



Unit Number

U3028611/KA4T**Key Skills****Application of Number****Level 4****Monday 13 June 2005****Total Marks: 50****No. of Questions: 5****Time: 2 hours 30 minutes****Materials required for examination**

This test paper

An answer booklet

A pen with black or blue ink

A pencil and eraser

A ruler marked in mm and cm

2mm squared paper

A scientific calculator

You may use a bilingual dictionary**Instructions to Candidates**

Do NOT open this test paper until you are told to do so by the supervisor.

In the boxes on the answer book, write your centre number, registration number, surname and initials. The paper reference is shown above.

Write in black or blue ink only.

At the end of the test, hand the test paper, the Answer Booklet(s) and all notes to the supervisor.

Information for Candidates

There are 5 questions to this test.

Question 1 - 10 marks

Question 4 - 10 marks

Question 2 - 9 marks

Question 5 - 15 marks

Question 3 - 6 marks

Try to answer ALL the questions.

Advice to Candidates

Make sure that your writing is clear, and show all your working.

Read each question carefully.

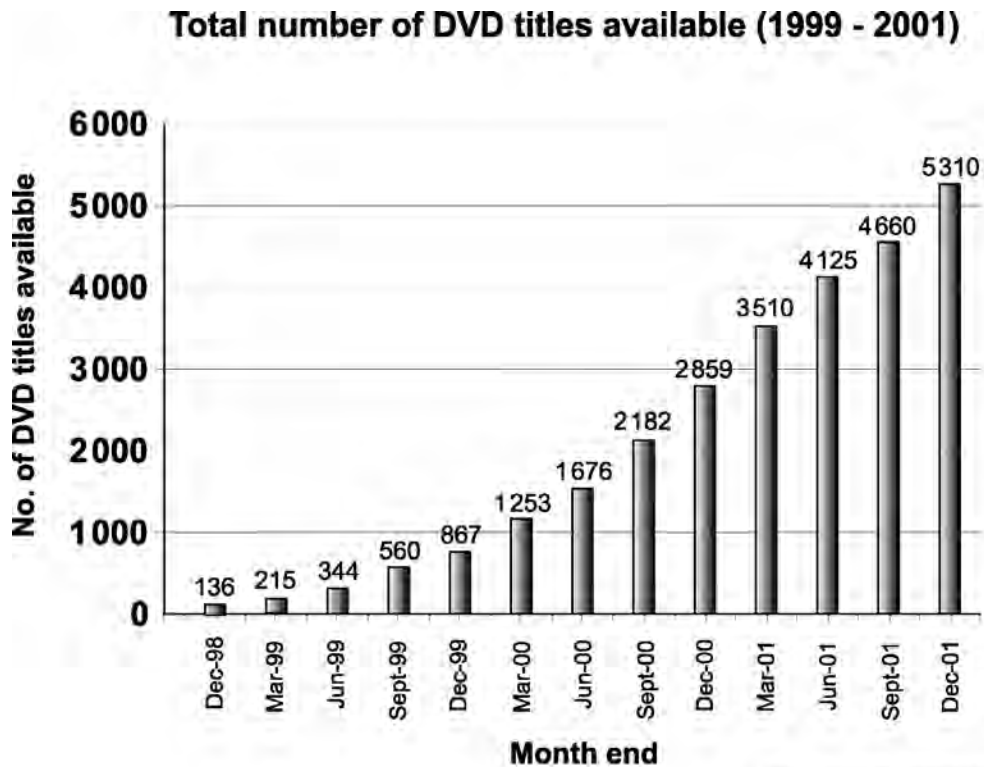
If you need extra paper, use a second answer booklet. Make sure you put your personal details on the front of this booklet too.

First published in 2005©Qualifications and Curriculum Authority 2005.Reproduction, storage, adaptation or translation, in any form or by any means, of this publication is prohibited without prior written permission of the publisher, unless within the terms of licenses issued by the Copyright Licensing Agency.Printed in Great Britain.The Qualifications and Curriculum Authority is an exempt charity under Schedule 2 of the Charities Act 1993.Qualifications and Curriculum Authority, 83 Piccadilly, London W1J 8QA. www.qca.org.ukRef: AON/L4/3.2/P32***Turn over***

- 1 The audio-visual department of a large retail organisation has carried out research into the growth of the DVD market with a view to predicting future trends.

Chart 1 shows the number of titles available in the UK in DVD format between the end of December 1998 and December 2001.

Chart 1



Source: BVA DVD committee Jan 2002

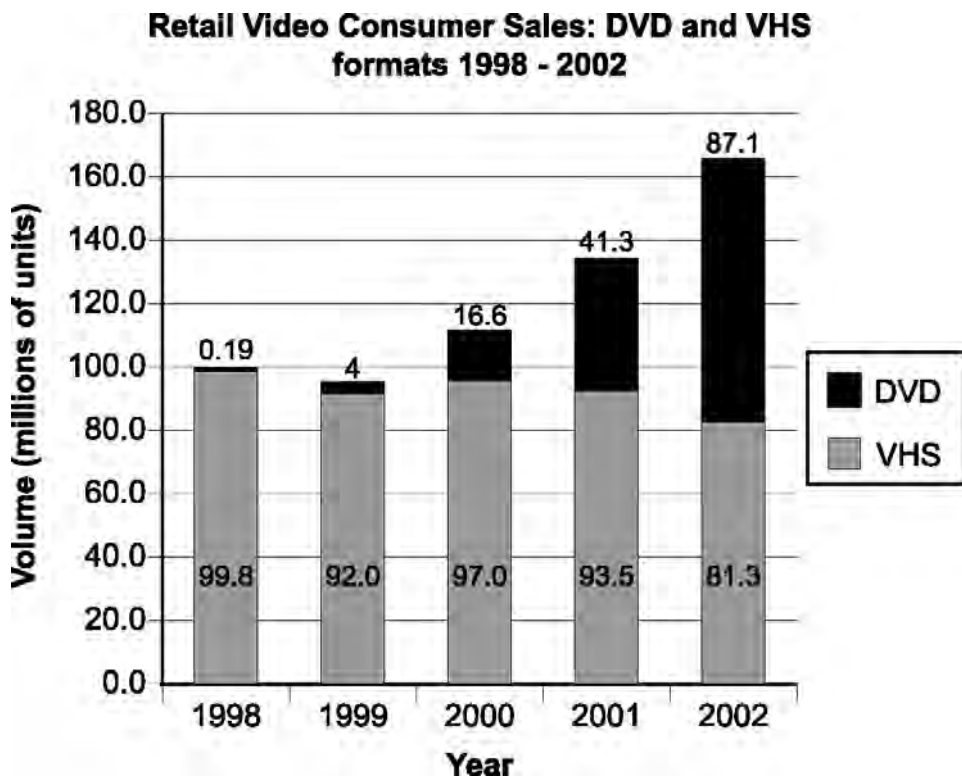
Based on this data, quadratic, linear and exponential models are proposed to forecast DVD title availability in the future.

- a Discuss the suitability of these three proposals and recommend, with justification, which model the large retail organisation should use for predicting future trends.

4 marks

Chart 2 shows the number of DVD and VHS format videos sold from 1998 to 2002 in the UK.

Chart 2



Source: BVA Yearbook 2002

- b Use the data in Chart 2 to describe, and quantify, the changes that have occurred in retail video consumer sales. Without further analysis, make some initial predictions about general trends in sales which the organisation might expect in the future.

3 marks

The table below shows data relating to the sales of DVD players from 1998 to 2002.

DVD Players: UK Sales by Volume 1998 - 2002	
Year	Volume (thousand units)
1998	15
1999	266
2000	1050
2001	1950
2002	3950

Source: Snapshots International (UK)

- c The retail organisation is interested in the ratio of cumulative sales of DVD format videos to cumulative sales of DVD players. What does this ratio represent and how is it changing?

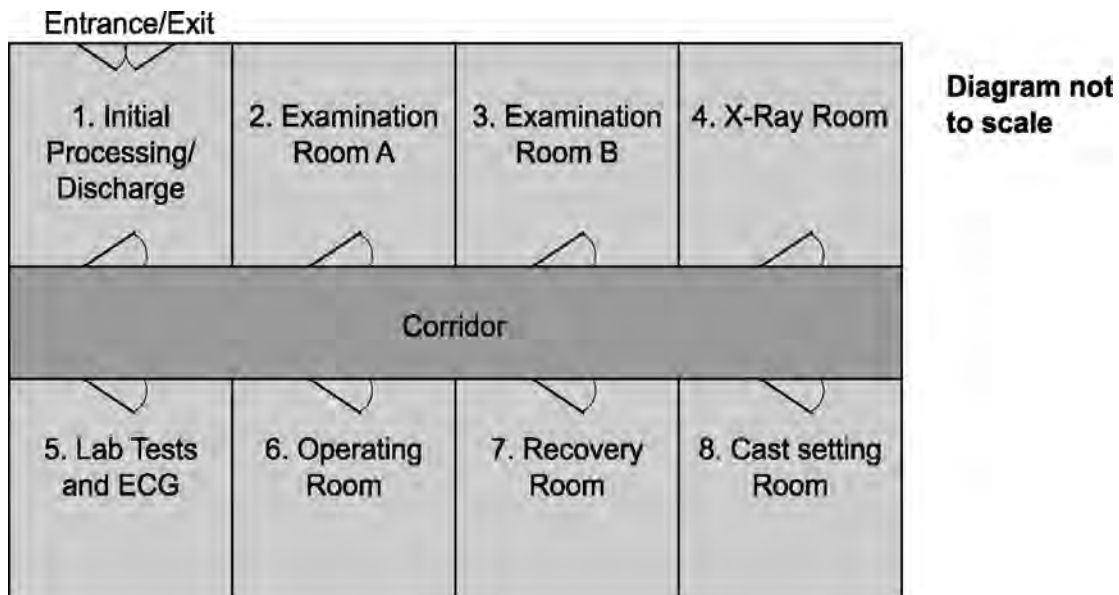
3 marks

Total 10 marks

Please go on to the next page

- 2 The Snow-Bird Hospital is a small emergency-orientated facility located in a popular ski resort in northern Michigan. They wish to reduce the time spent moving patients between departments by rearranging the location of the different hospital functions within the current layout. The only restriction is that the Initial Processing/Discharge room stays in its current position; otherwise all the departments can be moved.

A simplified version of the layout is shown below with the current arrangement of departments.



Each room is 5 metres by 5 metres with a door in the middle of the wall facing the corridor. The corridor is 3 metres wide. All patients enter and leave through the main entrance in room 1.

The movements of the first 200 patients seen by the hospital in one month are monitored. The number of patient trips (to the nearest 10) between departments is given in the table below:

From Department	To Department							
	1	2	3	4	5	6	7	8
1	-	100	100	0	0	0	0	0
2	30	-	0	50	20	0	0	0
3	30	0	-	30	30	10	0	0
4	40	0	0	-	20	0	0	20
5	30	0	0	0	-	30	0	10
6	0	0	0	0	0	-	40	0
7	40	0	0	0	0	0	-	0
8	30	0	0	0	0	0	0	-

- a Estimate the average distance covered by these patients moving between departments. State any assumptions made.

3 marks

- b Develop, apply and evaluate a strategy to rearrange the location of departments in order to reduce patient movement between the departments. You should:

- Outline the strategy, justifying your choice of method
- Demonstrate how you applied it
- Present your solution
- Evaluate your strategy by calculation
- Discuss how your model could be refined

6 marks

Total 9 marks

3 A chain letter starts with the following:

I was amazed when I saw how much money came flooding through my letterbox... I turned £10 into £47540 within the first 60 days of operating this business plan. If you decide to take action on the following instructions, I will personally guarantee that you will enjoy a similar return.

The letter contains a list of six names and addresses, numbered 1 to 6 and the following instructions:

1. *Send a £10 gift to the first name on the list.*
2. *Delete the first name, move all names up the list and add yours at number 6.*
3. *Photocopy 200 copies of the letter and your new list of six names and addresses (with your name at number 6) and send them to 200 people of your choice.*

The letter states that only 2% of people will respond to this type of letter, but that this will be a sufficient number to secure the personally guaranteed return.

- a Evaluate the claim made by the letter assuming that the instructions are followed, and that 2% of people respond to their letters. Comment on these assumptions.

4 marks

The world population was approximately 6.3×10^9 in 2003.

- b Many chain letter schemes similar to this are illegal to protect people from losing money. Explain and demonstrate why the returns from schemes such as this cannot be sustainable.

2 marks

Total 6 marks

- 4 A small business offers a lawn mowing service and needs to buy a new petrol driven mower. The three mowers being considered are listed in the following table, taken from a supplier's website.

Make/model	Blade width (cm)	Fuel usage (mins/litre)	Purchase price (£)	Expected lifespan (hrs)
Centurion '16' (3.5 hp)	40	120	130	1000
McCulloch 3846S (4 hp)	46	100	150	1000
JCB PM43R (4 hp)	42	100	200	1500

Source: www.mowdirect.co.uk

- a Using the information in the table, select the two mowers from the table which appear to offer the best value for money, justifying your choice.

1 mark

It has been suggested that, assuming the mower is operated at an average speed of 3 kilometres per hour, the time taken to cut a rectangular lawn measuring X metres by Y metres can be estimated by the formula:

$$T = \frac{2XY}{W}$$

where T = time in minutes and

W = blade width of the mower in centimetres

- b Critically reflect on the suitability of this formula, and make and justify a suggestion for refining the formula.

3 marks

When deciding on which mower to purchase the small business also needs to consider the following costs:

- the lawnmower operative is paid £5 per hour
 - servicing of each mower (new blades, lubrication etc) costing £30 is required after every 100 hours of use and
 - fuel costs approximately 80 pence per litre.
- c Investigate which of the two mowers selected in part a would be the best buy for the small business, taking into account the additional information above. Justify your recommendation and state any assumptions made. Without further calculation, state with a reason, whether the mower rejected in part a would be worth reconsidering.

6 marks

Total 10 marks

Please go on to the next page

- 5 The accompanying source document (entitled 'English Hospitals') is a copy of the A-Z Guide to how the 174 NHS Trusts in England compare, published in the Sunday Times.

"Whether a patient lives or dies is a crucial performance indicator by which a hospital can be judged.....However, comparing hospitals on the number of patients who die is not straightforward and must be approached with extreme caution."

Source: Sir Brian Jarman, Sunday Times, Jan 2001

One of the measures used to compare the Trusts is calculated mortality indices. The mortality index is based on published death rates of patients in the hospitals, adjusted to make allowance for those *patient* factors that have a significant effect on death rates. A hospital that has exactly the national average number of deaths after taking into account the allowance would have a mortality index of 100. A higher figure indicates a higher number of deaths than would have been expected.

- a Comment on the benefits, or otherwise, of using mortality indices as a measure of hospital performance compared with the use of raw data such as published death rates.
- 2 marks
- b Assess the A-Z Guide to English Hospitals in terms of
- The usefulness of the data for members of the general public
 - The presentation of the data

2 marks

Table 1 is an extract from the *A-Z Guide to English Hospitals*, showing data relating to the NHS Trusts in Trent region.

Table 1 Extract from A-Z Guide to English Hospitals

TRENT NHS REGION

	NHS Trust	Mortality Index	Doctors per 100 beds
1	Central Sheffield University Hospitals	86	53
2	Nottingham City Hospital	91	34
3	Northern General Hospital	96	35
4	University Hospitals of Leicester	97	45
5	North East Lincolnshire	99	31
6	Scunthorpe and Goole Hospitals	101	29
7	Chesterfield and North Derbyshire Royal	103	34
8	The King's Mill Centre	103	33
9	Bassetlaw Hospital and Community Health	104	31
10	United Lincolnshire Hospitals	105	31
11	South Derbyshire Acute Hospital	106	35
12	Barnsley District General Hospital	106	29
13	Rotherham General Hospitals	108	27
14	Queen's Medical Centre Nottingham	109	46
15	Doncaster Royal and Montagu Hospital	109	38

Source: Sunday Times (Jan 2001)

The following assertion has been made:

'The relative number of doctors in a hospital is a predictor of mortality index'

- c Investigate the accuracy of this statement using the data in Table 1, supporting your answer with a suitable graphical illustration. Find an algebraic model relating the number of doctors to the mortality index. Explain what the model shows about the relationship, and discuss its limitations.

5 marks

- d Discuss the validity of using the sample of data given in Table 1 in order to investigate the claim. Recommend an alternative method which could be used to obtain a suitable sample of the 174 Trusts listed in the *A-Z Guide to English Hospitals*, justifying your choice of method.

2 marks

Table 2 presents alternative data for Scotland.

Table 2 SCOTLAND: Number of doctors and nurses per 100 beds and Mortality rates in the regions covered by the health authorities. (Mortality rate is number of deaths per 1000 population).

	NHS Trust	Doctors per 100 beds (1)	Nurses per 100 beds (2)	Regional Mortality rate (3)
1	Lothian University Hospitals	49	141	10.8
2	North Glasgow University Hospitals	36	90	12.8
3	South Glasgow University Hospitals	24	78	12.8
4	West Lothian Healthcare	20	88	10.8
5	Tayside University Hospitals	19	58	13.0
6	Grampian University Hospitals	18	52	10.3
7	Ayrshire and Arran Acute Hospitals	15	63	12.6
8	Highland Acute Hospitals	15	51	11.7
9	Lanarkshire Acute Hospitals	14	50	11.0
10	Fife Acute Hospitals	12	51	11.2
11	Borders General Hospital	12	50	12.4
12	Dumfries and Galloway Acute and Maternity	12	48	12.6
13	Forth Valley Acute Hospitals	12	44	11.3
14	Argyll and Clyde Acute Hospitals	11	39	12.6
correlation coefficient with mortality rate		-0.11	-0.19	

Source: (1) and (2) Sunday Times Good Hospital Guide (3) Registrar General for Scotland (2000) Annual Report 1999

Based on the data in Table 2, a Member of the Scottish Parliament (MSP) stated that:

'Press reports showing that Argyll and Clyde hospitals which are used by the majority of patients in my constituency had the lowest numbers of doctors and nurses in the whole of Scotland has caused great concern in the communities they serve..... (The First Minister) has agreed to look into my concerns and come back with answers, which will hopefully reassure my constituents that we are getting the healthcare in Argyll that is equal to the rest of Scotland.'

Source: George Lyon MSP News Release Jan 2001

- e Assess and evaluate the concerns of the MSP, using the data given in Table 2 to justify your comments. Suggest further information which should be researched in order to address his concerns more fully.

4 marks

Total 15 marks

End of test

Source booklet

English Hospitals

ENGLISH HOSPITALS

AN A-Z GUIDE TO HOW THE 174 NHS TRUSTS IN ENGLAND COMPARE

Mortality index: ■ Low, below 90 ● Average, 90-110 ▲ High, above 110

Region	NHS Trust	Mortality index	Doctors per 100 beds	Cardiology waiting list
E	■ Addenbrook's Cambridge	99	40	79%
NW	■ Aintree Hospitals	97	26	70%
NY	● Airedale	84	26	39%
SE	■ Ashford and St Peter's Hospital	96	43	n/a
L	■ Barnet and Chase Farm Hospitals	106	43	77%
T	■ Barnsley District General Hospital	106	29	n/a
L	● Bart's and The London*	70	53	96%
E	■ Basildon and Thurrock General Hospital	108	34	80%
T	■ Bassetlaw Hospital and Community Health Services	104	31	n/a
E	● Bedford Hospital	86	36	56%
WM	■ Birmingham Heartlands and Solihull	93	36	82%
NW	■ Blackburn, Hyndburn and Ribble Valley Healthcare	110	26	n/a
NW	■ Blackpool Victoria Hospital	107	41	50%
NW	▲ Bolton Hospitals	113	25	n/a
NY	■ Bradford Hospitals	96	37	81%
SE	■ Brighton Health Care	98	45	98%
L	■ Bromley Hospitals	97	38	64%
NW	▲ Burnley Health Care	112	25	46%
WM	■ Burton Hospitals	100	35	26%
NW	■ Bury Health Care	110	22	90%
NY	■ Calderdale Health Care	99	24	41%
NY	■ Carlisle Hospitals	96	32	36%
NW	■ Central Manchester Healthcare	99	61	55%
T	● Central Sheffield University Hospitals	86	53	90%
L	● Chelsea and Westminster Healthcare*	82	64	83%
T	■ Chesterfield and North Derbyshire Royal Hospital	103	34	n/a
NW	■ Chorley and South Ribble	94	26	n/a
WM	■ City Hospital, Birmingham	106	45	53%
NY	■ City Hospitals Sunderland	100	30	84%
NW	■ Countess of Chester Hospital	109	38	43%
SE	▲ Dartford and Gravesham	111	29	77%
NY	■ Dewsbury Health Centre	106	29	n/a
T	■ Doncaster Royal and Montagu Hospital	109	38	n/a
WM	■ Dudley Group of Hospitals	102	32	n/a
L	■ Ealing Hospitals	103	42	66%
E	■ East and North Hertfordshire	107	30	74%
NW	■ East Cheshire	102	26	100%
SW	■ East Gloucestershire	96	24	92%
SE	■ East Kent Hospitals	101	37	34%
SW	▲ East Somerset	112	29	27%
SE	■ Eastbourne Hospitals	96	28	51%
L	■ Epsom and St Helier	102	38	45%
E	▲ Essex Rivers Healthcare	111	29	93%
L	■ Forest Healthcare, London	106	25	35%
SE	■ Frimley Park Hospitals	98	34	n/a
NY	■ Gateshead Health	106	21	59%
WM	▲ George Eliot Hospital, Nuneaton	114	33	n/a
SW	■ Gloucestershire Royal	100	28	n/a
WM	■ Good Hope Hospital, Sutton Coldfield	105	31	n/a
L	▲ Greenwich Healthcare	112	17	75%
L	● Guy's and St Thomas's Hospital*	82	59	96%
NW	■ Halton General Hospital, Runcorn	104	26	70%
L	● Hammersmith Hospitals	88	41	98%
NY	■ Harrogate Health Care	94	25	n/a
SE	■ Hastings and Rother	99	30	n/a
L	▲ Havering Hospitals	112	36	66%
SE	▲ Heatherwood and Wixham Park Hospitals	115	33	85%
WM	● Hereford Hospitals	85	37	53%
L	▲ Hillingdon Hospitals	111	33	92%
E	■ Hinchingsbrooke Healthcare	104	33	43%
L	■ Homerton Hospital, London*	92	33	67%
NY	■ Huddersfield Healthcare	93	27	n/a
NY	■ Hull and East Yorkshire Hospitals	101	33	80%
E	■ Ipswich Hospital	103	33	n/a
SE	■ Isle of Wight Healthcare	95	29	43%
E	■ James Paget Healthcare, Great Yarmouth	100	29	n/a
SE	■ Kettering General Hospital	104	22	75%
L	■ King's College Hospital, London*	95	54	100%
E	■ King's Lynn and Wisbech Hospitals	104	30	36%
T	■ King's Mill Centre for Health Care Services	103	33	57%
T	■ Kingston Hospital	101	57	100%
L	● Leeds Teaching Hospitals	89	39	79%
L	■ Lewisham Hospitals*	106	37	36%
E	■ Luton and Dunstable	103	41	78%
SE	■ Maidstone and Tunbridge Wells	99	37	43%
L	■ Mayday Healthcare, Croydon	108	32	78%
SE	■ Medway, Gillingham	106	40	56%
NW	▲ Mid Cheshire Hospitals	114	27	n/a
E	▲ Mid-Essex Hospital Services	117	31	46%
WM	■ Mid Staffordshire General Hospitals	106	30	n/a
SE	■ Mid Sussex	90	32	n/a
SE	■ Milton Keynes General	104	43	100%
NW	■ Morecambe Bay Hospitals	91	24	93%
NY	● Newcastle upon Tyne Hospitals	87	36	86%
L	■ Newham Healthcare, London*	109	29	92%
E	■ Norfolk and Norwich Healthcare	93	41	79%
SW	■ North Bristol	100	25	68%

Key to NHS regions with average mortality index

E	Eastern 103	NW	Northwest 103	SE	Southeast 98	SW	Southwest 97	WM	West Midlands 103
L	London 96	NY	Northern and Yorkshire 97	* indicates Inner London		T	Trent 102		

ENGLISH HOSPITALS

AN A-Z GUIDE TO HOW THE 174 NHS TRUSTS IN ENGLAND COMPARE

Mortality index: ■ Low, below 90 ● Average, 90-110 ▲ High, above 110

Region	NHS Trust	Mortality index	Doctors per 100 beds	Cardiology waiting list
NY	North Durham Healthcare	102	27	61%
T	North East Lincolnshire	99	31	91%
SE	North Hampshire Hospitals	88	25	34%
NW	North Manchester Healthcare	112	39	11%
L	North Middlesex Hospital	88	49	48%
WM	North Staffordshire Hospital	106	36	70%
NY	North Tees and Hartlepool	101	32	n/a
L	North West London Hospitals	85	53	68%
NY	Northallerton Health Services	89	27	n/a
SE	Northamptonshire General Hospital	96	36	n/a
SW	Northern Devon Healthcare	102	22	n/a
T	Northern General Hospital	96	35	60%
NY	Northumbria Healthcare	100	22	n/a
T	Nottingham City Hospital	91	34	52%
NW	Oldham	110	27	n/a
SE	Oxford Radcliffe Hospitals	96	70	78%
E	Peterborough Hospitals	102	33	79%
NY	Pinderfields and Pontefract Hospitals	97	18	32%
SW	Plymouth Hospitals	90	42	52%
SW	Poole Hospitals	102	21	90%
SE	Portsmouth Hospitals	90	41	55%
NW	Preston Acute Hospitals	93	40	71%
E	Princess Alexandra Hospital, Harlow	104	47	n/a
WM	Princess Royal Hospital, Telford	91	29	100%
L	Queen Mary's, Sidcup	103	37	61%
T	Queen's Medical Centre Nottingham	109	46	87%
L	Redbridge Healthcare	108	19	72%
NW	Rochdale Healthcare	109	25	53%
T	Rotherham General Hospitals	108	27	n/a
SE	Royal Berkshire and Battle Hospitals	97	39	68%
SW	Royal Bournemouth and Christchurch Hospitals	100	27	72%
SW	Royal Cornwall Hospitals	89	38	79%
SW	Royal Devon and Exeter Healthcare	88	33	n/a
L	Royal Free Hamstead, London*	79	48	41%
NW	Royal Liverpool and Broadgreen University Hospitals	92	25	96%
WM	Royal Shrewsbury Hospital	90	42	84%
SE	Royal Surrey County Hospital	91	46	86%
SW	Royal United Hospital Bath	86	55	78%
SE	Royal West Sussex	81	37	71%
WM	Royal Wolverhampton Hospitals	101	37	27%
NW	Salford Royal Hospitals	99	40	36%
SW	Salisbury Health Care	104	26	n/a
WM	Sandwell Healthcare	117	29	34%
NY	Scarborough and North East Yorkshire Healthcare	96	27	n/a
T	Scunthorpe and Goole Hospitals	101	29	n/a
SE	South Buckinghamshire	104	33	n/a
SW	South Devon Healthcare	98	23	87%
NY	South Durham Healthcare	104	28	n/a
NW	South Manchester University Hospitals	95	42	96%
NY	South Tees Acute Hospitals	98	36	60%
NY	South Tyneside Health Care	106	19	n/a
WM	South Warwickshire General Hospitals	107	33	72%
SE	Southampton University Hospitals	104	56	56%
E	Southend Hospital	96	34	72%
T	Southern Derbyshire Acute Hospital	106	35	45%
NW	Southport and Ormskirk Hospital	98	30	n/a
L	St Georges Healthcare, London	91	49	81%
NW	St Helens and Knowsley Hospitals	111	24	27%
L	St Mary's Hospital, London*	91	59	63%
NW	Stockport	101	29	n/a
SE	Stoke Mandeville Hospital	93	39	82%
SE	Surrey and Sussex Healthcare	105	32	52%
SW	Swindon and Marlborough	102	35	61%
NW	Tameside and Glossop Acute Services	104	30	n/a
SW	Taunton and Somerset	104	26	n/a
NW	Trafford Healthcare	104	26	54%
SW	United Bristol Healthcare	96	44	74%
T	United Lincolnshire Hospitals	105	31	49%
L	University College London Hospitals*	68	63	78%
WM	University Hospital Birmingham	97	47	94%
T	University Hospitals of Leicester	97	45	95%
WM	Walsall Hospitals	119	23	n/a
WM	Walsgrave Hospitals, Coventry	107	33	55%
NW	Warrington Hospital	101	31	49%
NY	West Cumbria Healthcare	115	21	23%
SW	West Dorset General Hospitals	88	35	48%
E	West Hertfordshire Hospitals	104	40	56%
L	West Middlesex University Hospital	109	45	92%
E	West Suffolk Hospitals	109	22	76%
SW	Weston Area	87	28	n/a
L	Whittington Hospital, London*	90	43	94%
NW	Wigan and Leigh Health Services	105	27	n/a
SE	Winchester and Eastleigh Healthcare	94	32	n/a
NW	Wirral Hospital	101	26	43%
WM	Worcestershire Acute Hospitals	104	35	67%
SE	Worthing and Southlands Hospitals	94	30	n/a
NY	York Health Services	106	22	n/a

Doctors per 100 beds: the average for English NHS Trusts is 35
Cardiology waiting list: percentage of outpatients seen within 13 weeks

BLANK PAGE