Time Series Analysis for selected clinical indicators from the Quality and Outcomes Framework 2001-2006

Title	**Time Series Analysis for selected clinical indicators from the Quality and Outcomes Framework 2001-2006**
Document Type	**Final Report for The Information Centre for health and social care**
Version	**1-1**
Project	**R22 HSCIC – QOF project**
Author	**Julia Hippisley-Cox, Yana Vinogradova, Carol Coupland**

Revision History

Revision date	Version	Summary of Changes
017 Dec 2006	1.0	Original

Related file

Date	Version	Filename
17th Dec 2006	1.0	R22 HSCIC QOF Times Series Analysis QRESEARCH 2001-2006 - Tables (v1-0).xls

1 Executive summary

- This report for The Information Centre for health and social care, describes a five year time series of nineteen selected quality indicators from General Practice based on the national GMS contract for GPs (the Quality and Outcomes Framework, 'QOF').

- This report underpins a secondary analysis which will be undertaken in collaboration with the Department of Health. This analysis will link the time series to a cost-weighted time series of general medical practice activity for use within a wider cost weighted activity index of NHS output. This aspect of the project will be reported separately.

- The present analysis has been conducted on the QRESEARCH database. The full database consists of 525 general practices in the UK (http://www.qresearch.org). The present analysis was restricted to 498 practices in England and to those with complete data for the five year study period 2001-2006. The population covered was 3.4 million patients.

- QRESEARCH (version 12) has been used for this analysis because it is a representative sample of general practices and the data are of high quality. Historical data from QRESEARCH is available for 10 years for the majority of practices enabling historical time series analysis to be undertaken.

- In addition, the QRESEARCH analysis includes an analysis by age and sex and quarter. In contrast, the current QOF data are only available by year from April 2005 onwards and do not have a breakdown by age and sex.

- The quality indicators which have been selected reflect partial outcome measure in several major disease groups (coronary heart disease, stroke, hypertension, chronic kidney disease, epilepsy and diabetes).

- The quality indicators selected for the analysis are listed below (the numbering relates to the national numbering of indicators in the QOF).

    - CHD1: Prevalence of coronary heart disease (CHD)
    - CHD6: Blood pressure (BP) under 150/90 in last 15 months
    - CHD8: Cholesterol < 5 mmol/l in last 15 months
    - Stroke1: Prevalence of stroke
    - Stroke6: BP < 150/90 in last 15 months
    - Stroke8: Cholesterol < 5 mmol/l in the last 15 months
    - Diabetes1: Prevalence of diabetes
    - Diabetes6: Glycosylated haemoglobin (HBA1C) in the last 15 months <=7.4
    - Diabetes7: Glycosylated haemoglobin (HBA1C) in the last 15 months <=10
    - Diabetes12: BP < 145/85 mm Hg in last 15 months
    - Diabetes17: Cholesterol under 5 mmol/l in last 15 months

- Epilepsy1: Prevalence of epilepsy
- Epilepsy4: Convulsion free in the last 12 months
- Hypertension1: Prevalence of hypertension
- Hypertension4: Blood pressure recorded in last 9 months
- Hypertension5: BP < 150/90 as measured in the last 9 months
- CKD1: Prevalence of chronic kidney disease
- CKD2: Blood pressure recorded in the previous 15 months
- CKD3: BP < 140/85 mm hg in the previous 15 months

- The results of the study show a very good correspondence of prevalence rates except for diabetes between the data derived from QRESEARCH for April 2006 and national Quality Outcome Framework (QOF) data for England. This is a further indication of the reliability and representativeness of the QRESEARCH analysis[1]. For example, the prevalence of coronary heart disease in both data sources is 35.7 per 1000, hypertension had slightly lower prevalence in QRESEARCH (116 vs. 119 per 1000) and stroke prevalence was slightly higher (16.8 vs.15.7 per 1000).

- As expected, the recorded prevalence of all six diseases (coronary heart disease, stroke, hypertension, chronic kidney disease, epilepsy and diabetes) increased over the five year study period. The increase in the prevalence of hypertension was the most marked whilst the increase in the prevalence of epilepsy was only marginal.

- Some of the increases in the recorded disease prevalence are likely to be due to the changes in the Read codes used to record diseases. For example, the Read codes to denote chronic kidney disease have only recently been introduced and so the increase which is apparent in 2006 will partly reflect the change in usage of Read codes within clinical practice.

- However, some of the increase of the recorded disease prevalence is likely to be due to the ageing population, better screening, better recording, changes in diagnostic thresholds, increased incidence or improved survival.

- The increases of disease prevalence across the five year study period were consistent across different age bands and among men and women.

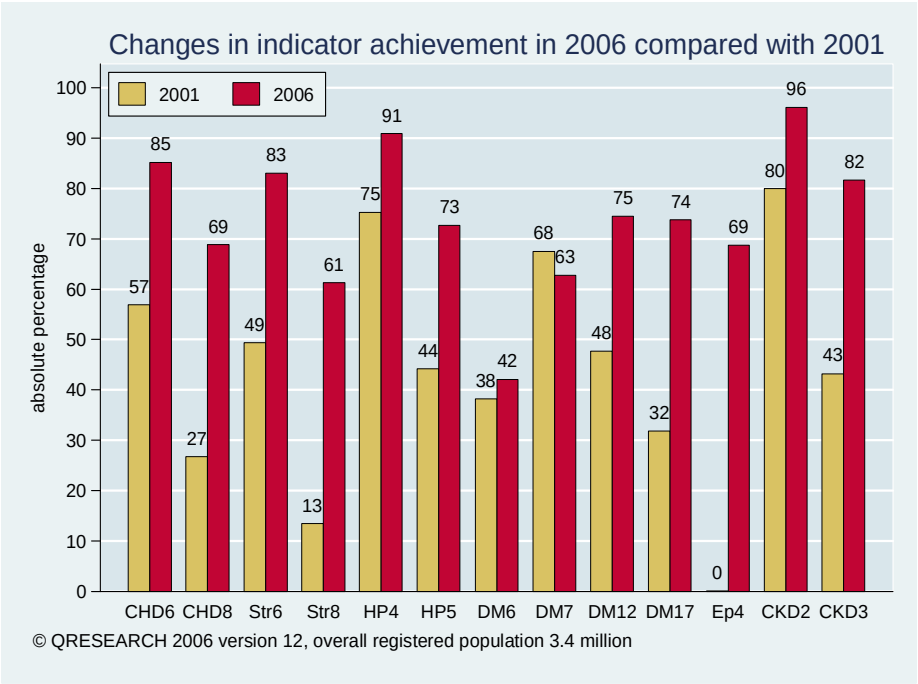
- There was an increase in the percentage achievement of all the quality indicators included in the study across the five year study period in all ages and among men and women.

- The next table summarises each indicator, the percentage of patients achieving the indicator in 2001 and in 2006 along with the change in percentage across the two time points.

Percentage achievement for each indicator in April 2001 and April 2006

Indicator	Description	% in 2001	% in 2006	% increase
CHD1	Prevalence of CHD	3.4	3.6	6.2
CHD6	BP < 150/90 in last 15 months	56.9	85.2	49.7
CHD8	Cholesterol < 5 mmol/l in last 15 months	26.7	68.8	157.6
Stroke 1	Prevalence of stroke	1.4	1.7	17.9
Stroke 6	BP < 150/90 in last 15 months	49.3	83.1	68.4
Stroke 8	Cholesterol < 5 mmol/l in last 15 months	13.4	61.3	356.2
Diabetes 1	Prevalence of diabetes	1.2	2.6	117.4
Diabetes 6	HBA1C in last 15 months <=7.4	38.2	42.1	10.1
Diabetes 7	HBA1C in last 15 months <=10	67.5	62.8	-7.0
Diabetes 12	BP < 145/85 in last 15 months	47.7	74.5	56.2
Diabetes 17	Cholesterol < 5 mmol/l in last 15 months	31.8	73.8	131.6
Epilepsy 1	Prevalence of epilepsy	0.5	0.6	15.6
Epilepsy 4	Convulsion free in the last 12 months	0.0	68.8	n/a
Hypertension1	Prevalence of hypertension	8.7	11.7	34.6
Hypertension 4	BP recorded in last 9 months	75.2	90.9	20.9
Hypertension5	BP < 150/90 in last 9 months	44.2	72.7	64.6
CKD1	Prevalence of chronic kidney disease	0.0	0.3	n/a
CKD2	BP recorded in last 15 months	80.0	96.1	20.2
CKD3	BP < 140/85 mm hg in last 15 months	43.2	81.6	88.8

The % increase is not shown. The baseline is too low to make a meaningful comparison



- Overall, this analysis shows prevalence of disease and absolute percentage of indicator achievements have increased in the last 5 years. The increase is likely to be due to a variety of reasons (eg improved recording and screening,

lowering thresholds, the changes in disease definitions, etc.), however, it is not possible to identify the reason from this type of analysis.

- The most striking increase in indicators was observed for stroke where there was a 356% relative increase (95% CI 182-637%) in the percentage of stroke patients with cholesterol of under 5 mmol/l in the preceding 15 months. In April 2001 13% of patients had a cholesterol under 5 mmol/l and in April 2006 it was 61%. This is the largest relative increase for any indicator over the five year study period (except for several indicators where extremely low recording at baseline made the results impossible to interpret).

- The changes to the diagnostic definition for diabetes introduced in 2006/7 (see section 5.6) have had an unexpected effect on our analysis – artificially decreasing the prevalence of diabetes and skewing the measurement of diabetes related indicators. This will affect QMAS results as well as our analysis and hence the data need to be used with great caution.

- Whilst there have been substantial increases in achievement of indicators since introduction of the new QOF in April 20004, there is good evidence that the changes predated the QOF give the increase observed since April 2001.

2 Acknowledgments

The authors acknowledge the contribution of EMIS practices who contribute data to QRESEARCH freely and also to EMIS for expertise in helping create and maintain QRESEARCH. The authors also acknowledge the funding for this project from the Information Centre for health and social care and the expertise of Mike Heaps in extracting the data from the QRESEARCH database.

Table of contents

Deleted: 7-28

Deleted: 7-30

Deleted: 7-31

Deleted: 7-33

Deleted: *7-34*

Deleted: *7-34*

Deleted: 8-36

Deleted: 9-37

3 Background

Economic output traditionally measures expenditure, or more recently for the NHS is based on a time series of cost-weighted activity, but there is recognition that we need to incorporate other measures of quality such as quality of care and health gain for patients (Atkinson Report, ONS 2005). It is important to try to determine the extent to which the additional funding has been matched by an improvement in quality of care as well as activity.

QRESEARCH is a very large consolidated database of general practice clinical records. The database is currently used to measure primary care outputs in terms of activity based on estimates of consultations for the national accounts[2]. The estimates include primary care consultations with a nurse or a GP. The information is broken down according to the location of the consultation i.e. whether it was conducted in the home, surgery or on the telephone.

However, there is now more scope than before to measure quality of care using nationally agreed quality indicators such as those from the new General Medical Services Contract, referred to as the Quality and Outcomes Framework (QOF)[3]. The QOF process gives a positive endorsement to indicators, including confirming that practices are able to measure them and that outcomes are regarded as attributable to good quality care by general practice.

The Department of Health requires a five year time series of selected QOF indicators which started before the QOF in order to estimate the impact of the QOF since its introduction in 2004. The time series needs to include quarterly estimates which can be combined with quarterly estimates of consultations at a later stage for inclusion in the national accounts. Whilst the QOF was first introduced into clinical practice in April 2004, the first results were not available until April 2005 and these were simply counts at practice level. In addition, there was no baseline data prior to the introduction of the QOF, no data available by quarter or by age and sex. Each of these factors make it impossible to use existing QMAS data to fully assess changes in the QOF over time, more information is required from QRESEARCH.

This proposal builds on previous work done by QRESEARCH and the Department of Health (Aileen Simkins) in which a quarterly time series of coronary heart disease (CHD) indicators were analysed.

The current proposal is to update and extend that work to other indicators which are (partial) outcome indicators of patients' health – such as blood pressure control, blood sugar control, cholesterol control and freedom from epileptic fits.

4 Aims

The aim of this study is to describe a time series of partial outcome clinical indicators in several major disease groups over the past five years in General Practice (2001-2006). It spans the period during which the QOF was introduced into clinical General Practice and therefore offers an opportunity to examine changes before and after the introduction of the new GMS contract

This analysis will underpin the development of a method of measuring change in the quality of care provided in General Practice using indicators from the national GMS contract for GPs (the Quality and Outcomes Framework). Eventually, the time series will be linked to a cost-weighted time series of general medical practice activity for use within a wider cost weighted activity index of NHS output. Further work, also outside the scope of this first report, includes an analysis of the epidemiological changes for the population, over the 5 years of the study, demonstrated by the partial outcome measures in several major disease groups, and estimate health gain in Quality Adjusted Life Years or other available measures. This aspect of the project will be reported separately.

5 Methods

5.1 Database version

The QRESEARCH database (version 12) was used for this analysis which contains data until 01 October 2006.

5.2 Validation of the database

QRESEARCH is a recently established clinical database containing the clinical records of over 10 million patients ever registered with 525 practices over the last 16 years. The information recorded on the database includes patient demographics (year of birth, sex, socio-economic data associated with postcode area), characteristics (height, weight, smoking status), symptoms, clinical diagnoses, consultations, referrals, prescribed medication and results of investigations. The QRESEARCH database has been validated by comparing birth rates, death rates, consultation rates, prevalence and mortality rates with other data sources including the General Household Survey and the General Practice Research Database[4].

The age-sex structure of the QRESEARCH population is similar to that reported in the UK 2001 census. There is a good correspondence for all of these measures (results available on request) although in some instances QRESEARCH prevalence figures[5] of chronic diseases such as diabetes, hypertension, stroke are marginally higher than less recent data although extremely similar to QOF. We have also compared practices taking part in regional research networks on these and other measures and found a good correspondence[6]. Detailed analyses have shown good

levels of completeness and consistency[7]. The database has been used for studies investigating effects of non-steroidal anti-inflammatory drugs[8 9] and statins[10].

5.3 Study period

The study period was the five year period from 01 April 2001 (36 months before the QOF was introduced) to 01 April 2006. The quarters were defined as starting on 01 April, 01 July, 01 October and the 01 January in each year. Total QOF registered patient numbers are needed for each quarter, as well as the numbers of patients with the relevant diseases.

5.4 Study population

All practices in England were included if they had complete data for the whole 5 year period. Patients were included in the analysis for each quarter if they were registered on the 1st day of each quarter. Hence there were different numbers of patients in each of the quarters during the study period.

5.5 Quality Indicators

We selected 19 indicators from the QOF as listed in the table below. The diseases and indicators were selected because they represent intermediate health outcomes i.e. control of blood pressure to recommended levels or control of cholesterol or glycosylated haemoglobin. The definitions used exactly matched those used in the new GMS contract for 2006/7.

Indicator number	**Description**
CHD1	Prevalence of CHD
CHD6	BP < 150/90 in last 15 months
CHD8	Cholesterol < 5 mmol/l in last 15 months
Stroke 1	Prevalence of stroke
Stroke 6	BP < 150/90 in last 15 months
Stroke 8	Cholesterol < 5 mmol/l in the last 15 months
Diabetes 1	Prevalence of diabetes
Diabetes 6	HBA1C in last 15 months <=7.4
Diabetes 7	HBA1C in last 15 months <=10
Diabetes 12	BP < 145/85 in last 15 months
Diabetes 17	Cholesterol < 5 mmo/l in last 15 months
Epilepsy 1	Prevalence of epilepsy
Epilepsy 4	Patients aged 16 plus on epilepsy treatment who have been convulsion free in the last 12 months recorded in the last 15 months
Hypertension1	Prevalence of hypertension
Hypertension 4	Blood pressure recorded in last 9 months
Hypertension5	Last recorded blood pressure < 150/90 as measured in the last 9 months
Chronic kidney disease CKD1	Prevalence of chronic kidney disease
CKD2	The percentage of patients on the chronic kidney disease register whose notes have a record of blood pressure in the previous 15 months.

CKD3	The percentage of patients on the chronic kidney disease register in whom the last blood pressure reading, measured in the previous 15 months, is 140/85 mm hg or less.

It is very important to note that there have been some changes to the definition of the QOF indicators in 2006/07 compared with 2004/5 and 2005/6. In this analysis, we have applied the same criteria from 2006/7 across all 21 quarters to enable a better comparison to be made.

5.6 Special consideration for diabetes

The case definition for diabetes mellitus has changed in 2006/7 compared with previous years. Prior to April 2006, patients with diabetes were identified and included in the national QOF if they had a high level Read code in their electronic record (C10%). From April 2006, the definition changed such that only patients with a more specific Read code which indicated the type of diabetes were included on the disease register (ie patients with either C10E or C10F code were included).

However, our analysis shows that one third of all patients with a C10% Read code did not have a more specific Read code and so were initially lost from the diabetes register and recall facilities within the practices.

It is clear from the analysis, that some GPs have then added an additional more specific Read code to the patient's electronic record so that the patient could then be included in the diabetes register again and be recalled for clinical care.

However, the business rule set for diabetes excludes patients from the denominator patients who have only recently been 'diagnosed with diabetes' and this is based on the date of the first entry of the C10E and C10F Read codes. In other words, patients who only had a general Read code have been lost from the register and then some of them have been added again but the date associated with the new codes mean that they do not then appear in the denominator for the searches. The overall consequence of the changes to the diabetes coding introduced in April 2006 is an unexpected pattern both in the disease prevalence for diabetes (which is falsely low) and also peculiar pattern for the achievement of several related disease indicators (whereby lots of patients are excluded because they appear to be newly diagnosed with diabetes).

5.7 Descriptive analysis

We have presented descriptive analysis including the percentage of patients who meet each indicator including analysis by age and sex and quarter. The tabular data can be found in the associated excel spreadsheet.

For each indicator for each time point, we have reported the following:

- Numerator (i.e. number patients achieving each indicator)
- Denominator (i.e. number patients eligible for each indicator)
- Proportion of those eligible who achieve each indicator

The results have been presented as follows:

- England overall
- England by age and sex (0-4; 5-14; 15-24; 25-34; 45-54; 55-64; 65-74; 75 plus)

5.8 Time series analysis plan

We have used April 2001 as the baseline and compared the prevalence of each indicator and the proportion of eligible patients meeting each target at each quarter. We used robust poisson regression modelling to estimate the relative risks of the change from baseline at each time point with 95% confidence intervals. We also adjusted the results by age and sex in order to present adjusted rate ratios with 95% confidence intervals for each time point relative to the baseline. Stata SE (version 9.2) was used for the analysis. Changes were considered to be statistically significant if the 95% confidence intervals did not span one.

6 MREC and scientific peer review

The project was submitted to the QRESEARCH Scientific Advisory Board for peer review and to Trent Multi Centre Research Ethics Committee

7 RESULTS

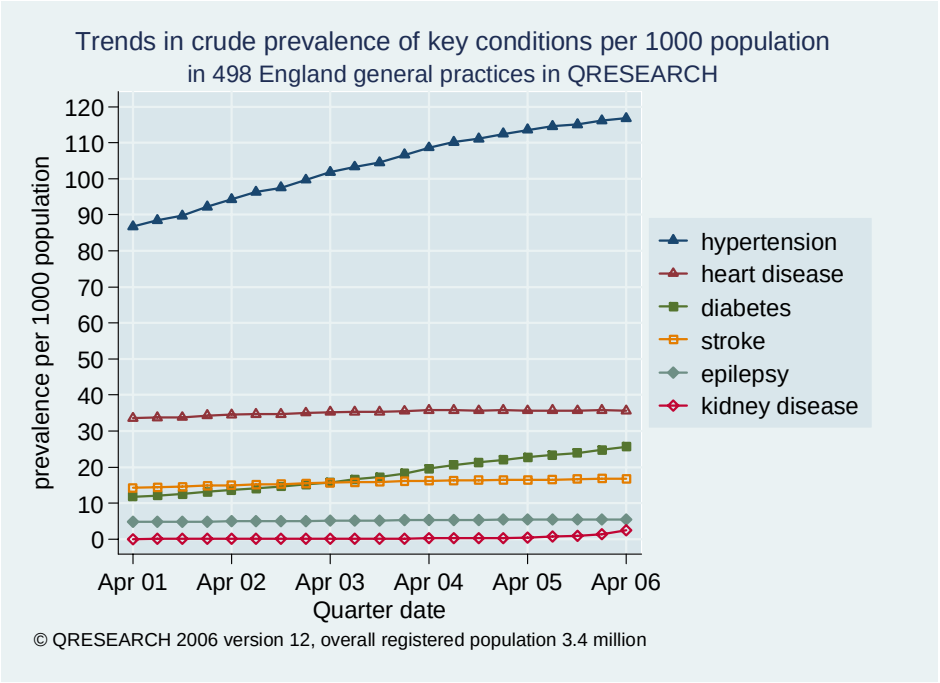
This next section describes the results of our analysis and should be read in conjunction with the associated excel workbook which presents the detailed tabular data underlying the graphs presented here. (R22 HSCIC QOF Times Series Analysis QRESEARCH 2001-2006 - Tables (v1-0).xls).

7.1 Study population

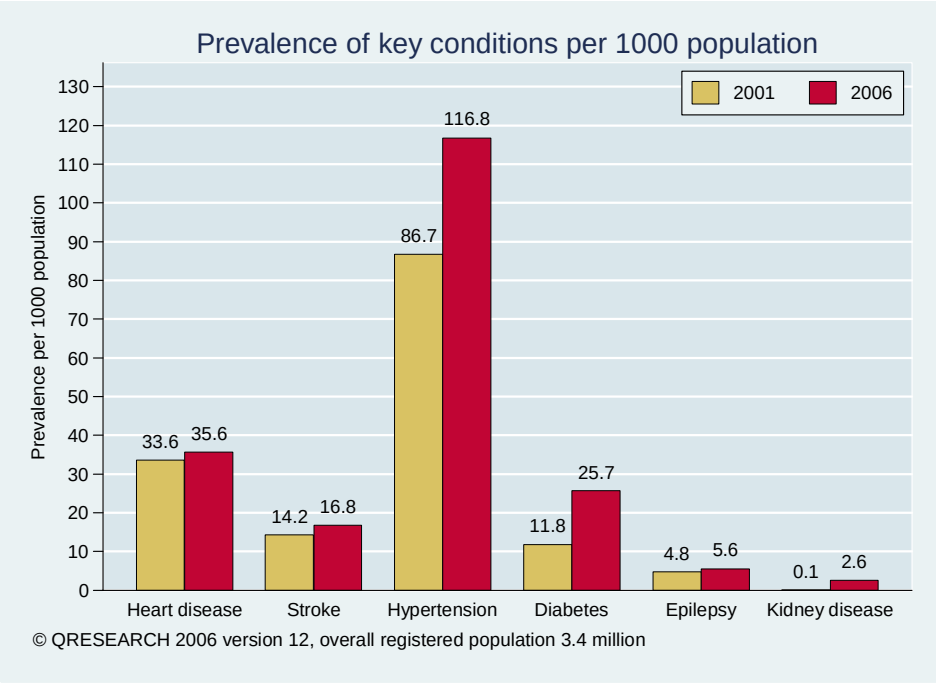
There were 498 QRESEARCH practices in England which met our inclusion criteria with a total registered population of 3.27 million in April 2001 rising to 3.4 million by April 2006. Table 1 in the excel workbook shows the numbers of registered patients on each of the 21 quarters of the study.

7.2 Crude prevalence of each condition

The next graph (and table 2 in the excel workbook) shows the trends in crude prevalence of each of the six key conditions per 1000 for each of the 21 quarters. Hypertension is the most commonly recorded disease and has increased the most. Chronic kidney disease (CKD) is the least commonly recorded disease. However, the Read codes used to identify CKD patients have only recently been introduced as a national standard in April 2006 and would not have been in regular clinical use before that.



The next graph directly compares the crude prevalence of each condition in QRESEARCH for April 2001 with that in April 2006. There have been increases in the recorded prevalence for all six diseases with the largest increase being for hypertension. For example, the recorded prevalence of hypertension in April 2001 was 86.7 per 1000 rising to 116.8 per 1000 in April 2006.



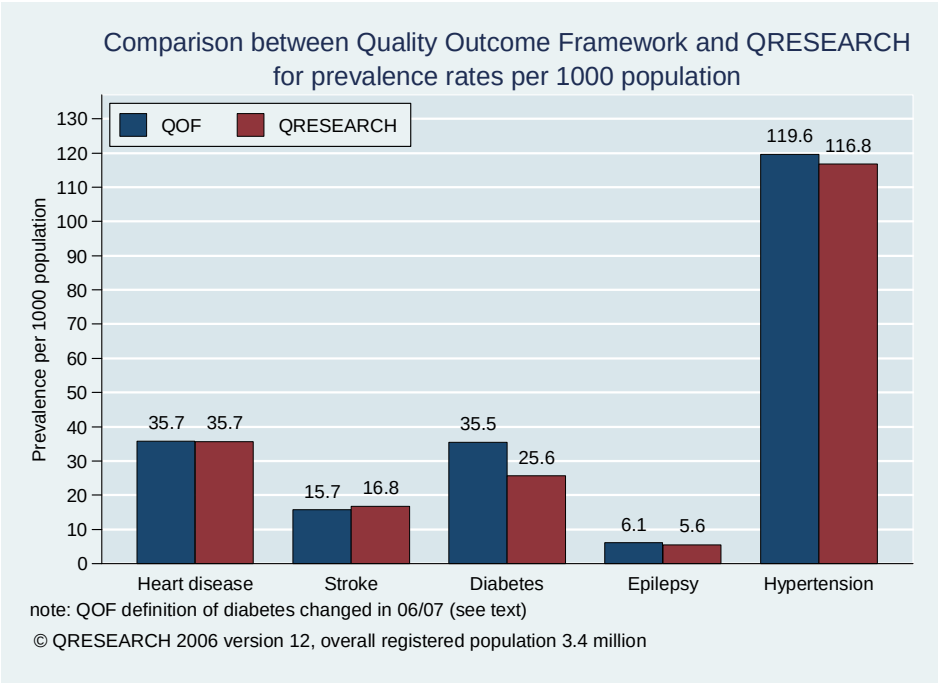
The Read codes used to diagnose diabetes in electronic health records changed with the 2006/7 national dataset definition from a general diabetes code (C10) to two specific diabetes codes (C10E and C10F) to denote type one and type two separately. From other analyses it is clear that one third of patients with diabetes have a general code but not a specific type one or type two code. Patients with a non specific diabetes Read code only (ie those without C10E or C10F) will not therefore be included in the analyses. Hence the 2006/7 definitions of diabetes used in the QRESEARCH analysis across each of the five study years (which will also be used in future QOF analyses) of diabetes will substantially under-estimate the true prevalence of diabetes.

7.2.1 Comparison of QRESEARCH and QOF national data

The next graph shows a side by side comparison of prevalence rates based on national QOF data for England (http://www.ic.nhs.uk/servicesnew/qof06/) with those derived from QRESEARCH for April 2006. There is a very good correspondence between the two data sources except for diabetes.

For example the prevalence of coronary heart disease in both data sources is 35.7 per 1000, hypertension had slightly lower prevalence in QRESEARCH (116 vs. 119 per 1000) and stroke prevalence was slightly higher (16.8 vs.15.7 per 1000).

For diabetes, however, the QOF analysis is based on the old diabetes codes whereas the QRESEARCH one is based on the 2006/7 diagnostic codes (C10E or C10F). This means that the QOF prevalence rate appears higher than the QRESEARCH one. This is entirely due to the change in diagnostic codes as when identical definitions for diabetes are used for both QMAS and QRESEARCH analyses, then identical rates are obtained.



7.3 Age specific prevalence rates of each condition

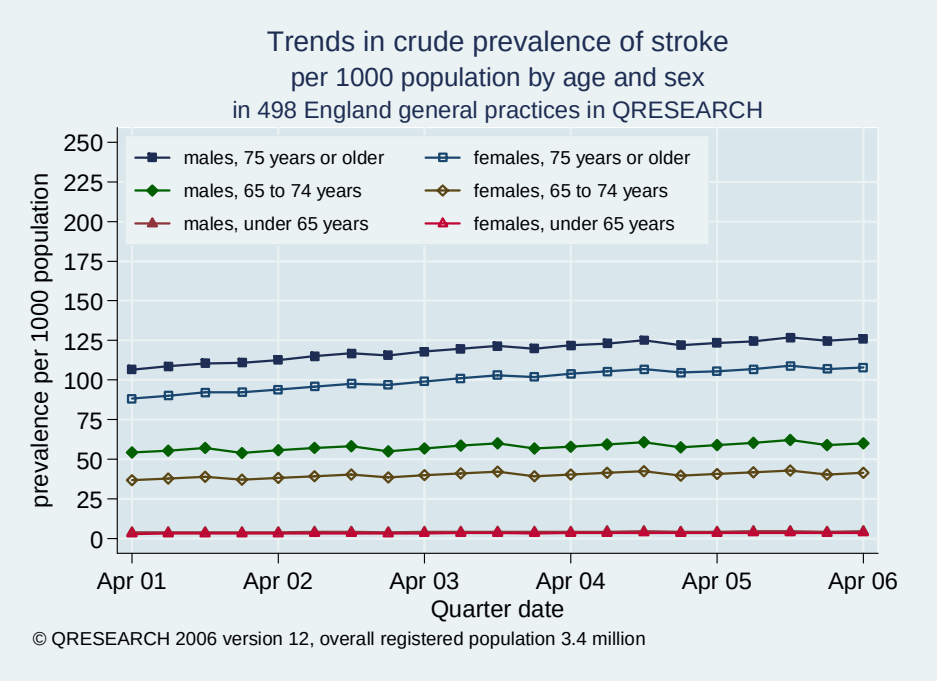
Prevalence is a very important measure for the NHS since is represents the number of patients in a population with a specified disease at a point in time. These patients all therefore require medical care or monitoring and so prevalence is sometimes referred to as a measure of the 'burden of a disease'. In general, prevalence of a disease

increases either because the incidence of the disease has increased (i.e. more people are being diagnosed with it for the first time) or because people are living longer with it (i.e. survival has improved). With data recorded in routinely collected data from general practice computer systems, there are other factors to consider which might explain increases or decreases in prevalence. These include better screening, improved recording on computer, changes in diagnostic thresholds as well as a true change in disease prevalence.

The next series of graphs shows the age sex specific prevalence rates per 1000 registered population for each condition for each quarter (table 3 in the excel workbook has more detailed age-band data).

7.3.1 Prevalence of stroke

As expected, the prevalence of stroke and TIA is strongly related to age with the greatest prevalence among those aged 75 plus, and is higher in males than in females. There has been a slow increase in the prevalence of stroke over the last 5 years in those aged 75 or older which could reflect an increased incidence, better recording or better survival or a combination of these.



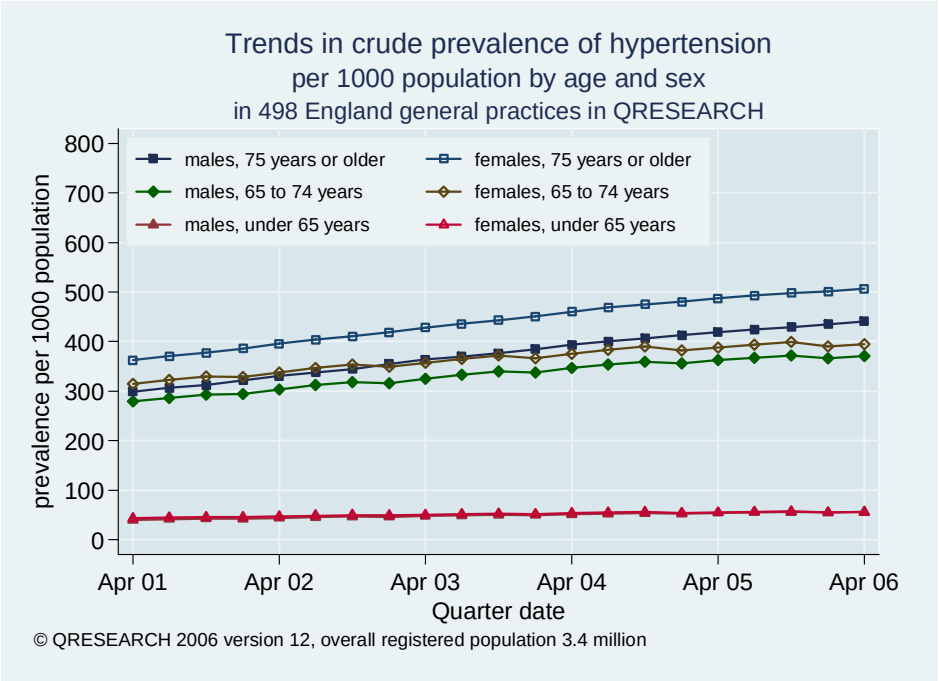
7.3.2 Prevalence of hypertension

The next graph shows the prevalence of hypertension by age and sex. Hypertension (or persistently raised blood pressure) is clinically important since it can increase the risk of stroke or a heart attack (myocardial infarction). Good control of blood pressure can reduce the risk of a stroke or heart attack.

In April 2006 almost 50% of patients aged 75 or older (44% in males, 51% in females) have a recorded diagnosis of hypertension and this is continuing to rise.

There has also been a substantial increase in hypertension prevalence among patients aged 65-75 years from 29% in April 2001 to 38% of patients (37% in males, 39% in females) with a recorded diagnosis in 2006.

The increase could be due to better screening, better recording or a lowering of the threshold for diagnosing hypertension. It could also reflect an improved survival for patients with hypertension or a combination of all of these factors.



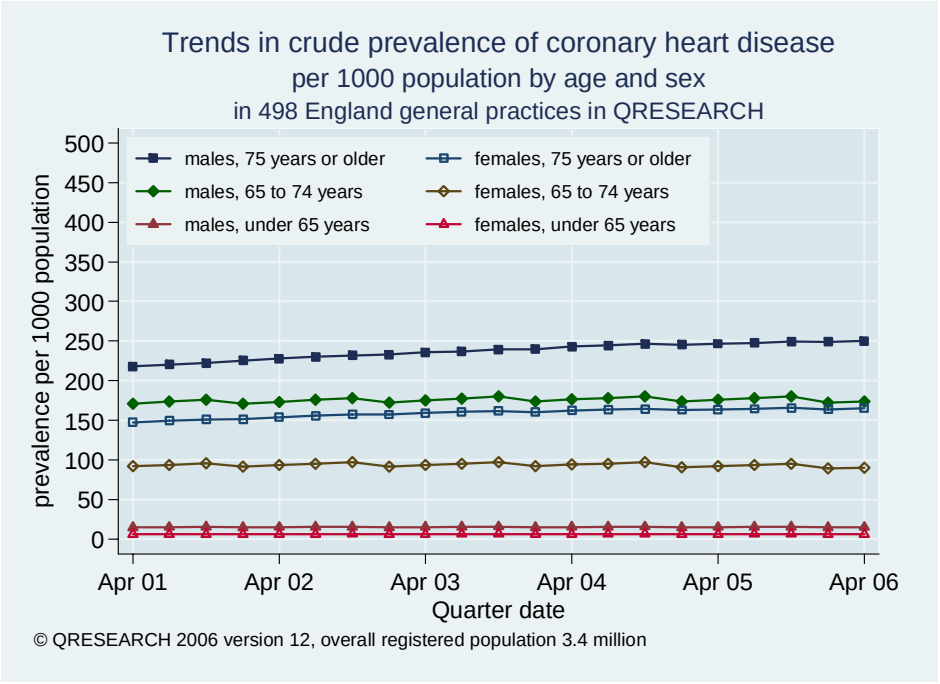
7.3.3 Prevalence of coronary heart disease

Coronary heart disease became a new GMS Contract indicative disease in the wake of the publication of the National Service Framework (NSF) for Coronary Heart Disease (CHD). The NSF was itself prompted by the realisation of the importance of primary prevention, active acute intervention and secondary prevention in population and individual patient care. It is likely that more years of life will be saved through active intervention in coronary heart disease than in any other area.

The next graph shows trends in coronary heart disease by age and sex – the overall pattern over time is similar to hypertension although the absolute recorded prevalence rates are lower. Males have much higher prevalence than females (1.5-fold in males 75 years and older compared with females and 1.9-fold higher in 65 to 74 years population).

The prevalence of coronary heart disease in our study has increase slightly over the 12 quarters studied in the report. This increase could reflect improved computer recording, better case ascertainment or the effect of an ageing population.

However, whilst these factors are likely to be important, other QRESEARCH analyses have shown that the age standardised prevalence of coronary heart disease has increased over the last ten years at the same time as the incidence has decreased[11]. Improved survival for coronary heart disease patients may be the explanation for the increase in prevalence described in the report and this deserves further study.

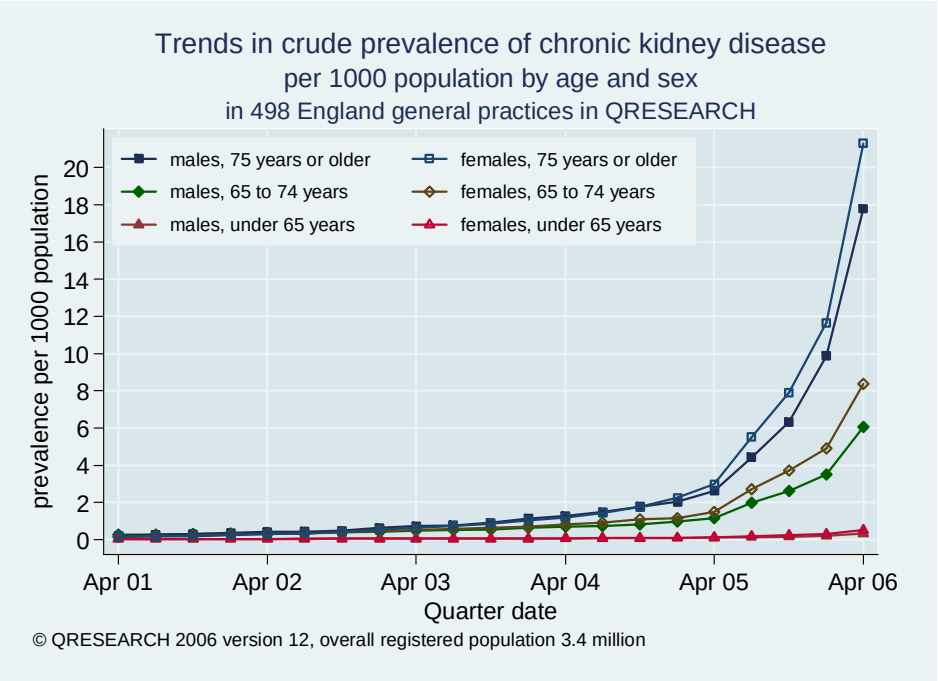


7.3.4 Prevalence of chronic kidney disease

Chronic kidney disease refers to a condition where the kidney does not work as well as it should to excrete waste product from the blood stream. It can be diagnosed by a urine test or a blood test. Further tests then need to be done in order to understand and treat any underlying causes. Close monitoring of raised blood pressure can help limit further damage to the kidneys and there is now a new indicator on QOF to measure blood pressure control in patients with chronic kidney disease.

The next graph shows the prevalence of chronic kidney disease (CKD) over time by age for patients aged 18 or over. The prevalence prior to April 2006 is likely to be artificially low because the diagnostic codes were not in regular use prior to April 2006 when it was introduced as a national standard in the GP contract.

It is likely that the prevalence of CKD will rise markedly in the next 1-2 years as case finding and recording improves in General Practice. As expected, older people and females have higher prevalence of the CKD compared with younger patients.

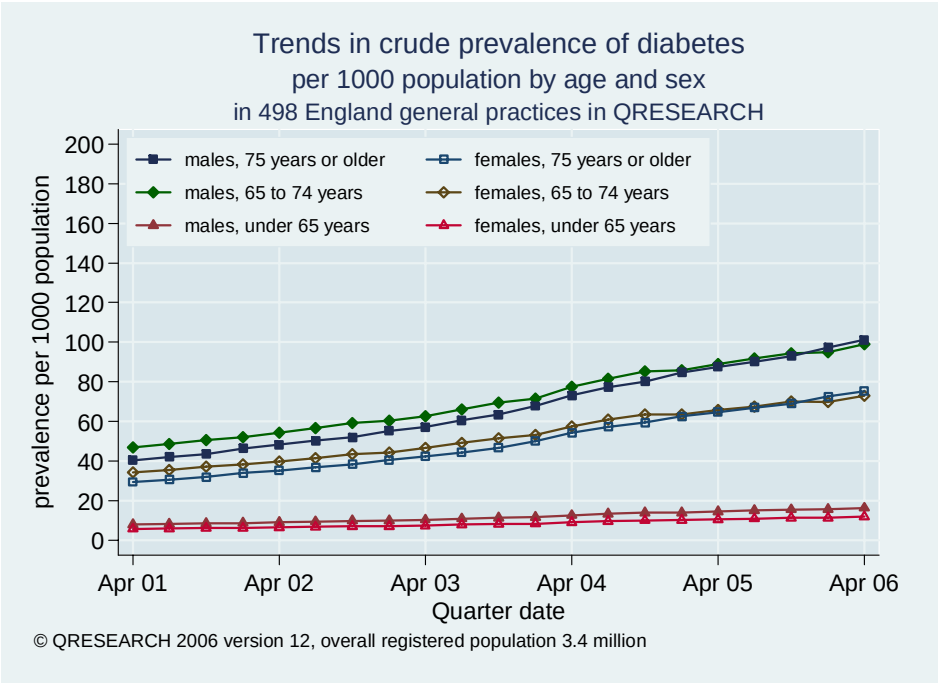


7.3.5 Prevalence of diabetes

Diabetes is a condition affecting blood sugar levels in the body. It can be due to a lack of insulin or an inability of the body to respond to the insulin which it has. There has been a world wide increase in the prevalence of diabetes over the last 20 years which has also been observed in the UK[12].

Most of the increase in the recorded prevalence of diabetes in this analysis, shown on the next graph, has occurred in those aged 65 and older, more in males than in females.

Again this could be due to better screening, better recording, a true increase in prevalence or improved survival. It is important to note, however, that the 2006/7 definition of diabetes (ie the new more selected diagnostic Read codes) has been used for this analysis and applied backwards to April 2001. This definition only includes patients with two specific diagnostic Read codes for diabetes (C10E or C10F) so does not include up to one third of diabetes patients who have a more general diabetes Read code in their electronic record.



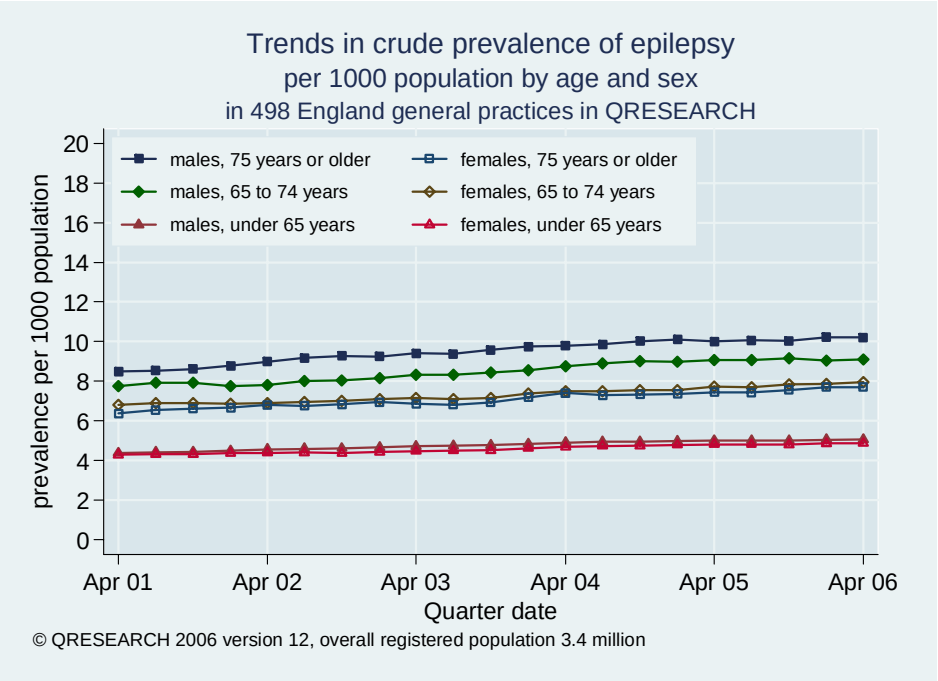
7.3.6 Prevalence of epilepsy

Epilepsy is a condition which gives rise to fits or seizures. In general the fits can be controlled by careful use of medication called anticonvulsants.

The prevalence of epilepsy, as shown in the next graph, is generally quite low compared to the other diseases included in this report. Also there has been little change over the last 5 years.

However, it is important to note that the GP contract definition of epilepsy only includes patients aged 18 or over. Children with epilepsy tend to have their care organised within secondary care.

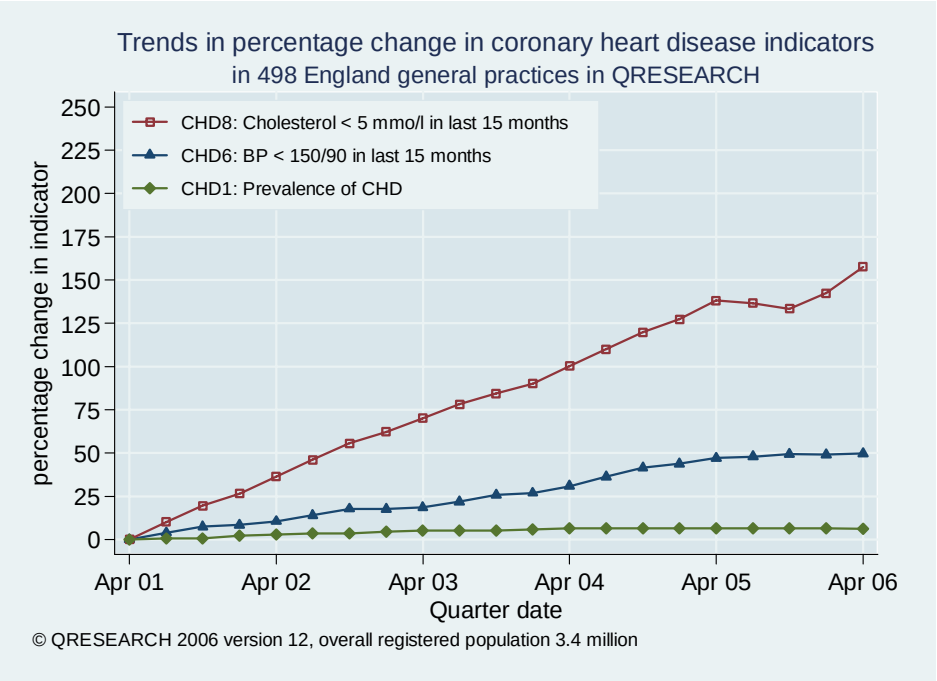
Older people have much higher prevalence of epilepsy compared with patients aged 18-65 years (almost 2-fold in males and 1.6-fold in females). Epilepsy is also slightly more common on older males than older females.

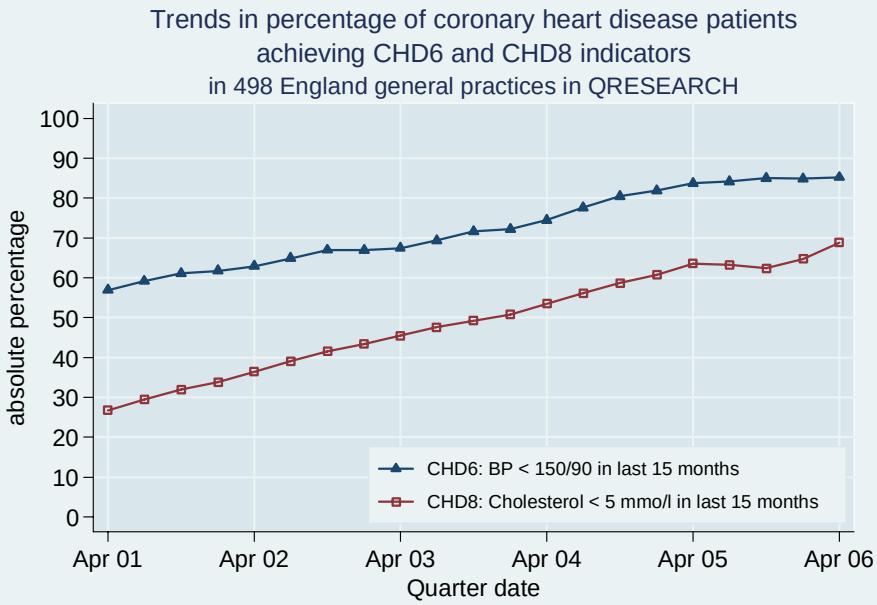


7.4 Achievement of indicators

7.4.1 Coronary heart disease indicators

Table 4 in the excel workbook shows the numerator and denominator for each of the coronary heart disease clinical indicators included in the study for each quarter. For example in April 2001 57% of coronary heart disease patients had achieved target blood pressure levels (i.e. CHD6) rising to 85% in April 2006 (see table 4). This is equivalent to a relative increase of 50% (95% CI 37%-63%) over the five year study period as shown in the graph below (and also table 6 in the excel work book). The next series of graphs shows the percentage change in each indicator compared with April 2001 (which is taken as the reference value and so appears as zero on the graph below). Whilst there has been a steady increase in the percentage of CHD patients who have their blood pressure controlled < 150/90 hg mm (ie CHD8), the rate of increase for controlled serum cholesterol levels is much greater. In contrast, in April 2001, 27% of patients achieved CHD8 (i.e. cholesterol levels < 5 mmol/l) rising to 68% in 2006. This is equivalent to a 158% relative increase (95% CI 79%-271%) or a tripling of the absolute percentage of patients achieving CHD8 over the 5 year study period.





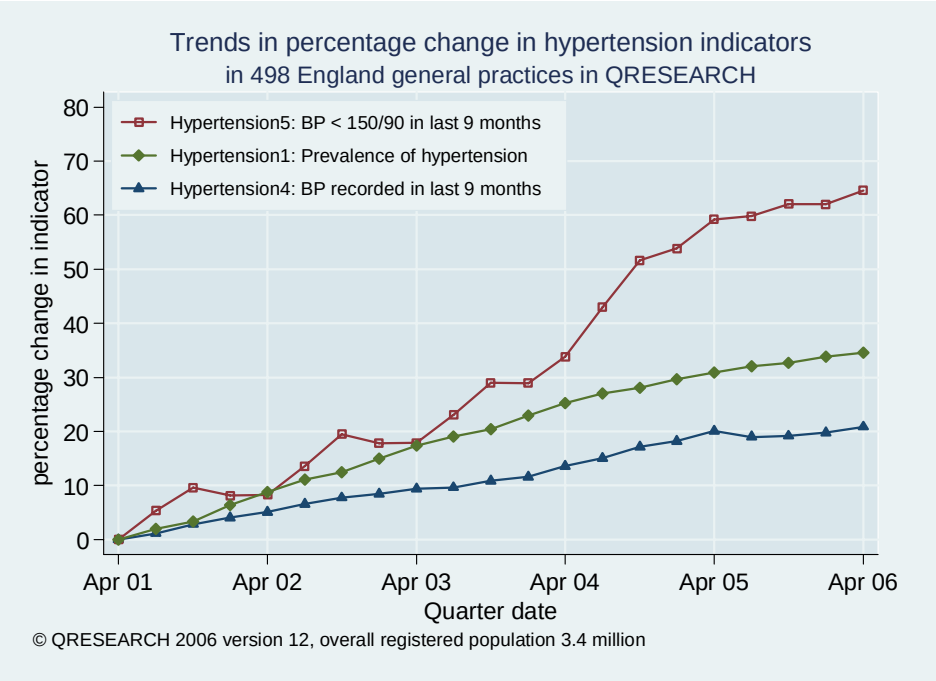
7.4.2 Hypertension indicators

The next graph shows the trends in relative percentage change for hypertension indicators over the five year study period for each quarter.

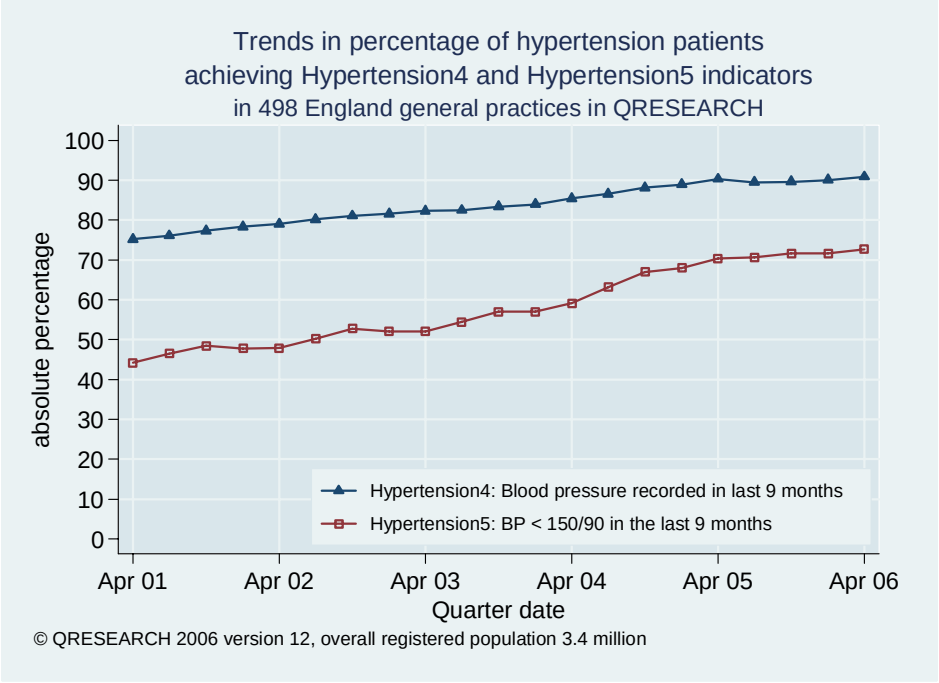
There was a 35% (95% CI -41 - 209) relative increase in the recorded prevalence of hypertension (BP1).

The biggest increase occurred in BP4 – the recording of hypertension in the last 9 months where there was a 21% (95% CI 17-25) relative increase. In April 2001 75% of patients had a blood pressure level recorded in the preceding 9 months rising to 91% by April 2006.

There was a 65% (95% CI 51-79%) relative increase in the percentage of patients with controlled blood pressure levels (BP5). In April 2001 44% of patients had a blood pressure level in the target range rising to 73% by April 2006.



The following graph shows the trends in the absolute percentage of patients achieving the indicator (rather than the relative increase over time as shown above)



7.4.3 Diabetes indicators

Patients with diabetes need to have their condition monitored at regular intervals by their GP. The monitoring includes a range of testings including a blood test called glycosylated haemoglobin (HBA1C) which is a measure of how well the blood sugar levels have been controlled over the previous few months.

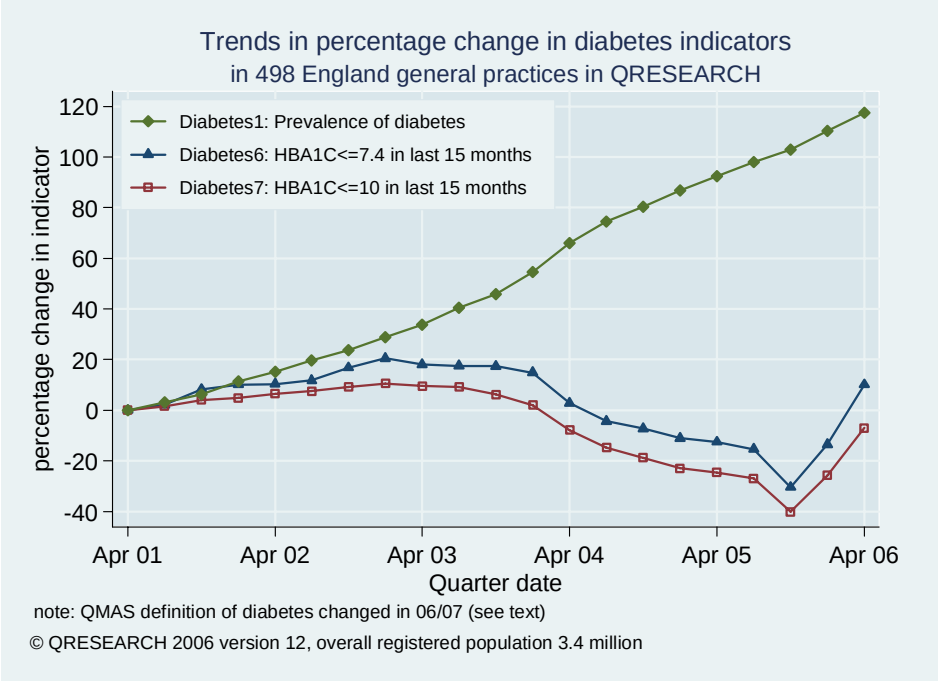
The change in the method for identifying patients with diabetes, described in section 5.6, has had an unexpected effect on the HBA1C indicators making this analysis very difficult to interpret (see section 5.6 for further details). These results must therefore be viewed with extreme caution – as the results of the corresponding QMAS analysis will need to be viewed. .

Using the new 2006/7 definitions, there was a 117% (95% CI 115-120) relative increase in the recorded prevalence of diabetes (Diabetes1).

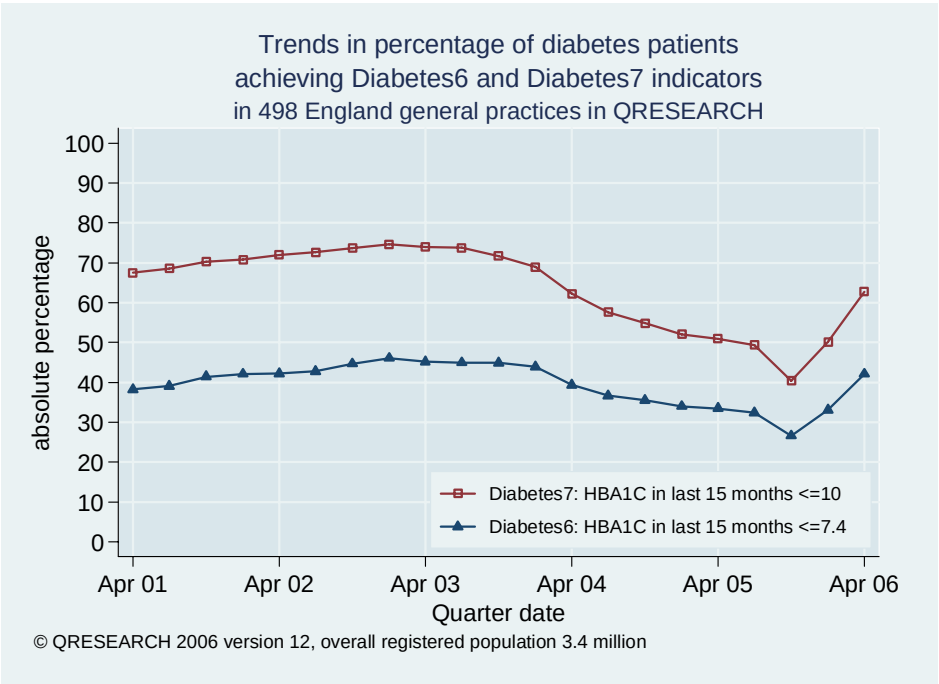
There was a 21% relative increase (95% CI 4-40%) between April 2001 and January 2003 in the percentage of patients with HBA1C <= 7.4 mmol/l in the preceding 15 months. These decreased substantially until October 2005 and then increased steeply. In April 2001 38% of patients had a HBA1C<=7.4 mmol/l and in April 2006 it was 42%.

There was a similar pattern in the percentage of patients with HBA1C <= 10 mmol/l in the preceding 15 months – an 11% relative increase (95% CI 3-18%) inbetween April 2001 and January 2003, then substantial decrease until October 2005 and then a steep increase. In April 2001 68% of patients had a HBA1C<=10 mmol/l and in April 2006 it was 63%.

The unexpected dip is entirely due to the unintended effect of changing the diagnostic codes used to identify patients with diabetes (see section 5.6). When 2005/6 definitions were applied across the 21 quarters, there was a steady increase as we would have expected (data not shown).

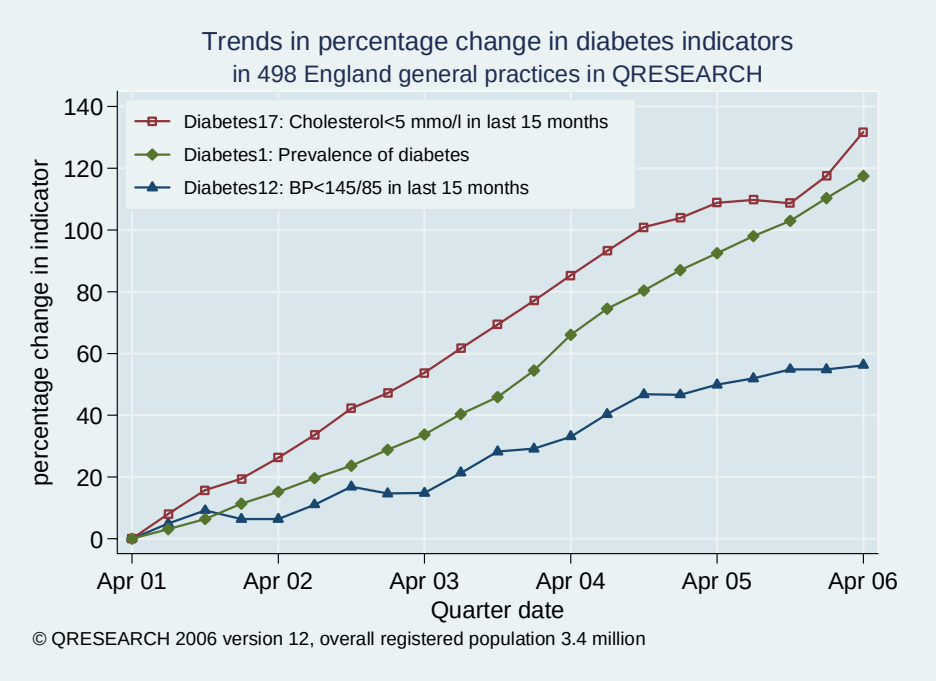


The following graph shows the trends in the absolute percentage of patients achieving the indicator (rather than the relative increase over time as shown above). The unexpected dip is entirely due to the unintended effect of changing the diagnostic codes used to identify patients with diabetes (see section 5.6)

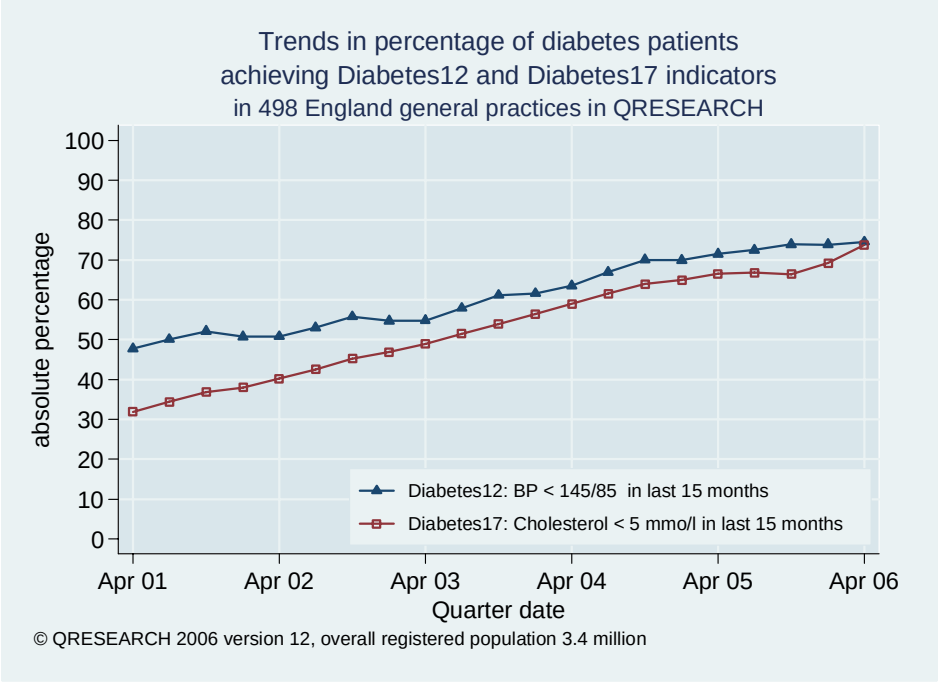


The next graph shows there was a 132% relative increase (95% CI 95-176%) in the percentage of diabetes patients with cholesterol < 5 mmol/l in the preceding 15 months. In April 2001 32% of patients had a cholesterol < 5 mmol/l and in April 2006 it was 74%.

There was a 56% relative increase (95% CI 47-66%) in the percentage of patients with a blood pressure reading < 145/85 mm hg in the preceding 15 months. In April 2001 48% of diabetes patients had a blood pressure reading < 145/85 mm hg and in April 2006 it was 74%.



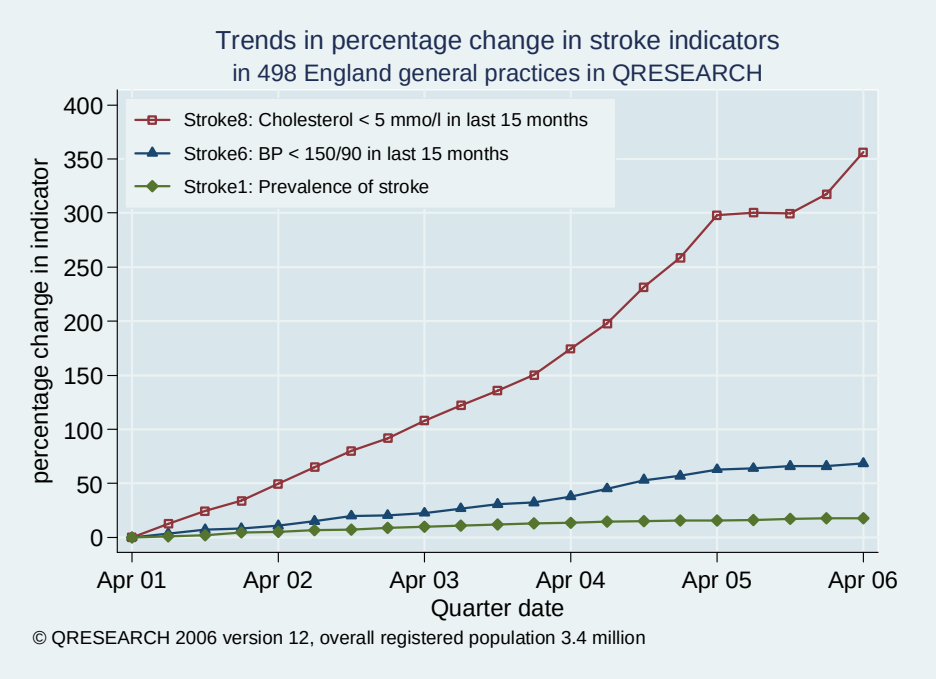
The following graph shows the trends in the absolute percentage of patients achieving the indicator (rather than the relative increase over time as shown above)



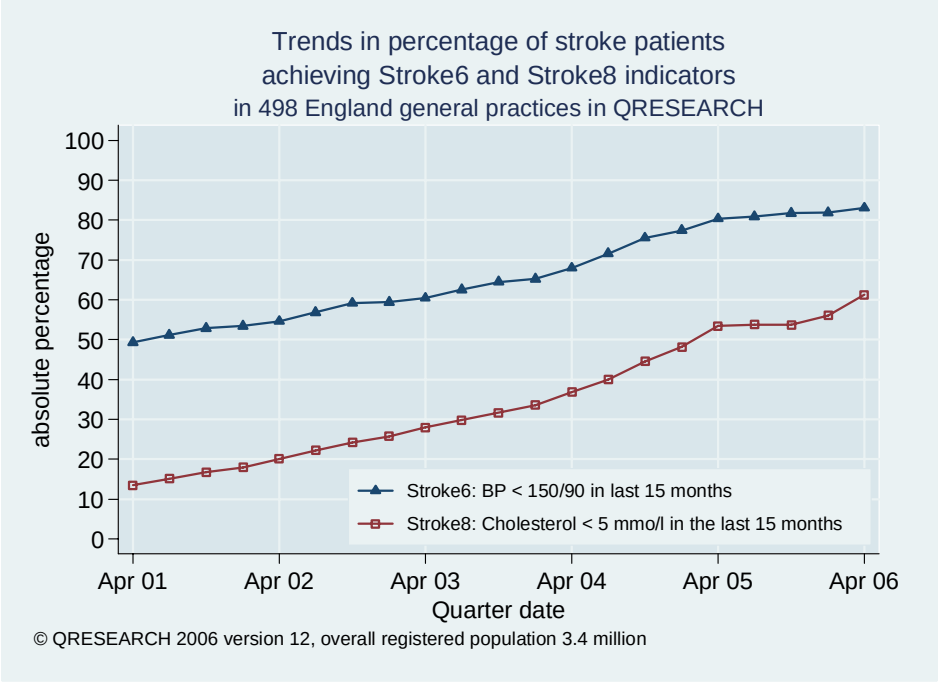
7.4.4 Stroke indicators

The next graph shows a striking 356% relative increase (95% CI 182-637%) in the percentage of stroke patients with cholesterol < 5 mmol/l in the preceding 15 months. In April 2001 13% of patients had a cholesterol < 5 mmol/l and in April 2006 it was 61%. This is the largest relative increase for any indicator over the five year study period (except for several indicators where extremely low recording at baseline made the results impossible to interpret)

There was a 68% relative increase (95% CI 55-83%) in the percentage of patients with a blood pressure reading < 150/90 mm hg in the preceding 15 months. In April 2001 it was 49% of stroke patients with a blood pressure reading < 150/90 mm hg and in April 2006 it was 83%.

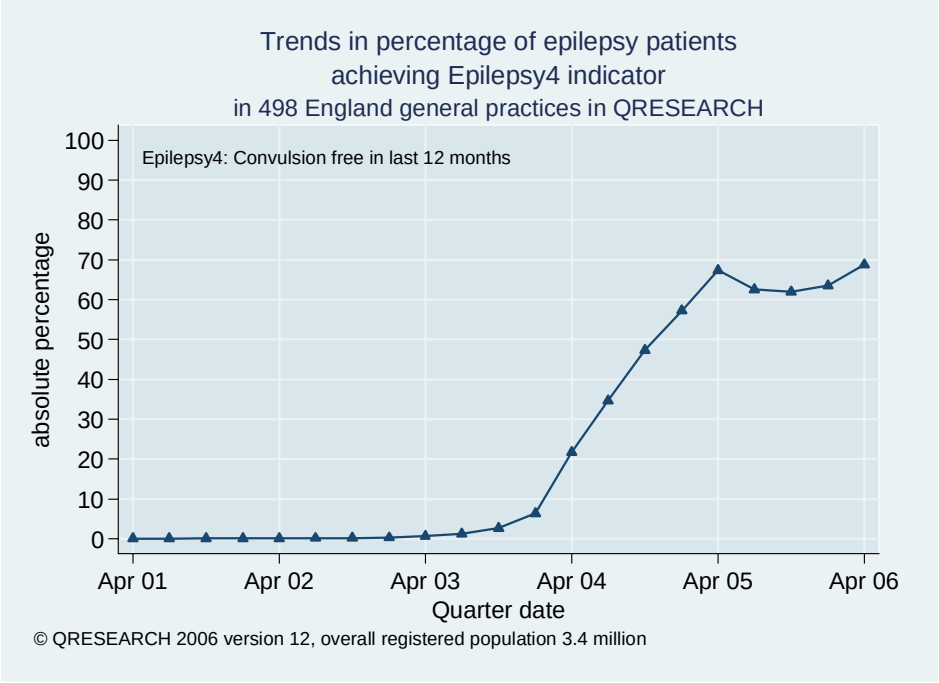


The following graph shows the trends in the absolute percentage of patients achieving the indicator (rather than the relative increase over time as shown above)



7.4.5 Epilepsy indicators

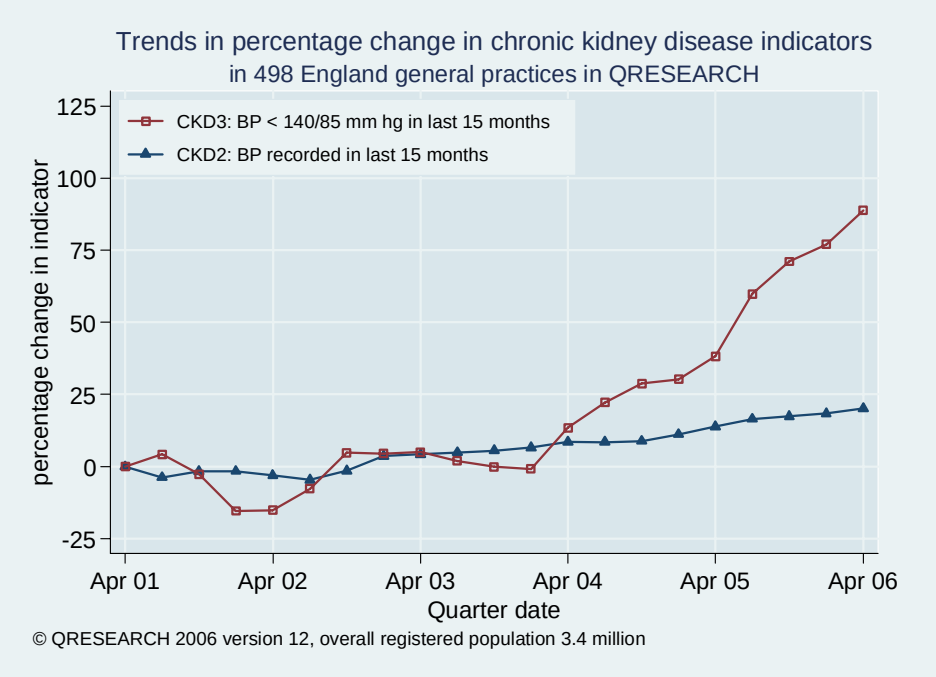
The next graph shows there was a 69% increase in the percentage of Epilepsy4 indicator (patients aged 16 plus on epilepsy treatment who have been convulsion free in the last 12 months recorded in the last 15 months). However, the Read codes to record this were not in general use in general practice prior to April 2003 and so the increase is likely to represent an increase in recording rather than a true increase.



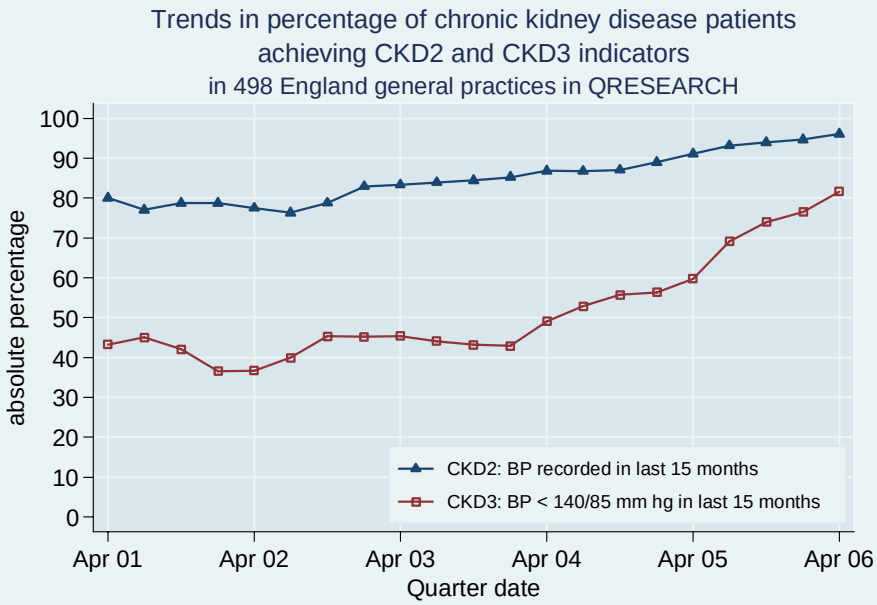
7.4.6 Chronic kidney disease indicators

The next graph shows there was a 20% relative increase (95% CI 3-32%) in the percentage of patients with chronic kidney disease and blood pressure recorded in preceding 15 months. In April 2001 80% of patients had blood pressure recorded and in April 2006 it was 96%.

There was an 89% relative increase (95% CI 59-124%) in the percentage of patients with a blood pressure reading < 140/85 mm hg in the preceding 15 months. In April 2001 it was 43% of kidney disease patients with a blood pressure reading < 140/85 mm hg and in April 2006 it was 82%

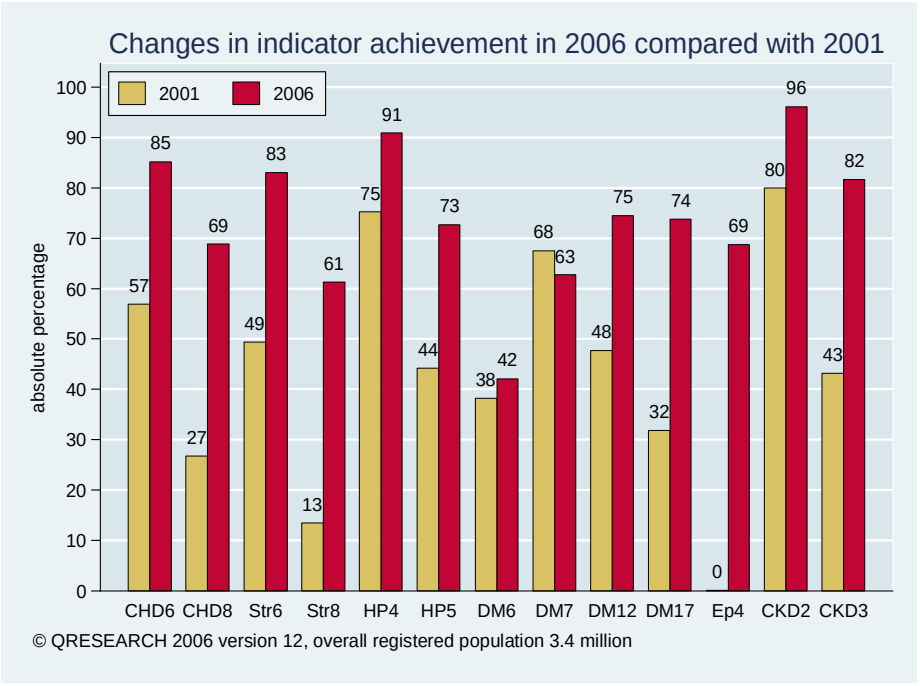


The following graph shows the trends in the absolute percentage of patients achieving the indicator (rather than the relative increase over time as shown above)



7.4.7 Summary for all indicators

The next graph shows the change in each indicator achievement in 2006 compared with 2001. All indicator achievements apart from Diabetes7 (HBA1C in last 15 months <=10) have increased their values. The biggest percentage change occurred in Epilepsy4 indicator but this reflects the very low recording rates at baseline The next biggest change was an almost 5-fold increase in cholesterol control for patients with stroke (ie Stroke8, cholesterol < 5 mmol/l in the last 15 months). This rose from 13% to 61%.



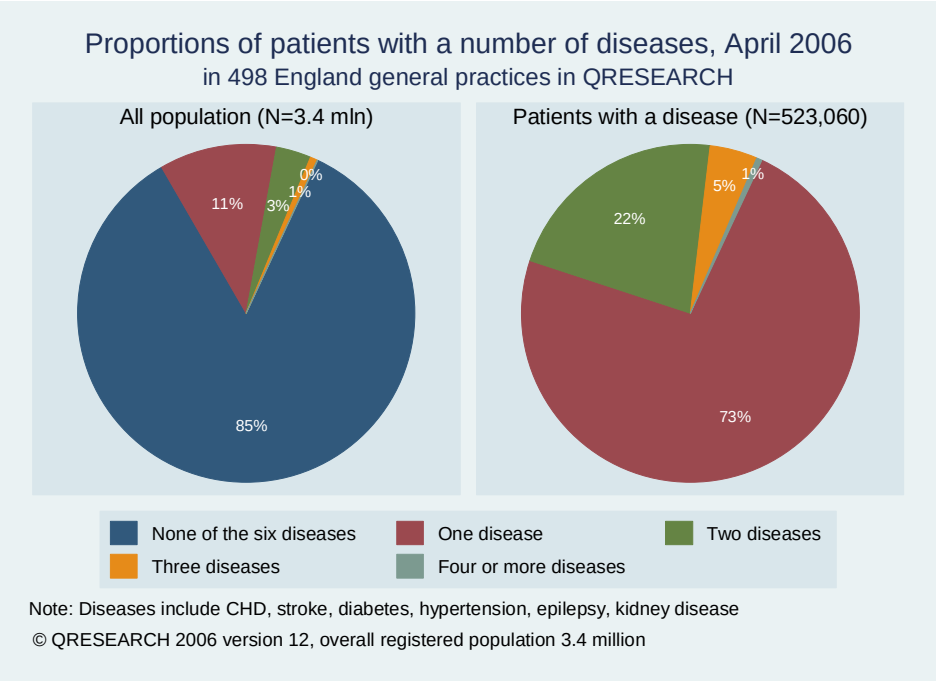
CHD6	BP < 150/90 in last 15 months
CHD8	Cholesterol < 5 mmol/l in last 15 months
Str6	BP < 150/90 in last 15 months
Str8	Cholesterol < 5 mmol/l in the last 15 months
HP4	Blood pressure recorded in last 9 months
HP5	BP < 150/90 in the last 9 months
DM6	HBA1C in last 15 months <=7.4
DM7	HBA1C in last 15 months <=10
DM12	BP < 145/85 in last 15 months
DM17	Cholesterol < 5 mmol/l in last 15 months
Ep4	Convulsion free in last 12 months
CKD2	BP recorded in last 15 months
CKD3	BP < 140/85 mm hg in last 15 months

7.5 Analysis of indicators by age and sex

Table 5 in the excel workbook shows the numerator and denominator for each of the clinical indicators included in the study for each quarter, the same as table 4, but broken down by age and sex. Adjusting the relative increase of the indicators for age and sex did not significantly change it.

7.6 Co-existing diseases

We have described the number of patients with each disease and the number of patients who have 1, 2, 3, 4, 5, 6 of the diseases at each time point. Table 7 in the excel work book give the breakdown for each disease. The next graph shows that 15% of the total population in QRESEARCH in 2006 had at least one disease. Of the half a million patients with at least one disease, then just over one fifth had a combination of two diseases.



In terms of the GP contract, the important disease combinations are those where the same indicator is used in more than one disease group. For example, blood pressure control is an indicator for stroke, CHD and hypertension. Chronic kidney disease and diabetes also have blood pressure indicators but use lower control levels. Cholesterol control is an indicator for stroke, CHD and diabetes. Therefore we have described co-morbidity in patients where the indicator (either blood pressure or cholesterol) is met.

Table 8 in the excel work book shows the numbers of patients with combinations of stroke, hypertension and coronary heart disease whose last recorded blood pressure was below 150/90 mm hg. The proportion of such patients increased from 5% in 2006 to 10% in 2006. The next graph compares the breakdown of patients with blood pressure below 150/90 mm hg in 2001 compared with that for 2006. For example, in April 2001, there were 162 thousand patients with either CHD or stroke or diabetes whose last blood pressure was below 150/90 mm hg. Of these, 54% had hypertension only, 20% had CHD only; 4% had stroke only, 13% had both hypertension and CHD, 5% had both hypertension and stroke and 2% had all three. By 2006, the corresponding percentages, based on 341 thousand patients, were different for hypertension only (61%), and CHD only (13%).

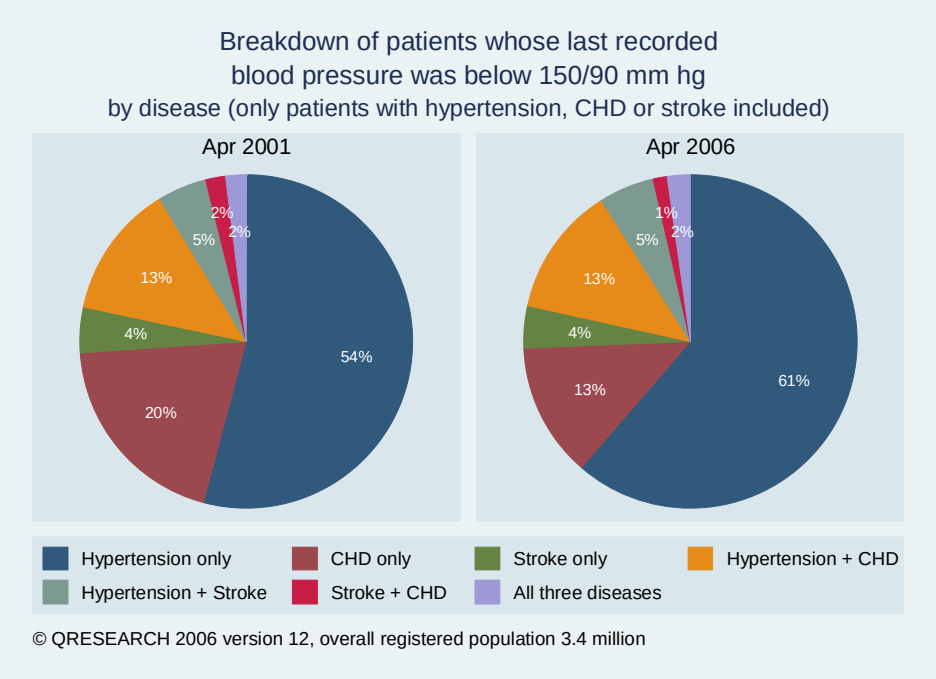
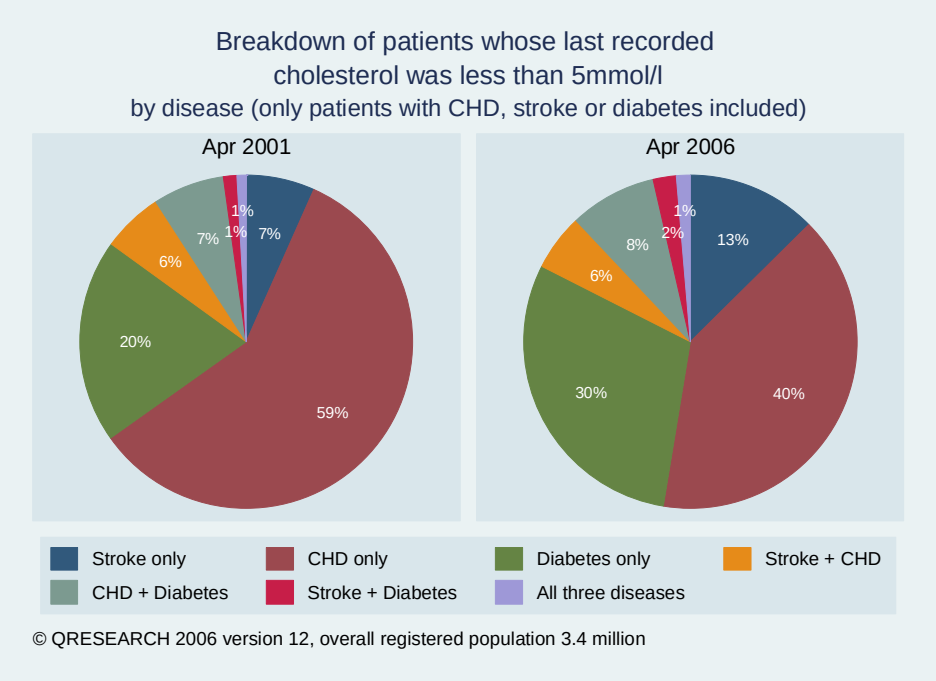


Table 9 in the excel work book shows the numbers of patients with combinations of diabetes, coronary heart disease and stroke whose last recorded cholesterol (recorded in the last 15 months) was below 5 mmol/l. The proportion of such patients increased from 1.1% in 2006 to 4.0% in 2006. The next graph compares the proportion with cholesterol < 5 mmol/l in 2001 with that for 2006. For example, in April 2001, there were 37 thousand patients with either CHD or stroke or diabetes whose last cholesterol was < 5 mmol/l. Of these, 59% had CHD only, 20% had diabetes only; 7% had stroke only and 6% had both CHD and stroke. By 2006, the corresponding percentages, based on 135 thousand patients, were 40%, 30%, 13% and 6%.



8 Future work

This report represents the first phase of the whole project which was commissioned by the HSCIC for QRESEARCH to undertake. Additional analyses will be led by Aileen Simkins with a view to a co-authored publication by the Department of Health which will be a successor to 'Accounting for Quality Change' (Dec 2005). A separate co-authored paper for a medical journal will also be considered by the Department of Health and QRESEARCH.

Whilst the QOF measures some intermediate health outcomes such as control of blood pressure or control of lipid levels it does not measure true clinical outcomes. Future work using QRESEARCH could attempt to address this shortfall by measuring additional outcomes at a population level.

For example:

- Better control of diabetes should lead to fewer clinical complications (such as leg ulcers, renal failure, myocardial infarction, blindness etc).

- More active secondary prevention of coronary heart disease including better blood pressure, lipid control use of statins and aspirin, should help improve survival and reduce further coronary events.

- Secondary prevention of stroke should lead to improved survival and lower risk of subsequent stroke.

However, these are complex disease processes and therefore would require multivariate regression modelling to adjust for confounding factors and to examine for changes over time. Such analyses are possible using QRESEARCH as has already been demonstrated in the published literature

9 References

1. Hippisley-Cox J, Vinogradova Y, Coupland C, Pringle M. Comparison of key practice characteristics between general practices in England and Wales and general practices in the QRESEARCH data. Report to The Information Centre for health and social care.: University of Nottingham, 2005.

2. Fenty J, Coupland C, Hippisley-Cox J, Gravelle H. Determinants of consultation rates over time: Implications for estimating the national volume of consultations. Report to The Information Centre for health and social care: University of Nottingham, 2006.

3. The NHS Confederation. The New GMS Contract. London: The NHS Confederation, 2003:108.

4. Key Health Statistics from General Practice 1998: series MB6 (no 2). London: Office for National Statistics, 2000.

5. Hippisley-Cox J, Pringle M. Prevalence, Care and Outcomes for patients with diet controlled diabetes in general practice: cross sectional survey. *Lancet* 2004;364:423-428.

6. Hammersley V, Hippisley-Cox J, Wilson A, Pringle M. A comparison of research General Practices and their patients with other practices - cross sectional survey in Trent. *British Journal of General Practice* 2002;52:463-468.

7. Hippisley-Cox J, Hammersley V, Pringle M, Coupland C, Crown N, Wright L. How useful are General Practice databases for research? analysis of their accuracy and completeness in one research network. *Health Informatics Journal* 2004;10:91-109.

8. Hippisley-Cox J, Coupland C, Logan R. Risk of upper gastro-intestinal complications in patients taking Cox 2 and conventional NSAIDs: cohort study with nested case control analysis. *British Medical Journal* 2005;331:1310-1316.

9. Hippisley-Cox J, Coupland C. Risk of myocardial infarction in patients on Cox 2 inhibitors or conventional non-steroidal anti-inflammatory drugs: population based nested case control analysis. *British Medical Journal* 2005;330:1366-1374.

Deleted: .

10. Hippisley-Cox J, Coupland C. Effect of combinations of drugs on all cause mortality in patients with ischaemic heart disease: nested case control analysis. *British Medical Journal* 2005;330:1059-1063.

11. Hippisley-Cox J, Coupland C. Trends in incidence rates of diagnosed diabetes and ischaemic heart disease: how much is explained by the obesity epidemic? *American Journal of Epidemiology* 2006 (submitted June).

12. Hippisley-Cox J, Ryan R. Incidence, prevalence and mortality of diabetes in the UK 1994 to 2003. Report to the Statistics Division, Department of Health. Nottingham: University of Nottingham, 2004.