

	Yes	No
Is the work performed or closely supervised by a physicist holding corporate membership of IPEM?	30	1
Has at least one physicist received basic training in general diagnostic radiological physics and radiation protection?	31	0
Has at least one physicist in the service attended the IPEM Mammography Physics Training Course which takes place every 2 years?	30	1
Has at least one physicist in the service attended the IPEM Mammography Physics Update Training day which takes place every 2 years?	30	0
Does at least one physicist perform QA surveys on at least 6 mammography units at least once a year, or on 2 mammography sets and have extensive experience of general diagnostic work?	31	0
Does the service participate in a review of the data from QA surveys on at least 6 mammography units at least once a year, and have access to such data when necessary?	30	1
Has at least one physicist made a 'buddy' visit in the last 2 years?	15	15

9. QA OF PHYSICS SERVICE

Answers to questions on the quality assurance of the physics services are given in Table 6. A number of physics services have ISO9002 accreditation; however this is not a requirement in the QA guidelines.

Table 6: QA of physics service

	Yes	No
Is there a written procedures manual for the physics service?	30	1
Are records maintained of the survey reports?	31	0
Are records maintained of the instrument calibrations?	31	0
Do physicists participate in a recognised CPD scheme?	30	1
Does the service participate in NHSBSP national physics reviews?	29*	2
Does the service have external accreditation?	ISO 9002 8	23

*of which two participate 'where practicable' or 'try to'.

10. STAFFING

The total number of physics staff working for the NHSBSP is summarised in Table 7. There are currently some 79 physicists and 39 medical technical officers (MTOs) who do some work for the NHSBSP. Few of these staff are committed full-time. Some services have separately identified time spent fulfilling a regional or sub-regional coordinating role, and this amounts to about 10% of the time spent overall on routine work. This is probably a underestimate of the total as this work was not always separately identified.

Table 7: Physics staff involved in routine work for the NHSBSP

	Total staff involved in service to NHSBSP	Total whole time equivalent (wte)
Routine work		
Physicists	79	19.0
MTOs	39	8.7
TOTAL	118	27.7
Regional coordination		
Physicists		2.6
MTOs		0.2
TOTAL		2.8
OVERALL TOTAL		30.5

The *QA Guidelines* recommend a minimum of one physicist for 15 mammography x-ray sets, which corresponds to 0.067 wte physicists per x-ray set and does not take account of development work, teaching, regional co-ordination etc. This would require about 31 physicists for the whole country, which is close to the total of actual time spent. More recently, a figure of one physicist for 13 mammography X-ray sets has been recommended, which would require about 36 physicists for the whole country. The total allocation of staff time (physicists and MTOs) in each region is shown in Figure 2. Note that these staff allocations are based on the service as provided rather than as funded.

Figure 2 shows that the amount of physics staff time (excluding coordination) devoted to the NHSBSP varies greatly from region to region. Further wide variation occurs within regions; considering the services separately, the actual wte. per x-ray set ranges from 0.012 to 0.10, with a mean of 0.054. These differences may partially reflect variations in funding and the level of service provided.

Some physics services gave clear answers on the level of funding per x-ray set. Others were unable to do so, because the service is funded by the host trust for both mammography physics and work in other areas, without defining the funding for mammography specifically. Funding per x-ray set per annum ranged from £511 to £2700 for the 21 services that provided clear figures. The higher level of funding per x-ray set in some areas (e.g. Wales, Scotland) reflects the higher costs and greater time commitment involved in travelling to remote areas. Conversely, where screening is carried out on-site or nearby, a lower level of funding per x-ray set may be appropriate.

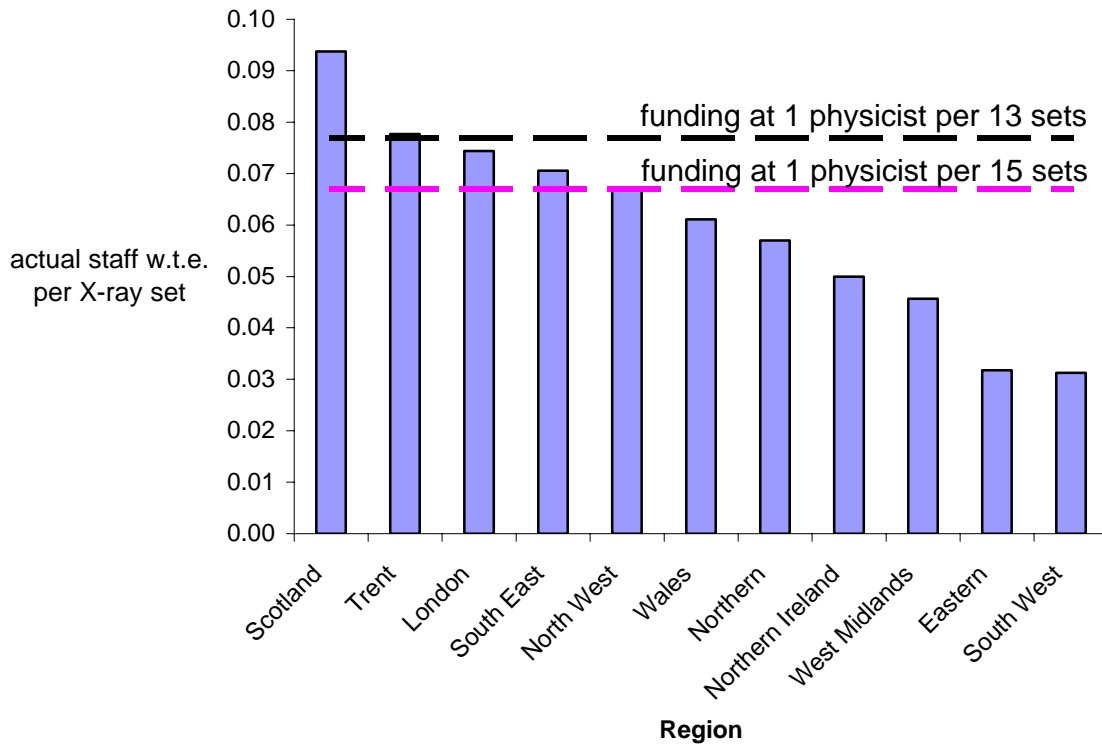


Figure 2: Actual staff allocation (physicists and MTOs excluding coordination) per mammography system in each region

11. REFERENCES

1. *Quality Assurance Guidelines for Medical Physics Services*. NHS Breast Screening Programme 1995 (NHSBSP Publication No 33)
2. *Audit of Physics Services to the NHSBSP in 2001*. NHS Cancer Screening Programmes 2001 (Report 01/03)
3. *Commissioning and Routine Testing of Mammographic X-ray Systems*. Report 59/2 of the Institute of Physical Sciences in Medicine (IPSM) (1994).

Appendix 1: Qualifications, experience and training

Physics service code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	28	29	30	31	32	34
Number of physicists involved in work for the NHSBSP	3	1	4	3	3	2	2	3	2	4	1	2	2	2	3	3	4	2	1	3	2	2	3	1	1	1	15	2	3	1	2
How many of the physicists have received basic training in general diagnostic radiological physics and radiation protection?	3	1	2	3	3	2	2	3	2	3	1	2	2	2	3	3	4	1	2	3	2	2	3	1	1	1	15	2	3	1	2
Is the work performed or closely supervised by a physicist holding corporate membership of IPEM?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
How many of these physicists have attended the IPEM Basic Mammography training course?	1	1	1	3	2	2	2	3	2	3	1	2	1	2	2	3	3	0	2	3	2	1	3	1	1	1	15	2	2	1	1
How many of these physicists have attended the IPEM Mammography Update training day?:	1	1	1	3	2	2	2	3	2	3	1	2	2	2	2	3	1	2	3			2	2	1	1	1	15	2	2	1	2
How many of the physicists perform QA surveys on at least 6 mammography units at least once a year, or on 2 sets and have extensive experience of general diagnostic work?	3	1	1	3	2	2	2	3	2	3	1	2	2	2	1	3	3	1	2	2	1	2	3	1	1	1	14	2	2	1	2
Does the service participate in a review of the data from QA surveys on at least 6 mammography units at least once a year, and have access to such data when necessary?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	only when requested	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of MTOs involved in work for the NHSBSP	4	3	2	1	0			3	1	0	3	3	1	1	2	3	3	1	0	0	1	0		1	1		3	0	1	0	1
How many of these MTOs have attended the IPEM Basic Mammography training course?	2	2	2	2	0			2	0	0	2	3	1	1	1	2	1	1	0	0	1		0	1	1		3	0	1	0	1
How many of these MTOs have attended the IPEM Mammography Update training day?	4	2	2	2	0			2	0	0	2	3	0	1	1	2	1	1	0	0			0	0	1		3	0	1	0	1
How many physicists have made a 'buddy' visit in the last 2 years?	1	1	1	1	0	1	0	0	1	0	0	0	0	1	1	2	0	0	1	0	0	2	1	1		0	2	0	2	0	0
How many 'buddy' visits from physicists have been received in the last 2 years?	1	3	1	1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	1	0	1	0	1		2	2	0	0	2	0

