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RESEARCH

# Waiting times for carotid endarterectomy in UK: observational study

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## ABSTRACT

**Objectives** To assess timeliness of carotid endarterectomy services in the United Kingdom.
**Design** Observational study with follow-up to March 2008.
**Setting** UK hospitals performing carotid endarterectomy.
**Participants** UK surgeons undertaking carotid endarterectomy from December 2005 to December 2007.
**Main outcome measures** Provision and speed of delivery of appropriate assessments of patients; carotid endarterectomy and operative mortality; 30 day postoperative mortality.
**Results** 240 (61% of those eligible) consultant surgeons took part from 102 (76%) hospitals and trusts. Of 9913 carotid endarterectomies recorded on hospital episode statistics, 5513 (56%) were included. Of the patients who underwent endarterectomy, 83% had a history of transient ischaemic attack or stroke. Of these recently symptomatic patients, 20% had their operation within two weeks of onset of symptoms, and 30% waited more than 12 weeks. Operative mortality was 0.5% during the inpatient stay and 1.0% (95% confidence interval 0.7% to 1.3%) by 30 days.
**Conclusion** Only 20% of symptomatic patients had surgery within the two week target time set by the National Institute for Health and Clinical Excellence (NICE). Although operative mortality rates are comparable with those in other countries, some patients might experience disabling or fatal stroke while waiting for surgery and hence not be included in operative statistics. Major improvements in services are necessary to enable early surgery in appropriate patients in order to prevent strokes.

## INTRODUCTION

Pooled analysis of data from randomised controlled trials of endarterectomy versus medical treatment for symptomatic carotid stenosis showed that surgery reduced the risk of stroke in patients with 50-99% carotid stenosis[1] but the benefit decreased substantially if surgery was delayed for more than two weeks after the presenting event.[2] In 2004 the RCP Sentinel Audit reported that only half of stroke patients had carotid imaging within 12 weeks.[3] Randomised patients from the UK in a recent trial of local versus general anaesthetic had a 12 week delay to surgery,[4] and similar delays were reported in an audit of all symptomatic endarterectomy patients in Scotland in 1997-9 and again in 2005-7.[5,6] The 2006 RCP Sentinel Audit showed some improvement, but delays in investigation and treatment were still excessive. There are no published data on current performance nationally. The purpose of the UK Carotid Endarterectomy study was to assess the quality of carotid endarterectomy services and mortality within 30 days of operation.

## METHODS

We invited all surgeons in the UK who performed carotid endarterectomy to participate. We obtained data for each trust from the hospital episode statistics or equivalent body to use for comparison. Surgeons were asked to submit all data on all carotid endarterectomies they performed over the study period (December 2005 to December 2007) via a web based tool.

For each operation we collected data in two phases: preoperative and operative data up to discharge (phase 1) and data on 30 day survival and follow-up outcome assessment (phase 2). Phase 1 data included: admission; history, referral; indications; imaging at time of referral; confirmatory carotid imaging before operation; most recent symptom and neurological status before surgery; previous carotid intervention; preoperative tests; preoperative drug use; operation; procedure; level of postoperative care; complications and timing; and discharge. Phase 2 data included patient status at 30 days, follow-up visit, complications, and drug use.

The minimum criterion for inclusion of a case in the analyses was completion of phase 1.

## RESULTS

We identified 396 eligible surgeons, and 240 (61%) contributed cases to the study. The median number of cases per surgeon was 18 (interquartile range 8-32). We have included only those patients who underwent surgery. We do not know how many operations were cancelled or how many patients had a disabling or fatal stroke before they could undergo surgery.

Phase 1 details were complete for 5513 patients by 31 March 2008 (from 240 surgeons in 120 hospitals).

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Baseline phase 2 data were available for 4964 cases (from 206 surgeons in 105 hospitals), and complete data were available for the 4404 patients who attended follow-up appointments. The total number of cases listed on hospital episode statistics for the data collection period of this study was 9913, giving a 56% rate of case submission.

Of the 5513 patients, 3751 (68%) were men, with mean age of 70 (71 for women). Twelve per cent of all patients were aged over 80 (660/5513), 2.9% over 85 (160/5513), and 0.6% over 90 (31/5513). Most patients were British white (95%, 5115/5377). Twenty one per cent (1178/5509) had diabetes, 32% (1762/5513) had a history of ischaemic heart disease or chronic heart failure, 31% (1671/5476) were current smokers, and 80% (4403/5492) had hypertension.

Sixteen per cent of patients (889/5513) were recorded as being asymptomatic, with 84% having some symptom attributable to carotid disease. Of these, 41% (1914/4624) had a transient ischaemic attack, 35% (1634/4624) had stroke, 20% (916/4624) had amaurosis fugax, and 3% (160/4624) none of these three symptoms.

Stroke (38%, 2117/5513) or care of the elderly (13%, 717/5513) physicians referred most patients, with neurologists (11%, 596/5513) and general practitioners (13%, 701/5513) referring substantial numbers. The 1382 other referrals came from sources including cardiologists, ophthalmologists, and other vascular surgeons. The fastest pathway from referral to surgery was through neurologists (median delay 25 days, interquartile range 10-63 days) and stroke physicians (30, 16-67 days). Referrals through care of the elderly physicians (48, 24-85 days) and general practitioners (68, 34-151 days) were considerably slower.

There was considerable delay between the most recent symptom and surgery (table). Nearly a third (1372/4591) of patients waited more than 12 weeks, and only 20% (944/4591) underwent surgery within two weeks.

Delays from referral to operation were considerable. The median delay from referral to surgery was 40 days (17-84 days). Once admitted, 15% (818/5513) had their operation on the day of admission, and 94% (5186/5513) were operated on within two days.

Preoperatively, 90% of patients were taking a statin (4982/5513) and 32% (1781/5512) were taking a β blocker. Nearly all (5378/5513) were taking at least one antithrombotic drug before surgery.

Surgery on the left carotid artery was slightly more common (52%, 2863/5504) than on the right. Some 3733 patients underwent confirmatory imaging of the ipsilateral carotid before operation. Seven per cent (269/3717) of patients had 50-69% stenosis, 55% (2032/3717) had 70-89% stenosis, and 35% (1285/3717) had 90-99%. The level of stenosis in the contralateral carotid artery was not imaged in 1075 cases. Fifty six per cent (1462/2633) had less than 50% contralateral stenosis, 14% (381/2633) had a level of 50-69%, 19% (498/2633) had 70-99%, and 11% (292/2633) had an occluded artery.

Phase 2 (follow-up) data were known for 4964 (90%) patients. Ninety five per cent (4593/4818) were offered an appointment, and, of these, 96% (4404/4593) attended, with median time from operation to follow-up of 50 days (41-65 days).

Most patients (91%, 4499/4964) were taking antithrombotic drugs. Eighty four per cent (4158/4964) were taking statins, and 21% (1054/4934) were taking β blockers. Inpatient mortality was 0.5% (29/5512). The principal cause of inpatient death was stroke, followed by myocardial infarction. Risk of inpatient death increased with age (0.1% (1/820) at <60 years, 0.6% (23/4032) at 60-80 years, 0.8% (5/660) at >80 years). The 30 day mortality was 1.0% (48/4944). Of the 5512 patients, 101 (1.8%) were reported to have had a stroke as an inpatient and of these 67 had the stroke within 24 hours of surgery, which gives a 24 hour stroke rate of 1.2%. Thirty patients had a stroke after discharge. The rate of stroke from admission to follow-up was 2.6% (124/4681).

**Delay between most recent symptom and surgery**

| Delay (weeks) | No of cases* (%) |
|---|---|
| ≤2 | 944 (20) |
| 2-4 | 654 (14) |
| >4-12 | 1621 (34) |
| >12 | 1372 (30) |

*Total=4591; 33 missing.

## DISCUSSION

This large survey of carotid endarterectomy practice in the UK shows that the operation is underused compared with other similar countries. Of the 120 000 people who have a transient ischaemic attack or stroke every year in the UK at least 10 000 might be suitable for carotid endarterectomy yet only 4500 procedures are being performed each year.

### Comparison with other studies

Recently published NICE guidelines suggest that carotid endarterectomy should be performed within two weeks of presenting symptoms. The most important finding of our survey is that, despite major changes in clinical practice in recent years, there are still unacceptable delays between symptom and operation in the UK.

Two prospective population based studies identified all patients undergoing carotid imaging for transient ischaemic attack or stroke in Oxfordshire in 2002-4.[7] Among 853 patients who had carotid imaging, median (interquartile range) times from presenting event to referral, scanning, and endarterectomy were 9 (3-30), 33 (12-62), and 100 (59-137) days, respectively. Forty nine patients had endarterectomy, but only three (6%) had surgery within two weeks of their presenting event and only 21 (43%) within 12 weeks. Risk of stroke before endarterectomy in those with 50-99% stenosis was 32% (17-47%) at 12 weeks, and half the strokes were disabling or fatal.

There were differences in speed of referral from different physicians in our survey. Neurologists and stroke physicians might have speedier access to imaging facilities than other specialties.

## WHAT IS ALREADY KNOWN ON THIS TOPIC

Stroke and transient ischaemic attack are common causes of death and disability in the UK

Many patients do not report symptoms of transient ischaemic attack or minor stroke promptly and there is a high risk of stroke within 30 days

A considerable proportion of symptomatic patients have tight carotid stenosis

Early carotid endarterectomy after symptoms will effectively prevent future stroke

## WHAT THIS STUDY ADDS

Most UK patients have carotid surgery after symptoms, but there are long delays between symptoms and surgery

Only a fifth of symptomatic patients have surgery within the two weeks recommended by NICE guidelines

Carotid endarterectomy for symptoms is urgent and should have priority over elective surgery

Recent updates of carotid endarterectomy in Scotland took place in 2005 and 2007. The mean time from referral to seeing the surgeon was 10.8 days, with a mean time from surgical consultation to surgery of just over three weeks (22.5 days). Overall, only 38% had their intervention within the Scottish target of 30 days.[6] This is similar to our findings of 34% being operated on within four weeks of their symptoms.

### Implementing faster surgical referral

The Department of Health's stroke strategy now recommends that carotid surgery should be carried out within 48 hours of symptoms in patients with transient ischaemic attack or minor stroke who are neurologically stable.[8] Imaging services will need to provide carotid ultrasonography seven days a week, and carotid surgery in symptomatic patients will need to be regarded as an urgent procedure, having precedence over elective cases. A weekly multidisciplinary team meeting to assess suitability for surgery will be insufficient because operations will need to be scheduled for the next day. Anaesthetic staff with a special interest in vascular anaesthesia will also need to be available at short notice.

Operative mortality in our study was about 1% and is comparable with other studies.[1 2 9 10] Some deaths and strokes occur after discharge, and, in our survey, half the deaths occurred outside hospital. Strokes are under-reported when surgeons report their own operative outcomes, and the risk of death and non-fatal stroke in our survey (2.5%) is lower than that in symptomatic trials with independent assessment of patients.

Earlier operation in symptomatic patients will have lasting benefit on stroke prevention.[2 11 12] More symptomatic patients should be fast tracked, allowing them to benefit from early surgery. Further research is required to identify the appropriate proportion of younger (up to 75 years) patients with asymptomatic stenosis in whom prophylactic surgery will provide cost effective stroke-free survival.[13 14]

### Limitations of study

The data were self reported by the proportion (61%) of UK surgeons who took part and a considerable number of surgeons did not contribute. A comparison with the Scottish data for the same period suggests that the delays are similar but that stroke rates might be underreported.[6] Not all the patients in the survey attended a follow-up appointment and this might contribute to the low reported rates of complications. The survey captured only those patients undergoing surgery and there might have been other patients potentially eligible for carotid endarterectomy who did not receive surgery. Nevertheless, the process data are likely to be reasonably reliable and have important implications for routine clinical practice, particularly in relation to delays in investigation and treatment.

The large number of cases collected is a tribute to the hard work and dedication of the surgeons and their teams in submitting data. We thank Professor Walter Holland who encouraged us and the Stroke Association and the Chest, Heart and Stroke Association of Northern Ireland who sponsored the pilot study.

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**Competing interests:** None declared.

**Ethical approval:** Not required.

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# Self administered cognitive screening test (TYM) for detection of Alzheimer's disease: cross sectional study

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## ABSTRACT

**Objective** To evaluate a cognitive test, the TYM ("test your memory"), in the detection of Alzheimer's disease.

**Design** Cross sectional study.

**Setting** Outpatient departments in three hospitals, including a memory clinic.

**Participants** 540 control participants aged 18-95 and 139 patients attending a memory clinic with dementia/amnestic mild cognitive impairment.

**Intervention** Cognitive test designed to use minimal operator time and to be suitable for non-specialist use.

**Main outcome measures** Performance of normal controls on the TYM. Performance of patients with Alzheimer's disease on the TYM compared with age matched controls. Validation of the TYM with two standard tests (the mini-mental state examination (MMSE) and the Addenbrooke's cognitive examination-revised (ACE-R)). Sensitivity and specificity of the TYM in the detection of Alzheimer's disease.

**Results** Control participants completed the TYM with an average score of 47/50. Patients with Alzheimer's disease scored an average of 33/50. The TYM score shows excellent correlation with the two standard tests. A score of ≤42/50 had a sensitivity of 93% and specificity of 86% in the diagnosis of Alzheimer's disease. The TYM was more sensitive in detection of Alzheimer's disease than the mini-mental examination, detecting 93% of patients compared with 52% for the mini-mental state examination. The negative and positive predictive values of the TYM with the cut off of ≤42 were 99% and 42% with a prevalence of Alzheimer's disease of 10%. Thirty one patients with non-Alzheimer dementias scored an average of 39/50.

**Conclusions** The TYM can be completed quickly and accurately by normal controls. It is a powerful and valid screening test for the detection of Alzheimer's disease.

## INTRODUCTION

Cognitive tests aid the diagnosis of dementia and are important in the medical and social management of patients and in the assessment of capacity. Once there are effective treatments for Alzheimer's disease, there will be an even greater need for a quick sensitive test that is suitable for use in primary care and by non-specialists.

Many cognitive tests are available, but none meets the three requirements for widespread use by a non-specialist—that is, take minimal operator time to administer, test a reasonable range of cognitive functions, and are sensitive to mild Alzheimer's disease. We designed the TYM ("test your memory") to fulfil these requirements.

The TYM was administered to normal controls, patients with Alzheimer's disease/amnestic mild cognitive impairment, and patients with non-Alzheimer's degenerative dementias. We validated the test against scores on the mini-mental state examination[1] and Addenbrooke's cognitive examination-revised.[2] We determined the specificity and sensitivity of the TYM in the detection of Alzheimer's disease, and assessed inter-rater reliability.

## METHODS

### The TYM test

The TYM is a series of 10 self administered tasks (see appendix 1 on bmj.com). The tasks are orientation, ability to copy a sentence, semantic knowledge, calculation, verbal fluency, similarities, naming, visuospatial abilities, and recall of a copied sentence. The ability to do the test is also scored.

### Participants

*Patients with Alzheimer's disease*—Patients were seen and diagnosed by a consultant neurologist in a dedicated memory clinic at Addenbrooke's Hospital between March and December 2007. A total of 108 patients (59 men, 49 women) received a clinical diagnosis. Alzheimer's disease was diagnosed in 85 and amnestic mild cognitive impairment in 23. Nine patients with a diagnosis of amnestic mild cognitive impairment who scored below the cut off for dementia on the Addenbrooke's cognitive examination-revised (≤83[2]) were included in the Alzheimer's cohort. Fourteen patients with a diagnosis of amnestic mild cognitive impairment who scored above the cut off for dementia on the Addenbrooke's cognitive examination were analysed separately.

*Controls*—Controls were recruited from relatives accompanying patients to the memory clinic, attending neurology and medical outpatients departments at two other hospitals, and some dermatology outpatients. We excluded people with a history of neurological disease, memory problems, or brain injury. We tested 540 controls aged 18-95. Over half (54%) were women. We calculated normal values for each decade from the age of 30 with standard errors. Three age matched controls were selected for each patient with Alzheimer's disease.

### Testing, validation, and comparisons

The 94 patients in the Alzheimer's cohort were given the TYM as well as the Addenbrooke's cognitive examination-revised (that includes the mini-mental state examination). We compared the scores of patients and age matched controls on subsets and total scores. We compared the TYM scores of patients with the Addenbrooke's and mini-mental scores. The internal consistency of the TYM was assessed.

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We used data from the 94 patients with Alzheimer's disease to plot a receiver operating characteristic curve. Three age matched controls (n=282) were randomly selected for each patient with mild Alzheimer's disease. We calculated positive and negative predictive values for different TYM scores for different prevalences of Alzheimer's disease.

We directly compared the TYM and the mini-mental state examination in identifying the 94 patients with Alzheimer's disease. Fourteen patients in the mild cognitive impairment cohort (average age 67.9) were given the TYM as well as the Addenbrooke's examination. We compared these scores with the TYM scores of the controls used for the Alzheimer's cohort. A consultant, a specialist registrar, and a registered general nurse independently scored the same 100 TYM sheets.

## RESULTS

*Reliability and normative data*—The TYM was filled in quickly and efficiently by controls and patients with minimal supervision from a receptionist or nurse. The average time for a control to complete the test was five minutes. The value of Cronbach's α for all participants and subsets was 0.80. The average TYM score for controls was about 47 for ages 18-70. Above the age of 70, there was a small decline in performance, which became significant above the age of 80. One way analysis of variance confirmed a significant effect of age group on total TYM score ($F_{5,534}$=6.4, P<0.001). All subscores except semantic knowledge showed a mild decrease with increasing age; semantic knowledge showed a small improvement.

*Alzheimer's disease and test validation*—We found strong and significant correlations between all scores on the TYM, the Addenbrooke's cognitive examination-revised, and the mini-mental state examination in patients with Alzheimer's (TYM *v* Addenbrooke's $R^2$=0.66, P<0.001; TYM *v* mini-mental $R^2$=0.51, P=0.001; Addenbrooke's *v* mini-mental $R^2$=0.70, P<0.001).

**Comparison of performance (mean (SD) scores) on TYM (total and subscores) between patients with Alzheimer's disease (n=94) and age matched controls (n=282)**

| Subscore (maximum) | Controls | Patients | Difference | P value* |
|---|---|---|---|---|
| Orientation (10) | 9.9 (0.5) | 8.3 (2.0) | 1.6 | <0.001 |
| Copying (2) | 1.8 (0.6) | 1.7 (0.7) | 0.1 | 0.09 |
| Semantic knowledge (3) | 2.6 (0.6) | 1.4 (1.0) | 1.3 | <0.001 |
| Calculation (4) | 3.7 (0.6) | 3.1 (1.2) | 0.7 | <0.001 |
| Fluency (4) | 3.5 (1.0) | 2.2 (1.5) | 1.4 | <0.001 |
| Similarities (4) | 3.4 (1.0) | 3.0 (1.3) | 0.5 | 0.002 |
| Naming (5) | 4.9 (0.4) | 4.4 (1.1) | 0.5 | <0.001 |
| Visuospatial 1 (3) | 2.7 (0.7) | 1.8 (1.2) | 1.0 | <0.001 |
| Visuospatial 2 (4) | 3.7 (0.7) | 2.9 (1.5) | 0.8 | <0.001 |
| Anterograde (6) | 5.2 (1.5) | 0.9 (1.8) | 4.2 | <0.001 |
| Executive (help) (5) | 5.0 (0.2) | 3.7 (1.2) | 1.3 | <0.001 |
| Total (50) | 46.6 (4.0) | 33.2 (8.2) | 13.4 | <0.001 |

*Two tailed significance (uncorrected). Significance values shown are for independent samples *t* tests and are uncorrected; after Bonferroni correction for multiple comparisons level for significance is P=0.004.

*Comparison of TYM scores*—The table shows comparisons between the total TYM score and subscores for patients and controls. The mean age was the same in both groups (69.0). As expected, patients with Alzheimer's were particularly impaired on anterograde memory scores relative to controls. Patients also scored poorly on semantic knowledge, fluency, visuospatial tasks, and executive function. After Bonferroni correction for multiple comparisons all subtests except sentence copying showed a significant decrease in patients with Alzheimer's compared with controls.

*Sensitivity and specificity*—The area under the ROC curve for differentiating between mild AD and controls was 0.95. If a single cut off is required then a score of ≤42 predicts mild Alzheimer's in this population, with a sensitivity of 93% and specificity of 86%. The negative and positive predictive value for various TYM scores at different prevalences of Alzheimer's show that negative predictive values are high: 100% for a score of ≤42 with a prevalence of Alzheimer's up to 5%. Positive predictive values are lower: a score of ≤42 has a predictive value of 26% with a prevalence of Alzheimer's of 5% (see bmj.com).

*Comparison of sensitivity*—We compared the power of the TYM and the mini-mental state examination to detect the 94 patients with Alzheimer's. With a cut off of ≤42 the TYM detected 93%. With the established cut off of ≤23 the mini-mental state examination detected 52%.[3]

*TYM in patients with mild cognitive impairment*—The patients with mild cognitive impairment scored highly on all cognitive tests, averaging 27.8/30 on the mini-mental state examination, 86.9 on the Addenbrooke's examination, and 45/50 on TYM. Their scores on 10 of the subtests of memory test were similar to controls, but they tended to score worse than controls on anterograde memory (3.4/6 *v* 5.2/6, $t_{13.5}$=2.7, P=0.02 uncorrected).

*Inter-rater variability*—The TYM scores calculated by the three raters were highly correlated (see bmj.com).

## DISCUSSION

The new "test your memory" (TYM) test was quick to use and detected 93% of cases of Alzheimer's disease. From the age of 18 to 70 the average score in controls was stable at 47/50, with a small decline after this age. The score of controls remained constant in widely different age ranges in both sexes and all geographical backgrounds. This is likely to be a ceiling effect. The test was designed to be easy for normal controls to allow quick and accurate completion. This ceiling effect suggests that education and social class would have only mild effects on the score, but we did not formally assess this.

### Patients

Patients with Alzheimer's disease perform much poorer than controls on the TYM. They scored an average of 33/50; 13.4 points below the control group. All parts of the test, except copying a sentence, are performed less well by patients than controls.

We separately analysed patients with mild memory problems. These patients had a clinical diagnosis of

## WHAT IS ALREADY KNOWN ON THIS TOPIC

There is no available short cognitive test that is quick to use, examines various skills, and is sensitive to Alzheimer's disease

There is confusion over how to score and interpret current short cognitive tests

## WHAT THIS STUDY ADDS

The new "test your memory" (TYM) test is quick to use, examines 10 cognitive skills, and detects 93% of cases of Alzheimer's disease

There are normative data and a scoring sheet to allow consistent scoring and interpretation

amnestic mild cognitive impairment and scored well on the Addenbrooke's examination (>83) and are unlikely to progress to Alzheimer's.[4] The patients with mild cognitive impairment scored an average of 45/50 on the TYM, with a trend towards problems in anterograde memory. We also separately examined the performance of the 42 patients with Alzheimer's aged 70 or over (average age 76.8). There was little difference in these patients compared with the younger patients (33.9 *v* 32.6). This suggests that it is a useful test to detect older patients with Alzheimer's.

The sensitivity and specificity of TYM for detecting Alzheimer's in this cohort is high. A score of ≤42 detects 93% of cases of mild Alzheimer's with a specificity of 86%; a score of ≤44 detects 96% of patients with mild Alzheimer's.

As individuals fill in the test sheet themselves, the tester has minimal influence on the score. The use of a strict scoring scheme minimises the influence of the rater. Scores calculated by the single rater correlated closely with the scores of the other two raters in the inter-rater analysis.

### TYM *v* mini-mental state examination

The mini-mental state examination has been the standard short cognitive test for 30 years. It has many strengths but fails three of the requirements for a brief screening test for the non-specialist: minimal operator time, testing a wide range of cognitive domains, and sensitivity to mild Alzheimer's. In contrast, the TYM fulfils the three requirements. If a patient completes the test while in the waiting area supervised by the receptionist, it can be scored and analysed by the doctor in two minutes.

The 11 tasks in the TYM examine more cognitive domains than the mini-mental state examination. The inclusion of two visuospatial tasks is important in distinguishing Alzheimer's disease from pure amnestic syndromes. The test has a high sensitivity for detecting Alzheimer's. In our study it detected 93% of cases of Alzheimer's compared with 52% detected by the mini-mental state examination.

The small range of scores in the mini-mental state examination limit its suitability for monitoring, but it is widely used for this purpose. The TYM has a much wider scoring range than the mini-mental state examination, with over 13 points between the average control and the average patient with mild Alzheimer's.

### TYM *v* Addenbrooke's cognitive examination

The Addenbrooke's examinations are sensitive and specific in the diagnosis of degenerative dementia.[2,5] The major drawback of the revised examination is that it fails to fulfil the time requirement for a test for non-specialists. There was a strong correlation between the TYM score and the Addenbrooke's score in both Alzheimer's and non-Alzheimer's dementias. The TYM score averages 50% of Addenbrooke's score, enabling the two tests to be easily compared.

### Other strengths and weaknesses of TYM

The TYM has several other advantages over current bedside cognitive tests. There is a brief but rigorous scoring system, which requires only 10 minutes' training. Inter-rater agreement for scoring is excellent. The simplicity of the memory test should allow it to be administered and scored in a different language with help from a relative.

The high negative predictive value of scores ≥42 shows that in unselected groups a good score makes Alzheimer's disease unlikely. The test is also a good screening test for memory problems. In unselected groups the positive predictive value of a score of ≥42 is relatively low, showing that the test alone cannot be used to diagnose Alzheimer's disease. In selected groups where the prevalence of Alzheimer's will be higher—for example, older patients with memory complaints—the positive predictive value of a score ≥42 is much higher. One disadvantage of the TYM is the need for the specially printed sheets. A website is being developed to help to solve this problem.

This work would not have been possible without the nurses and receptionists at Queen Elizabeth Hospital, King's Lynn, North Cambridgeshire Hospital, Wisbech, and Addenbrooke's Hospital, Cambridge, who administered the tests. We thank colleagues in the memory clinic, Cambridge, for permission to include their patients and for helpful discussions. A website is being prepared (www.tymtest.com) that will allow downloading of tests, scoring sheets, and instructions.

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**Competing interests:** None declared.

**Ethical approval:** This study was performed under ethical approval from Cambridgeshire 2 research ethics committee. All participants gave informed consent.

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# Career progression and destinations, comparing men and women in the NHS: postal questionnaire surveys

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**EDITORIAL by Winyard**
**RESEARCH, p 1430**

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**STUDY QUESTION** Are the career trajectories and destinations of male and female NHS doctors different?

**SUMMARY ANSWER** A smaller percentage of women than men reached consultant or general practice principal status; of those who did, women progressed less quickly than men. This was attributable to part time working. Specialty destinations of women who had worked part time differed from those of women who had always worked full time and of men.

### Participants and setting

We surveyed all doctors working in the NHS who graduated from all UK medical schools in 1977, 1988, or 1993.

### Design, size, and duration

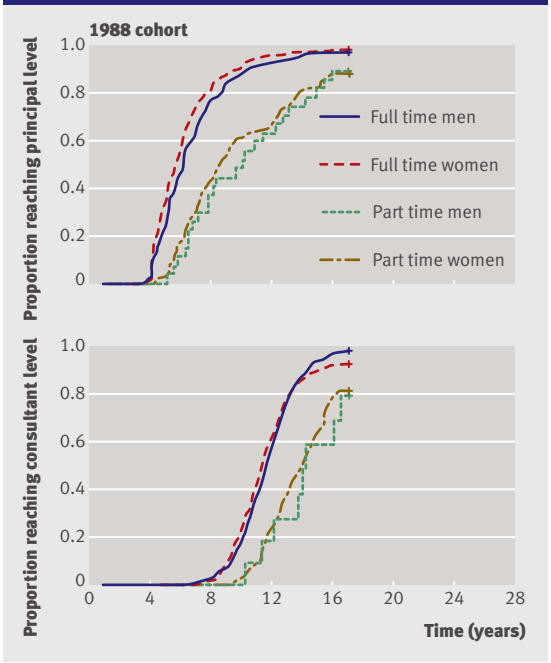
We used postal questionnaires for 10 344 doctors and analysed the replies by using descriptive statistics, $\chi^2$ and Fisher's exact tests, and Kaplan-Meier "survival" analysis. We measured percentages of men, women, and women who had always worked full time who attained NHS general practice principal and consultant posts; speed of career progression; and specialty of career destination.

### Main results and the role of chance

The response rate was 68% (7012/10 344). Within general practice, 97% (1208/1243) of men, 99% (264/267) of women who had always worked full time and 87% (1083/1248) of all women were principals. Of 1977 and 1988 graduates in hospital practice, 96% (1293/1347) of men, 92% (276/299) of women who had always worked full time, and 67% (277/416) of women who had not were consultants. The key factor that determined career progression was working pattern, not female sex (figure). Median times to principal post were 5.8 (95% confidence interval 5.6 to 6.0) years for men, 5.6 (5.4 to 5.8) years for women who had always trained full time, and 6.8 (6.5 to 7.0) years for all women. Median times to consultant post were 11.7 (11.5 to 11.9) years for men, 11.3 (11.0 to 11.6) years for women who had always trained full time, and 12.3 (12.0 to 12.6) years for all women.

More men (16%) than women who had worked full time (6%) or part time (2%) were in surgery. The corresponding percentages for hospital medical specialties were 15%, 16%, and 10%. Thus, under-representation of women in surgery is associated both with part time working and with female sex; under-representation of women in hospital medical specialties is attributable to part time working. Five per cent of men, 9% of women who had always worked full time, and 8% of women who had worked part time were in psychiatry. Thus, over-representation of psychiatrists among women is attributable to female sex and not to working part time. General practice was the destination of 37% of men, 31% of women who had always worked full time, and 56% of women who had not. Thus, over-representation of women in general practice is strongly associated with part time working.

**TIME AFTER QUALIFICATION TO SENIOR NHS POSTS IN 1988 COHORT**




### Bias, confounding, and other reasons for caution

Responder bias is possible. We had no data on possible indirect discrimination such as women's views on the practicalities of working in different specialties.

### Generalisability to other populations

Our findings are generalisable to UK doctors who qualified in the 1970s, 1980s, and 1990s.

### Study funding/potential competing interests

The Policy Research Programme, Department of Health, funds the UK Medical Careers Research Group. The NIHR Co-ordinating Centre for Research Capacity Development funds the Unit of Health-Care Epidemiology. The views in this paper are not necessarily those of the funders.

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# Retention in the British National Health Service of medical graduates trained in Britain: cohort studies

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RESEARCH, p 1429

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**STUDY QUESTION** What percentage of medical graduates from British medical schools eventually practise medicine in the NHS, and do rates of practice differ between men and women, between recent and older generations, and between entrants to British medical schools from Britain and those from overseas?

**SUMMARY ANSWER** Most British medical graduates from British medical schools practised in the NHS in the short and long term, and there was no important difference between men and women in this respect. Attrition from the NHS was no greater in recent cohorts compared with older ones at similar times after qualification. Most graduates from overseas homes remained in Britain as junior doctors but about half left Britain eventually.

**Participants and setting**
We studied all doctors who graduated in 1974, 1977, 1983, 1988, 1993, 1996, 1999, 2000, and 2002 from all medical schools in Great Britain at one, three, and five years after qualification and at longer intervals thereafter.

**Design, size, and duration**
We used postal questionnaires and NHS employment data for 32013 graduates; we analysed data using descriptive statistics, $\chi^2$ tests, capture-recapture analysis, and confidence intervals on the capture-recapture estimates. The primary outcome was working in the NHS at seven census years from two years after qualification.

**Main results and the role of chance**
Eighty nine per cent of doctors in the nine cohorts (28 439/32 013) replied to our questionnaires at least once. Of doctors from British homes, 88% of men (6807/7754) and 88% of women (7909/8985) worked as doctors in the NHS two years after qualification; values were 87% (7483/8646) and 86% (7364/8594) at year five, 86% (6803/7872) and 86% (5407/6321) at year 10, 85% (5404/6331) and 84% (3206/3820) at year 15, and 82% (2534/3089) and 81% (1132/1395) at year 20. Part time work by women in the NHS was common. At no time was there an abrupt departure of doctors from the NHS. Of doctors from overseas homes who went to medical school in Britain, 76% were in the NHS at two years (776/1020), 72% at five years (700/972), 63% at 10 years (448/717), and 52% at 20 years (128/248). Most doctors who were not in the NHS were working in medicine overseas or in medicine outside the NHS within Britain.

**Bias, confounding, and other reasons for caution**
Responder bias is possible, but the use of capture-recapture analysis means that the results are likely to be accurate. Confidence intervals around the percentages were small.

**Generalisability to other populations**
Our findings are probably generalisable to other cohorts of UK doctors who qualified in the 1970s, 1980s, 1990s, and early 2000s but cannot be assumed to apply to medical graduates in other countries.

**Study funding/potential competing interests**
The Policy Research Programme, Department of Health, funds the UK Medical Careers Research Group. The National Institute for Health Research Co-ordinating Centre for Research Capacity Development funds the Unit of Health-Care Epidemiology. Views in the paper are not necessarily those of the funders.

**PERCENTAGE (95% CI) OF GRADUATES FROM HOMES IN BRITAIN WORKING IN THE NHS, COMBINED COHORTS**

| Year after qualification | Men | Women | Total |
|---|---|---|---|
| 2 | 87.8 (87.4 to 88.2) | 88.0 (87.7 to 88.4) | 87.9 (87.7 to 88.2) |
| 5 | 86.5 (86.0 to 87.1) | 85.7 (85.2 to 86.2) | 86.2 (85.8 to 86.5) |
| 10 | 86.4 (86.0 to 86.8) | 85.5 (85.0 to 86.1) | 86.0 (85.7 to 86.4) |
| 15 | 85.4 (85.0 to 85.7) | 83.9 (83.4 to 84.5) | 84.9 (84.6 to 85.3) |
| 20 | 82.0 (81.5 to 82.6) | 81.1 (80.0 to 82.2) | 81.7 (81.2 to 82.2) |
| 25 | 80.9 (80.4 to 81.3) | 80.5 (79.6 to 81.4) | 80.8 (80.3 to 81.2) |

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# Perceptions of genetic discrimination among people at risk for Huntington's disease: a cross sectional survey

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**STUDY QUESTION** What is the nature and prevalence of genetic discrimination experienced by people at risk for Huntington's disease who had undergone genetic testing or remained untested?

**SUMMARY ANSWER** Genetic discrimination was commonly reported by people at risk for Huntington's disease and was a source of psychological distress. Family history, and not genetic testing, was the major reason for genetic discrimination.

### Participants and setting

We recruited 233 asymptomatic people at risk for Huntington's disease from seven genetics and movement disorders clinics servicing rural and urban communities in Canada. Of these, 167 had undergone genetic testing (83 had the Huntington's disease mutation, 84 did not) and 66 had chosen not to be tested.

### Design

We undertook a cross sectional, self reported survey by means of a validated questionnaire in 2006.

### Primary outcome(s)

Our primary interest for this study was respondents' reported experiences of genetic discrimination and related psychological distress because of family history or genetic test results.

### Main results and the role of chance

Based on an 80% response rate, discrimination was reported by 93 respondents (39.9%). Although respondents who were aware that they carried the Huntington's disease mutation reported the highest levels of discrimination, participation in genetic testing was not associated with increased levels of genetic discrimination. Family history of Huntington's disease, rather than the result of genetic testing, was the main reason given for experiences of genetic discrimination. Psychological distress was associated with genetic discrimination ($P<0.001$).

### Bias, confounding, and other reasons for caution

Our findings are based on data from Canada and may not be generalisable to jurisdictions without universal health care. The cross sectional design did not allow us to make conclusions about causal effects of genetic status or family history on experiences of genetic discrimination. Discrimination experiences were self reported and could not be validated; thus, reported experiences are the respondents' perception of discrimination. Our sampling strategy relied on reports of discrimination among people attending clinics and participating in research, who may be more resourceful and better able to cope with the psychosocial consequences of testing or research.

### Generalisability to other populations

Predictive testing for Huntington's disease represents an extreme model for an autosomal dominant disease of high penetrance for which there is a well validated test. Even in such an extreme case, our study highlights the importance of the family history in people's experiences of genetic discrimination. Ultimately, asymptomatic individuals at genetic risk are at similar risk for discrimination because of their label of having a family history of disease.

### Study funding/potential competing interests

Funding for this project from the Canadian Institutes of Health Research (CIHR) was received by MRH and JLB. Supplemental funding from the National Institutes of Health and the National Institute of Neurological Disorders and Stroke was awarded to JSP (No 3 R01 NS040068). YB was supported by the CIHR, the Michael Smith Foundation for Health Research, and the Child and Family Research Institute.

**SETTINGS OF GENETIC DISCRIMINATION EXPERIENCES REPORTED BY 233 ASYMPTOMATIC PEOPLE AT RISK FOR HUNTINGTON'S DISEASE**

| Setting | No (%) of respondents who experienced discrimination | | | | |
|---|---|---|---|---|---|
| | | Genetically tested | | | |
| | Total (n=233) | Total (n=167) | Positive test (n=83) | Negative test (n=84) | Not tested (n=66) |
| Overall | 93 (39.9) | 71 (42.5) | 42 (50.6) | 29 (34.5) | 22 (33.3) |
| Insurance | 68 (29.2) | 53 (31.7) | 31 (37.3) | 22 (26.2) | 15 (22.7) |
| Family | 36 (15.5) | 31 (18.6) | 19 (22.9) | 12 (14.3) | 5 (7.6) |
| Social | 29 (12.4) | 25 (15.0) | 17 (20.5) | 8 (9.5) | 4 (6.1) |
| Employment | 16 (6.9) | 15 (9.0) | 12 (14.5) | 3 (3.6) | 1 (1.5) |
| Health care | 20 (8.6) | 14 (8.4) | 11 (13.3) | 3 (3.6) | 6 (9.1) |
| Public sector | 9 (3.9) | 9 (5.4) | 5 (6.0) | 4 (4.8) | 0 (0.0) |