Association for Respiratory Technology & Physiology

Breathing Inspiration and Quality into Respiratory Healthcare

ARTP 2012 Survey of Respiratory & Sleep Services

Butterfield AK[1], Cooper BG[2], Bucknall M[3] and Sylvester K[4], on behalf of ARTP

(1) Dorset County Hospital, Dorchester, (2) University Hospital Birmingham,
(3) St George's University of London. (4) Addenbrooke's Hospital, Cambridge.

CONTENTS

(Revision 1.0)

INTRODUCTION

Lung function testing services generally grew out of respiratory research departments with an interest in physiology in the 1950-1960's, and by the 1970's most large hospitals in the UK could offer some kind of lung function testing facility. In 1976 ARTP was formed as a professional body to set training programmes and standards of practice in place. Initially termed 'technicians', the roles of the staff in lung function have expanded to cover a range of physiological techniques to assess airway function (for asthma & COPD), gas transfer (pulmonary fibrosis, emphysema) and specific patterns of physiological change in other respiratory disorders. The staff who undertake these roles are Healthcare Scientists and now mainly use the titles 'Clinical Physiologist' and 'Clinical Scientist'.

The most fundamental lung function test is spirometry, which assesses how much and how fast a patient can expel air in a forced manoeuvre. Lung volume measurements can identify distinctive patterns of restricted lungs or over-expanded lungs. Finally the ability to transfer gas can be assessed relatively simply at rest. Patients may also have blood gas samples analysed either non-invasively or by having a blood sample taken.

Modern respiratory departments have branched out to investigate breathing during sleep; the investigations for sleep apnoea and nocturnal desaturation and their treatment now can form over 50% of the workload. For patients with sleep-breathing disorders there are a range of screening studies using simple probes (e.g. oximetry) right through to lots of channels of signals looking at chest wall and airflow and sometimes 'sleep stage'. There are also many departments in the UK which specialise in sleep diagnostics and will use full polysomnography, and other tools, to diagnose and treat a variety of routine and complex parasomnias.

Clinical Physiologists and Clinical Scientists are also as likely to be involved in both therapeutics (home oxygen, nebulisers, CPAP and non-invasive ventilation) as they are in diagnostics. In fact, given the amount of time they spend with patients performing volitional tests in a controlled, accurate and safe way, they are well placed to educate patients and improve their medication advice. Whilst a lot of routine tests are performed in large numbers, there are also growing numbers of more sophisticated tests looking at muscle function, cardio-pulmonary exercise function, advanced gas exchange and breathing patterns.

In the 1970s, the training programme was an apprenticeship at ONC, HNC (Ordinary and Higher National Certificates) level and then HND (Higher National Diploma) level. In the 1990's all physiological measurement trainees were trained via a 4 year B.Sc. route, which in 2011 was remodelled into the Modernising Scientific Careers programme. This offers a suite of training from assistant (certificate), to practitioner (degree), to scientist (masters) and soon to a consultant (doctoral) level programme.

From a patient perspective, the lung function and sleep laboratories will offer breathing and sleep tests utilising complicated equipment measuring many different physiological parameters with different techniques while being guided by well-trained scientific staff, who understand the limits of their disease/condition and can safely encourage meaningful values to help in their diagnosis and treatment.

Most ARTP practitioners are Clinical Physiologists, but there is a small number of Clinical Scientists who have a more research orientated role, although at higher levels, this difference has become blurred.

SURVEY HISTORY

The ARTP has periodically conducted surveys of respiratory services and staffing. These surveys date back to 1995 and the last survey was conducted in 2005, which was then the most comprehensive survey to date. The data collected at that time has been used extensively by the ARTP to inform interested parties, in particular the Department of Health, the Workforce Review Team (England) and the Centre for Workforce Intelligence and has been recognised as the best reference dataset for any Physiological Science group.

This survey addresses the number and type of staff working nationally as well as the types of tests and facilities available in UK lung function and sleep departments.

The findings reported here are from the most recent survey, which was conducted electronically in February 2012, and brings this dataset up to date providing a revised snapshot of respiratory and sleep diagnostic service provision in the United Kingdom.

RESPONSES & LABORATORY TYPES

Those labs replying to the survey were overwhelmingly providing services for the NHS.

The lung function lab database held by the ARTP records 251 practising laboratories in the UK at the time of this survey, 156 responses were received which was a 62.2% response rate.

Only seven responses were received from labs that only perform sleep services, excluding these from the responses identifies that 63%, labs providing respiratory services also provide sleep diagnostic investigations.

Table 1: Responses and Laboratory Types

Survey	Responding / Total Labs	Overall Response Rate	Lab Type		
			Resp	Multi-Disp	Specialist
2002	203 / 203	(100%)			
2003	152 / 248	(61%)	54%	38%	8%
2005	229 / 253	(91%)	49%	45%	6%
2012	156 / 251	(62%)	38%	60%	2%

Comparing the laboratory types to those responding to the survey the profile of labs was representative of the spread of lab types across the different regions of the UK.

39% of responding labs declared themselves to be purely respiratory, 27% combine respiratory and sleep, 22% are cardio-respiratory and 7% sleep only. The remaining 7% were multi-disciplinary.

4 specialist paediatric labs responded.

This seems to mark a trend away from single disciplinary respiratory laboratories (see Table 1) however it is more likely that those that who, in the past, reported themselves as 'respiratory' are now reporting themselves as 'respiratory and sleep'. Specialist labs appear to be in decline but this is possibly just a lack of responses from these centres.

Table 2: Responding Laboratory Types

Lab Type	Total Labs
Respiratory	61
Respiratory and Sleep	45
Cardio-Respiratory	36
Multi-Disciplinary	10
Sleep	7
Cardio-Respiratory and Sleep	1
Paediatric Respiratory	3
Paediatric Sleep	1

Table 3: Responses by Country

Country	Total Labs
England	143
Scotland	11
Northern Ireland	4
Wales	3
Eire	2

STAFFING

Staff Numbers

We received responses for **individual staff** from 120 responding departments covering 586 individuals across the UK (though unfortunately not all sets of data were complete for each individual). This report has been adjusted to reflect the national picture.

The survey asked respondents to differentiate the time spent between respiratory and other investigations. In multi-disciplinary labs individuals may have their job plan split between, for example, respiratory and cardiology duties so the Whole Time Equivalent (WTE) figure should reflect time committed to providing a respiratory service.

Table 4: Headcount & WTE 2003-2012

Year	Support Grades	Qualified Grades	Headcount	WTE
2003	237	862	1099	-
2005	273	889	1259	856.5
2012	256	1004	1297	1023.5

A total of 1259 HCS posts were reported (when projected up to adjust for the sample size) which compares with 1297 posts recorded in 2005 (See Table 7).

Between the 2005 & 2012 surveys Agenda for Change (AfC) [1] was introduced which changed the grading system from the old Medical Technical Officer (MTO) Scales to AfC Bands. In order to permit comparison across the years it has been assumed that Band 5 and MTO 1 equate to the basic grade for a qualified post.

In 2005 Senior & Assistant Technical Officers and Trainees accounted for 273 posts and there were 889 in MTO grades.

In 2012 this compares with 256 posts below Band 5 and 1004 posts at Band 5 or greater.

Whilst it has to be acknowledged that the calculation to upscale the data to reflect a national picture is derived from a relatively crude percentage calculation it is reassuring that the figures between the 2 surveys are fairly similar and ARTP has not been aware of any significant change in workforce numbers, although these data may reflect a small fall in the workforce headcount which would not be surprising considering the recent financial climate.

However while in 2005 we recorded 856.5 WTE working in respiratory diagnostics the latest data from this survey now suggests 1023.5 WTE, a 19.5% expansion in workforce resources (See Table 8). This increase seems to be mainly in qualified grades (i.e. there is still similar WTE in the supporting grades when compared with 2005). This would seem to be consistent with the increasing numbers being seen to be undertaking the ARTP Professional Exams over this period - 7 candidates undertook the Part 2 Examination in 2005 and 52 sat in 2012.

Regional Responses

In Northern Ireland we had 4 responses from 8 known labs, in Wales we had 3 responses from 19 known labs and in Scotland we had 10 responses from 34 known labs. These numbers and response rates make it difficult to draw any significant conclusions, however there are relatively contemporary data with which it is possible to compare figures for the English labs which has been extracted from the ARTP survey.

Data published by the Centre for Workforce Intelligence (CfWI) reports the number of qualified healthcare scientists employed in the NHS in (just) England as at September 2011 [2], according to the NHS IC Non-Medical Census (NHS IC, 2011a) was 502 (464 FTE) - See Table 5.

Table 5: CfWI Estimates of HCS Workforce in Respiratory

Specialism		Staff Grade				
		Qualified staff	Consultant clinical scientist	Manager	Clinical scientist	Clinical physiologist
Respiratory physiology	HC	502	6	13	35	449
	FTE	464	6	13	31	414
	FTE/HC	0.92	1.00	1.00	0.89	0.92

HC = Headcount and FTE = Full Time Equivalent

We know there are 201 respiratory labs in England; 135 responded to our survey but only 104 reported the employment detail for individual staff. For this section of the survey this was a response rate of 51.7% (making the multiplier for up-scaling the survey response = 1.93).

So, according to the ARTP survey, the English Qualified Headcount = 763 and employed WTE = 670. This is substantially more than that reported by the Centre for Workforce Intelligence and we can conclude that the 'official' figures for the size of the qualified respiratory workforce are again a gross under-estimation. This will have implications for workforce planning nationally; however the CfWI took its data from the Electronic Staff Record and does acknowledge shortcomings in the occupational coding.

Comparable figures for England extracted for the 2005 ARTP Survey showed Qualified Headcount = 737 and employed WTE = 528.6 which suggests there are now 26 more qualified posts but considerably more WTEs working in respiratory diagnostics. Figure 1 shows how the English posts and WTE changes are distributed across the grades. There are fewer grade 6 & 8 posts but more 5 (basic) and 7 (higher specialist) grade posts but more WTE being committed across all grades, perhaps due to multi-disciplinary staff allocating more time to respiratory duties. The most significant changes are seen in the lower (unqualified) bands where the grades appear to have shifted up.

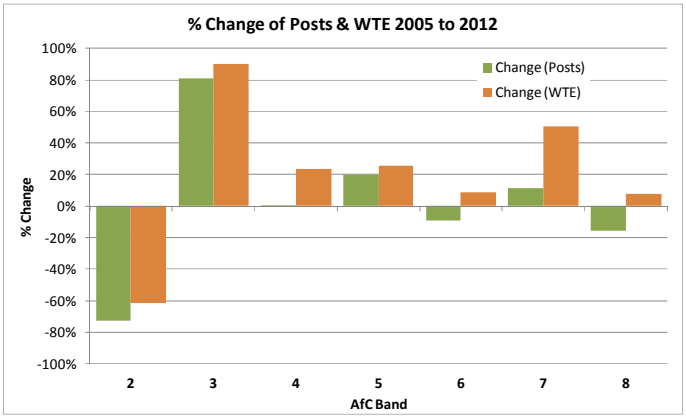
Contrary to the CfWI headcount of 35 Clinical Scientists there are, to our knowledge, only 8 practising Clinical Scientists working in the field of Respiratory Physiology on the HCPC register. Clinical Scientist is a protected title and should only be used by those registered with the Health & Care Professions Council (HCPC) otherwise prosecution can occur.

In this respect the results of the ARTP survey are consistent with the findings in the CfWI report …

'The continuing move towards non-invasive diagnostics is increasing demand on senior physiologists. At the same time, screening programmes, community settings and one-stop clinics to improve the patient experience are encouraging the development of associate practitioners for the high-volume low-skill work.'

This change may be due to recognition of the skill base of respiratory & sleep support staff during the Agenda for Change assimilation process, especially in multidisciplinary labs where they may need to be competent across a wide range of duties.

Figure 1: Change of Posts & WTE 2005 to 2012



According to this survey snapshot an 'average' laboratory has 2.8 (IQR 1-2) Full Time and 1.3 (IQR 0-1) Part Time Healthcare Scientists (across all grades).

The CfWI report also states there was a 0.8% vacancy rate within respiratory HCS. Monitoring of posts advertised through the ARTP in the past few years has shown that between 30% & 60% of advertised posts remain un-filled following advert. This would seem to confirm that there isn't a surplus of qualified respiratory physiologists looking for jobs. For several years the CfWI has cited respiratory physiology as being in 'shortage' and the respiratory 'cohort ' for the MSC PTP is currently consistently failing to recruit adequate numbers of trainees to fill any future vacancies

The CfWI report also cautions that …

> *'The need to provide services more cost effectively or closer to the patient's home is likely to drive service reconfiguration, and there may be new non-NHS providers offering physiological services in the future, which may present issues regarding the availability of accurate workforce planning and data. This issue is being considered as part of the workforce information architecture project.'*

… which may prove to be a confounding factor in future ARTP surveys.

Recent coding changes [3] for the NHS Electronic Staff Record have at least refined the capture of data on Healthcare Scientists but failed to make any distinction between the different disciplines within Physiological Sciences. We have already shown that centrally collected data is flawed so this still leaves professional bodies having to collate and provide accurate data for use in workforce planning.

Staff Numbers in Laboratories

Table 6: No. of Qualified Posts Performing Respiratory Procedures vs. No. in Lab

Lab Type	1	2	3	4	5	6	7	8	9	10	11	15
Cardio-Respiratory	56	52	8	14	14	14	2					
Multi-Disciplinary	8	6	13	6	6					25		25
Paediatric Respiratory	3	3										
Respiratory	51	69	79	37		21	7				15	
Respiratory and Sleep	37	58	18	14	36		11	12	9		41	
Sleep				10		10						
Total (n = 790)	**155**	**188**	**118**	**81**	**56**	**45**	**20**	**12**	**9**	**25**	**56**	**25**
	20%	24%	15%	10%	7%	6%	3%	2%	1%	3%	7%	3%

Most labs performing respiratory diagnostics operate with small numbers of qualified staff (69% with 4 or less - see Table 6) and some possible implications for service provision might be proposed:

- The impact of staff taking annual leave – does the service stop or reduce?
- Maintaining a service if staff go on unexpected or long term sick
- May lead to increased waiting times caused by unstable staffing levels
- Reliance on agency staff to cover services
- Potential to lead to errors in practice
- Staff recruitment/retention problems due to lack of variety in daily work
- Staff loneliness/isolation and no effective team-working
- Little opportunity for service improvement, research or innovation
- With low staff numbers it is possible that staff feel unable to take sick leave which impacts on infection control
- Stress & 'burnout' in staff struggling to maintain services
- Limitation on Staff CPD activities(e.g. time for study leave, including mandatory training)
- Ability to get involved in professional activities outside the employing body is restricted
- Poor patient experience
- High grade staff providing cover for basic grade duties

Gender

In the qualified grades there has been a continued shift towards more males. In 2005 a shift from 81.5% (in 2003) to 76.8% of the qualified grades being female was observed. By 2012 this has shifted to 69.9% female.

Table 7: Gender Analysis vs Banding (Posts)

Band	F	M	Total	% Total	% Female
2	47	4	**52**	4%	**92%**
3	103	17	**120**	10%	**86%**
4	65	13	**77**	6%	**83%**
5	159	67	**226**	18%	**70%**
6	267	88	**355**	28%	**75%**
7	206	82	**288**	23%	**72%**
8	71	67	**138**	11%	**52%**
TOTAL (Posts)	**918**	**338**	**1256**		**73%**

Table 8: Gender Analysis vs Banding (WTE)

Band	F	M	Total	% Total	% Female
2	34.9	1.9	**36.8**	**4%**	**95%**
3	66.0	15.5	**81.5**	**8%**	**81%**
4	41.2	10.0	**51.2**	**5%**	**80%**
5	138.5	64.5	**203.0**	**20%**	**68%**
6	201.6	75.9	**277.5**	**27%**	**73%**
7	158.2	93.8	**251.9**	**25%**	**63%**
8	58.5	63.0	**121.5**	**12%**	**48%**
TOTAL (WTE)	**698.9**	**324.6**	**1023.5**		**68%**

Support grades continue to be largely female; Bands 2-4 all have >83% female and there is a distinct divide in terms of part-time working; there are 0.68 WTE per post in these bands compared with 0.86 WTE per post in the qualified bands. It should however be noted that this statistic could be affected by full-time workers in multi-disciplinary labs who may be splitting their duties between respiratory and other disciplines therefore appearing to be part-time workers while holding a full time post.

The gender gap only becomes more balanced at Band 8. In 2005 the top grade of MTO5 was split 65% female : 35% male but it is now 52% female.

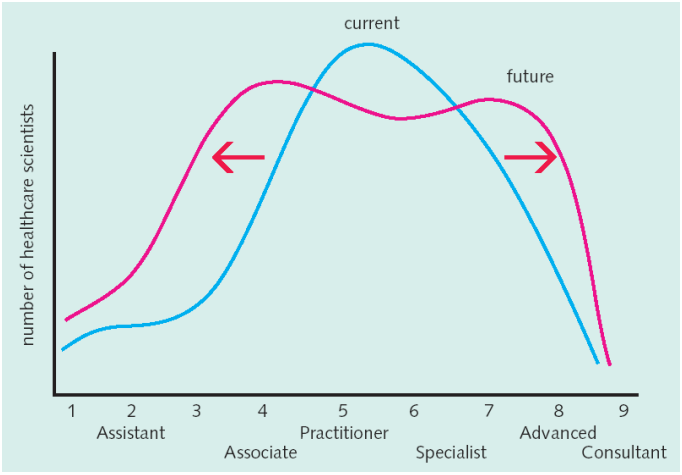
(NB: The numbers derived from the sample have been calculated to reflect the full population in Table 7 & Table 8.)

In November 2005 the Department of Health (DH) published their Healthcare Scientist Careers Framework [4] which projected changes for the future workforce:

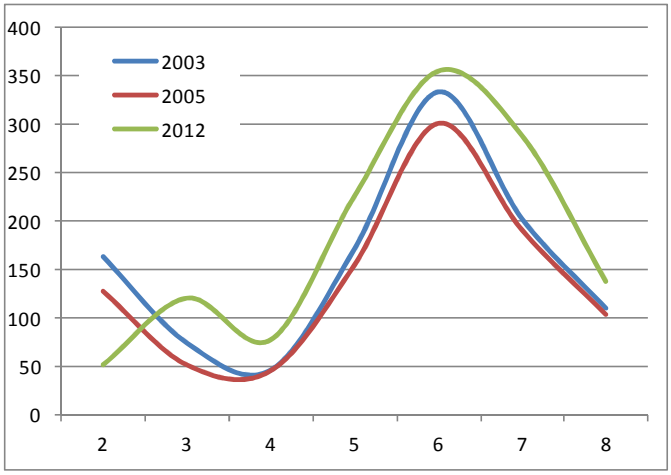
a) The need for more skills and competences to be transferred to assistants and associates.
b) The creation of more advanced and consultant level posts to support the scientific and technological advancement of healthcare and new roles at the medical scientific interface.
c) The need for scientific workforce numbers to increase.

The graphs below show the DH's own projection for the expected change in the workforce profile (left) and compares the respiratory HCS profiles as measured in the last 3 ARTP surveys.

Figure 2: Profile of the surveyed workforce compared to DH HSC Career Framework



(HCS Careers Framework 2005)



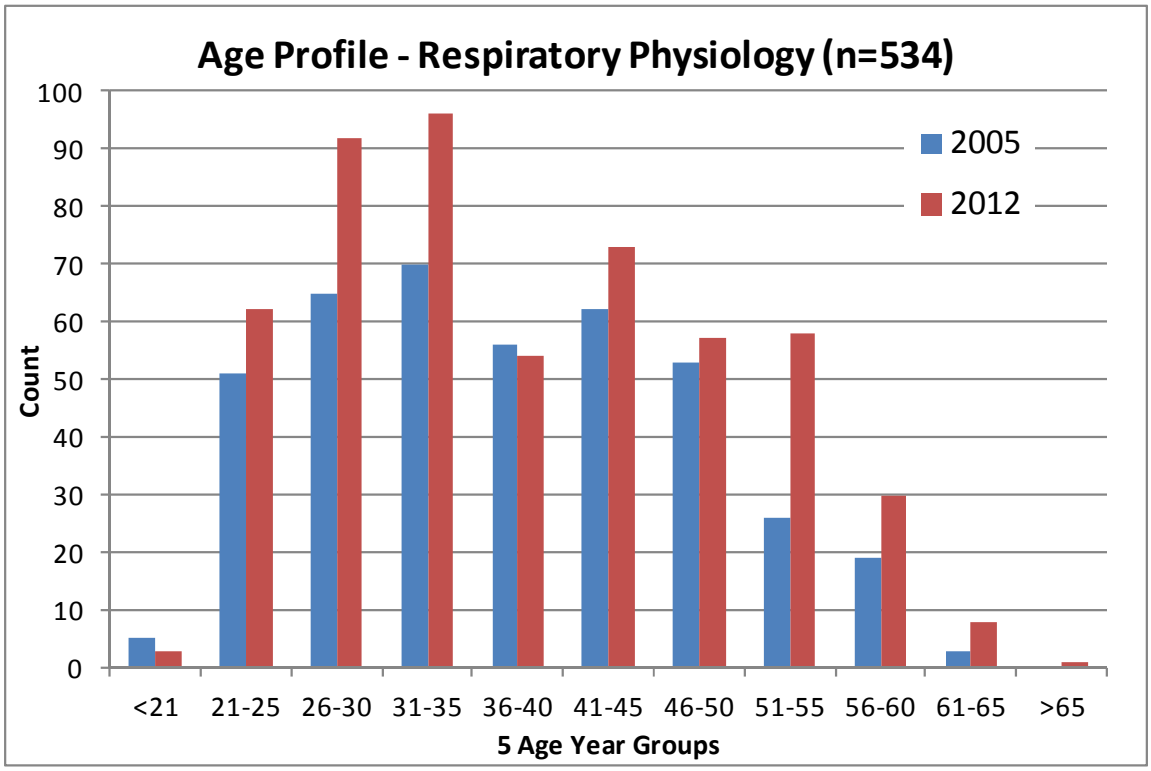
(ARTP Surveys)

Although not quite matching the DH's projected 'molar tooth' pattern and not shifting dramatically from the DH's 2005 'current' profile, it can be seen that a 'bi-modal' distribution now occurs with a shift from Bands 1-2 to band 3-4 posts, there has been an overall increase across all the grades and a significant growth at the higher grades (7 & 8) which is in accordance with the above 3 statements from the Healthcare Scientist Careers Framework. Plans are also currently afoot to create more, higher grade, posts analogous to a Higher Specialist Scientific Training (HSST) Consultant grade through Modernising Scientific Careers [5].

Age Profile

534 of the individuals surveyed gave their age (52 didn't). When plotted (Figure 3) the 36-40 age band appears to be significantly different from the trend. The sample size from the 2005 survey was proportionally smaller but at that time the same dip appears in the same age band. Looking further back to survey data collected in 2000 there is a similar dip in the 31-35 age group which also corresponds to a small dip in the 26-35 age group in the survey conducted 5 years prior to that.

Figure 3: Age Profile



The recent data suggest some under recruitment 15-20 years ago. Ken Hutchinson, ARTP Non-Exec Director (HR) offers a possible explanation…

> In the period 1991 to 1995, self-governing NHS Trusts were being established. The background was retrenchment in the NHS and workforce numbers 'flat-lined'. There was considerable uncertainty about workforce planning and training commissions at regional level were reorganised. This period of uncertainty about who was funding training could have reduced recruitment.
>
> Following recognition of over-zealous cutbacks and massively increased funding for the NHS from 1999 onwards (led by the NHS Plan in 2000 [6]) recruitment increased. Regrettably, the recent economic decline has led to further retrenchment and the cycle will probably continue.

There are only small numbers above the age of 60 suggesting that there is not likely to be any imminent problems with service provision associated with retirement.

Experience

Figure 4: Experience by Grade

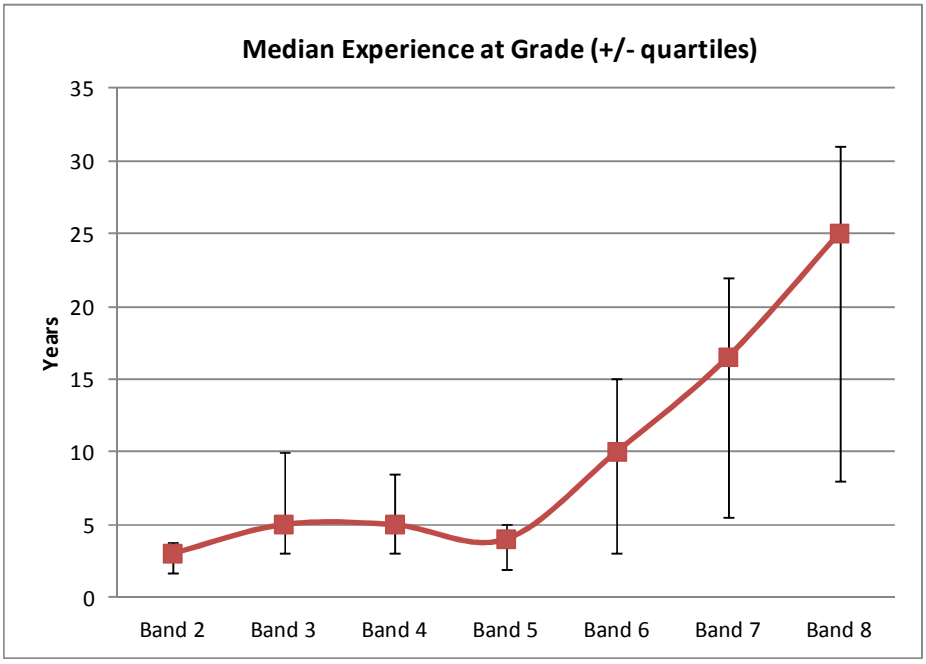


Table 9: Average Experience at Band

AfC	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8
Avg.(yrs)	3.2	6.3	6.5	5.4	11.9	17.7	24.1

When experience is compared by gender there is no significant difference except at Bands 3 & 4 where, on average, females in these grades have 2 to 3 times more experience (2.2 & 2.9 times respectively).

Table 9 and Figure 4 show the average experience of individuals at their current Band and the data were drawn from a total of 689 individuals. With Band 5 being taken as a starting point for the qualified career it can be seen that the experience is cumulative up into the higher grades. An average of 5 years experience is spent in Band 5 and approximately 6 years in each of the subsequent bands.

Recommendation 1:	**Until more robust ESR coding is established ARTP will still need to run surveys to determine workforce numbers. [Action: Workforce Committee]**
Recommendation 2:	**Scotland, Wales & N. Ireland should attempt to verify their workforce data. [Action: Workforce Committee / Regional Groups]**
Recommendation 3:	**There are missing elements of workforce data that need collecting and their impact assessing in the context of service delivery (eg staff absence/sickness rates, attrition rates, etc.) [Action: Workforce Committee]**
Recommendation 4:	**ARTP needs to continue to work with MSC, Education providers and commissioners to influence the recruitment & training of the future workforce. [Action: Education Committee]**
Recommendation 5:	**The implications of the survey findings (eg low numbers in labs) needs to be reviewed and recommendations made (eg examining the roles & workforce allocation within typical departments). [Action: Workforce Committee]**
Recommendation 6:	**Recommendations should be made available to help standardise the coding of respiratory and sleep physiology staff on the Electronic Staff Record against the new coding set [3]. [Action: Workforce Committee]**

Staff Autonomy

For the first time the ARTP survey has tried to determine how many practitioners who responded had autonomy in clinical decision-making. This was deemed to be important given the changing roles of healthcare scientists, the development of Modernising Scientific Careers (MSC) training programmes, especially the Scientist Training Programme (STP) & Higher Specialist Scientific Training (HSST), and the suspected variation in practice around the UK. This is particularly important as clinical physiologists are expanding their roles increasingly towards intervention and monitoring, rather than the traditional diagnostic services.

Questions were asked which would inform firstly, how many ARTP practitioners routinely make autonomous clinical decisions and secondly what was the minimum grade making these decisions. This was limited to four areas of, predominantly, interventions where the clinical decisions made can be considered to be major clinical interventions that affect the patient pathway and impact on their quality of life (i.e. CPAP, NIV & home oxygen) and sleep diagnostics.

Results

The number of autonomous ARTP members was collated firstly in absolute terms and then as a percent of the response to the survey (n=168 - including sleep labs). We further looked at the number and percentage of those who were regulated and finally the number who were Band 6 or above as the minimum grade. The results are shown in Table 10.

Table 10: Autonomous Service Provision by Healthcare Scientists

	Sleep	CPAP	NIV	HOX
No. Autonomous Workers	**79**	**76**	**50**	**54**
% Response	(47%)	(45%)	(30%)	(32%)
No. Regulated	**76**	**70**	**49**	**52**
% Regulated	(96%)	(92%)	(98%)	(96%)
No. >Band 5	**69**	**56**	**40**	**49**
% >Band 5	(87%)	(74%)	(80%)	(91%)

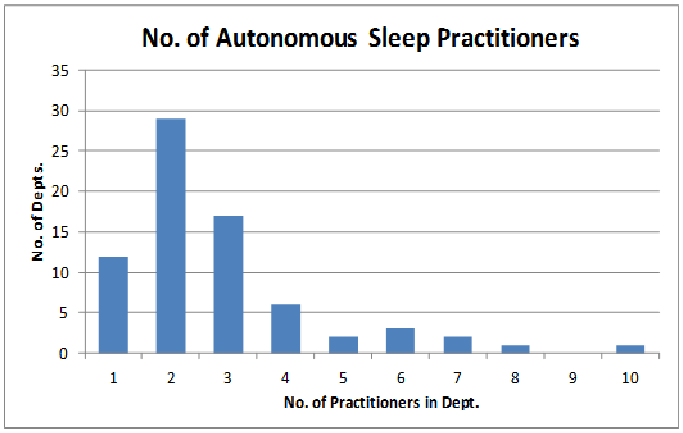
Sleep – Sleep (diagnostic)
CPAP – Continuous Positive Airways Pressure (therapeutic)
NIV – Non-Invasive Ventilation (therapeutic)
HOX – Home Oxygen (diagnostic &therapeutic)

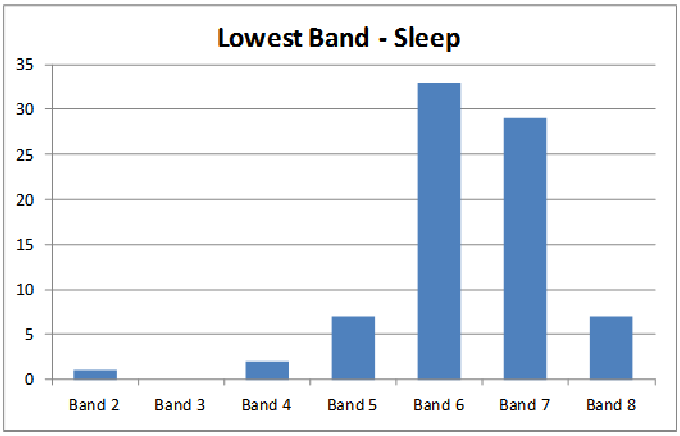
In Sleep and CPAP almost half of labs offer some level of autonomous service provision by healthcare scientists. In NIV and home oxygen, this was the case for only about a third of centres. For Sleep, NIV and home oxygen services over 95% of autonomous decisions were made by (probably) regulated practitioners, with the majority of these being at Band 6 or above. In CPAP over 90% were regulated with a larger proportion operating below Band 6.

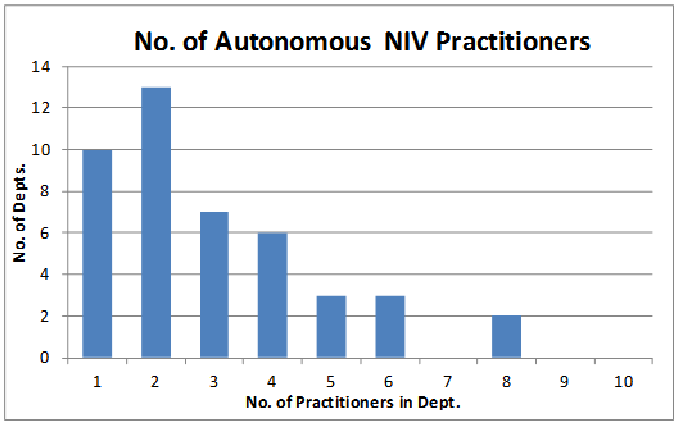
Further analysis of the survey data shows the breakdown of the number of autonomous practitioners in each department and the minimum banding of autonomous practitioners in these specified services (See Figure 5).

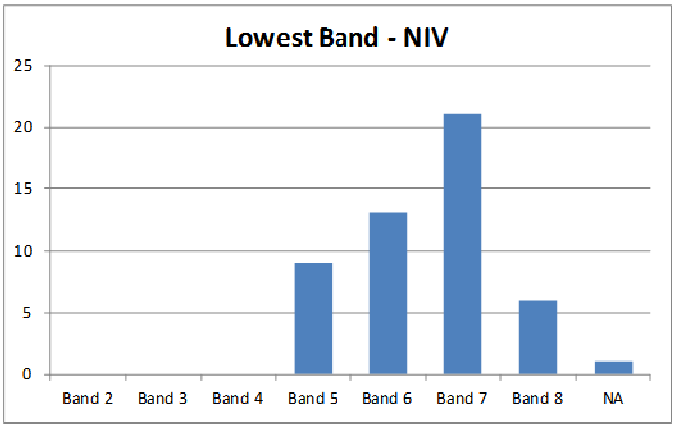
Given the changing roles of Clinical Physiologists/Scientists and the modified MSC career pathway, it is evident that the amount of autonomy that staff have in their day-to-day practice needs to be clarified. There is a need to understand the concept of 'truly autonomous' working and 'working to protocol with limited options' by lower bands 5/6 that are over-seen, or checked, by a senior bands 7/8. This subtle difference can be used to upgrade staff or expand services using lower grade staff, but service demands and resources will be determining factors for this. However, at all times, clinical governance, patient safety and quality standards must be maintained.

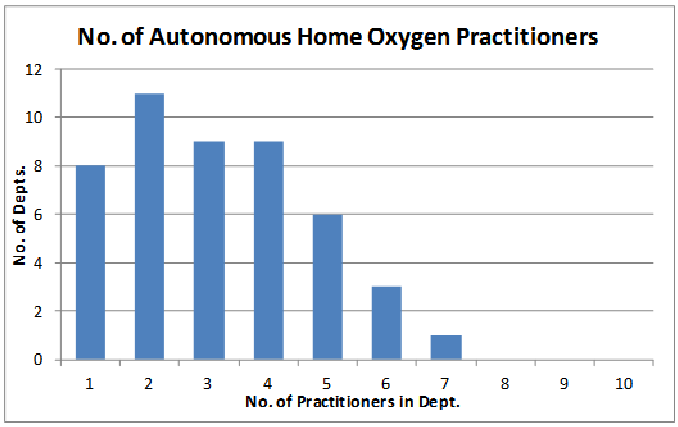
Figure 5: Numbers & Banding of Autonomous Healthcare Scientists

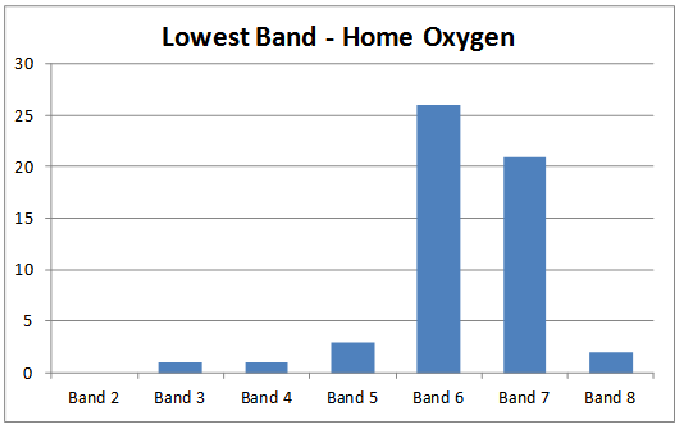


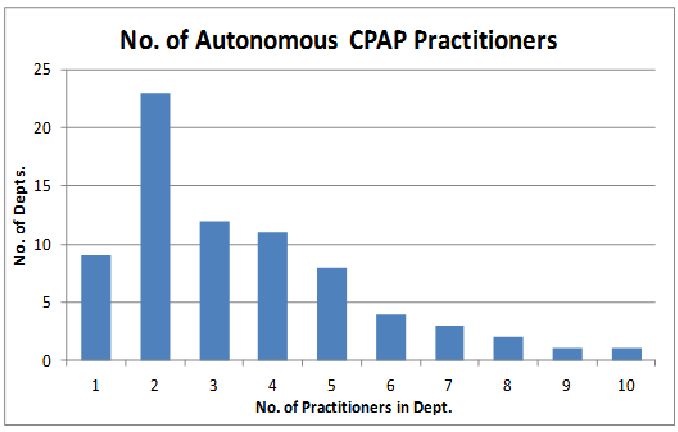


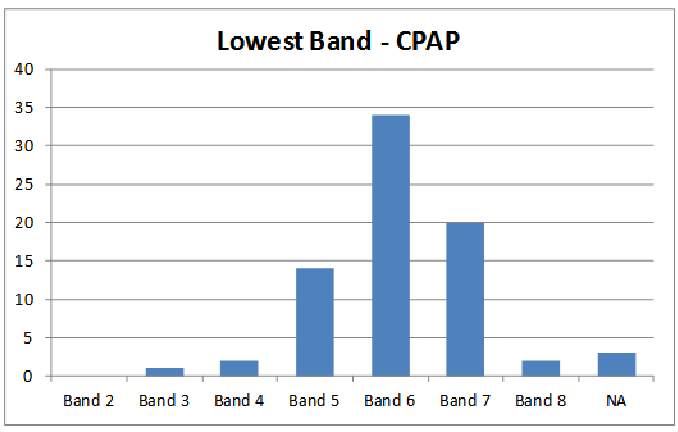












Discussion

This is the first ARTP Survey which has collected data on autonomous practice so it is not possible to prove definitively that there has been any increase autonomy of practice in respiratory & sleep clinical physiology, however it is likely that there has and these data can now be used as a benchmark for future surveys.

It is encouraging that most autonomous working is undertaken by regulated (assuming all Band 5 practitioners are RCCP regulated) and the majority are Senior (Band 6 and above) grade with training and experience. It is assumed that standard operating procedures (SOPs) and local policy permit this practice to occur safely.

At first glance it may be concerning that there are a few Band 2, 3 & 4 staff who are practising autonomously, but it is likely that they are well-supervised, that clinical governance is in place and that they are well trained and experienced. If this is not the case, then departments operating in this way run a high risk of adverse clinical incidents and poor governance which may lead to patient harm.

It is not surprising that the high volume services of Sleep and CPAP are utilising some lower band staff to deliver services, because once the clinical decision is made and the patient is established on CPAP for example, routine care can be straightforward and fairly repetitive. It is good to see that for the more clinically risky services of Home Oxygen and NIV, relatively senior and regulated staff are usually making the clinical decisions.

Most centres who deliver services where autonomous decisions are made by healthcare scientists have between 1-4 members operating in this way. Of course by looking at the minimum band we are missing who is actually making these decisions, but at least from the head count, it is possible to deduce how many centres operate in this way.

Autonomous working can include both “truly autonomous” workers and “supervised but working to strict protocol” workers to produce a flexible workforce that operate safely to quality standards.

It will be interesting to see how this pattern changes in future surveys with the changes to the healthcare landscape, catalysing different ways to deliver care more cheaply but safely.

Recommendation 7: **ARTP needs to promote the advantages of HCSs working in autonomous practice in order to raise the profile of the profession. [Action: Workforce Committee]**

Recommendation 8: **Future changes in autonomous practice need to be closely monitored to identify any workforce needs eg. individual development, education & training, regulation, etc. [Action: Workforce Committee]**

Administrative Support

Figure 6: Admin Support Poll

Admin Support	n	%
Full time	22	36%
Part Time	22	36%
none	17	28%
Total	**61**	

A separate online survey conducted via the ARTP email forum in May 2012 [7] asked labs in if their services had administrative support. There were 61 responses, showing that over a quarter of units had no administrative support and less than 40% had full time administrative support. This implies in many labs skilled staff are diverted from clinical activities to perform routine administrative duties such as booking appointments etc which could be more appropriately assigned to lower grade posts or other administrative staff.

Recommendation 9: Respiratory/Sleep labs should have appropriate administrative support in their establishment numbers to allow clinical staff to concentrate on clinical duties. [Action: Workforce Committee]

PROCEDURES

Availability of Procedures & Services

The availability of many diagnostic test procedures was assessed in the 2005 Survey (not in previous surveys) so the change in prevalence of certain tests can be estimated. This assumes that the samples are comparable although the sample size is a little smaller in the 2012 survey (the labs performing purely sleep diagnostics have been removed from this analysis).

Some prior data for availability of procedures from the 2003 ARTP Survey can also be found in the 2005 ARTP Survey Report [8] which is available on the ARTP Website.

These data are presented in Table 15; greater than or equal to 5% has been taken as being a significant change.

Lung Function

Full Pulmonary Function Tests (PFTs) possibly gives us a benchmark that we have about 2% tolerance when we compare this and the previous survey; though it may be that we have had responses from a few more 'spirometry only' labs this time.

In the Advanced PFTs section the fall in gas dilution methods and significant rise in plethysmographic techniques would seem to suggest a shift toward body plethysmograph becoming the primary method of measuring lung volumes. The two figures are not of the same magnitude as most labs on acquiring a body plethysmograph would probably want to retain a gas dilution technique.

Forced oscillometry (commercially known as IOS), has doubled in activity but is still only available in 20% of labs. Since 2005 but the measurement of mouth pressures has significantly increased and exhaled NO has seen a substantial rise (perhaps with the technology becoming more affordable and the technique becoming useful for diagnosis and control of asthma).

Blood Gases

Whereas access to arterial blood gas sampling has only slightly increased there has been a substantial rise in the use of capillary blood gases the driver for this probably being the introduction of the new national contract in 2006 and the associated BTS Clinical Component [9] which started a move towards formal oxygen assessments which has still not yet, remarkably, been fully adopted.
Transcutaneous assessment of blood gases is also rising, perhaps again due to equipment affordability.

Sleep Studies

Respiratory based Sleep Study techniques show a rise in availability, probably being driven by the publication of the NICE CPAP Health Technology Appraisal (TA139) [10] in March 2008 and the emphasis placed on sleep diagnostic waiting times introduced into the DH monthly census in 2006 [11].

Up to a third of 'Respiratory' or 'Cardio-Respiratory' labs only have overnight oximetry available for the investigation of sleep disordered breathing though this falls to only 6% in those who describe themselves as 'Respiratory and Sleep' who have the other more complex sleep investigations at their disposal.

Table 11: Responding Labs Doing Sleep

Response	Total Labs
Yes	109
No	29
No answer	24
Soon	1

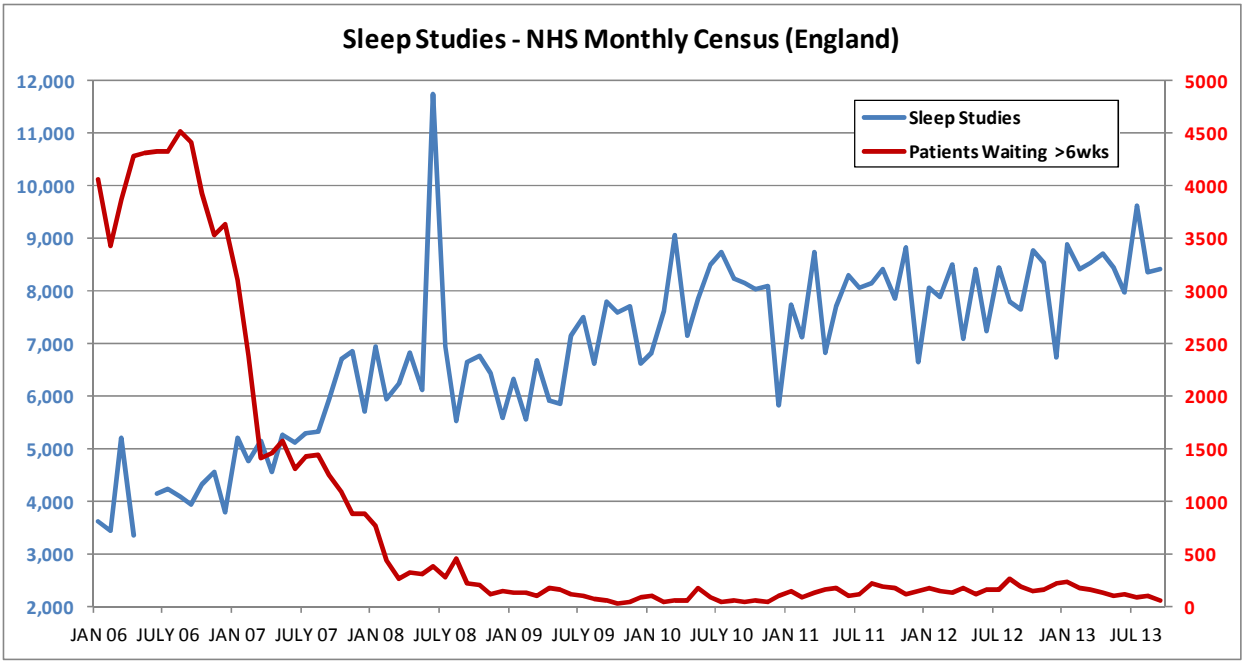
There is no change in Full Polysomnography (PSG) availability but this analysis only included respiratory and multi-disciplinary (not purely sleep) laboratories.

(Continued after Table 15 …)

Table 15: Procedure Availability 2005 - 2012

Procedure	2005 % responders	2012	Difference If greater than 5% change… Red=decrease / green=increase
Routine PFT's			
'Full' PFT's	96.6%	**95.0%**	**-1.6%**
Advanced PFT's			
Lung Volumes by Gas Dilution Methods	90.4%	**83.5%**	**-6.9%**
Lung Volumes by Body Plethysmography	51.8%	**71.4%**	**19.6%**
Airways Resistance by Body Plethysmography	43.4%	**68.3%**	**24.9%**
Lung Compliance by Body Plethysmography	19.3%	**40.3%**	**21.0%**
Impulse Oscillometry	8.9%	**16.3%**	**7.4%**
Mouth Pressures (MIPs/MEPs)	69.4%	**84.3%**	**14.9%**
Exhaled Nitric Oxide	10.9%	**35.8%**	**24.9%**
Blood Gases			
Oxygen Saturation by Oximetry ('Spot' testing)	89.4%	**88.7%**	**-0.7%**
Ear Lobe Capillary Blood Gas Sampling	40.4%	**61.0%**	**20.6%**
Arterial Blood Gas Sampling	51.6%	**54.1%**	**2.5%**
Transcutaneous Measurement of Blood Gases	28.8%	**37.6%**	**8.8%**
Sleep			
Overnight Oximetry	81.9%	**84.5%**	**2.6%**
Limited Multichannel Studies (< 5 signals)	48.0%	**56.1%**	**8.1%**
Limited Multichannel Studies (5 or more signals)	38.6%	**45.5%**	**6.9%**
Full Polysomnography, incorporating EEG	15.5%	**15.4%**	**-0.1%**
CPAP Assessments/Trials/Titration	61.9%	**61.6%**	**-0.3%**
CPAP Follow Up & Support	62.5%	**60.8%**	**-1.7%**
Challenge Tests			
Response to Hypoxic Challenge (flight)	47.8%	**64.6%**	**16.8%**
Challenge Testing (histamine/methacholine etc)	52.0%	**46.8%**	**-5.2%**
Challenge Testing - Mannitol	*n/a*	**43.2%**	---
Challenge Testing - Other	27.7%	**20.5%**	**-7.2%**
Exercise Tests			
Step Exercise Tests	*n/a*	**14.8%**	---
6 or 12 Minute Walk Tests	71.7%	**83.3%**	**11.6%**
Shuttle Walk Tests	46.9%	**54.5%**	**7.6%**
Exercise Induced Asthma (Bronchial Lability)	65.3%	**59.2%**	**-6.1%**
Gas Exchange, Ventilation and Work Rate (CPET)	32.7%	**46.8%**	**14.1%**
Other Treatments & Assessments			
Skin Allergen Testing	66.5%	**71.4%**	**4.9%**
Ambulatory Oxygen Assessment	53.1%	**64.5%**	**11.4%**
Long Term Oxygen Therapy Assessment	62.5%	**73.4%**	**10.9%**
Nebuliser Assessments	74.8%	**62.3%**	**-12.5%**
Services			
Acute NIV for Resp. Failure	56.3%	**63.4%**	**7.1%**
Inspiratory Muscle Training	13.8%	**24.2%**	**10.4%**
Pulmonary Rehabilitation	56.8%	**56.1%**	**-0.7%**
Respiratory Outreach Team / Community	59.2%	**59.3%**	**0.1%**
Direct Access Spirometry	33.3%	**26.2%**	**-7.1%**
Spirometry in the Community	26.3%	**13.1%**	**-13.2%**
'Over-reading' of Spirometry	*n/a*	**10.7%**	---

Figure 7: Sleep Studies - English National Monthly Census



To support the 18 week Referral To Treatment (RTT) initiative in England milestones were set for a set of diagnostic tests, sleep studies being one of the selected indicators. Milestones were set for a maximum wait for these indicators of 13 weeks by March 2007 and 6 weeks by March 2008.

Whether the spike in the graph (Figure 7) at June 2008 is genuine is debatable but pressure was being exerted in the early months of 2008 to increase capacity to bring down excessive waiting times to meet the 'milestone' and a step increase can be seen which does effect a reduction in waits.

Prior to June 2006 it was reported that 3900 studies per month were being performed. More recently, in the 6 months up to Sept 2013, 8586 studies per month (average) were performed, a 120% increase in activity, ie more than double. The majority of that increase was achieved over about 4 years (2006 to 2010).

Interestingly the availability of CPAP services shows no change despite the ARTP SAC Short Report - Impact of NICE CPAP HTA on Sleep Services published in December 2008 [12] suggesting a 75% rise in issues as a result of the NICE HTA. This would seem to suggest that the increased activity is being accommodated in the same number of centres.

Challenge Testing

Flight assessment availability has increased probably as a result of the BTS guideline Managing Passengers with Respiratory Disease Planning Air Travel which was originally published in 2004 and updated in 2011 [13]. The 2010 NICE COPD Guideline [14] also recommends that COPD patients should ideally be assessed in accordance with the BTS recommendations.

Traditional Histamine/Methacholine challenge testing has fallen slightly perhaps giving way in some labs to the new technique of Mannitol testing which wasn't available in 2005 and only recently achieved licensing for use in this country, this could probably legitimately be viewed as a 43.2% rise in availability.

The Exercise Induced Asthma (EIA) and 'Other' challenge techniques may also have fallen in preference to Mannitol.

Exercise Testing

The walk test protocols have both increased probably partly to accommodate ambulatory oxygen assessments but recent lung cancer/ILD guidelines have promoted their use for assessing prognosis.

Full Cardio-Pulmonary Exercise Testing (CPET) has also increased, probably as a result of increased demand for pre-operative assessments.

Other Treatments & Assessments

As mentioned in the Blood Gases section there has been a rise in the demand for LTOT and Ambulatory Oxygen Assessments.

A fall in formal nebuliser assessments may reflect a move away from nebulised to maximal inhaled therapy and/or an improvement in the pharmacology now available for managing chronic lung problems.

Services

Acute NIV shows a slight rise in availability.

Inspiratory Muscle Training although still not widely available is showing a significant increase.

The surprising findings in this section are the apparent stagnation of availability of Pulmonary Rehabilitation which should really be showing very significant growth following recommendations in the NICE COPD Guideline which was originally published in 2004 and its inclusion in the NICE Quality Standards for COPD [15]. This may just reflect that the PFT labs are not involved in delivery of Pulmonary Rehabilitation services which are usually mainly led by Physiotherapists.

Similarly the apparent fall in Direct Access Spirometry and Spirometry performed by lab staff in the community are confounding findings when the emphasis placed on Quality Assured Diagnostic Spirometry (QADS) in the NICE Quality Standards for COPD should really be driving an increase. However this is probably demonstrating that GPs are providing their own spirometry services and don't need to send patients in to the respiratory labs or have a clinical physiologist working in conjunction with the practice.

There has been a greater interest over the past few years in primary care staff obtaining the training to perform spirometry (e.g. ARTP Courses [16]) and so they have become less reliant on secondary care labs for these measurements. Over-reading of these primary care services is a service which seems to be getting a foothold.

Figure 8: ARTP Certificates Issued by Year

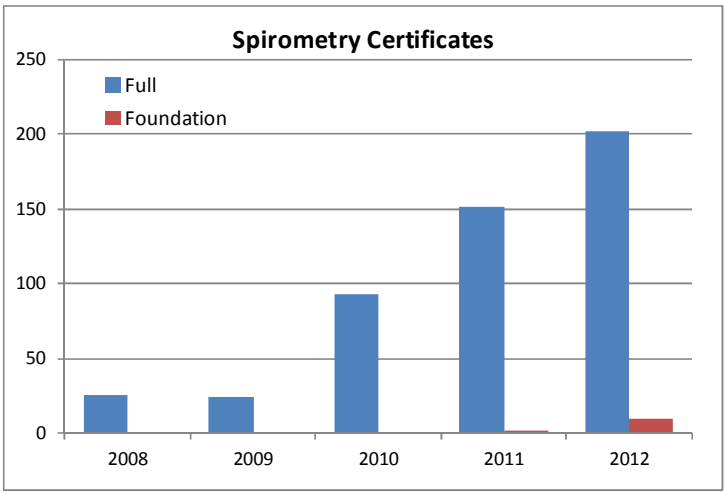


Figure 8 shows the increase in the number of people attaining the ARTP Spirometry Certificates. Nearly 500 candidates have now been certified.

The availability of most procedures has increased however (apart from the census data on sleep studies - Figure 7) these data do not verify any actual increase in activity levels. The 2005 survey provided a good snapshot of activity levels at that time. More work needs to be done to show what changes in activity there have been over time and compare that with the changes in workforce that have been established in this report. Accurate activity information will be crucial in establishing new HRG codes and securing Payment By Result (PBR) tariffs for respiratory procedures (see the companion paper on Coding to be published in conjunction with this survey report.)

Recommendation 10: A further survey needs to be conducted to determine changes in activity for procedures. [Action: Workforce Committee]

Recommendation 11: The 'companion' report on Activity & Coding to be published. [Action: Karl Sylvester]

Recommendation 12: Quality Assured Diagnostic Spirometry should be delivered to ARTP standards in all primary/community locations. [Action: Standards Committee]

Recommendation 13: The uptake of the ARTP Spirometry Certificates needs to be monitored over the next few years to gauge the quality of QADS being performed by non-HCS staff. [Action: Education Committee]

Recommendation 14: Full PFTs and Spot oximetry should be available as a minimum requirement, in all secondary care respiratory function services. [Action: Standards Committee]

Recommendation 15: ARTP should consider using the procedure availability data to identify a set of 'barometer' labs which could be used to more readily identify trends and changes in practice. [Action: Standards Committee]

Table 16: Minimum Band Performing Procedures

Procedure	Band 2	Band 3	Band 4	Band 5	Band 6	Band 7	Band 8	Nurse	Physio-therapist	Medic	n=
'Full' PFT's	0.9%	0.9%	11.9%	**52.3%**	26.6%	7.3%					**109**
Lung Volumes (Box)		1.1%	3.4%	**55.7%**	28.4%	10.2%	1.1%				**88**
Lung Volumes (Gas)	1.0%	2.0%	10.1%	**50.5%**	30.3%	6.1%					**99**
AWR (Box)		1.2%	3.6%	**50.0%**	34.5%	9.5%	1.2%				**84**
Compliance (Box)		2.0%	3.9%	**45.1%**	33.3%	13.7%		2.0%			**51**
Impulse Oscillometry	4.3%			**47.8%**	26.1%	8.7%		13.0%			**23**
Pressures (MIPs/MEPs)	2.1%	4.1%	5.2%	**52.6%**	29.9%	5.2%	1.0%				**97**
Exhaled Nitric Oxide	13.0%	8.7%	4.3%	**39.1%**	15.2%	4.3%		10.9%		4.3%	**46**
'Spot' Oximetry	23.4%	**29.0%**	14.0%	18.7%	8.4%	1.9%		3.7%		0.9%	**107**
ELC Blood Gas	7.1%	12.9%	5.7%	**31.4%**	21.4%	15.7%		5.7%			**70**
Arterial Blood Gas		1.8%		12.3%	**36.8%**	17.5%		5.3%		26.3%	**57**
Transcutaneous Blood Gas		2.1%		**37.5%**	29.2%	8.3%	2.1%	16.7%	2.1%	2.1%	**48**
											0
Overnight Oximetry	13.1%	**25.3%**	8.1%	22.2%	19.2%	7.1%		4.0%	1.0%		**99**
Multichannel Sleep (< 5)	3.0%	11.9%	4.5%	31.3%	**34.3%**	9.0%		4.5%	1.5%		**67**
Multichannel Sleep (5+)	3.5%	10.5%	3.5%	33.3%	**40.4%**	5.3%		3.5%			**57**
Full Polysomnography		7.4%		11.1%	**48.1%**	11.1%	3.7%	18.5%			**27**
CPAP Trials		5.1%	3.8%	22.8%	**43.0%**	12.7%		8.9%	3.8%		**79**
CPAP Follow Up	1.3%	7.7%	6.4%	20.5%	**37.2%**	10.3%	1.3%	11.5%	3.8%		**78**
Hypoxic Challenge	2.7%	2.7%		26.7%	**52.0%**	14.7%		1.3%			**75**
Bronchial Challenge				32.1%	**44.6%**	19.6%	1.8%	1.8%			**56**
Mannitol Challenge	1.8%			**40.0%**	**40.0%**	12.7%	3.6%	1.8%			**55**
Other Challenge				26.1%	**47.8%**	26.1%					**23**
Step Exercise				**44.4%**	16.7%			22.2%	16.7%		**18**
6 or 12 Minute Walk Tests	2.1%	2.1%	9.4%	**41.7%**	39.6%	3.1%		2.1%			**96**
Shuttle Walk Tests	4.8%	1.6%	9.7%	**33.9%**	32.3%	1.6%		1.6%	14.5%		**62**
Exercise Induced Asthma		1.4%		20.5%	**60.3%**	13.7%	2.7%	1.4%			**73**
CPET			1.7%	8.5%	**59.3%**	22.0%	1.7%	3.4%		3.4%	**59**
Skin Allergen Testing	2.6%	9.0%	5.1%	29.5%	**32.1%**	3.8%		16.7%		1.3%	**78**
Ambulatory O2 Assessment		4.3%	1.4%	8.6%	**50.0%**	14.3%	1.4%	15.7%	4.3%		**70**
LTOT Assessment		3.8%	2.6%	15.4%	**44.9%**	10.3%		21.8%		1.3%	**78**
Nebuliser Assessments	3.0%	4.5%	4.5%	**30.3%**	25.8%	6.1%		22.7%	3.0%		**66**
Acute NIV (Hospital)				14.3%	**23.8%**	19.0%	1.6%	**23.8%**	11.1%	6.3%	**63**
Inspiratory Muscle Training				8.3%	**16.7%**	**16.7%**		4.2%	**54.2%**		**24**
Pulmonary Rehabilitation		1.7%	1.7%	8.3%	15.0%	11.7%		10.0%	**51.7%**		**60**
Outreach / Community	1.9%		1.9%	11.3%	28.3%	7.5%		**39.6%**	9.4%		**53**
Direct Access Spirometry	17.2%	**31.0%**	20.7%	10.3%	6.9%	6.9%		6.9%			**29**
Spirometry in Community	18.8%	18.8%	**31.3%**	25.0%				6.3%			**16**

5% to 10% *>10% to 20%* *>20% to 40%* *>40%* ***Bold** = greater values for each procedure*

Grades Performing Procedures

Departments were asked to specify the 'minimum' grade of staff performing each procedure in their department and the summary of this information is presented in Table 16.

We also asked people to report the 'usual' grade performing each procedure however there were only 33 returns for this section would make any meaningful analysis inconclusive.

Similar information on 'minimum' grading was reported in the 2005 Survey in the same format so comparisons can be made looking for changes in practice between the two surveys.

To make comparisons it is necessary to make some assumptions about how the old grading system (MTOs) matches across to the current Agenda for Change (AfC) bands. General consensus is that the basic qualified practitioner level was MTO2 on the old system and is now Band 5 under AfC, though it has to be acknowledged that there are regional variations in how that has been applied.

Across the **Routine PFT** procedures there has been a shift towards the centre grades; a reduction in the higher bands and lower (ATO/SATO) grades, and no testing by nursing staff reported (4-5% in 2005). These data signal the more appropriate use of Band 5 for these procedures. Current service design ideas are that these tests could probably be appropriately undertaken by Band 4 and a slight rise at this grade is being demonstrated.

Exhaled Nitric Oxide, having become more widely available, seems to have become more devolved to HCA grades presumably as an outpatient clinic tool.

Spot Oximetry testing has also seen a significant move away from the qualified physiologist, even away from nursing staff, again possibly more to HCA staff in OPD settings. **Ear Lobe Capillary Blood Gases** register a slight move away from Nursing staff to HCA grades but there is a significant swing away from nursing and medical staff to physiologists performing **Arterial Blood Gases**, this demonstrates an expected cascading and delegation of skills into the diagnostic laboratory, most likely prompted by the increase demand for Oxygen Assessments.

Overnight Oximetry shows a movement towards lower bands, particularly Band 3 (presumably issuing recorders and downloading data but not interpreting). The 2 types of **Multichannel Sleep Studies** show a similar profile centred mainly on Band 5 & 6 with again some Band 3 support. The profile for **Polysomnography** has remained similar, perhaps just a small movement towards Band 5 however there remains a significant nursing cohort performing PSGs and, as those polled in this survey were mainly not sleep specialist labs this is probably not a true reflection of the sleep workforce as a whole.

It is interesting to note an absence of any medical involvement at all being reported for sleep diagnostics on this survey.

Both **CPAP Trials and Follow Up & Support** have shown a slight upward shift in the bandings and more significantly a doubling of nurse involvement.

Challenge Testing centres on the senior grade at Band 6 though with a slight increase in Band 5. Data on **Mannitol Testing** was not collected in 2005 but in this survey it seems to be a little more acceptable for basic grades to perform this procedure perhaps because it is a more standardised procedure/protocol than other challenge methods mainly requiring the application of high quality spirometry

Step Tests do not seem to be very widely used, only 18 labs report using them and a relatively large proportion are performed by nurses or physiotherapists.

Shuttle Walk Tests have been taken up more by physiotherapists, presumably because of them being used in Pulmonary Rehabilitation**. Timed Walk Tests** seem to show a move toward higher grades; probably as part of oxygen assessments being performed by physiologists who need to be a higher grade to make the associated decisions.

Bronchial Lability Exercise testing seems to have maintained popularity where it might have been thought that Mannitol might have reduced the need. There appears to be a shift towards delegating this test to lower grades than in the previous survey.

The vast majority of labs (>80%) deem full **CPET** testing to be the remit of Band 6 or higher physiologists.

There has been a significant shift away from nurses to physiologists performing **Skin Allergy Testing** (39% in 2005 to 17% in this survey).

Both **Ambulatory and Long Term Oxygen Assessments** have moved across significantly from the nurse/physio/doctors' domain to physiologists in Band 6 or 7. Conversely the majority of **Nebuliser Assessments** are being undertaken by nurses and where they are undertaken by physiologists it is mainly done by basic grades (Band 5).

Acute NIV is evenly split between physiologists and the other professions, administered only (appropriately) by qualified grades of physiologists.

There has only been a modest (10%) change in the availability of **Inspiratory Muscle Training** but whereas 8% of this was done by Physiologists in 2005 it is now about 40%.

There is certainly more physiologist involvement now in **Pulmonary Rehabilitation** with physiologists apparently taking the place of nurses.

Outreach/Community Working was previously almost exclusively in the nursing domain in 2005 but this survey shows almost 50% physiologist involvement (across the grades).

There is a very definite shift in the staff providing **Direct Access and Community Spirometry** with the bulk of it now being delivered by the unqualified HCS (Band 2-4) grades although these individuals may well hold appropriate competency (eg ARTP Certificates). In the qualified Band 5 there is 10% providing Direct Access but 25% in the Community where they are more likely to be operating unsupervised.

Recommendation 16: All staff performing and/or interpreting diagnostic tests should be appropriately trained and qualified or working under appropriate supervision.
[Action: Workforce Committee]

Recommendation 17: ARTP to consider commissioning a piece of work to determine appropriate grades for each procedure – to help to standardise & define AfC grades, perhaps to include typical 'job-plans'.
[Action: ARTP Exec Board]

REFERRAL SOURCES

We asked departments to estimate the relative percent of referrals received from respiratory teams in each different type of laboratory. Those declaring themselves to be respiratory services (the majority of labs surveyed) reported an average of about 70% of the referrals coming from respiratory teams; this was a little less in labs which also provide sleep services. For Multi-disciplinary labs the rate was a little higher at about 75 to 80% of respiratory referrals. Specialist services (paediatric and sleep) reported around 30% respiratory referrals, although this was a relatively small cohort.

129 laboratories responded to the question asking if they received PFT Referrals directly from Primary Care. 59% don't get direct access referrals from Primary Care. Of the 41% (48 labs) who do the responses are summarised in Table 17.

Table 17: Referrals from Primary Care by Lab Type

Lab Type	Avg of % referrals (range)	n=
Cardio-Respiratory	5.6 (1-10)	7
Cardio-Respiratory and Sleep	10.0	1
Multi-Disciplinary	28.3 (15-50)	3
Paediatric Respiratory	5.0	1
Respiratory	10.9 (1-40)	16
Respiratory and Sleep	13.5 (1-60)	19
Sleep	80.0	1

Respiratory Equipment

Table 18: Respiratory Physiology Equipment

	Frequency in Labs	Change since 2005
Full PFT Systems (a) (n =296)		
Jaeger	40%	+11%
Medisoft	17.5%	+12.5%
nSpire	27 %	
SensorMedics VMAX	14%	-9%
Medgraphics	1%	No change
Other	0.5%	
Spirometers (b) (n = 128)		
Micromedical	44%	+29%
Vitalograph	33.5%	-42.5%
Carefusion	11%	
nSpire	8%	
Medisoft	1.5%	
MIR	1.5%	
NDD	1%	
Cardiopulmonary Exercise Testing (a) (n=91)		
Jaeger	29%	-
SensorMedics	25%	-
Medisoft	15%	-
nSpire	13%	-
Medgraphics	8%	-
Geratherm	7%	-
Other	3%	-
Nitric Oxide monitoring devices (a) (n=64)		
Aerocrine	70%	
Bedfont	17%	
Medisoft	6%	
Other	7%	
Oximeter (Spot Oximetry) (a) (n = 372)		
Minolta (Pulsox 1 / 300 series)	56%	-13%
Nonin	12%	↑
Masimo (Radical 7)	8%	↑
Nellcor	6%	-3%
Ohmeda	3%	-15%
BCI (3301/3240Y)	2%	-
Other	13%	-

(a) Based on the total number of systems (b) Based on the lab's main spirometer

For full PFT equipment, the survey recorded the total number of systems reported. The data (summarised in Table 18) shows that there was an increase of 11% in Jaeger systems, making this now the most commonly used system (40%). There was also an increase in Medisoft systems (12.5%). In the 2005 survey Ferraris/Morgan equipment was the most common type of equipment, but this is no longer available in the UK. There was a fall (by 9%) in SensorMedics equipment.

83% and 12% of departments reported having a service or not having a service contract respectively. 5% of departments did not know if they had a service contract or not!

The market for service contracts in the UK is not insignificant. If each lab has one service contract at eg £3000/year then in the 251 UK labs, the lung function equipment service market alone is worth at least £753K (minimum) per year. Some centres will have more than one piece of equipment and some will have blood gas, CPET and sleep equipment, the servicing costs of which would probably add up to well over £1M/year. At an individual department level these 'running' costs represent significant proportion of the laboratory budget. Careful consideration of the appropriate level of cover and negotiation of contracts is important to ensure cost efficiencies are made. The ARTP Manufacturer's Liaison Committee is concerned about disproportionate costs for equipment servicing and intends to monitor and challenge companies' pricing policies.

For hand-held spirometers, we collected information on departments' main type of spirometer. The Micromedical spirometers have shown a large increase in popularity (+29%) and are the most popular (44%). There has been a large decrease in Vitalograph spirometers, which fell by 42.5% from being the most popular in 2005, to now being second most popular.

For cardiopulmonary exercise testing equipment, there is no comparative data from 2005, but the Jaeger equipment is the most commonly used (29%), closely followed by SensorMedics (25%). 55% of departments had a cycle ergometer and 14% had a treadmill only, indicating that the cycle ergometer is the exercise platform of choice. However, 30% of departments reported having both a treadmill and cycle ergometer available.

The most commonly used nitric oxide monitoring device is the Aerocrine device (70%). There is no comparative data from previous surveys.

Table 19: Blood Gas Analysers

Blood Gas Analysers	Laboratory Based (n=91)	Portable (n=42)
Radiometer ABL series	44%	36%
Instrumentation Labs GEM series	19%	14%
Siemens Rapid Lab	11%	-
Abbott i-STAT	11%	36%
Other	5%	7%
Alere Epoc	5%	7%
Roche Cobis	4%	-

Table 19 shows common blood gas analysers used for laboratory based and portable testing (departments were asked to reported the main device they use). In addition to blood gas analysers, some departments reported using non-invasive transcutaneous CO2 monitors.

Recommendation 18: All labs should ensure they have appropriate and adequate service continuity plans in the event of equipment breakdown. This may include contract or other maintenance support. [Action: Department Heads]

Sleep Equipment

Table 20: Sleep Physiology Equipment

	Frequency in Labs
Overnight Oximetry (a) (n = 118)	
Minolta	81%
Masimo	6%
Nonin	5%
Other	8%
Multichannel Studies (b) (n =357)	
ResMed Embletta	37%
Stowood Embletta	18%
SomnoMedics Somnoscreen	16%
Stowood Visi-Lab	8%
Respironics – Alice	5%
Respironics – Stardust	5%
Other	11%
Polysomnography (b) (n = 64)	
Somnomedics (Somnoscreen)	34%
Respironics (Alice)	20%
Stowood (Visi-lab)	14%
Embla (S7000/N7001)	14%
ResMed (Embletta)	6%
DeVilbiss (Porti)	3%
Compumedics	3%
Carefusion (Somnostar)	3%
Other	5%
CPAP equipment (a) (n = 80)	
ResMed	60%
Philips Respironics	31%
Fisher and Paykel	6%
DeVilbiss	2.5%
NIV Equipment (a) (n = 51)	
ResMed VPAP	27%
B + D NIPPV 3	18%
Philips Respironics REM Star BIPAP	16%
Breas/GE VIVO30	8%
Other	31%

(a) Based on the main device used in each department
(b) Based on the total number of devices used

For overnight oximetry, the Minolta range of pulse oximeters remain the most commonly used, with 81% of departments using these oximeters. This is an increase of 12% from the previous survey in 2005. For departments performing overnight oximetry, the number of oximeters per department ranged from 1 to 60 devices, with an average of 8 oximeters per department.

For multichannel sleep studies, the Embletta range is the most commonly used device. Somnomedics equipment is the most popular polysomnography device (34%).

For CPAP, the ResMed devices are the most popular with 60% of departments using these machines for their patients. For those departments loaning CPAP units the number of patients established on CPAP treatment ranged from 1 to 8151 patients, with a department on average having 1385 patients on CPAP treatment.

ResMed devices were also the most popular NIV equipment, with 27% of departments using these machines. In departments using NIV for long term domiciliary support the reported number of patients on this treatment ranged from 2 to 1530 patients, an average of 195 patients per department using NIV treatment.

Information Technology

In January 2013 Jeremy Hunt MP, The Health Secretary, issued a challenge for the NHS to go paperless by 2018[17]. This included an expectation that 'hospitals should plan to make information digitally and securely available by 2014/15'. The survey pre-empted this by asking a few questions to verify readiness for paperless systems.

Just half (52%) of the responding departments reported that they had lung function equipment that was linked via a network.

74% of departments indicated that they use an electronic diary/booking system to schedule their patient appointments. However, 26% of departments indicated that they do not have electronic diaries available, and this may mean that they are still relying on paper-based systems to schedule appointments. The limitations to using paper based systems include not being able to keep a robust record of patient appointments, monitoring of waiting times and possibly impacts on arranging payment for diagnostic procedures which may then also have a further impact on income & staff resources. ARTP recommend the use of electronic booking systems for diagnostic tests.

The majority of departments (56%) had no external link to allow diagnostic test results to be accessed from outside of their department. ARTP encourage the use of external report links wherever possible, so that results are readily available to clinicians, disruption to clinical care is reduced, results are stored securely and reducing the burden on respiratory/sleep staff having to reprint test results.

90% of departments reported using the patient's hospital number primarily as the patient identifier. Only 10% of departments were using the NHS number. The NHS will need to become the unique patient identifier in future to enable transfer of patient data between all healthcare systems, whether they are in primary care, secondary care, community care or even independent sector providers.

It is clear that the majority of respiratory labs will require considerable resources and support if they are to be able to meet the challenge to go paperless within the timeframe.

Recommendation 19: ARTP recommend the use of electronic booking systems for diagnostic tests. [Action: Standards Committee]

Recommendation 20: ARTP encourage the use of external report links wherever possible to enable remote access to test results. [Action: Standards Committee]

Recommendation 21: Laboratories need to ready themselves for the transition to paperless exchange of information. [Action: Department Heads]

REPORTING CRITERIA

Guidelines

Table 21: Guidelines Used For Lung Function Testing

Guidelines followed (n=140 responses)	% of departments using the guidelines
ARTP/BTS 1994 guidelines	51%
ATS/ERS 2005 guidelines	31%
ERS 1993 Update	10%
Other	4%
Unknown	4%

Table 21 shows that the most common guidelines used in respiratory testing departments are the ARTP/BTS 1994 guidelines [18], used by 51% of departments. 31% of departments were using the ATS/ERS 2005 guidelines [19][20][21][22][23].

4% of departments were unsure which guidelines they were following!

There were a small number of departments who stated they used both the ARTP/BTS and the ATS/ERS guidelines.

Bronchodilator Reversibility Criteria

The replies summarised in Table 22 show that a wide range of criteria are used to assess bronchodilator responses.

Table 22: Reversibility Criteria

Bronchodilator Reversibility Criteria (n=130 responses)	% of departments using the criteria
FEV1 = 200ml + 15%	40%
FEV1 = 200ml + 12%	23%
FEV1 > 160ml or VC > 330ml	14%
> 400ml change	12%
Unknown / Other	8%
FEV1 = 200ml +10%	3%

Reference Values

Responses regarding the reference equations used for the various pulmonary function tests are summarised in Table 23.

Table 23: Adult Reference Values

Adult Reference Values Used	% of departments
Spirometry (n=122 responses)	
ECCS / ERS 1993	**95%**
Other	3%
Unknown	2%
Static Lung Volumes (n=118)	
ECCS 1993	**90%**
Unknown	6%
Other	4%
Gas Transfer (n=119)	
ECCS 1993	**87%**
Other	7%
Unknown	6%
Respiratory Muscle assessment (n=100)	
Black and Hyatt	**31%**
Wilson	21%
Unknown	21%
Other	19%
Own reference values	8%
Cardiopulmonary Exercise testing (n=72)	
Wasserman	**57%**
Unknown	17%
Bruce	10%
Jones	8%
Other	8%

For adult reference values the survey shows that the ECCS 1993 equations [24] are the most commonly used equations in lung function departments for spirometry, static lung volumes and gas transfer measurements.

For non-invasive respiratory muscle assessment, the Black and Hyatt equations [25] are most commonly used. It is interesting to note that 8% of labs have developed and are using their own reference equations.

For cardiopulmonary exercise testing, reference equations by Wasserman [26] are those most commonly used (57%).

Paediatric Reference Values

Table 24: Paediatric Reference Values

Paediatric Reference Values Used	% of departments
Spirometry (n=85)	
Rosenthal	**55%**
Polgar	18%
Unknown	14%
ECCS 1993	4%
Zapletal	4%
Other	4%
NHANES	1%
Static Lung Volumes (n = 85)	
Rosenthal	**52%**
Unknown	15%
Other	15%
Polgar	9%
ECCS	4%
Zapletal	4%
NHANES	1%
Paediatric Gas Transfer (n = 80)	
Rosenthal	**51%**
Unknown	19%
Other	16%
Zapletal	5%
Polgar	4%
ECCS	4%
NHANES	1%

For paediatric reference values the Rosenthal predicted equations for spirometry [27] [28] are used most commonly (55%).

It is disappointing to note that many departments are not aware of the reference equations they are using.

Recommendation 22: Labs should be aware of what guidelines and reference values they are using and the limitations of their use and ensure that, where possible, reference equations should apply to the local population. [Action: Standards Committee]

Recommendation 23: UK labs should standardise on the new Global Lung Initiative References [29] as they become available. [Action: Standards Committee]

Recommendation 24: Manufacturers are encouraged to make the GLI equations available (free) to UK labs. [Action: Manufacturers' Liaison Committee]

Recommendation 25: The 1994 ARTP/BTS Testing Guidelines [18] need revising. [Action: Standards Committee]

CONCLUSIONS

In summary, we can see from this survey that qualified staff numbers continue to increase and there has been some shift in the distribution of tasks within the banding structure. Although overall the actual headcount has only slightly increased there has been a much larger increase in the whole time equivalent resource allocated to respiratory services.

The role of the HCS in respiratory services is extending with more patient interaction, more therapeutic interventions and the responsibility for some parts of service (e.g. Oxygen Assessments & NIV) being delegated.

Over the UK as a whole, more complex procedures are being adopted broadening the scope of diagnostics and requiring staff to be more versatile in the delivery of those services.

While firm evidence is currently lacking, it is also believed that the activity within laboratories is also increasing and ARTP endeavour to quantify and report on this in the near future.

As with the previous surveys conducted by ARTP this will again prove extremely useful supporting the ARTP Executive in representing the interests of our members, our patients and the service as a whole. To provide quicker identification of changing trends between major surveys like this one ARTP may wish look at setting up a cohort of 'barometer' labs which would mirror a cross-section of the national picture. These survey findings could be used to identify a representative cohort.

This report shows an overall improvement compared with previous surveys but ARTP will need to continue to spearhead the promotion of professional standards and unification of best practice as quality standards are pushed higher and higher.

This document will be published for open access on the ARTP website and as a supplement to the ARTP Journal *Inspire.* An abridged version is to be circulated to interested parties (e.g. Chief Scientific Officer, Respiratory Alliance, Academy of Healthcare Science, RCCP, Centre for Workforce Intelligence, Respiratory National Clinical Director, and British Thoracic Society).

Any comments or enquiries concerning the ARTP Survey should be directed through ARTP Administration (admin@artp.org.uk).

ACKNOWLEDGEMENTS

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Thanks to the main contributors who also assisted with comments and amendments during draft versions:

- Martyn Bucknall, Senior Lecturer in Physiology, St Georges University of London (Equipment, Reporting, Admin Support, Information Technology)
- Brendan Cooper, Consultant Clinical Scientist, University Hospital Birmingham (Sleep, Autonomy)
- Keith Butterfield, Senior Chief Clinical Physiologist, Dorset County Hospital, Dorchester (Staffing, Procedures, Referral Sources & Report Editor)
- Karl Sylvester, Chief Clinical Respiratory Physiologist, Addenbrooke's Hospital, Cambridge.

The final report was reviewed and ratified by the ARTP Board in January 2014.

SUMMARY OF RECOMMENDATIONS

The recommendations made in each section are compiled below for quick reference.

Each Recommendation has been allocated for action by a specific ARTP Group/Committee which should take responsibility for enabling the recommendation to be distributed and/or action initiated. For example; it may be appropriate to incorporate the recommendation into a guideline or position statement.

Recommendation 1:	Until more robust ESR coding is established ARTP will still need to run surveys to determine workforce numbers.	[Action: Workforce Committee]
Recommendation 2:	Scotland, Wales & N. Ireland should attempt to verify their workforce data.	[Action: Workforce Committee / Regional Groups]
Recommendation 3:	There are missing elements of workforce data that need collecting and their impact assessing in the context of service delivery (eg staff absence/sickness rates, attrition rates, etc.)	[Action: Workforce Committee]
Recommendation 4:	ARTP needs to continue to work with MSC, Education providers and commissioners to influence the recruitment & training of the future workforce.	[Action: Education Committee]
Recommendation 5:	The implications of the survey findings (eg low numbers in labs) needs to be reviewed and recommendations made (eg examining the roles & workforce allocation within typical departments).	[Action: Workforce Committee]
Recommendation 6:	Recommendations should be made available to help standardise the coding of respiratory and sleep physiology staff on the Electronic Staff Record against the new coding set [3].	[Action: Workforce Committee]
Recommendation 7:	ARTP needs to promote the advantages of HCSs working in autonomous practice in order to raise the profile of the profession.	[Action: Workforce Committee]
Recommendation 8:	Future changes in autonomous practice need to be closely monitored to identify any workforce needs eg individual development, education & training, regulation, etc.	[Action: Workforce Committee]
Recommendation 9:	Diagnostic labs should have appropriate administrative support in their establishment numbers to allow clinical staff to concentrate on clinical duties.	[Action: Workforce Committee]
Recommendation 10:	A further survey needs to be conducted to determine changes in activity for procedures.	[Action: Workforce Committee]
Recommendation 11:	The 'companion' report on Activity & Coding to be published.	[Action: Karl Sylvester]
Recommendation 12:	Quality Assured Diagnostic Spirometry should be delivered to ARTP standards in all primary/community locations.	[Action: Standards Committee]
Recommendation 13:	The uptake of the ARTP Spirometry Certificates needs to be monitored over the next few years to gauge the quality of QADS being performed by non-HCS staff.	[Action: Education Committee]
Recommendation 14:	Full PFTs and Spot oximetry should be available as a minimum requirement, in all secondary care respiratory function services.	[Action: Standards Committee]
Recommendation 15:	ARTP should consider using the procedure availability data to identify a set of 'barometer' labs which could be used to more readily identify trends and changes in practice.	[Action: Standards Committee]
Recommendation 16:	All staff performing and/or interpreting diagnostic tests should be appropriately trained and qualified or working under appropriate supervision.	[Action: Workforce Committee]
Recommendation 17:	ARTP to consider commissioning a piece of work to determine appropriate grades for each procedure – to help to standardise & define AfC grades, perhaps to include typical 'job-plans'.	[Action: ARTP Exec Board]
Recommendation 18:	All labs should ensure they have appropriate and adequate service continuity plans in the event of equipment breakdown. This may include contract or other maintenance support.	[Action: Department Heads]
Recommendation 19:	ARTP recommend the use of electronic booking systems for diagnostic tests.	[Action: Standards Committee]
Recommendation 20:	ARTP encourage the use of external report links wherever possible to enable remote access to test results.	[Action: Standards Committee]

Recommendation 21:	Laboratories need to ready themselves for the transition to paperless exchange of information.	[Action: Department Heads]
Recommendation 22:	Labs should be aware of what guidelines and reference values they are using and the limitations of their use and ensure that, where possible, reference equations should apply to the local population.	[Action: Standards Committee]
Recommendation 23:	UK labs should standardise on the new Global Lung Initiative References [29] as they become available.	[Action: Standards Committee]
Recommendation 24:	Manufacturers are encouraged to make the GLI equations available (free) to UK labs.	[Action: Manufacturers' Liaison Committee]
Recommendation 25:	The 1994 ARTP/BTS Testing Guidelines [18] need revising.	[Action: Standards Committee]

If any member, or group, considers other actions should arise from the contents of this report please address your suggestions to the ARTP Executive Board via admin@artp.org.uk

LIST OF TABLES

LIST OF FIGURES

GLOSSARY

Arterial blood gas (ABG)	A sample of blood is taken from an artery and analysed to measure levels of oxygen, carbon dioxide and other parameters.
Body Box	See *Plethysmography*.
Bronchodilator Reversibility	A test used to assess how airways respond to administration of respiratory drugs. This is commonly performed by measuring spirometry before and after the drug is administered at appropriate time intervals.
Cardiopulmonary Exercise Testing (CPET)	A test that involves a period of exercise to evaluate cardiovascular and respiratory responses.
Challenge Test	A test that involves administering a stimulus (e.g. exercise, pharmacological agent) that can induce bronchoconstriction.
Continuous Positive Airway Pressure (CPAP)	A method of ventilation where a pressure of air to administered via the mouth and/or nose to keep airways open. Commonly used as an effective treatment for moderate/severe obstructive sleep apnoea.
Earlobe Capillary Gas	A sample of blood is taken from a capillary in the earlobe and analysed to measure levels of oxygen, carbon dioxide and other parameters.
Exhaled NO	A breath test that detects levels of nitric oxide, used in diagnosis/monitoring of asthma and airway inflammation.
Flight assessment	A test performed to assess a patient's suitability for air travel. This is performed by administering a low oxygen concentration (15%) and monitoring of the patients oxygen levels.
Higher Specialist Scientific Training (HSST)	A doctoral level training programme for healthcare scientist, under the Modernising Scientific Careers initiative.
Histamine	A pharmacological agent than can be used when performing a challenge test
Impulse Oscillometry (IOS)	A diagnostic test that assesses airway function during normal breathing using sound waves.
Mannitol	A pharmacological agent than can be used when performing a challenge test.
Methacholine	A pharmacological agent than can be used when performing a challenge test.
Modernising Scientific Careers (MSC)	A series of new training programmes launched by the department of Health in 2010 for the healthcare science workforce.
Non-Invasive Ventilation (NIV)	A method of providing ventilatory support to a patient.
Overnight Oximetry	A method of assessing oxygen levels using a pulse oximetry that is connected during a period of sleep.
Plethysmography	A test where a patient sits in a sealed cubicle and performs a series of breathing manoeuvres to measure the size of the lungs.
Polysomnography (PSG)	A test used to evaluate sleep function, including measurements of brain activity during sleep.
Practitioner Training Programme (PTP)	A degree level training programme, incorporating clinical placements for healthcare scientists under the Modernising Scientific Careers initiative.
Pulmonary Function Tests (PFT)	A set of tests that commonly measure spirometry, gas exchange and the size of the lungs.
Reference Values	Regression equations that are used to calculate normal respiratory values for patients.
Scientist Training Programme (STP)	A Masters level training programme for healthcare scientists under the Modernising Scientific Careers initiative.
Spirometry	A diagnostic test that is commonly used to diagnose airflow obstruction, responses to medication and progression of disease.

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