Impact of removing indicators from the quality and outcomes framework: Retrospective study using individual patient data in England

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IMPACT OF REMOVING INDICATORS FROM THE QUALITY AND OUTCOMES FRAMEWORK: RETROSPECTIVE STUDY USING INDIVIDUAL PATIENT DATA IN ENGLAND

Report to NHS England

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Acknowledgements

Summary

NHS England are currently conducting a review of the Quality and Outcomes Framework (QOF). One of the key areas for investigation is the potential impact of removing the incentives on the quality of care delivered in general practice.

There is little evidence on the impact of removing financial incentives and the available evidence is inconclusive. There has been limited national monitoring of the consequences of the indicators that have been removed from the QOF in England in recent years. We used a large patient level dataset to examine changes in achievement of indicators once they were removed from the QOF.

We used data from a national sample of 131 general practices in the Clinical Practice Research Datalink over the period 2006/7 to 2016/17. We focused on indicators in the coronary heart disease, chronic kidney disease, hypertension, mental health and hypothyroidism domains. We analysed how achievement of the indicators changed in response to changes in the design of the associated financial incentives and their removal from the QOF. We examined overall performance as well as performance stratified by sex, age group, presence of comorbidities (Charlson Comorbidity Index), area deprivation (Index of Multiple Deprivation), and frailty (Electronic Frailty Index).

We find that practices responded quickly to the changes in the design of the QOF indicators and to their complete removal. Across all of the indicators, there were substantial increases in the proportions of patients who did not have a required measurement during the financial year when the indicator was removed. In some cases, performance dropped to levels lower than was recorded before the indicator was introduced.

In general, we found that the changes in indicator achievement were similar for women and men and by age group. The youngest and oldest patients tended to have the lowest rates of achievement across the period. There were drops in achievement both for patients without comorbidities and for patient with comorbidities, though the decreases tended to be smaller for patients with comorbidities and for the patients with the highest levels of frailty. Patients in more deprived areas had lower levels of indicator achievement throughout the period. There was little evidence of differential effects of indicator removal by level of deprivation.

We also undertake additional analyses on how indicator removal affects wider aspects of care provision, such as consultation rates and prescriptions. There was little relationship between indicator removal and consultation rates. For hypertension, there was evidence that the intensity of prescribing was related to indicator introduction and removal.

Amongst the patients who achieved indicators in the year prior to the incentives being withdrawn, females, patients aged over 85 years, patients classified as 'fit' in terms of frailty, and patients without comorbidities were more likely to fail the indicator in the following year.

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Introduction

NHS England are currently conducting a review of the Quality and Outcomes Framework (QOF). This review will inform the negotiations with GPC England on the GMS contract.

One of the key areas for investigation is the potential impact of removing incentives on the quality of care delivered in general practice. This is a generic problem facing all quality improvement schemes. Unless indicators are retired, quality improvement schemes grow in size and can become ossified. Removing indicators can lead to deteriorations in the quality of patient care if the improvement activities that lead to better quality are transitory rather than enduring.

There is limited evidence on the effect of removing indicators from pay-for-performance schemes and what is available is contradictory (Lester et al, 2010; Kontopantelis et al, 2014). As the QOF has been revised since its inception in 2004, there are examples of previous indicator retirements that can provide evidence on the likely consequences of removing incentives in the future.

Since 2014, NHS Digital has continued to collect performance data on 27 indicators retired from QOF in the Indicators No Longer in QOF (INLIQ) dataset.[1] This dataset has been analysed by NHS England.[2] This analysis showed that performance on all of the removed indicators fell after the incentive was removed. In the first year, the decreases in recorded performance ranged from 5.5% for recording of smoking status to 65.9% for completing physical activity questionnaires in patients with hypertension. Achievement of most of the indicators also became more variable across practices.

The decreases in performance were largest for the indicators which were thought to have limited validity and acceptability to the profession. Nonetheless, there were also decreases in performance for the indicators which had been incentivised for a long period of time and were generally thought to be more clinically acceptable.

The INLIQ data collection was discretionary until 2017/18 and only 2,827 (35%) practices submitted data continuously through the period of interest. The remaining 5,170 (65%) practices submitted data intermittently. Moreover, the INLIQ data only permit analysis at the practice level. It is important to understand how incentive removal affects the distribution of care across patient groups. It may be that, when indicators are removed, practices continue to provide care only to the patients for whom care is most beneficial and therefore the reduction in achievement has little impact on population health. Conversely, practices may stop delivering care to the most complex patients once the financial incentives for doing so are removed.

There is a need for examination of a consistent series of patient level data because:

- Participation in INLIQ may be related to performance
- GPs may no longer be coding activity in the same way and so extraction of coded data may misrepresent the true changes in activity
- The removal of indicators may impact on some patient groups more than others

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[1] http://digital.nhs.uk/catalogue/PUB30049
[2] NHS England. The impact of indicator retirement upon performance: initial analysis of data from the Indicators no Longer incentivised through QOF (INLIQ) database. Paper TWG007. November 2017.

- The removal of indicators may affect indicator performance but not have a substantial impact on the entirety of care provided to patients and to patient outcomes.

We aimed to analyse the effect of indicator removal in a large, nationally-representative cohort of patients whose care quality has been consistently recorded over time. The research provides intelligence on the likely patient impacts of changing existing incentives. This is key to understanding the risks of change, but also what the change in practice activity has been as a consequence of removing incentives.

Primary research questions

1. Is there a decline in activity following the removal of incentives?
2. In what ways does care delivery change when incentives are removed?
3. Which types of patients are most affected by incentive withdrawal?
4. Are there wider spillovers of indicator withdrawal on the care provided to patients?

Study period

We focused on the financial years 2006/7 to 2016/17, because a major update to the QOF occurred in 2006/7 with the introduction of numerous conditions and 2016/17 is the last available data point.

Indicators of interest

Retired indicators were categorised into five broad groups, which could provide complementary insights. We aimed to analyse at least one indicator in each group.

Group	Reason
1. Check of reliability of INLIQ extraction where no changes to recording are expected	Indicators in this category relate to aspects of care where the recording is fairly standard or where results are dropped into the medical record without requiring active coding on the part of the practice. Examples include whether or not patients have achieved a cholesterol target, BP recording and ACR/PCR testing.
2. Assess broader impact on care	In some cases changes to performance on an indicator may be directly related to other influences upon care. For example, cholesterol testing may have fallen due to an increase in the prescribing of high intensity statins thus rendering ongoing testing unnecessary. Similarly, with the loss of the epilepsy care indicators we may also see changes in health care utilisation amongst this group as well as specific changes in relation to the discrete activities in the indicators e.g. contraception prescribing, pregnancy and evidence of changes in seizure control.
3. Assess the effectiveness of non-QOF incentives	There are some overlaps between the QOF retirements and care which you might expect to be delivered through the Learning Disabilities DES; specifically the assessment of thyroid function in people with Down's

Group	Reason
	Syndrome.
4. Impact of retirement upon health promotion and disease identification	A small number of the retired indicators relate to health promotion and disease identification activities. Specifically, indicators have been retired in relation to CVD risk assessment for patients with RA and mental health problems, blood glucose monitoring in patients with mental health problems, fracture risk assessment in patients with RA and lifestyle advice in patients with hypertension.
5. Impact of retirement upon prevalence recording	One aspect of the data which QOF has generated which appears to be particularly valued is the information on disease prevalence. This has resulted in some anxieties about withdrawing the incentive related to this both nationally and in the local QOF variations. The only disease domain which has been withdrawn completely, including the register is hypothyroidism.

The indicators within each group and their characteristics over time are summarised in the table below, in which:

- The number of points an indicator is worth is included in each cell.
- Green indicates an active indicator; orange indicators a considerably changed indicator; and red indicates a removed indicator.

Name	Info	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Group 1	*Check of reliability of INLIQ extraction where no changes to recording are expected*											
CKD002	The percentage of patients on the CKD register in whom the last blood pressure reading (in the preceding 15 months) is 140/85 mm/Hg or less	11	11	11	11	11	11	11	11	11		
CKD004	The percentage of patients on the CKD register whose notes have a record of a urine albumin:creatinine ratio (or PCR) test in the preceding 15 months				6	6	6	6	6	6		
DM005	The percentage of patients with diabetes, on the register, who have a record of an albumin: creatinine ratio test in the preceding 15 months	3	3	3	3	3	3	3	3			
HYP003	The percentage of patients aged 79 years or under with hypertension in whom the last BP reading (measured in the preceding 9 months) is 140/90 mmHg or less.								50			
Group 2	*Assess broader impact on care*											
CHD003	The percentage of patients with CHD whose last measured total cholesterol (in the preceding 15 months) is 5 mmol/l or less	17	17	17	17	17	17	17	17			
PAD003	The percentage of patients with peripheral arterial disease in whom the last measured total cholesterol (in the preceding 15 months) is 5 mmol/l or less.							3	3			
STIA005	The percentage of patients with a stroke shown to be non-haemorrhagic, or a history of TIA whose last measured total cholesterol (in the preceding 15 months) is 5 mmol/l or less.	5	5	5	5	5	5	5	5			
EP002	The percentage of patients aged 18 or over on drug treatment for epilepsy who have been seizure free for the last 15 months, recorded in the preceding 15 months	6	6	6	6	6	6	6	6			
EP003	The percentage of women aged 18 and over and who have not attained the age of 55 who are taking antiepileptic drugs who have a record of information and counselling about contraception, conception and pregnancy in the preceding 15 months.							3	3	3		
Group 3	*Assess the effectiveness of non-QOF incentives*											

Name	Info	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
LD002	% of patients on the learning disability register with Down's Syndrome aged 18 or over with a record of blood TSH in last 15 months (excluding those on the thyroid disease register)						3	3	3			
Group 4	*Impact of retirement upon health promotion and disease identification*											
CVD-PP002	% of patients diagnosed with hypertension who are given lifestyle advice in the preceding 15 months for: smoking cessation, safe alcohol consumption and healthy diet				5	5	5	5	5			
MH004	The percentage of patients aged 40 years and over with schizophrenia, bipolar affective disorder and other psychoses who have a record of total cholesterol:hdl ratio in the preceding 15 months						5	5	5			
MH005	The percentage of patients aged 40 and over with schizophrenia, bipolar affective disorder or other psychoses who have a record of blood glucose or HbA1c in the preceding 15 months.						5	5	5			
MH006	The percentage of patients with schizophrenia, bipolar affective disorder and other psychoses who have a record of BMI in the preceding 15 months.						4	4	4			
RA003	The percentage of patients with rheumatoid arthritis aged 30 or over and who have not attained the age of 85 who have had a cardiovascular risk assessment using a CVD risk assessment tool adjusted for RA in the preceding 12 months.								7			
RA004	The percentage of patients aged 50 or over and who have not attained the age of 91 with rheumatoid arthritis who have had an assessment of fracture risk using a risk assessment tool adjusted for RA in the preceding 24 months.								5			
Group 5	*Impact of retirement upon prevalence recording*											
THY001	The contractor establishes and maintains a register of patients with hypothyroidism who are currently treated with levothyroxine	1	1	1	1	1	1	1	1			
THY002	The percentage of patients with hypothyroidism, on the register, with thyroid function tests recorded in the preceding 15 months.	6	6	6	6	6	6	6	6			

Data

The database used for this analysis is the Clinical Practice Research Datalink (CPRD), which contains electronic health records of patients from contributing general practices across the UK. The dataset contain rich information on all aspects of patient visits to general practices, with separate datasets within the CPRD for these aspects. The following datasets within the CPRD were used:

- Patient files containing basic demographic characteristics of patients, registration details and deprivation in the area of residence (available for the majority of patients following approval by the Independent Scientific Advisory Committee).
- Practice files containing region and data collection information from the practices.
- Clinical files contain the medical history of patients which can be extracted via the use of Read codes.
- Additional Clinical Details file, linked to events in the clinical files. For example, blood pressure measurements.

Number of Practices

We focused on data from practices in England that were 'up to standard' (Chapman, 2017), meaning that the practice data is deemed to be of research quality. The number of practices contributing to CPRD drops after 2011, reflecting the reduced market share of the Vision system, from which CPRD currently collects data. Our analysis focuses on 131 practices in England that contributed data continuously from 2011-12 to 2016-17.

Denominator (register) extraction

The extraction of patients on a condition register was completed through the use of Read codes, which is a thesaurus of clinical terms that can identify diagnoses along with other aspects of visits within the CPRD. Stata v14 was used for all data manipulations and analyses.

The first part of the extraction of a register was performed through the *pcdsearch* function in Stata (Olier et al, 2016), which uses key-word stubs and Read code stubs to return an inclusive code list that is then reviewed by clinicians. This generates a code list that is more inclusive than QOF code lists, to account for the possibility that QOF-specific codes may be replaced in practice by other codes following withdrawal of the incentives.

We used published code-lists that our research group has previously developed and published on www.clinicalcodes.org, a dedicated website for the re-use of clinical code lists.

Data were organised into annual financial year, 1st April to 31st March the following year. Patients were eligible for inclusion within a particular year if the following conditions were met:

1) Registered with the practice before the start of the respective year
2) Did not exit the database (due to death or another reason) before the end of the respective year
3) Diagnosed with the particular condition at any point in time during the respective financial year

Numerator extraction

Once this register was obtained, relevant data to construct the numerator were extracted, i.e. whether a particular indicator was met or not for a particular patient. Depending on the nature of the indicator, these included Read codes, biological measurements, prescriptions, or combinations of these. Missing information for the numerator (e.g. no record of blood pressure over the period of interest) was assumed to imply that the indicator was not met for a patient. Biological measurements were also cleaned to comply with a realistic range. For blood pressure, observations were only kept for systolic pressure between 30mm to 250mm and for diastolic between 20Hg and 150 Hg. For cholesterol levels, values were kept if they were greater than 1mmol and less than 50mmol.

One aspect that we did not explore was exception codes, since we were primarily interested in what has been called "population" rather than reported achievement. Reasons why an individual was exempted from care include: contraindication, informed dissent, or logistical reasons. (Kontopantelis et al, 2016).

Population achievement can be expressed as:

$$Population\ Achievement = \frac{N}{D + E}$$

Where,
N= number of cases where indicator was met
D = denominator (i.e. visited practice, eligible etc)
E = excepted for one of many reasons (contraindication, late registration, non-attendance or "informed dissent").

Patient characteristics

Age and sex is routinely available for all patients in the CPRD.

Frailty was measured using the electronic frailty index (eFI), for which the Read-code list is routinely available.

Comorbidity was quantified using the presence of other QOF conditions and also through the Charlson Comorbidity Index (Khan et al, 2010).

Socio-economic deprivation, as measured by the 2015 Index of Multiple Deprivation (IMD), was obtained for the subsample of English CPRD practices that have agreed to data linkages with the ONS. This is available at both practice level, and at patient level. We use quintiles of deprivation.

We have not included ethnicity due to it not being reported sufficiently in the CPRD.

Overview of the analysis

We focus our analysis on six quality indicators. We begin by presenting trends over time in the prevalence of each of the conditions to which these indicators relate. We then present trends in population achievement for each of these indicators.

Following these aggregate trends, we examine how indicator performance has changed over time for populations split by: (i) sex; (ii) age group; (iii) presence of other QOF conditions; (iv) area deprivation; (v) frailty; and (vi) comorbidity.

We then examine how two aspects of wider care provision have changed over time for these populations, consultation rates and drug therapy.

In the section that follows, we present charts on the timing of QOF measurements and examine whether these change following indicator removal.

The final section of the report contains the results of more sophisticated multivariable statistical models. For each indicator we present: (i) interrupted time series analyses at the population level, at the patient level and at the practice level; and (ii) analysis of whether patient characteristics are associated with the probability that individual patients (who received care when the incentive was active) fail to achieve the indicator when the incentive is withdrawn.

Prevalence rates

Coronary Heart Disease (CHD)

Patients must be aged 18 or over to be included in the calculation of CHD prevalence. The prevalence of Coronary Heart Disease is higher in men than in women, with overall prevalence remaining relatively constant across the financial years being studied.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	14,282	241,659	5.91%	8,565	242,485	3.53%	22,847	484,152	4.72%
2007/08	14,772	237,944	6.21%	8,872	238,442	3.72%	23,644	476,395	4.96%
2008/09	14,746	235,258	6.27%	8,755	235,716	3.71%	23,501	470,983	4.99%
2009/10	14,608	232,083	6.29%	8,519	232,590	3.66%	23,127	464,682	4.98%
2010/11	14,398	227,470	6.33%	8,230	228,152	3.61%	22,628	455,631	4.97%
2011/12	14,155	221,241	6.40%	7,921	223,690	3.54%	22,076	444,941	4.96%
2012/13	14,017	217,850	6.43%	7,721	221,401	3.49%	21,738	439,261	4.95%
2013/14	13,674	211,532	6.46%	7,404	216,721	3.42%	21,078	428,264	4.92%
2014/15	13,334	206,800	6.45%	7,092	211,909	3.35%	20,426	418,720	4.88%
2015/16	12,959	202,450	6.40%	6,835	207,677	3.29%	19,794	410,139	4.83%
2016/17	12,413	197,124	6.30%	6,427	203,078	3.16%	18,840	400,213	4.71%
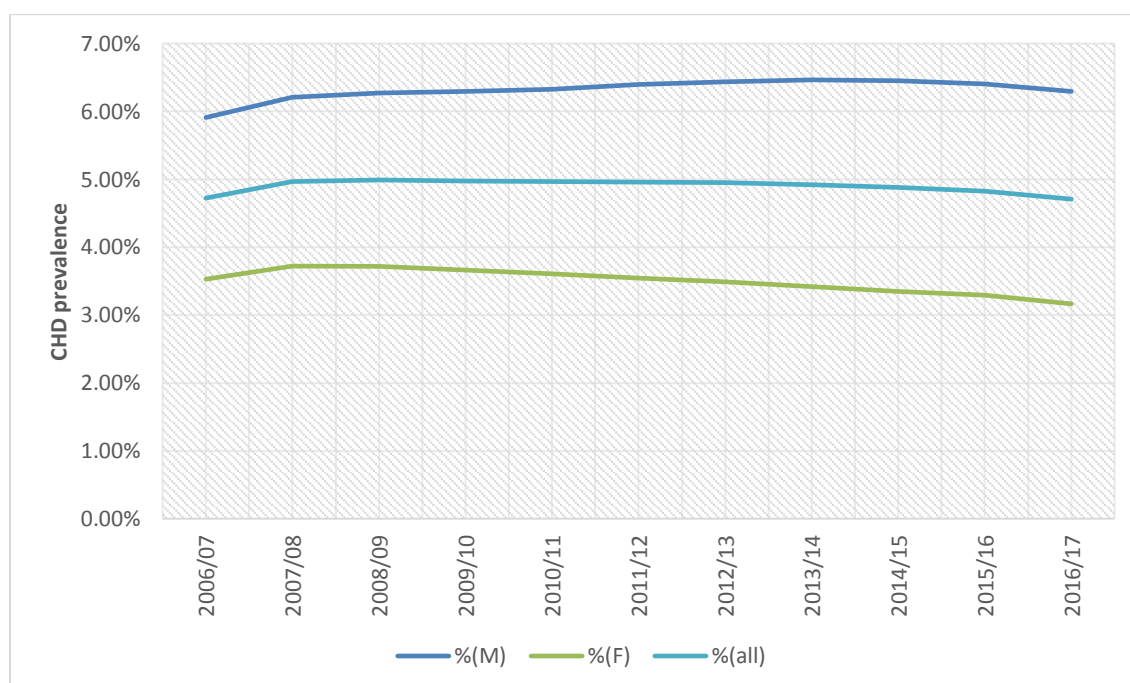
Chronic Kidney Disease (CKD)

Patients must be aged 18 or over to be included in the calculation of CKD prevalence. The prevalence of CKD is higher in women than men, with an increasing trend in the number of patients having a diagnosis of this disease over time.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	6,590	241,659	2.73%	9,168	242,485	3.78%	15,758	484,152	3.25%
2007/08	8,668	237,944	3.64%	12,426	238,442	5.21%	21,094	476,395	4.43%
2008/09	9,623	235,258	4.09%	14,155	235,716	6.01%	23,778	470,983	5.05%
2009/10	10,156	232,083	4.38%	14,885	232,590	6.40%	25,041	464,682	5.39%
2010/11	10,495	227,470	4.61%	15,219	228,152	6.67%	25,714	455,631	5.64%
2011/12	10,567	221,241	4.78%	15,307	223,690	6.84%	25,874	444,941	5.82%
2012/13	10,866	217,850	4.99%	15,714	221,401	7.10%	26,580	439,261	6.05%
2013/14	10,848	211,532	5.13%	15,660	216,721	7.23%	26,508	428,264	6.19%
2014/15	10,727	206,800	5.19%	15,521	211,909	7.32%	26,248	418,720	6.27%
2015/16	10,675	202,450	5.27%	15,398	207,677	7.41%	26,073	410,139	6.36%
2016/17	10,234	197,124	5.19%	14,738	203,078	7.26%	24,972	400,213	6.24%
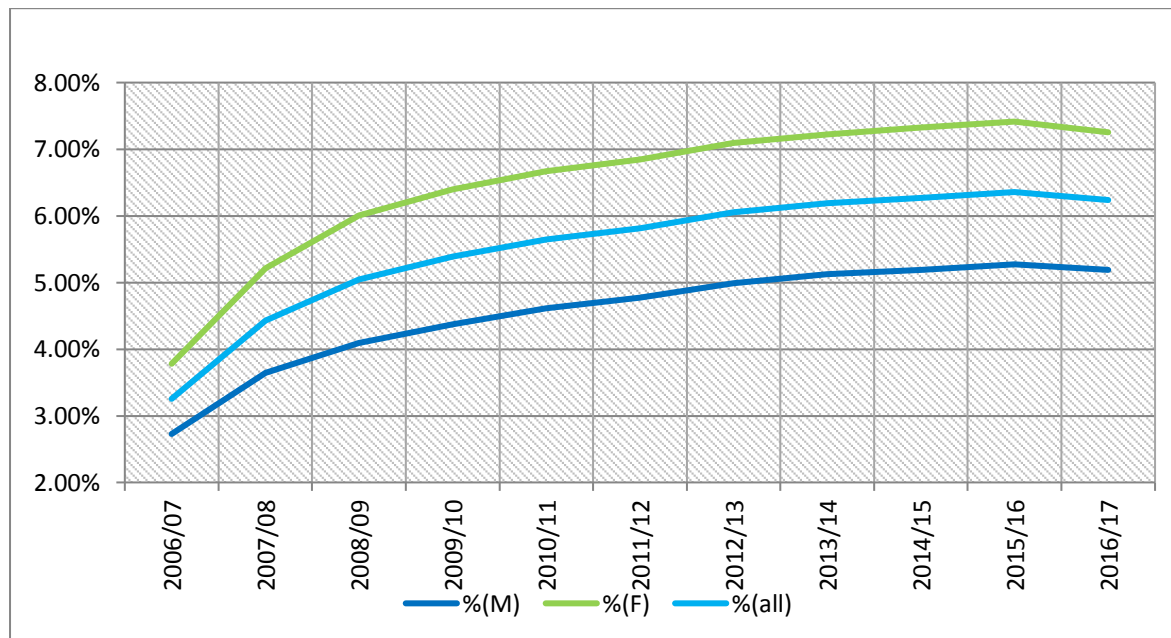
Hypertension (HYP)

There is no age restriction for the diagnosis of this condition. Women persistently have higher prevalence of hypertension across the study period, however the difference in prevalence between men and women narrows over time.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	39,093	241,659	16.18%	46,654	242,485	19.24%	85,747	484,152	17.71%
2007/08	40,809	237,944	17.15%	47,930	238,442	20.10%	88,739	476,395	18.63%
2008/09	41,817	235,258	17.77%	48,518	235,716	20.58%	90,335	470,983	19.18%
2009/10	42,444	232,083	18.29%	48,533	232,590	20.87%	90,977	464,682	19.58%
2010/11	42,466	227,470	18.67%	48,012	228,152	21.04%	90,478	455,631	19.86%
2011/12	42,223	221,241	19.08%	47,243	223,690	21.12%	89,466	444,941	20.11%
2012/13	42,304	217,850	19.42%	46,858	221,401	21.16%	89,162	439,261	20.30%
2013/14	41,884	211,532	19.80%	45,984	216,721	21.22%	87,868	428,264	20.52%
2014/15	41,187	206,800	19.92%	44,941	211,909	21.21%	86,128	418,720	20.57%
2015/16	40,734	202,450	20.12%	44,105	207,677	21.24%	84,839	410,139	20.69%
2016/17	40,135	197,124	20.36%	43,229	203,078	21.29%	83,364	400,213	20.83%
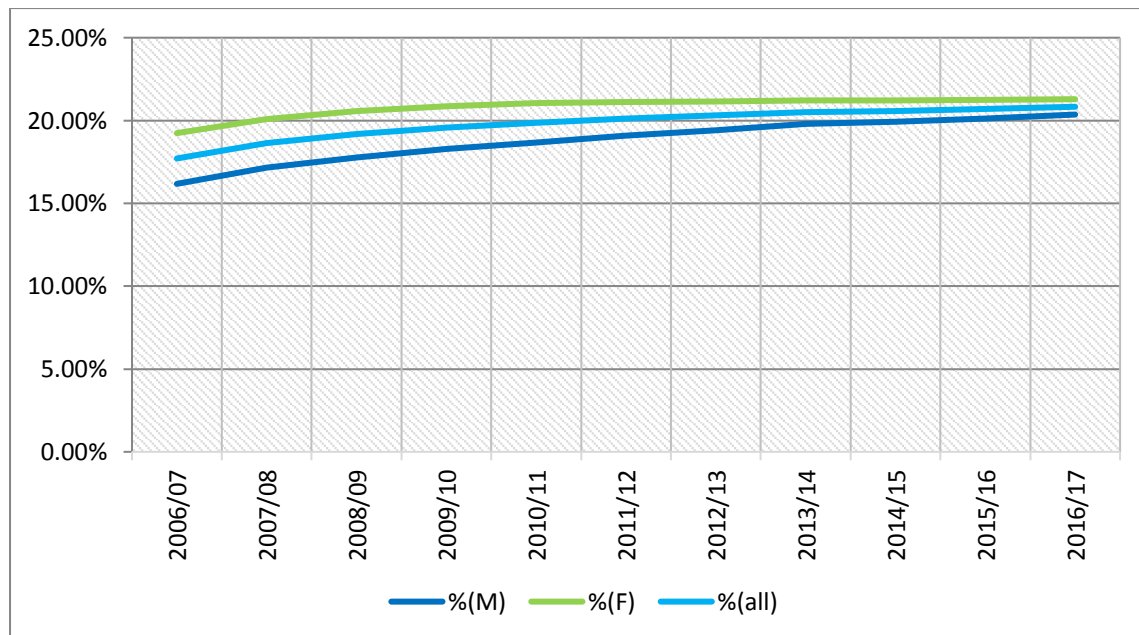
We also analysed the prevalence rates for patients under the age of 80 years old. There was higher prevalence of hypertension in women than men at the start of the study period. However, by 2013/14, the prevalence was higher in men.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	33,802	228,696	14.78%	35,918	219,534	16.36%	69,720	448,237	15.55%
2007/08	34,938	224,657	15.55%	36,312	215,425	16.86%	71,250	440,090	16.19%
2008/09	35,527	221,469	16.04%	36,414	212,450	17.14%	71,941	433,927	16.58%
2009/10	35,837	217,902	16.45%	36,204	209,166	17.31%	72,041	427,076	16.87%
2010/11	35,566	212,873	16.71%	35,543	204,532	17.38%	71,109	417,412	17.04%
2011/12	35,155	206,365	17.04%	34,730	200,030	17.36%	69,885	406,403	17.20%
2012/13	34,959	202,502	17.26%	34,192	197,430	17.32%	69,151	399,940	17.29%
2013/14	34,389	195,999	17.55%	33,365	192,750	17.31%	67,754	388,758	17.43%
2014/15	33,611	191,036	17.59%	32,362	187,785	17.23%	65,973	378,830	17.41%
2015/16	33,058	186,430	17.73%	31,569	183,391	17.21%	64,627	369,831	17.47%
2016/17	32,307	180,798	17.87%	30,764	178,660	17.22%	63,071	359,467	17.55%
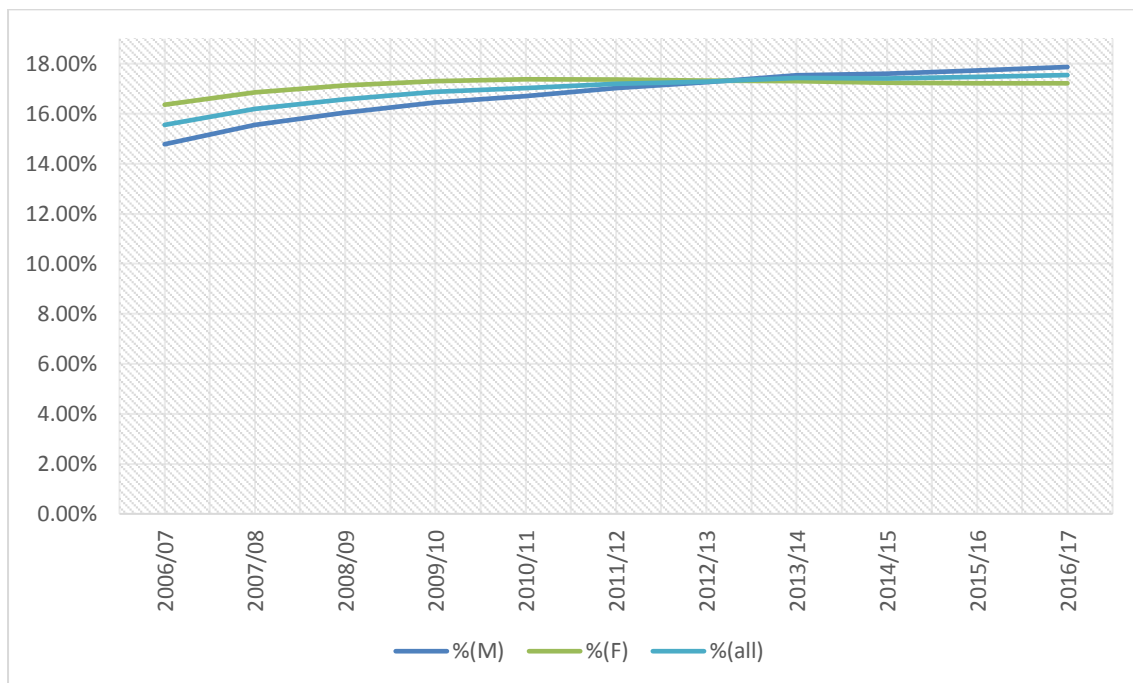
Mental Health (MH)

This QOF condition focuses on patients aged 40 years or over. The overall prevalence of mental health conditions for patients aged 40 years or over is low, but in line with prevalence reports from the national QOF data. There is relatively higher prevalence of mental health in women than men, with an increasing trend in prevalence and a very small decline in the final year.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	889	161,242	0.55%	1,129	170,965	0.66%	2,018	332,212	0.61%
2007/08	956	160,074	0.60%	1,216	169,862	0.72%	2,172	329,942	0.66%
2008/09	1,011	159,613	0.63%	1,290	169,485	0.76%	2,301	329,104	0.70%
2009/10	1,067	158,608	0.67%	1,341	168,682	0.79%	2,408	327,296	0.74%
2010/11	1,108	156,344	0.71%	1,361	166,936	0.82%	2,469	323,286	0.76%
2011/12	1,136	153,061	0.74%	1,410	164,811	0.86%	2,546	317,879	0.80%
2012/13	1,179	151,625	0.78%	1,460	164,414	0.89%	2,639	316,046	0.84%
2013/14	1,202	148,248	0.81%	1,462	161,967	0.90%	2,664	310,222	0.86%
2014/15	1,186	145,530	0.81%	1,432	159,364	0.90%	2,618	304,901	0.86%
2015/16	1,171	143,220	0.82%	1,399	156,959	0.89%	2,570	300,186	0.86%
2016/17	1,131	140,337	0.81%	1,360	154,546	0.88%	2,491	294,890	0.84%

Note: This is the prevelance rates for patients aged 40 years or over
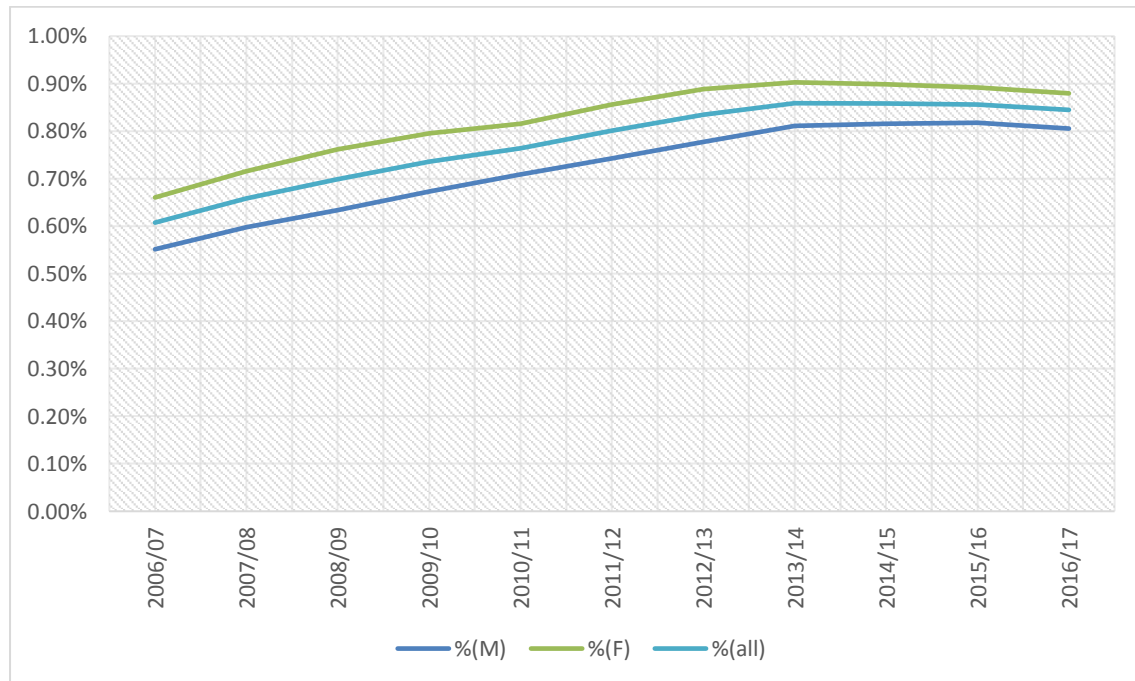
Hypothyroidism (THY)

Patients must be aged 18 years or over to be included in the calculation of hypothyroidism prevalence. The prevalence of this disease is considerably higher in women than men, with prevalence steadily rising over time. There was more than a one percentage point increase in the prevalence rate from the beginning to the end of the study period.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	3,012	241,657	1.25%	15,119	242,478	6.24%	18,131	484,143	3.74%
2007/08	3,174	237,942	1.33%	15,574	238,436	6.53%	18,748	476,387	3.94%
2008/09	3,359	235,256	1.43%	15,843	235,713	6.72%	19,202	470,978	4.08%
2009/10	3,484	232,081	1.50%	16,088	232,585	6.92%	19,572	464,675	4.21%
2010/11	3,599	227,468	1.58%	16,204	228,147	7.10%	19,803	455,624	4.35%
2011/12	3,665	221,239	1.66%	16,240	223,681	7.26%	19,905	444,930	4.47%
2012/13	3,806	217,849	1.75%	16,405	221,394	7.41%	20,211	439,253	4.60%
2013/14	3,861	211,528	1.83%	16,340	216,718	7.54%	20,201	428,257	4.72%
2014/15	3,816	206,799	1.85%	16,121	211,904	7.61%	19,937	418,714	4.76%
2015/16	3,761	202,448	1.86%	15,973	207,673	7.69%	19,734	410,133	4.81%
2016/17	3,712	197,124	1.88%	15,687	203,072	7.72%	19,399	400,207	4.85%
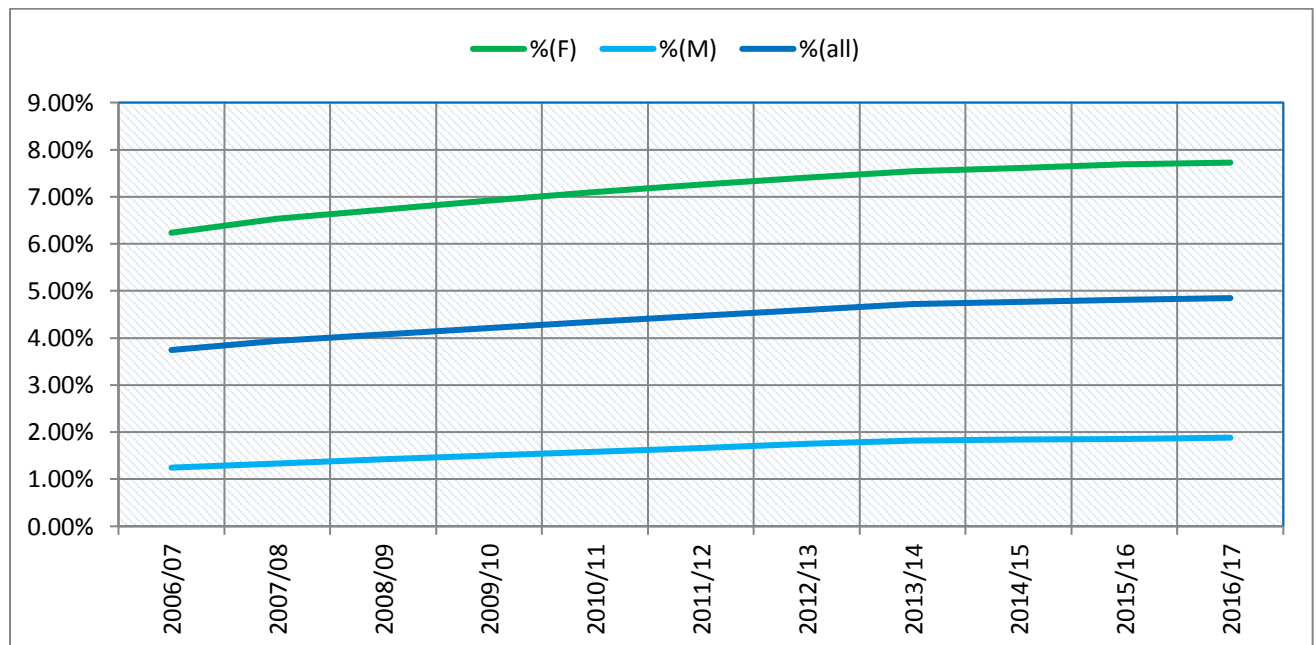
Learning Disability (LD)

The proportion of patients diagnosed with a learning disability increased slightly between 2006/7 and 2013/14. The rate was higher amongst men than amongst women. However due to low prevalence rates of learning disabilities we have decided not to analyse the indicator due to sample size implications.

Year	num(M)	den(M)	%(M)	num(F)	den(F)	%(F)	num(all)	den(all)	%(all)
2006/07	1,808	241,657	0.75%	1,157	242,478	0.48%	2,965	484,143	0.61%
2007/08	1,855	237,942	0.78%	1,356	238,436	0.57%	3,211	476,387	0.67%
2008/09	1,894	235,256	0.81%	1,345	235,713	0.57%	3,239	470,978	0.69%
2009/10	1,917	232,081	0.83%	1,341	232,585	0.58%	3,258	464,675	0.70%
2010/11	1,922	227,468	0.84%	1,312	228,147	0.58%	3,234	455,624	0.71%
2011/12	1,944	221,239	0.88%	1,288	223,681	0.58%	3,232	444,930	0.73%
2012/13	1,962	217,849	0.90%	1,283	221,394	0.58%	3,245	439,253	0.74%
2013/14	1,939	211,528	0.92%	1,259	216,718	0.58%	3,198	428,257	0.75%
2014/15	1,911	206,799	0.92%	1,232	211,904	0.58%	3,143	418,714	0.75%
2015/16	1,879	202,448	0.93%	1,202	207,673	0.58%	3,081	410,133	0.75%
2016/17	1,833	197,124	0.93%	1,178	203,072	0.58%	3,011	400,207	0.75%
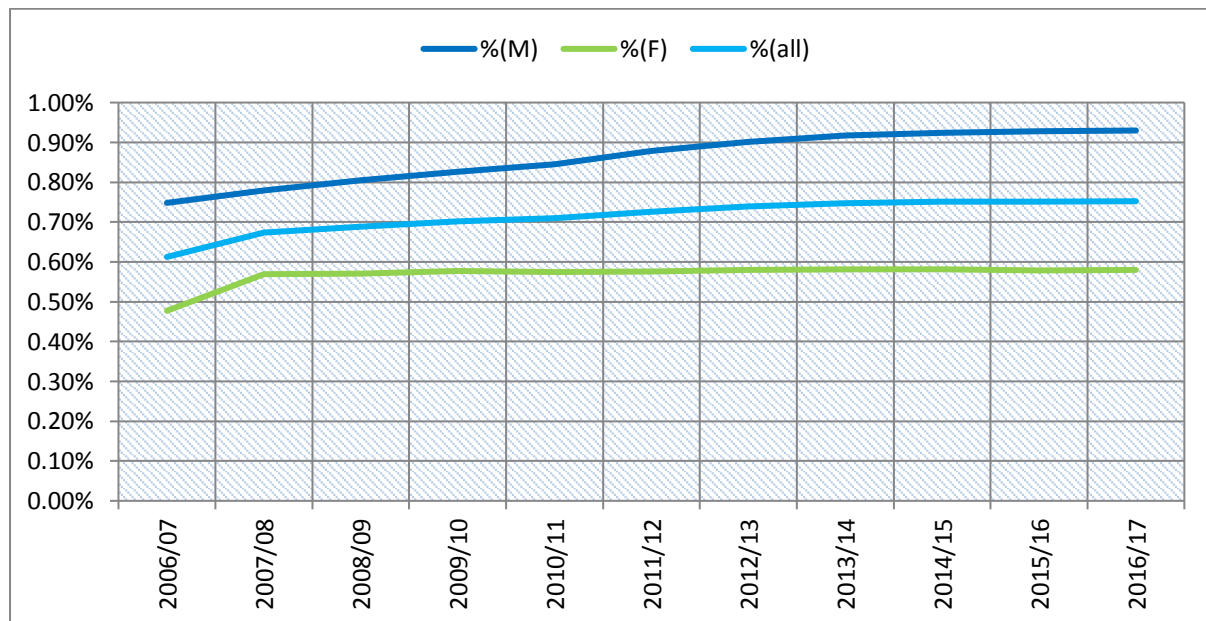
Overall indicator performance

CHD003

This indicator focuses on the percentage of patients with coronary heart disease whose last measured total cholesterol (measured in the preceding 15 months) is 5mmol/l or less. The indicator was retired in 2014/15. The summary of the development of the indicator is below.

Year	Indicator Rule	Points	Threshold	Timeframe (months)
2010/11	5 mmol/L or less	17	40 -70%	15
2011/12	5 mmol/L or less	17	40 -70%	15
2012/13	5 mmol/L or less	17	45–70%	15
2013/14	5 mmol/L or less	17	45–85%	12
2014/15	-	-	-	-
2015/16	-	-	-	-
2016/17	-	-	-	-

The overall indicator achievement is summarised below in the table and graph, showing actual achievement of the indicator across all patients with coronary heart disease.

Year	Indicator Performance
2007/08	74.29%
2008/09	73.01%
2009/10	73.01%
2010/11	72.49%
2011/12	71.05%
2012/13	70.24%
2013/14	70.39%
2014/15	57.86%
2015/16	57.38%
2016/17	57.55%
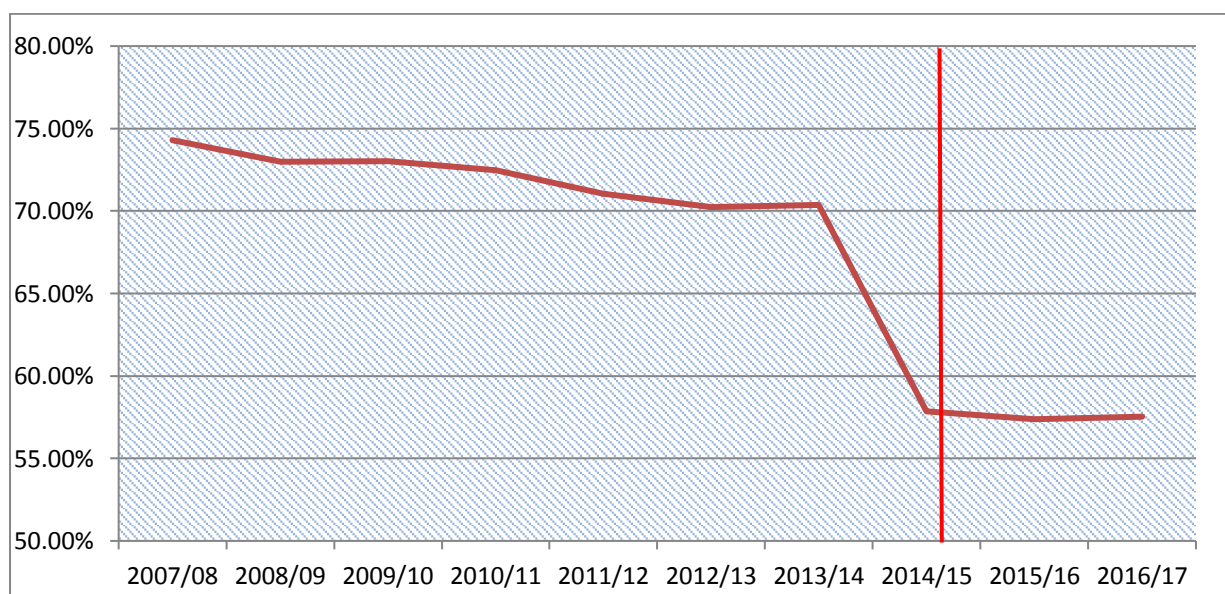
In order to have a better understanding of the reasons why patients failed to meet the indicator we classified patients into the following categories:

1. Last cholesterol measured in the preceding 12 months was 5 mmol/l or less
2. Last cholesterol measured more than 12 months but less than 15 months and was 5 mmol/l or less
3. Last cholesterol measured in last 15 months was more than 5 mmol/l but patient was on statins
4. Last cholesterol measured in last 15 months was more than 5 mmol/l and patient was not on statins
5. No cholesterol measured in the preceding 15 months but on statins
6. No cholesterol measured in the preceding 15 months and not on statins

The table and graph below show the changes over time in the distribution of these categories. In 2014/15, when the indicator was removed, there is 8.33% increase in missing cholesterol readings for patients with CHD, and a drop in the indicator performance by 12.53%. Missing readings for patients who are being treated by statins continue to increase once the indicator is retired, this increases by 7.19%, whereas patients who have missed a reading but not on statins remains stable.

Year	Met in under 12 months	Met in 12 to 15 months	Cholesterol>5 mmol on statins	Missing Reading on statins	Cholesterol>5mmol not on statins	Missing Reading not on statins
2007/08	68.14%	6.15%	8.57%	5.10%	6.15%	5.88%
2008/09	66.57%	6.43%	8.54%	5.50%	6.34%	6.63%
2009/10	66.34%	6.67%	8.43%	6.08%	6.25%	6.23%
2010/11	65.72%	6.76%	8.53%	6.68%	5.92%	6.39%
2011/12	63.69%	7.37%	8.49%	7.85%	5.97%	6.64%
2012/13	62.87%	7.37%	8.72%	8.79%	5.80%	6.45%
2013/14	70.39%	3.84%	7.88%	6.86%	5.32%	5.71%
2014/15	57.86%	8.29%	7.99%	14.05%	4.95%	6.85%
2015/16	57.38%	5.73%	7.54%	16.90%	4.53%	7.92%
2016/17	57.55%	5.47%	7.95%	16.49%	4.96%	7.58%
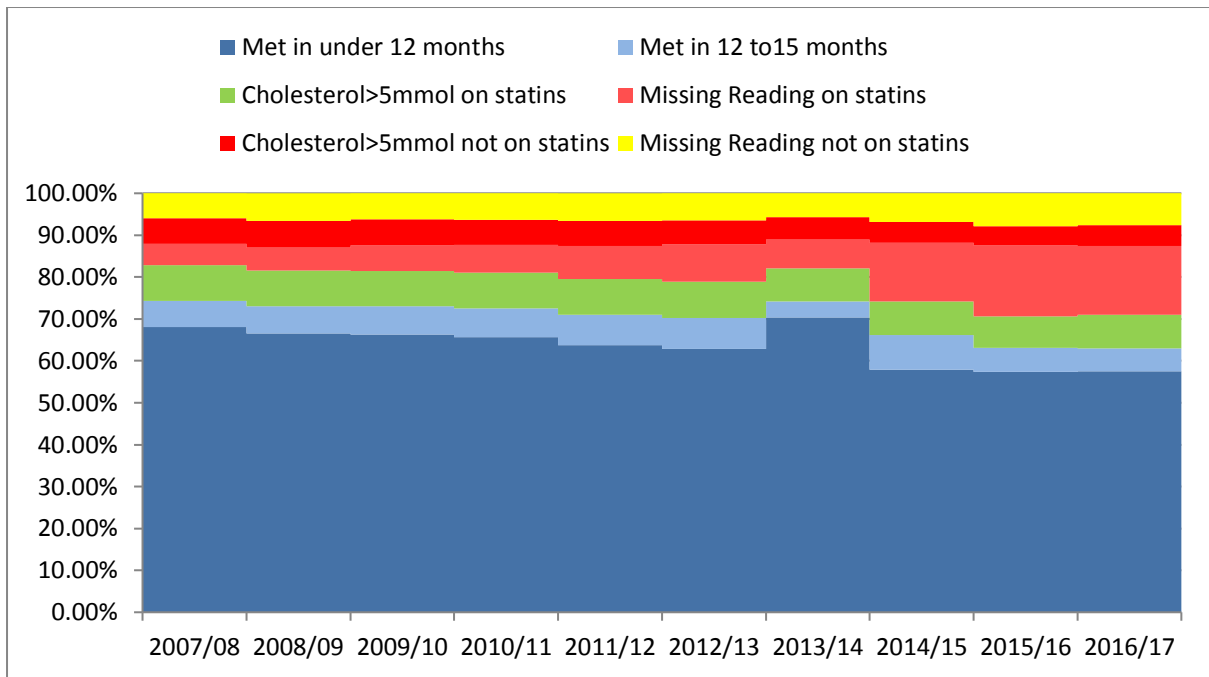
CKD002

This indicator measures the percentage of patients on CKD register in whom the last blood pressure reading (in the preceding 12 months) is 140/85 mm/Hg or less. The indicator was retired in 2015/16, the properties of the indicator are summarised below:

Year	Indicator Rule	Points	Thresholds	Timeframe (months)
2011/12	140/85	11	40 to 70%	15
2012/13	140/85	11	45 to 70%	15
2013/14	140/85	11	41 to 81%	12
2014/15	140/85	11	41 to 81%	12
2015/16	-	-	-	-
2016/17	-	-	-	-

We classified the patients into the following categories:
1. Met the target - last blood pressure reading (measured in the preceding 12 months) was 140/85 mmHg or less
2. Missed timing target - last blood pressure reading was 140/85 mmHg or less, but was measured between 12 and 15 months ago
3. Missed target - last blood pressure reading (measured in the preceding 15 months) was over 140/85 mmHg
4. No measurement - no blood pressure reading in the preceding 15 months.

The table and graph below show the changes over time in the distribution of patients between these categories. The definition of actual attainment combines both the level and the required timing being met according to the requirements in that year. When the indicator was retired in 2015/16, there was a decline in attainment by 7.78% with a rise in missing readings by 2.35% and an increase in readings over 140/85 by 4.32%. The higher achievement rate in 2013/14 and 2014/15 can be explained by an increase in the threshold to achieve the maximum number of QOF points available for this indicator.

Year	Indicator Met (BP under 140/85)	Timing between 12 and 15 months	Attainment in that year	BP over 140/85	Missing Reading
2007/08	58.24%	1.85%	60.10%	31.22%	8.68%
2008/09	59.73%	2.32%	62.05%	29.83%	8.12%
2009/10	60.68%	2.50%	63.19%	29.66%	7.15%
2010/11	62.43%	2.72%	65.15%	28.05%	6.79%
2011/12	63.40%	2.88%	66.28%	26.76%	6.96%
2012/13	63.60%	3.21%	66.81%	25.36%	7.83%
2013/14	70.72%	2.56%	70.72%	19.45%	7.27%
2014/15	68.92%	2.85%	68.92%	19.86%	8.37%
2015/16	61.14%	3.96%	61.14%	24.18%	10.72%
2016/17	61.87%	2.76%	61.87%	25.26%	10.11%
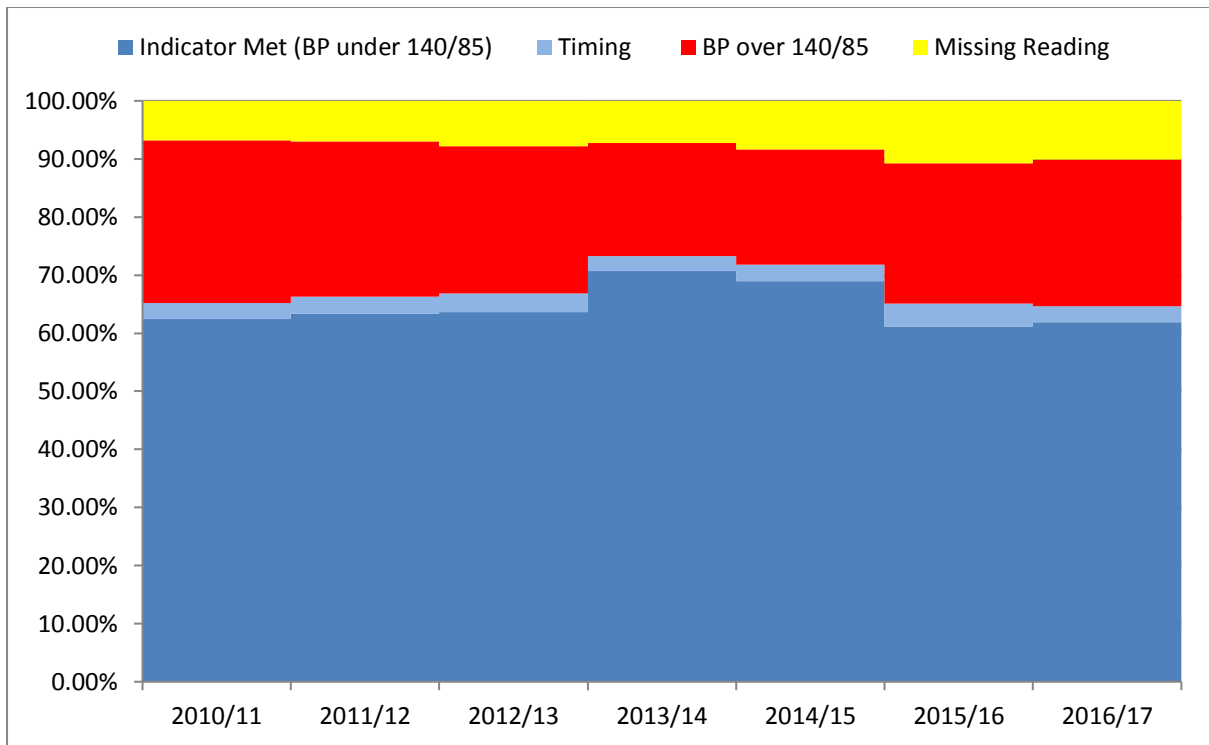
HYP002/HYP003

The following indicator was introduced in the Quality and Outcomes Framework (QOF) in the 2013/14 financial year only:

HYP003: The percentage of patients aged 79 years or under with hypertension in whom the last blood pressure reading (measured in the preceding 9 months) is 140/90 mmHg or less.

Prior to 2013/14, the QOF had contained the following indicator for patients of all ages:

HYP002: The percentage of patients with hypertension in whom the last blood pressure (measured in the preceding 9 months) is 150/90 mmHg or less

This indicator remained in place in 2013/14, but attracted fewer points. This is summarised in the table below:

| Year | All ages | | | | Patients under 80 years only | | | |
	Blood Pressure	Time Frame (months)	Points	Thresholds	Blood Pressure	Time Frame (months)	Points	Thresholds
2011/12	150/90	9	57	40-70%	-	-	-	-
2012/13	150/90	9	55	45-80%	-	-	-	-
2013/14	150/90	9	10	44-84%	140/90	9	50	40-80%
2014/15	150/90	12	20	45-80%	-	-	-	-
2015/16	150/90	12	20	45-80%	-	-	-	-
2016/17	150/90	12	20	45-80%	-	-	-	-

To understand further why indicator performance has changed over time, we classified individual patients into five categories:
1. Met stricter level target - last blood pressure reading (measured in the preceding 9 months) was 140/90 mmHg or less
2. Missed the stricter but met the looser level target - last blood pressure reading (measured in the preceding 9 months) was over 140/90 mmHg, but was 150/90 mmHg or less
3. Missed stricter timing target - last blood pressure reading was 140/90 mmHg or less, but was measured between 9 and 12 months ago
4. Missed looser level target - last blood pressure reading (measured in the preceding 12 months) was over 150/90 mmHg
5. No measurement - no blood pressure reading in the preceding 12 months.

The table and graph below show the results for patients aged 79 years and under. There was a nine percentage point increase in the proportion of patients meeting the stricter level target when it was introduced in 2013/14. There was an eight percentage point decrease in the proportion of patients missing the stricter target but meeting the looser target in the same year. There was a four percentage point increase in the proportion of patients missing the tighter timing target when it was relaxed in 2014/15. In the same year, there was an almost four percentage point increase in the proportion of patients with no recorded blood pressure measurement.

The column labelled HYP002 indicator attainment is the total of the previous columns which depends on the changing timeframe of the indicator. In 2013/14, the value corresponds to the sum of met stricter target plus met looser target. In 2014/15, this value is the sum of stricter target, looser target and also timing due to increased timeframe in 2014/15.

Year	Met stricter level target	Met looser level target	Missed stricter timing target	HYP002 Indicator attainment	Missed looser level target	No measurement
2007/08	54.50%	21.21%	2.10%	75.71%	16.37%	6.48%
2008/09	55.18%	20.53%	2.43%	75.71%	15.61%	6.91%
2009/10	55.44%	20.56%	2.57%	76.00%	15.03%	7.06%
2010/11	56.53%	20.63%	2.53%	77.16%	13.80%	7.16%
2011/12	58.27%	19.32%	2.47%	77.59%	13.05%	7.57%
2012/13	59.20%	18.88%	2.44%	78.08%	12.00%	8.16%
2013/14	68.54%	10.77%	3.05%	79.31%	10.05%	8.23%
2014/15	57.16%	14.71%	7.20%	79.07%	9.75%	11.85%
2015/16	55.01%	15.91%	7.98%	78.90%	9.47%	12.28%
2016/17	54.50%	16.32%	8.72%	79.54%	9.34%	11.80%
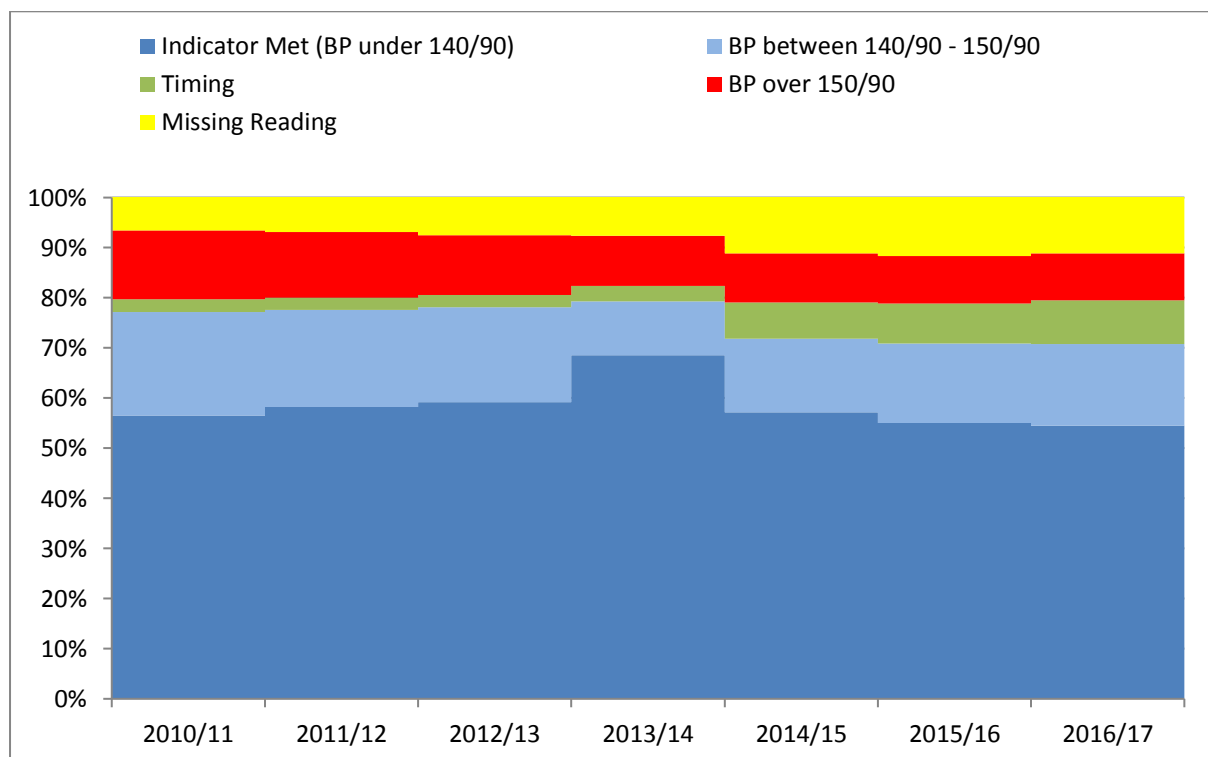
The table and graph below shows the analogous figures for patients aged 80 years or over. Although these patients were not affected by the introduction and removal of the stricter level target in 2013/14, the pattern of the changes was similar, though to a lesser degree.

Year	Met stricter level target	Met looser level target	Missed stricter timing target	HYP002 Indicator attainment	Missed looser level target	No measurement
2007/08	49.75%	21.92%	2.74%	71.67%	17.10%	8.50%
2008/09	51.03%	21.53%	3.17%	72.56%	15.51%	8.76%
2009/10	52.12%	21.26%	3.09%	73.38%	14.36%	9.17%
2010/11	53.83%	20.75%	3.09%	74.58%	13.32%	9.01%
2011/12	55.77%	19.55%	3.03%	75.32%	12.93%	8.72%
2012/13	56.89%	19.13%	2.89%	76.02%	11.61%	9.48%
2013/14	60.43%	15.46%	4.41%	75.89%	9.22%	10.49%
2014/15	57.14%	15.41%	7.08%	79.62%	9.12%	11.26%
2015/16	53.09%	17.83%	8.09%	79.01%	8.75%	12.24%
2016/17	53.20%	18.20%	8.71%	80.11%	8.29%	11.59%
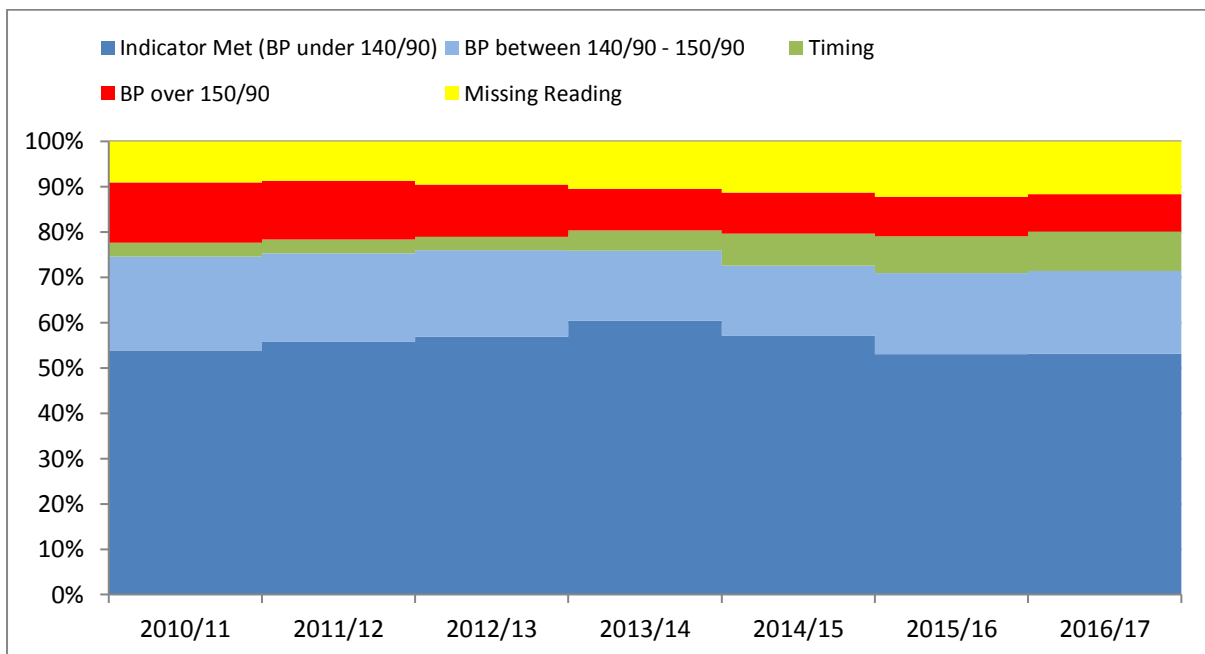
MH004

This indicator focuses on whether a patient's total cholesterol:hdl ratio is recorded.

MH004: The percentage of patients aged 40 or over with schizophrenia, bipolar affective disorder or other psychoses who have a record of total cholesterol:hdl ratio in the preceding 12 months.

The MH004 indicator was retired in 2014/15. In 2013/14, the timeframe for the indicator to be achieved was reduced from 15 months to 12 months. The lower threshold was also increased. The development of the indicator is summarised below.

Year	Time Frame	Points	Thresholds
2011/12	15	4	40 to 90%
2012/13	15	5	45 to 80%
2013/14	12	4	45 to 80%
2014/15	-	-	-
2015/16	-	-	-
2016/17	-	-	-

We divided indicator performance into the following categories:

1. Cholesterol:hdl ratio recorded in the last 12 months
2. Cholesterol:hdl ratio recorded in the last 12 to 15 months
3. Missing Reading

There is a column for actual achievement based on the change in time frame in 2013/14 to 12 months. The results are summarised below in the table and the graph, with the indicator only being introduced in 2011/12. Once the indicator was removed there was an 18.19% drop in indicator performance, and an increase in missing readings by 12.12%.

| Year	Cholesterol Reading within 12 months	12 to 15 months	Achievement	Missing Reading
2007/08	34.07%	5.06%	39.13%	60.87%
2008/09	37.81%	5.22%	43.02%	56.98%
2009/10	39.16%	5.48%	44.64%	55.36%
2010/11	40.38%	6.93%	47.31%	52.69%
2011/12	69.01%	5.89%	74.90%	25.10%
2012/13	58.13%	15.46%	73.59%	26.41%
2013/14	69.37%	6.01%	69.37%	24.62%
2014/15	51.18%	11.92%	51.18%	36.90%
2015/16	51.01%	7.90%	51.01%	41.09%
2016/17	51.51%	7.87%	51.51%	40.63%
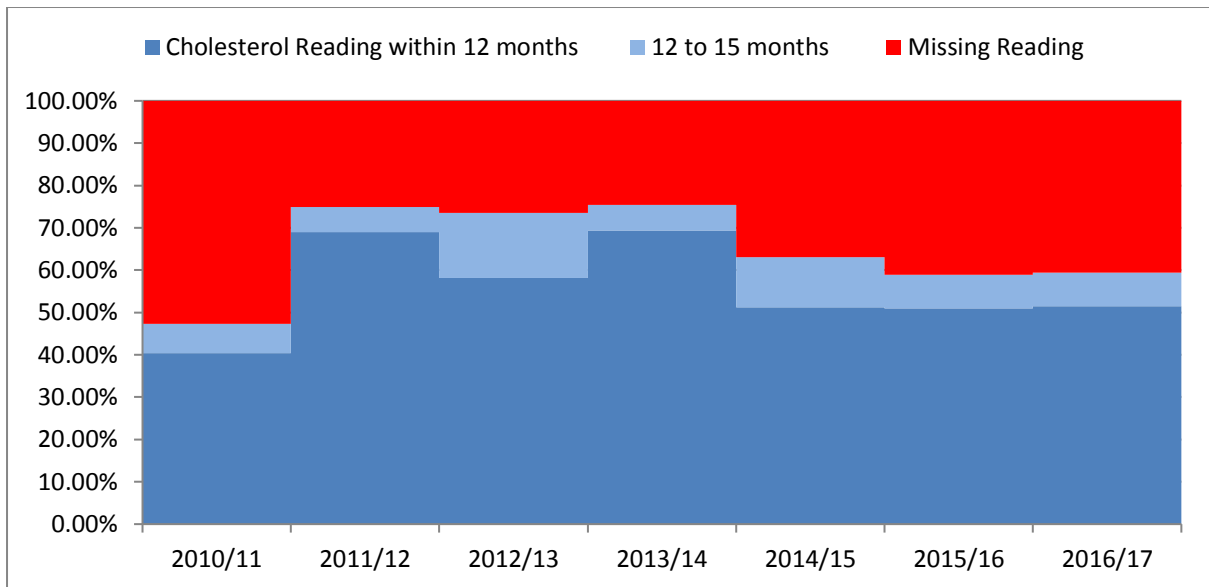
THY001

This indicator focuses on the maintenance of a register of patients with hypothyroidism who are currently treated with levothyroxine. This indicator was removed in 2014/15, and only attracted one point throughout the study period. To assess whether patients maintain the register, we looked into new diagnosis of patients that meet the indicator criteria, and excluded all patients who were diagnosed before the study period.

Pre-indicator retirement there were stable increases in new diagnosis of the condition. After the indicator was removed, there was a decline in the rate of new diagnosis. The graph shows the percentage of new diagnosis of hypothyroidism each year.

Year	New Diagnosis of Hypothyroidism	
	Count	Percent
2006/07	1,242	9.40%
2007/08	1,738	13.15%
2008/09	1,567	11.86%
2009/10	1,390	10.52%
2010/11	1,218	9.22%
2011/12	1,133	8.57%
2012/13	1,381	10.45%
2013/14	1,086	8.22%
2014/15	847	6.41%
2015/16	863	6.53%
2016/17	749	5.67%
Total	13,214	100.00%
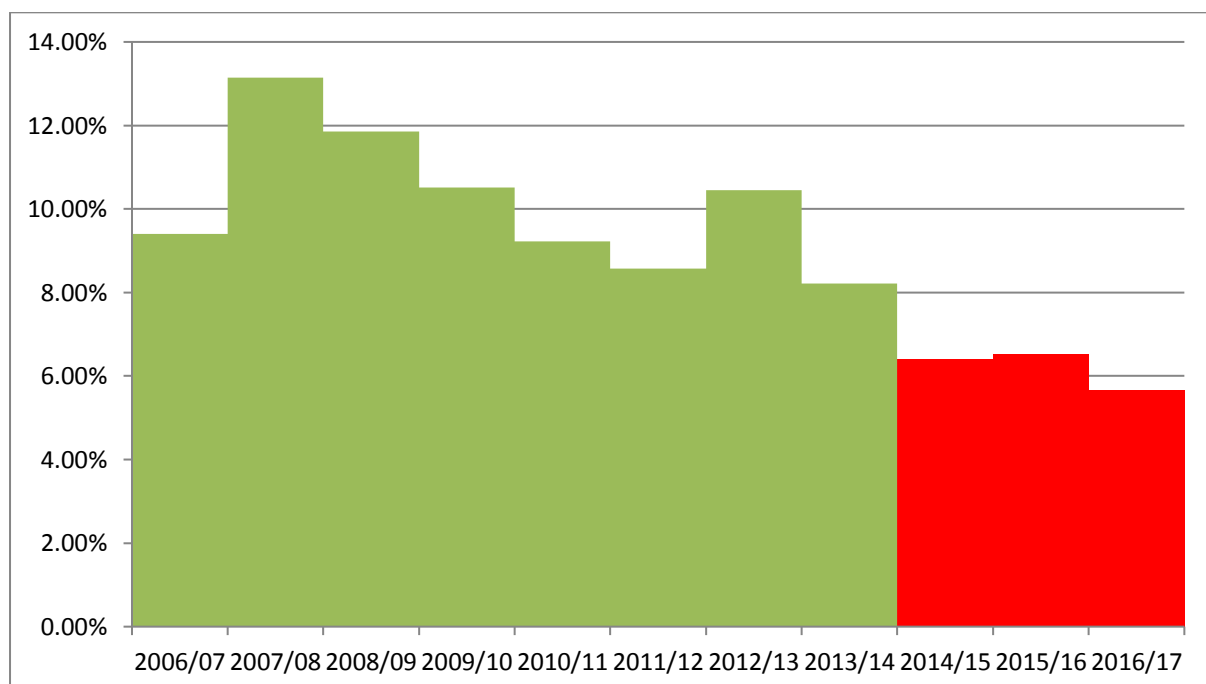
THY002

This indicator focuses on hypothyroidism patients who have had a thyroid function test.

THY002: The percentage of patients with hypothyroidism, on the register, with thyroid function tests recorded in the preceding 15 months.

The THY002 indicator was retired in 2014/15. In 2013/14, the timeframe for the indicator to be achieved was reduced from 15 months to 12 months. The lower threshold was increased. This is summarised below.

Year	Time Frame	Points	Thresholds
2011/12	15	6	40 to 90%
2012/13	15	6	50 to 90%
2013/14	12	6	50 to 90%
2014/15	-	-	-
2015/16	-	-	-
2016/17	-	-	-

We divided indicator performance into the following categories:

1. Thyroid Function Test in the last 12 months
2. Thyroid Function Test in the last 12 to 15 months
3. Missing Reading

When the indicator was retired the indicator achievement dropped by 11.03 p.p. and remained stable thereafter. Post-indicator removal there is a rise in the number of missed readings by 5.8 p.p. from 2013/14 to 2014/15.

| Year	Reading in 12 months	12 to 15 months	Actual Achievement	Missed
2006/07	86.85%	6.32%	93.17%	6.81%
2007/08	86.96%	6.26%	93.22%	6.78%
2008/09	86.19%	6.48%	92.67%	7.19%
2009/10	85.69%	6.77%	92.46%	7.35%
2010/11	85.16%	7.58%	92.74%	7.09%
2011/12	85.10%	7.85%	92.95%	6.91%
2012/13	84.57%	7.94%	92.51%	7.49%
2013/14	90.45%	3.36%	90.45%	6.18%
2014/15	79.42%	8.40%	79.42%	11.98%
2015/16	79.13%	6.78%	79.13%	13.92%
2016/17	80.46%	6.23%	80.46%	13.11%
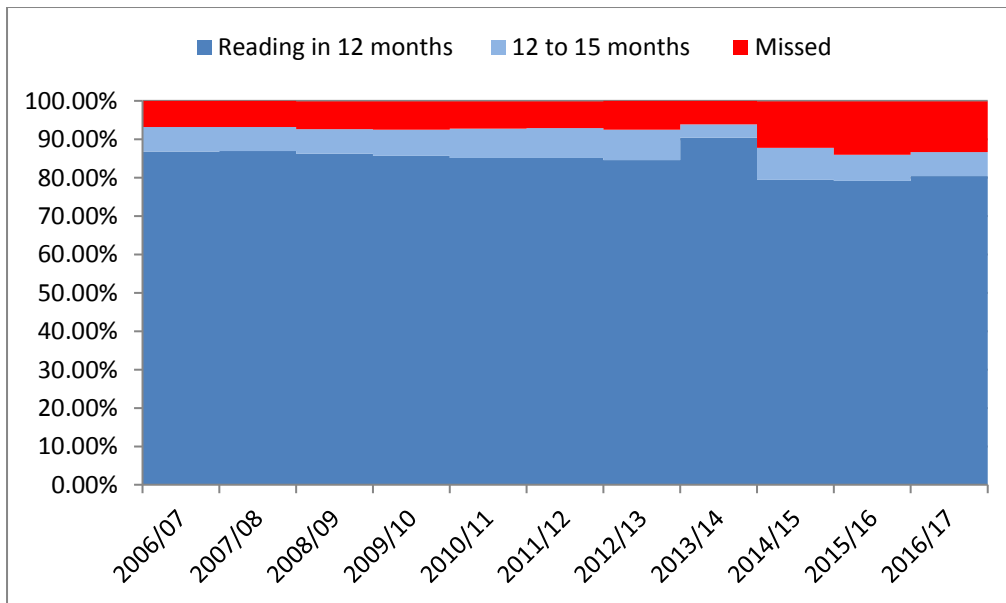
Indicator performance by sex

Summary

Across all indicators studied, males and females both experience drops in performance when the indicators are retired. For all indicators except THY002 and HYP003, males experience better indicator achievement than females. Whilst the trends follow similar patterns over time, there are some stark differences in actual performance. For example, there is a 15 p.p. difference in achievement by sex for indicator CHD003.

CHD003

This indicator measures the percentage of patients with coronary heart disease whose last measured total cholesterol (measured in the preceding 15/12 months) is 5mmol/l or less (retired in 2014/5). For this indicator we have based the actual achievement for both males and females on the changing time frame of the indicator to 12 months in 2013/14 from 15 months.

The results are summarised in the table and graph below. Throughout the whole study period, males have higher indicator performance than females. In the year prior to the indicator being retired, the proportion of males achieving the indicator is 15.53% higher than that of the females. When the indicator is retired, the proportion of males achieving the indicator is 12.53% higher than females achieving the indicator.
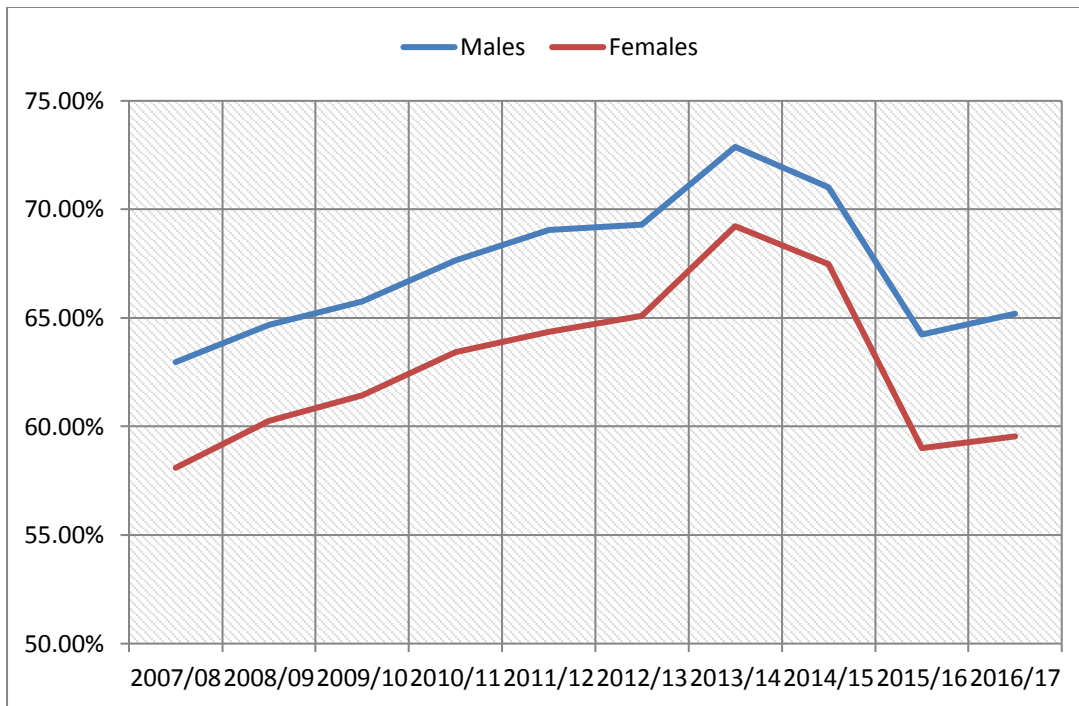
Indicator Achievement

Year	Male	Female
2007/08	80.09%	64.64%
2008/09	78.78%	63.28%
2009/10	78.68%	63.29%
2010/11	78.16%	62.55%
2011/12	76.64%	61.07%
2012/13	75.72%	60.29%
2013/14	75.84%	60.31%
2014/15	62.21%	49.68%
2015/16	62.04%	48.54%
2016/17	62.36%	48.25%
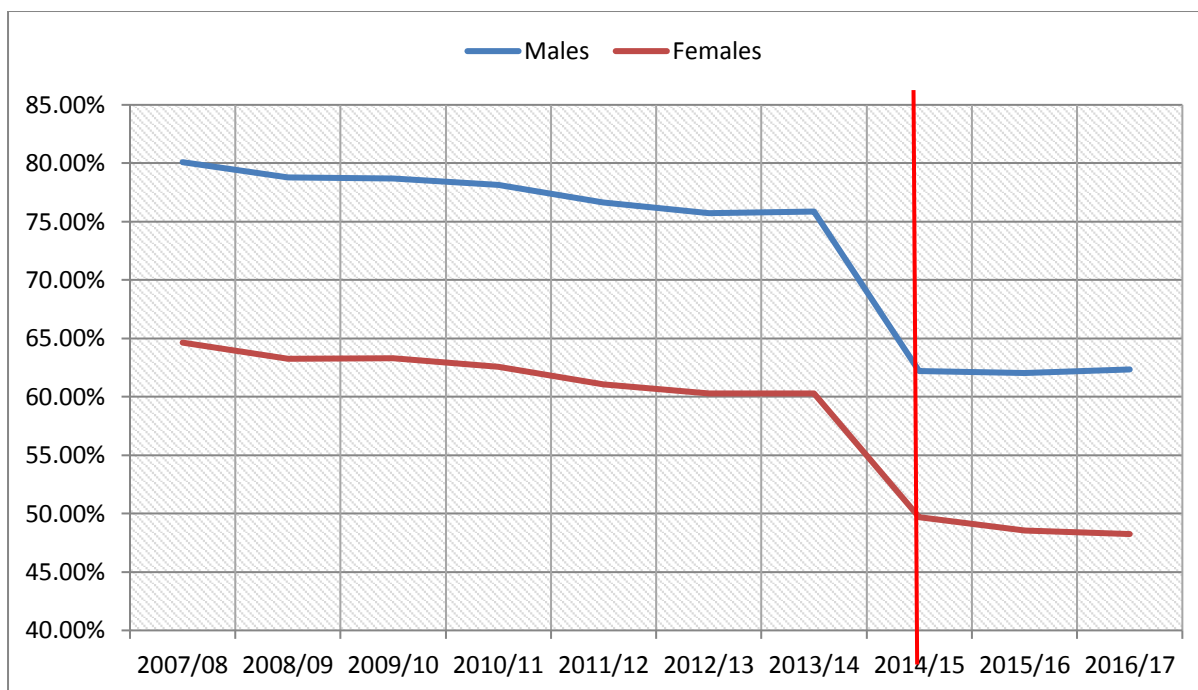
CKD002

The percentage of patients on CKD register in whom the last blood pressure reading (in the preceding 12 months) is 140/85 mm/Hg or less. This indicator's timeframe was reduced in 2012/13 from 15 months to 12 months. Throughout the whole study period, males perform consistently better in indicator performance than females. In the year prior to the indicator being retired, the difference in proportion of patients achieving the indicator is 3.53%.

	Indicator Achievement	
Year	Male	Female
2007/08	62.97%	58.10%
2008/09	64.67%	60.27%
2009/10	65.76%	61.43%
2010/11	67.66%	63.42%
2011/12	69.06%	64.36%
2012/13	69.29%	65.09%
2013/14	72.88%	69.23%
2014/15	71.01%	67.48%
2015/16	**64.23%**	**58.99%**
2016/17	**65.20%**	**59.55%**

HYP002

The percentage of patients with hypertension for who the last blood pressure (measured in the preceding 9 months) is 150/90 mmHg or less. Overall males perform better than females; however the absolute difference in indicator achievement is small.

|	Indicator Met (BP under 150/90)	
Year	Male	Female
2007/08	78.76%	74.88%
2008/09	78.36%	74.95%
2009/10	78.12%	75.25%
2010/11	79.39%	76.35%
2011/12	79.79%	76.83%
2012/13	79.48%	77.14%
2013/14	80.12%	78.22%
2014/15	80.23%	78.79%
2015/16	80.81%	78.54%
2016/17	81.30%	79.43%
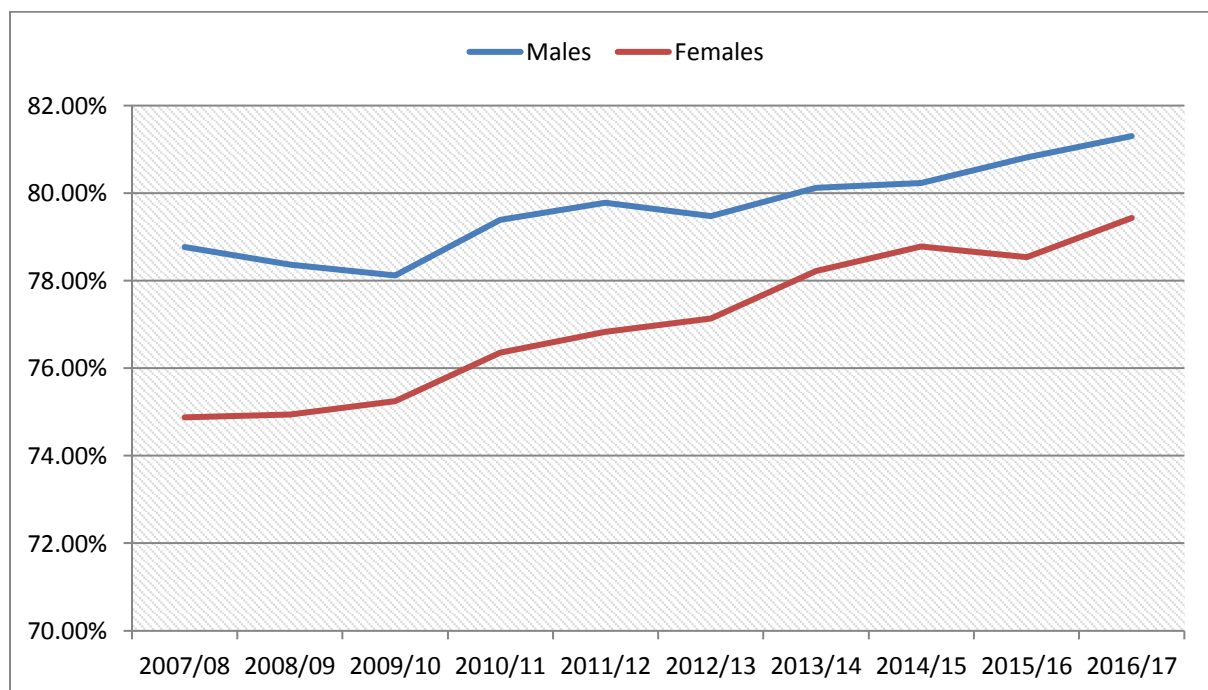
HYP003

The percentage of patients aged 79 years or under with hypertension in whom the last blood pressure reading (measured in the preceding 9 months) is 140/90 mmHg or less.

The results are summarised below in the table and graph. Both males and females follow the same pattern in attainment and trends in achievement. In the year that the indicator was live, males experienced a 9.27% increase in achievement and females a 9.34% increase in achievement. However it is important to allow for the fact that there was the HYP002 indicator was active through the whole study period and this had a less strict target of 150/90 mmHg. After the indicator was removed in 2014/15, there was a 11.27% drop in indicator achievement for males and 11.35% drop in achievement for females. Consistently females have a higher achievement than males throughout the study period, however this differences in achievement begins to narrow after the indicator is removed to only 0.81% difference in achievement.

Indicator Met (BP under 140/90)

| Year	Male	Female
2007/08	53.14%	55.11%
2008/09	53.91%	55.69%
2009/10	54.11%	56.04%
2010/11	55.42%	56.91%
2011/12	57.24%	58.53%
2012/13	57.99%	59.63%
2013/14	67.26%	68.96%
2014/15	55.99%	57.61%
2015/16	54.07%	55.26%
2016/17	53.74%	54.55%
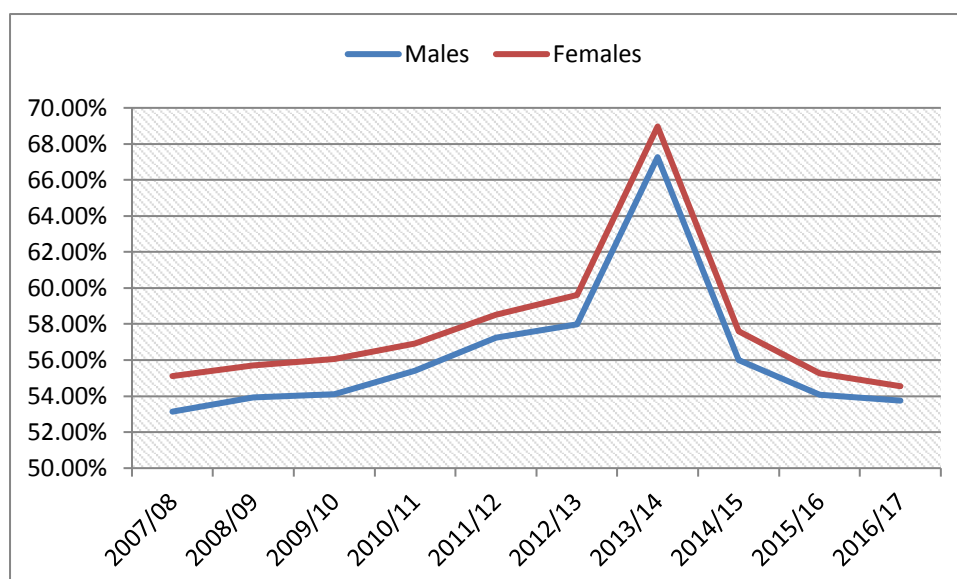
MH004

The percentage of patients aged 40 or over with schizophrenia, bipolar affective disorder or other psychoses who have a record of total cholesterol:hdl ratio in the preceding 12 months.

This indicator was introduced in 2011/12 with a 15 month time frame then was reduced to a 12 month timeframe in 2013/14, then retired the following year. The results by sex are summarised below in the table and graph. Both males and females follow the same pattern in achievement, with relatively small differences in achievement. When the indicator was live in 2011/12, males achieved a 1.61% higher proportion of achievement compared to females. Post-indicator removal in 2015/16, the differences in achievement narrowed further.

Indicator Achievement

Year	Male	Female
2007/08	41.21%	37.50%
2008/09	44.02%	42.25%
2009/10	46.58%	43.10%
2010/11	51.81%	43.64%
2011/12	75.79%	74.18%
2012/13	73.88%	73.36%
2013/14	70.22%	68.67%
2014/15	52.78%	49.86%
2015/16	50.81%	51.18%
2016/17	51.99%	51.10%
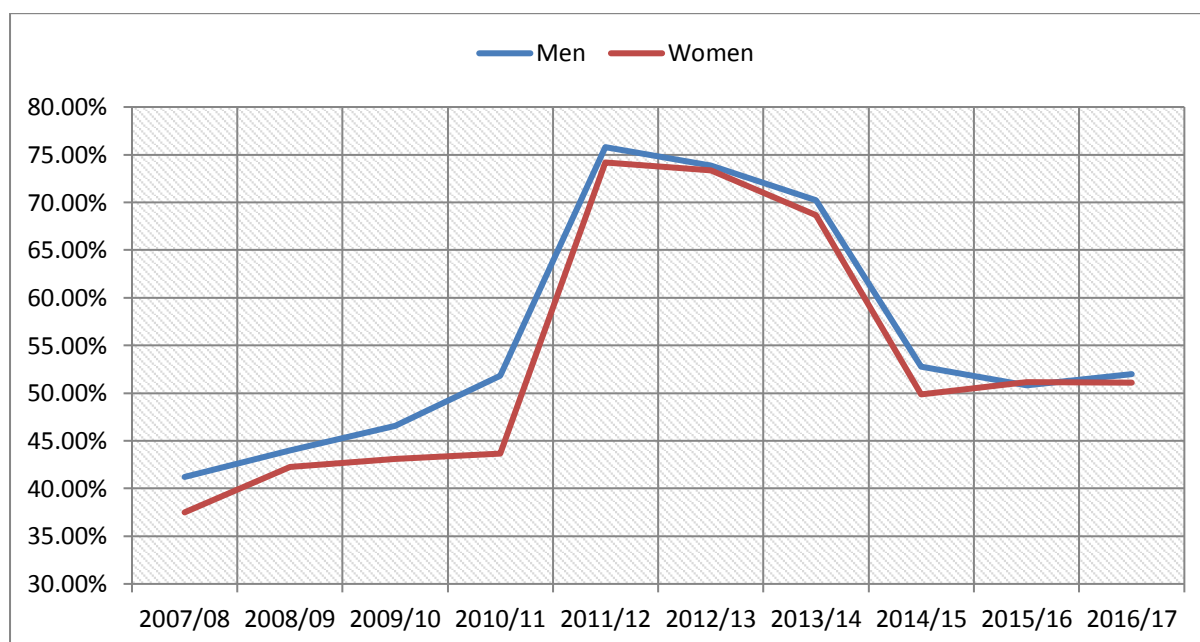
THY002

Throughout the study period females have a higher indicator performance than males. The difference in performance is around 2 p.p. and when the incentive is removed both male and female experience an immediate drop in indicator performance. Post-indicator removal both men and women experience an increasing trend in achievement, despite the incentive being withdrawn.

Year	Male	Female
2006/07	91.20%	93.59%
2007/08	91.40%	93.59%
2008/09	90.83%	93.23%
2009/10	90.96%	93.01%
2010/11	91.91%	93.13%
2011/12	92.22%	93.29%
2012/13	91.57%	92.73%
2013/14	89.64%	90.65%
2014/15	77.33%	80.16%
2015/16	77.32%	79.78%
2016/17	78.07%	81.27%
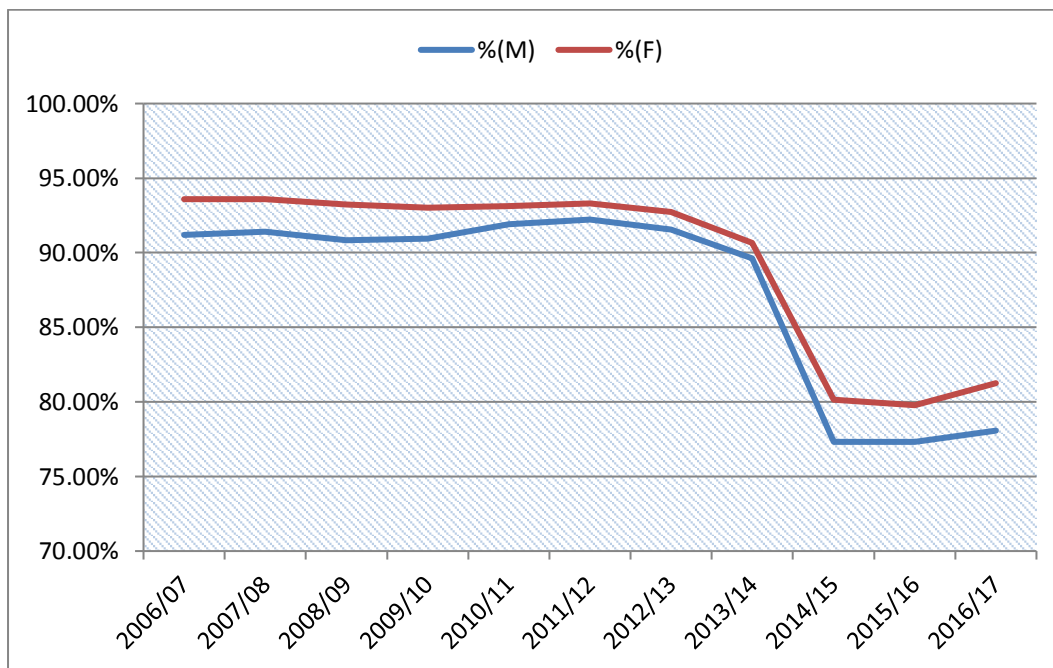
Indicator performance by age group

Summary

Overall the oldest patients (aged 90 years +) perform worst in the indicator achievement across the majority of indicators, with a high proportion of missed readings. The patients who are the youngest (aged under60 years) have surprisingly worse outcomes than older patients, with across most indicators this younger cohort having the next worse indicator achievement after that of over 90. Furthermore this younger patient group has a high proportion of missed readings. This younger patient group has the greatest potential to gain from incentive schemes such as the QOF, due to longer term health benefits and the prevention of comorbidities developing.

CHD003

The percentage of patients with coronary heart disease whose last measured total cholesterol (measured in the preceding 15 months) is 5mmol/l or less (retired in 2014/5).

We assessed the different age structures in two aspects:

- met the 5mmol target within 12 months versus all others
- Missing readings versus all others

Below we present the proportion of patients who meet the target cholesterol of 5mmol or less within the financial year. Patients aged over 90 years old, have the lowest proportion of patients with a cholesterol reading below 5mmol compared to any other age group, with patients aged 70 – 79 year olds having the highest indicator performance for all years. Patients aged under 60 years old achieve worse than the majority of age groups, however in 2016/17 they were the only group of patients to have an increase in performance in the retired indicator.

Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	65.41%	76.10%	79.29%	79.94%	78.90%	73.76%	66.78%	54.36%
2008/09	62.84%	73.80%	78.67%	78.07%	79.11%	73.74%	65.20%	52.39%
2009/10	62.59%	73.47%	77.13%	78.07%	78.79%	74.75%	67.65%	52.63%
2010/11	63.85%	72.59%	77.36%	77.24%	76.57%	74.71%	67.75%	53.52%
2011/12	61.23%	71.49%	75.07%	76.69%	75.64%	73.55%	66.67%	52.23%
2012/13	61.49%	70.19%	74.54%	74.92%	74.51%	73.09%	66.98%	50.71%
2013/14	61.00%	70.29%	74.90%	76.35%	75.77%	72.10%	65.75%	51.34%
2014/15	50.87%	58.54%	62.85%	63.67%	61.90%	59.52%	50.89%	40.91%
2015/16	49.76%	58.43%	62.29%	64.16%	63.25%	58.44%	48.47%	39.55%
2016/17	53.92%	58.30%	62.05%	63.71%	62.54%	57.93%	50.30%	36.40%
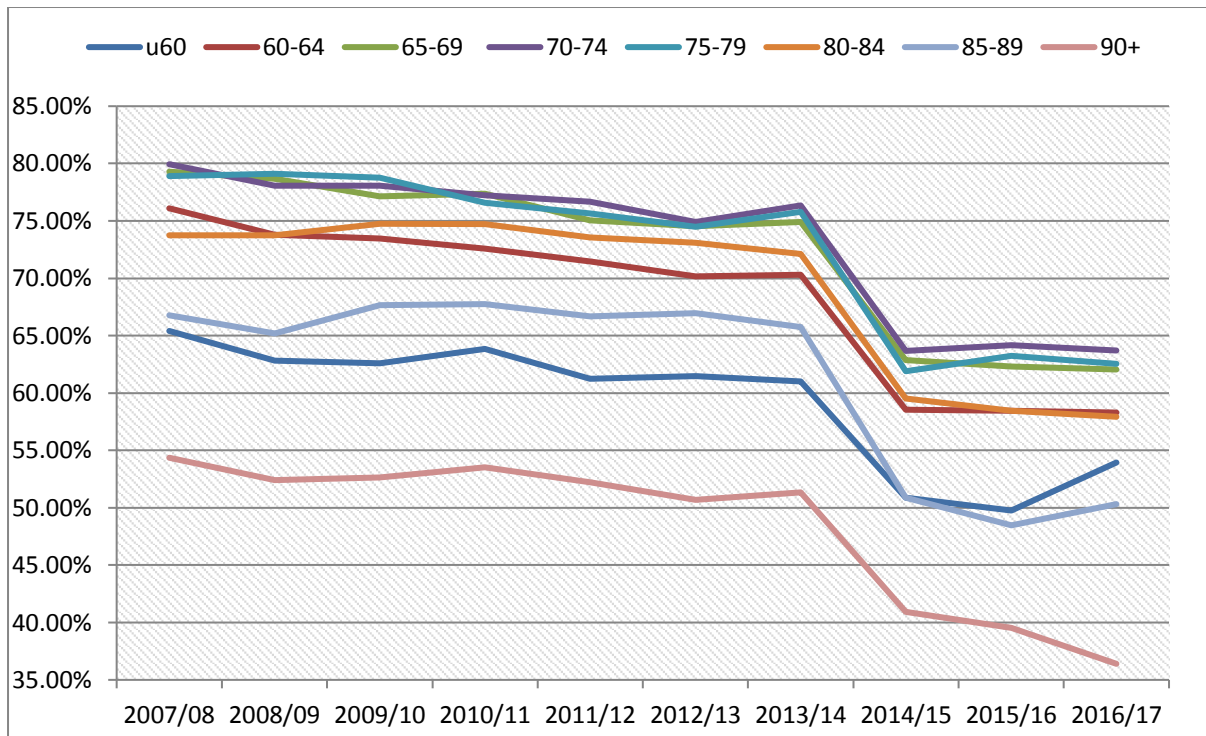
Below we present the proportion of patients in each age group who have missing readings in the financial year. The patients aged over 90 years old, have the highest proportion of missing cholesterol readings, which provides insight in why the indicator performance was particularly low.

| Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	16.53%	9.54%	8.07%	7.00%	7.47%	10.06%	12.79%	22.08%
2008/09	17.26%	10.07%	8.83%	8.25%	8.13%	11.47%	15.63%	27.94%
2009/10	17.94%	11.05%	9.02%	8.46%	8.41%	11.88%	16.78%	29.03%
2010/11	17.70%	11.13%	9.17%	8.77%	8.83%	12.37%	16.47%	29.51%
2011/12	19.31%	12.73%	10.47%	10.21%	10.85%	13.36%	18.68%	30.99%
2012/13	19.42%	13.38%	11.51%	10.57%	10.94%	13.25%	18.23%	31.90%
2013/14	17.36%	11.34%	9.08%	8.28%	8.75%	11.24%	15.55%	27.25%
2014/15	22.37%	17.23%	15.33%	15.36%	15.91%	18.87%	25.28%	35.57%
2015/16	27.52%	21.64%	20.14%	18.98%	19.07%	23.85%	31.15%	44.52%
2016/17	24.78%	20.12%	19.28%	18.97%	19.93%	24.01%	31.25%	46.98%
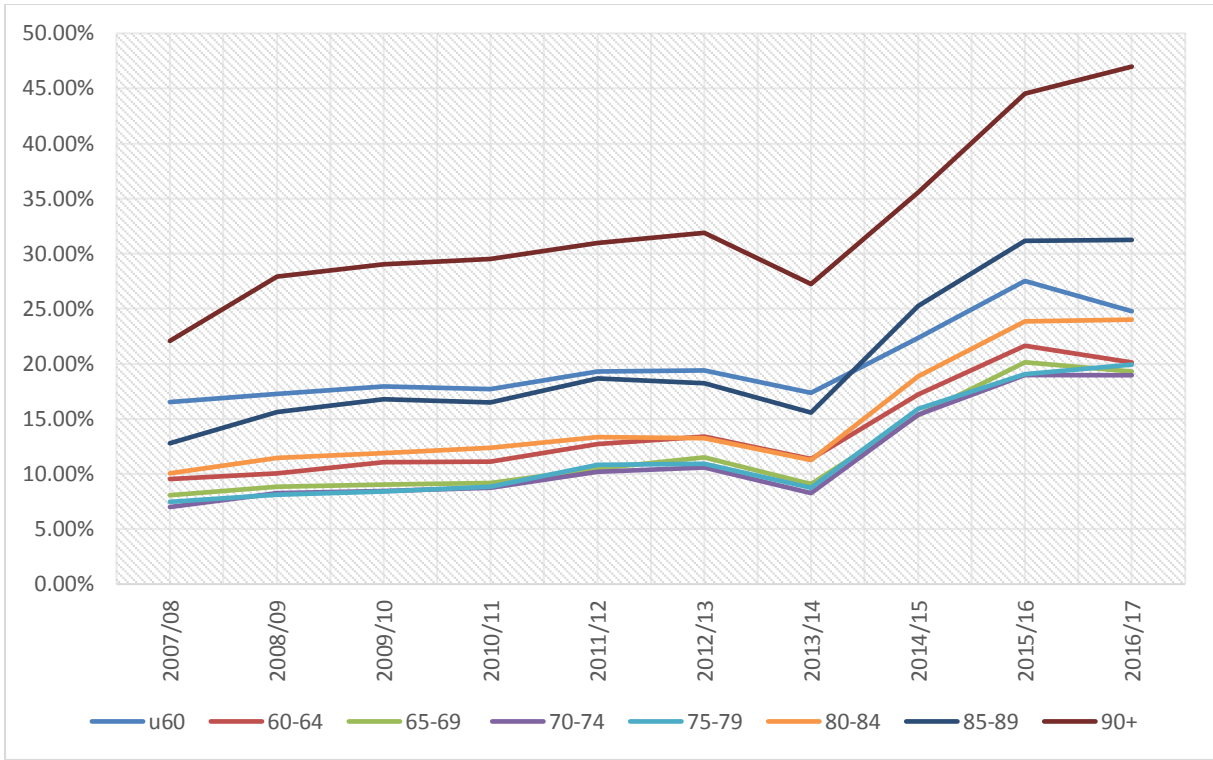
CKD002

We assessed the indicator performance by age groups split into 5 year bands based on the indicator rule of a blood pressure reading of 140/85 mmHG or below within 12 months of the financial year. The results are summarised below in the table and graph. The oldest and the youngest patients perform worst in indicator achievement. Patients aged between 65 to 69 years old exhibited the biggest drop in indicator performance post removal.

Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	57.63%	61.39%	62.07%	60.99%	61.30%	60.42%	57.16%	57.30%
2008/09	60.48%	61.51%	62.23%	63.89%	64.22%	61.70%	59.53%	59.58%
2009/10	60.74%	63.13%	63.95%	65.55%	64.08%	63.22%	62.52%	58.26%
2010/11	63.95%	64.85%	68.56%	67.56%	64.24%	65.17%	63.57%	62.43%
2011/12	62.19%	65.37%	67.73%	67.73%	68.31%	67.01%	64.56%	63.04%
2012/13	62.41%	65.27%	67.95%	68.65%	68.87%	67.21%	65.93%	63.52%
2013/14	65.19%	68.49%	73.41%	73.66%	74.08%	72.22%	68.08%	63.14%
2014/15	62.16%	66.73%	71.01%	70.77%	72.18%	70.06%	67.70%	62.84%
2015/16	53.48%	58.08%	60.56%	63.65%	63.47%	62.91%	62.01%	55.62%
2016/17	53.02%	58.04%	61.74%	64.45%	64.10%	63.89%	62.76%	56.49%

Next we examined which age groups had the largest proportion of missing readings, i.e. no blood pressure readings in each financial year. The results are summarised below. Patients aged under 60 years old had the highest overall proportion of missing readings across the study period. However patients aged 60-64 exhibited the biggest increase in percentage of missing readings post-retirement of the indicator with a 3.84% increase in missing readings.

| Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	13.33%	10.59%	9.37%	7.73%	7.37%	7.66%	8.86%	8.91%
2008/09	12.84%	9.56%	8.86%	7.55%	6.08%	6.47%	8.40%	9.78%
2009/10	11.64%	9.12%	7.03%	6.04%	5.26%	5.43%	7.39%	11.61%
2010/11	10.52%	9.19%	6.55%	4.81%	5.36%	5.60%	6.79%	10.97%
2011/12	13.25%	8.87%	6.49%	5.68%	5.09%	5.06%	6.97%	10.00%
2012/13	13.76%	11.12%	7.09%	6.75%	4.99%	6.56%	7.83%	10.80%
2013/14	12.62%	9.17%	8.40%	5.84%	5.25%	5.65%	7.11%	10.92%
2014/15	15.27%	11.37%	8.81%	7.65%	6.49%	6.34%	7.88%	10.33%
2015/16	17.55%	15.20%	12.02%	10.06%	9.14%	8.26%	9.39%	13.78%
2016/17	18.34%	14.77%	11.59%	9.79%	7.60%	7.00%	9.32%	12.74%
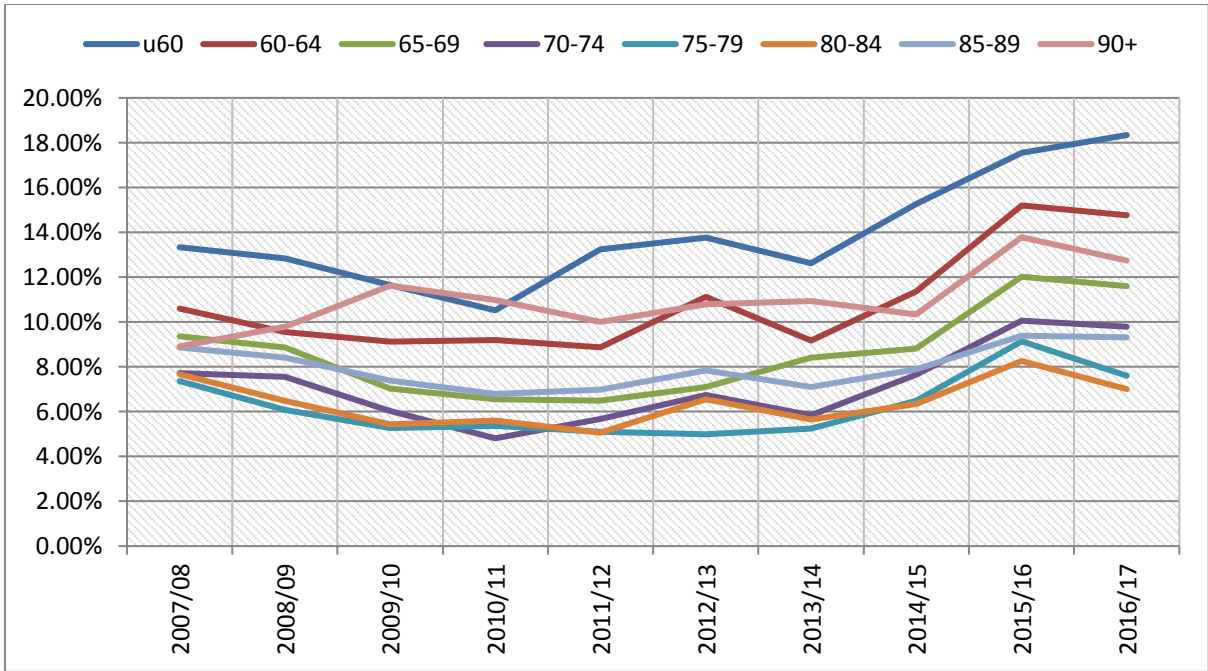
HYP003

We assessed indicator performance across age groups for hypertension. This was assessed across two categories:

1. Met the 140/90 mm/Hg target within 9 months versus all others
2. Missing reading versus all others

The table and graph below summarise the results for part 1. Patients aged between 70 to 74 years old had the highest indicator performance when the indicator was active in 2013/14. This age group also had the largest drop in performance when the indicator was removed the following year with a 12.13% decline in achievement.

Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	52.68%	54.11%	55.73%	55.37%	54.37%	51.09%	49.44%	44.90%
2008/09	52.96%	55.48%	56.22%	55.73%	55.38%	52.38%	50.92%	46.85%
2009/10	52.89%	55.52%	56.31%	56.25%	56.08%	53.42%	52.23%	46.78%
2010/11	54.14%	56.25%	57.09%	57.56%	57.04%	55.73%	53.81%	48.69%
2011/12	55.06%	57.53%	59.50%	59.95%	60.01%	57.94%	54.89%	50.65%
2012/13	55.47%	58.30%	60.05%	60.97%	60.74%	59.46%	55.32%	52.65%
2013/14	**61.74%**	**68.06%**	**70.19%**	**72.08%**	**71.99%**	**63.29%**	**60.25%**	**53.92%**
2014/15	51.45%	56.08%	58.13%	59.95%	60.57%	59.50%	57.04%	51.42%
2015/16	50.52%	54.03%	55.73%	57.24%	57.06%	56.09%	52.94%	46.03%
2016/17	49.40%	53.46%	56.01%	56.73%	56.59%	55.83%	53.45%	46.81%
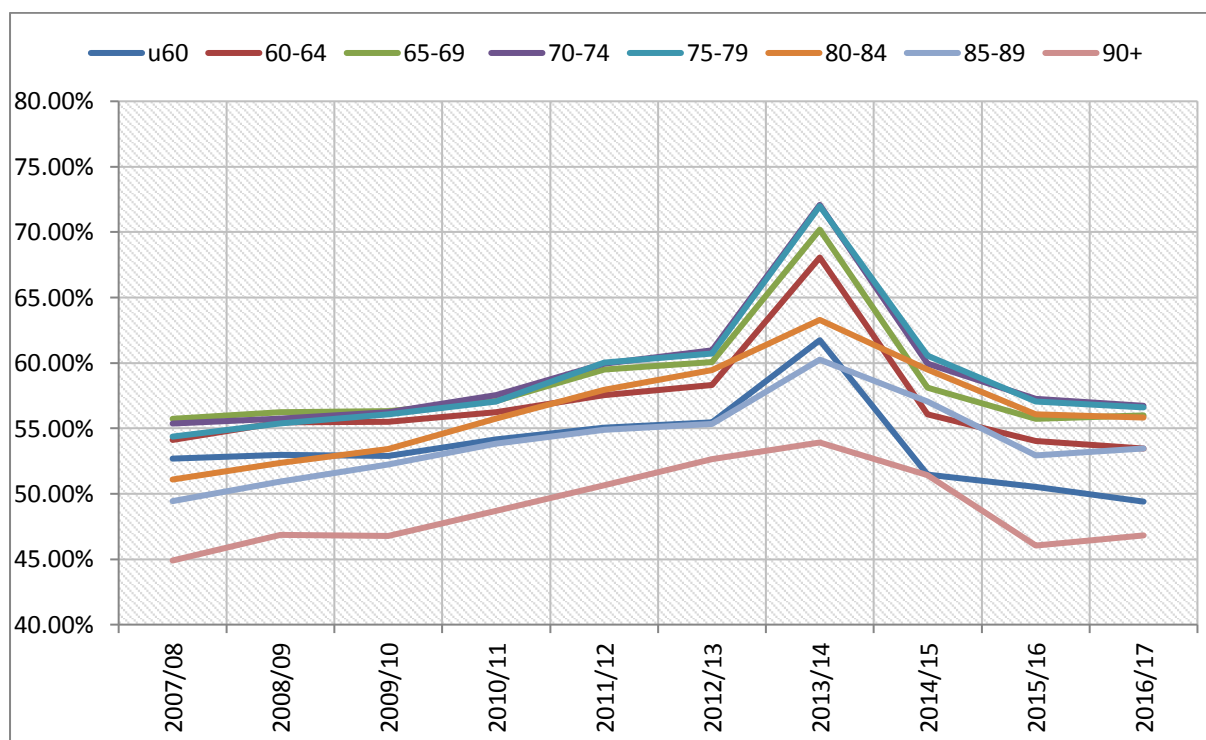
The table and graph below contains the results the proportion of missing readings across age groups. Patients aged 90 years and older experienced the highest proportion of missed blood pressure readings followed by patients aged under 60 years old. Furthermore patients aged under 60 years, had the largest increase in missed blood pressure readings post indicator removal with a 4.4% increase.
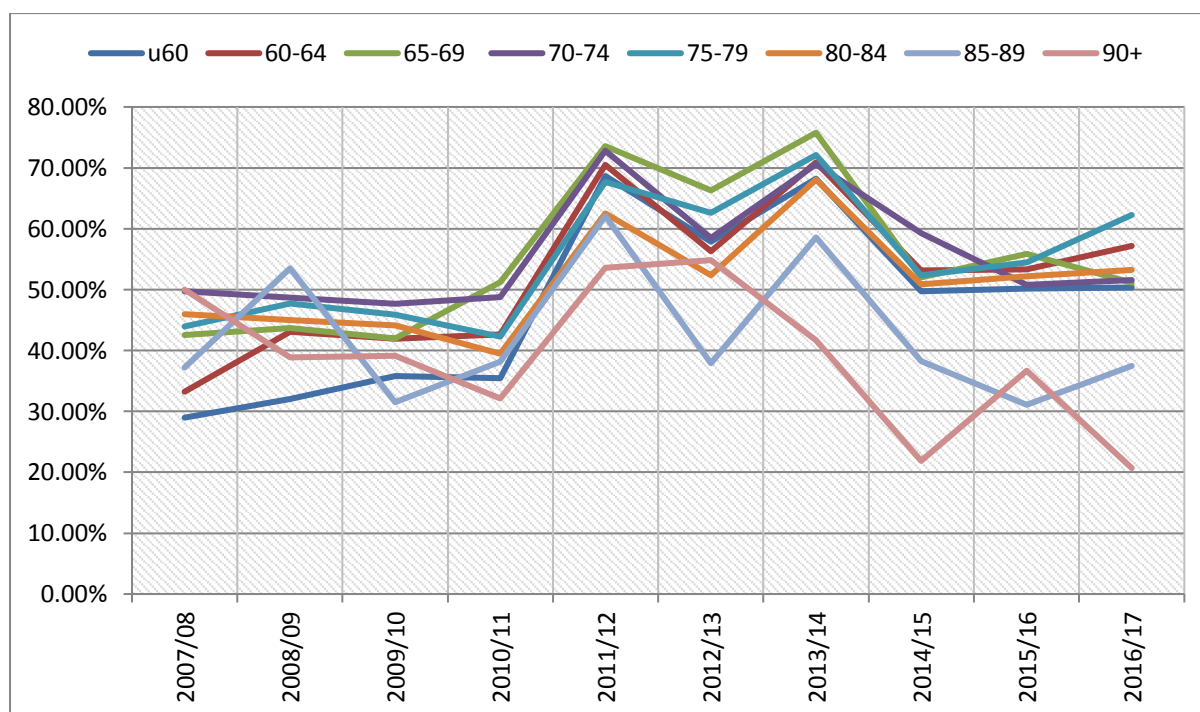
Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	9.66%	6.03%	5.15%	4.24%	4.28%	6.71%	8.49%	15.13%
2008/09	9.97%	6.96%	5.25%	4.74%	4.64%	6.32%	9.53%	16.09%
2009/10	10.39%	6.81%	5.41%	4.95%	4.81%	6.51%	9.64%	17.22%
2010/11	10.40%	7.30%	5.77%	4.75%	4.94%	6.55%	9.03%	16.54%
2011/12	11.20%	7.97%	6.13%	4.97%	4.77%	6.69%	8.94%	14.36%
2012/13	12.01%	8.45%	6.84%	5.42%	5.45%	7.08%	9.77%	15.40%
2013/14	**12.82%**	**8.44%**	**6.67%**	**5.54%**	**5.03%**	**8.12%**	**10.46%**	**16.30%**
2014/15	17.26%	12.43%	10.30%	8.98%	7.27%	8.68%	11.67%	17.38%
2015/16	17.19%	13.27%	10.73%	9.49%	8.67%	9.15%	13.05%	19.15%
2016/17	16.85%	12.67%	10.32%	8.87%	8.38%	8.72%	11.74%	18.84%
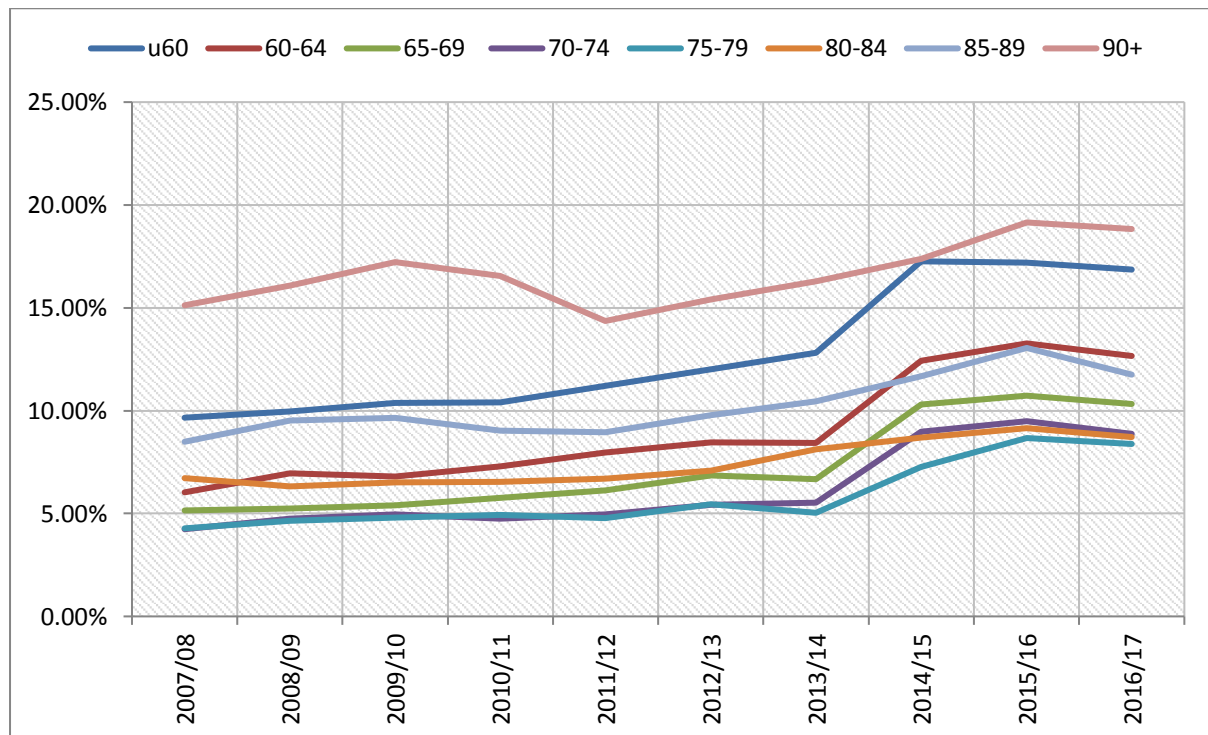
MH004

For this indicator, we have assessed the achievement by age groups via the proportion of patients who had a cholesterol:hdl ratio in the past 12 months. These results are summarised below in the table and graph. When the indicator was active, patients aged 65 to 69 years old had the consistently highest achievement in the indicator and this aged group experienced the largest drop in achievement once the indicator was no longer incentivised. The oldest patients had the lowest achievement when the indicator was being incentivised, and experienced large drops in performance when the incentive was removed.

Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2007/08	28.97%	33.23%	42.53%	49.71%	43.93%	45.98%	37.21%	50.00%
2008/09	32.04%	43.07%	43.65%	48.68%	47.71%	45.00%	53.49%	38.89%
2009/10	35.77%	41.93%	41.98%	47.67%	45.87%	44.14%	31.48%	39.13%
2010/11	35.47%	42.61%	51.23%	48.77%	42.28%	39.47%	38.18%	32.14%
2011/12	68.65%	70.51%	73.60%	72.81%	67.69%	62.50%	62.07%	53.57%
2012/13	57.84%	56.34%	66.32%	58.51%	62.59%	52.38%	37.93%	54.84%
2013/14	68.22%	70.89%	75.76%	70.56%	72.11%	68.07%	58.62%	41.67%
2014/15	49.77%	53.15%	52.01%	59.32%	52.38%	50.86%	38.24%	21.88%
2015/16	50.16%	53.29%	55.87%	50.78%	54.48%	52.14%	31.08%	36.67%
2016/17	50.34%	57.19%	51.16%	51.53%	62.25%	53.23%	37.50%	20.69%

THY002

Patients aged over 90 have the lowest indicator performance throughout the study period, followed by patients aged 85-89 years.

Year	u60	60-64	65-69	70-74	75-79	80-84	85-89	90+
2006/07	92.09%	93.92%	94.54%	95.49%	95.23%	93.70%	90.80%	85.56%
2007/08	92.53%	94.82%	93.99%	94.80%	94.17%	93.81%	91.52%	83.57%
2008/09	92.18%	93.64%	94.05%	94.55%	94.63%	92.81%	89.21%	85.71%
2009/10	91.58%	93.70%	94.67%	94.58%	94.29%	92.73%	89.54%	85.82%
2010/11	92.02%	93.81%	94.29%	95.22%	94.48%	93.48%	90.02%	84.47%
2011/12	91.86%	93.78%	94.59%	95.13%	94.74%	93.75%	91.68%	86.46%
2012/13	91.04%	94.15%	94.40%	93.95%	94.77%	92.60%	90.64%	85.86%
2013/14	89.07%	91.25%	91.42%	92.76%	93.09%	90.90%	89.44%	82.68%
2014/15	78.60%	80.94%	81.37%	81.19%	82.47%	79.42%	76.89%	70.60%
2015/16	78.67%	81.03%	80.79%	81.82%	81.24%	78.75%	76.54%	67.98%
2016/17	79.84%	84.10%	83.22%	82.95%	79.48%	80.66%	78.42%	69.16%
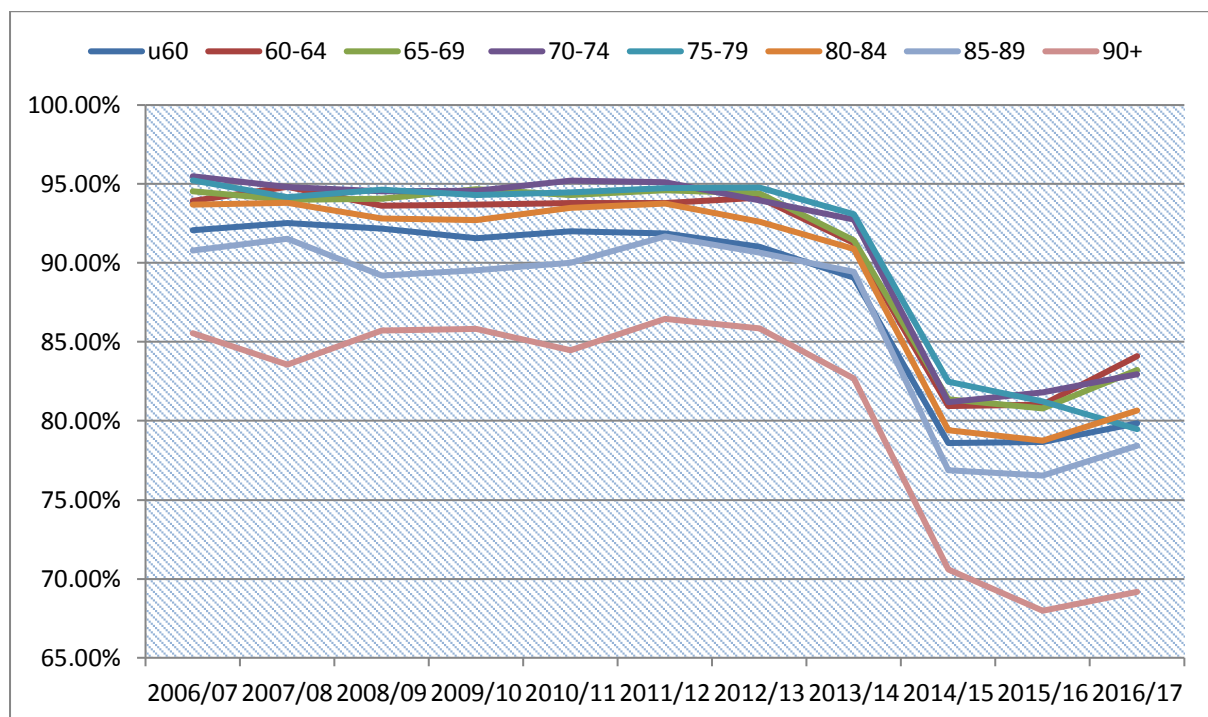
Indicator performance by comorbidity

Summary

Overall indicator performance is higher in patients who have at least one comorbidity that is jointly incentivised in the QOF, for example patients with hypertension and chronic Kidney disease. For coronary heart disease patients the patients with at least one comorbidity had a 10 p.p. higher indicator achievement than patients with no comorbidity. The removal of indicators affects patients with no comorbidity worse than patients with at least one. These findings are apparent across all indicators with jointly incentivised comorbidities.

CHD003

The percentage of patients with coronary heart disease whose last measured total cholesterol (measured in the preceding 15 months) is 5mmol/l or less (retired in 2014/5). As part of the QOF there are three other diseases that have the same cholesterol incentivised, these are:

- Stroke
- Peripheral Artery Disease
- Diabetes

The results are summarised below for indicator attainment for patients with at least one comorbidity and patients with no comorbidity. When the indicator was retired in 2014/15, the patients with a comorbidity had a 8.82% drop in indicator performance, compared to patients with no comorbidity who experienced a 14.94% drop in achievement. Throughout the whole sample the patients with a comorbidity had a higher achievement and had a smaller proportion of missing readings compared to patients with no comorbidity.

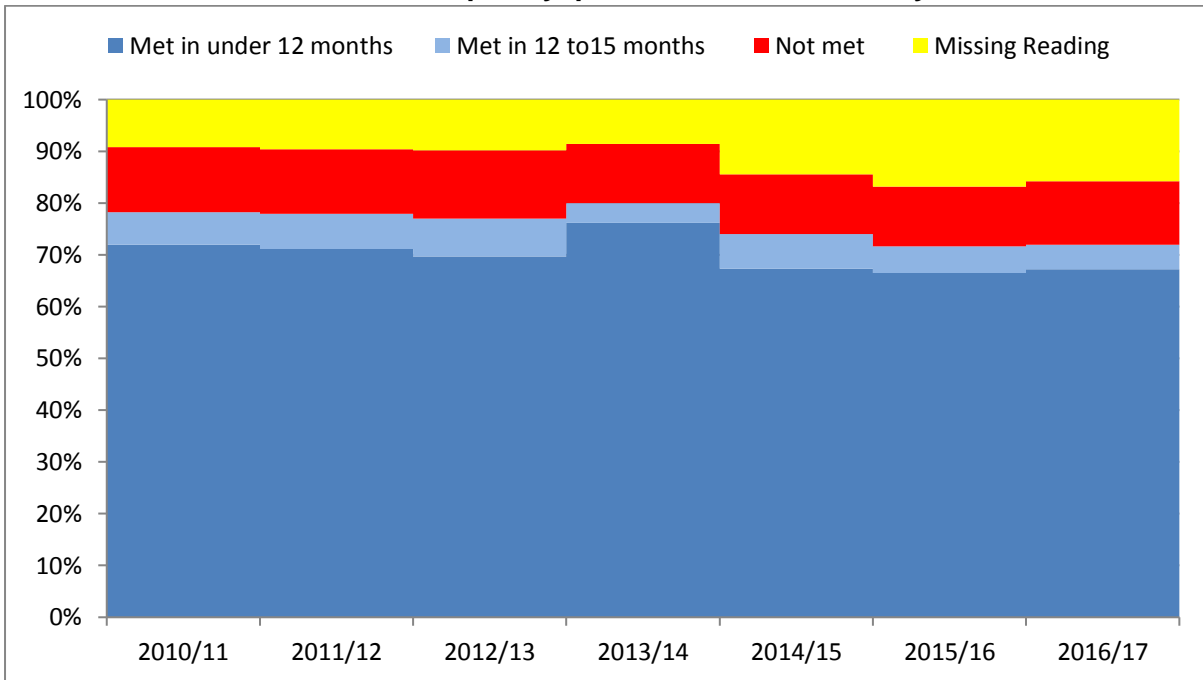**Measurement attainment and frequency, patients with comorbidity**

Year	Met in under 12 months	Met in 12 to 15 months	Actual Attainment	Not met	Missing Reading
2007/08	74.17%	5.59%	79.76%	12.55%	7.68%
2008/09	72.07%	6.50%	78.57%	12.67%	8.76%
2009/10	72.10%	6.44%	78.54%	12.63%	8.83%
2010/11	71.94%	6.31%	78.25%	12.53%	9.23%
2011/12	71.16%	6.81%	77.97%	12.47%	9.56%
2012/13	69.65%	7.35%	77.00%	13.19%	9.81%
2013/14	76.16%	3.79%	76.16%	11.52%	8.53%
2014/15	**67.34%**	**6.69%**	**67.34%**	**11.50%**	**14.47%**
2015/16	**66.50%**	**5.19%**	**66.50%**	**11.47%**	**16.83%**
2016/17	**67.23%**	**4.69%**	**67.23%**	**12.34%**	**15.74%**

Measurement attainment and frequency, patients with no comorbidity

Year	Met in under 12 months	Met in 12 to 15 months	Actual Attainment	Not met	Missing Reading
2007/08	64.89%	6.46%	71.35%	15.90%	12.76%
2008/09	63.51%	6.40%	69.91%	16.10%	13.99%
2009/10	63.05%	6.80%	69.85%	15.85%	14.30%

2010/11	62.12%	7.03%	69.15%	15.56%	15.30%
2011/12	59.24%	7.70%	66.94%	15.65%	17.41%
2012/13	58.75%	7.38%	66.13%	15.32%	18.55%
2013/14	66.77%	3.88%	66.77%	14.25%	15.10%
2014/15	**51.83%**	**9.31%**	**51.83%**	**13.86%**	**25.00%**
2015/16	**51.40%**	**6.08%**	**51.40%**	**12.46%**	**30.06%**
2016/17	**51.01%**	**5.99%**	**51.01%**	**13.29%**	**29.70%**

Measurement attainment and frequency, patients with comorbidity

Measurement attainment and frequency, patients with no comorbidity
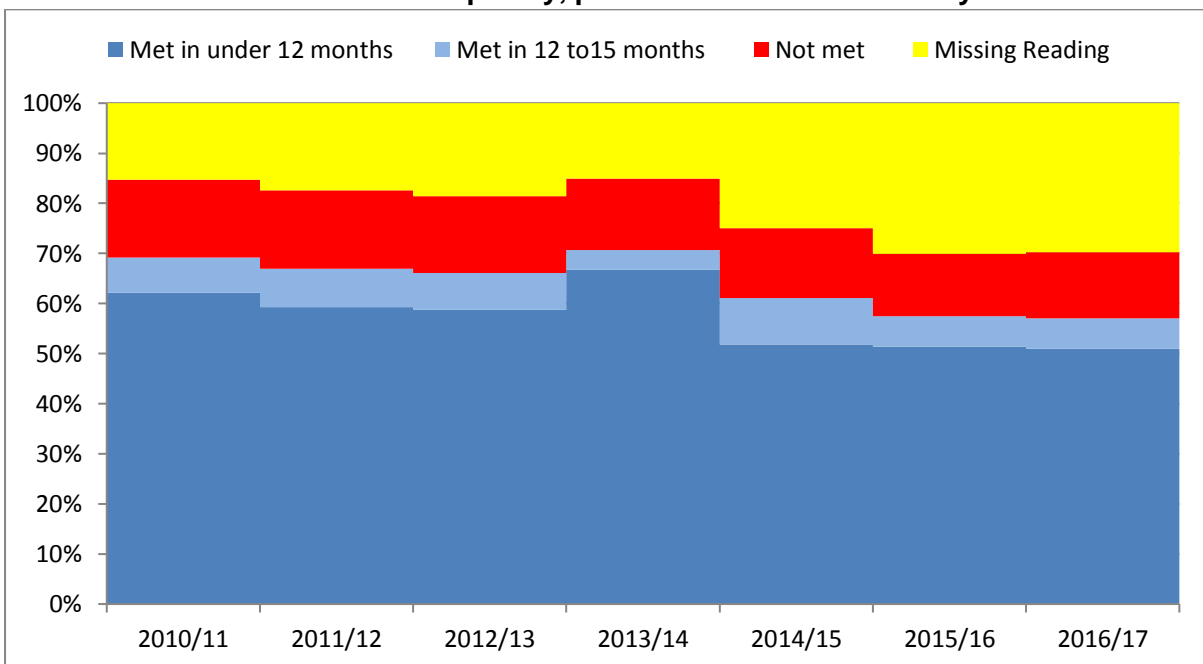
CKD002

As part of the QOF, there are five other diseases that have blood pressure management incentivised offering a range of different points and thresholds. Patients with a comorbidity that had blood pressure incentives are expected to have better indicator performance since there is an incentive for general practices to meet another indicator alongside CKD, they are likely to be called to more clinics and the patient and GP may view the CKD as a more serious issue.

The patient registers for the following conditions were extracted from CPRD and patients with CKD were classified by whether or not they appeared on one of the other disease registers in that year. The following comorbidities were included:
- Chronic Heart Disease – with 150/90 mm/Hg target
- Stroke – with 150/90 mm/Hg target
- Diabetes- – with 150/90 mm/Hg target & further target of 140/80 mm/Hg
- Hypertension – with 150/90 mm/Hg target & further target in 2014/14 of 140/90mmHg for under 80s
- Peripheral Artery Disease – with 150/90 mm/Hg target.

The results are summarised in tables and graphs below. Patients with at least one comorbidity have higher achievement rate of the indicator throughout the sample period. Post indicator removal patients with no comorbidity experience a 9.55% drop in performance, compared to patients with comorbidity experience a 4.44% drop in achievement. Furthermore patients with no comorbidities have a higher proportion of missed blood pressure readings throughout the whole study period, compared to patients with at least one comorbidity.
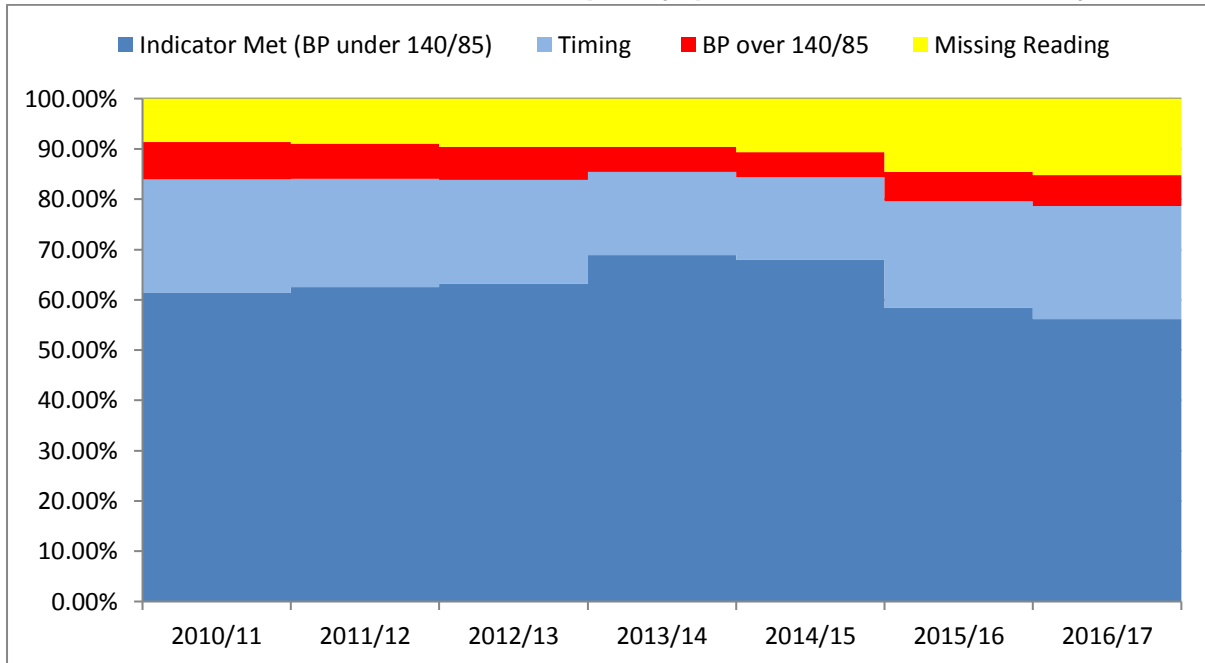
Measurement attainment and frequency, patients with comorbidity

Year	Indicator Met (BP under 140/85)	Timing	Actual Attainment	BP over 140/85	Missing Reading
2007/08	63.24%	22.97%	86.21%	6.60%	7.18%
2008/09	65.01%	21.94%	86.95%	6.48%	6.57%
2009/10	66.18%	22.27%	88.45%	5.90%	5.66%
2010/11	67.94%	21.32%	89.26%	5.26%	5.48%
2011/12	69.08%	20.27%	89.35%	5.16%	5.49%
2012/13	69.50%	19.07%	88.57%	4.90%	6.53%
2013/14	76.59%	14.37%	76.59%	3.55%	5.49%
2014/15	74.70%	15.06%	74.70%	3.58%	6.66%
2015/16	70.26%	17.87%	70.26%	4.09%	7.78%
2016/17	71.13%	18.83%	71.13%	3.81%	6.22%

Measurement attainment and frequency, patients with no comorbidity

Year	Indicator Met (BP under 140/85)	Timing	Actual Attainment	BP over 140/85	Missing Reading
2007/08	55.48%	24.03%	79.51%	9.60%	10.89%
2008/09	57.82%	23.82%	81.64%	8.03%	10.33%
2009/10	59.08%	23.13%	82.21%	8.59%	9.20%
2010/11	61.34%	22.64%	83.98%	7.43%	8.59%
2011/12	62.51%	21.55%	84.06%	7.01%	8.93%
2012/13	63.20%	20.63%	83.83%	6.61%	9.56%
2013/14	68.91%	16.52%	68.91%	4.95%	9.63%
2014/15	67.90%	16.45%	67.90%	5.02%	10.63%
2015/16	58.35%	21.21%	58.35%	5.87%	14.57%
2016/17	56.18%	22.47%	56.18%	6.20%	15.15%

Measurement attainment and frequency, patients with comorbidity

Measurement attainment and frequency, patients with no comorbidity

Legend: Indicator Met (BP under 140/85) ■ Timing ■ BP over 140/85 ■ Missing Reading

X-axis: 2010/11, 2011/12, 2012/13, 2013/14, 2014/15, 2015/16, 2016/17

Y-axis: 0.00% to 100.00%
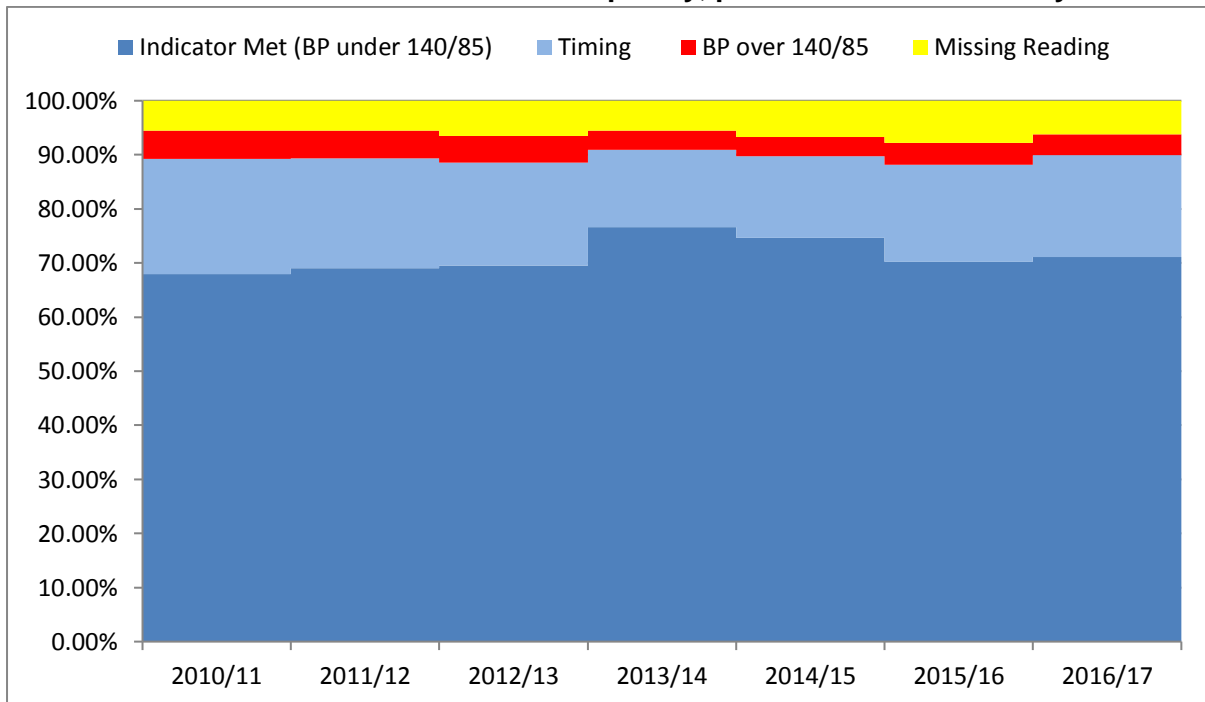
HYP002

As part of the QOF, there are five other diseases that have blood pressure management incentivised offering a range of different points and thresholds. Patients with a comorbidity that had blood pressure incentives are expected to have better indicator performance since there is an incentive for general practices to meet another indicator alongside hypertension, they are likely to be called to more clinics and the patient and GP may view the hypertension as a more serious issue.

The patient registers for the following conditions were extracted from CPRD and patients with hypertension were classified by whether or not they appeared on one of the other disease registers in that year. The following comorbidities were included:
- Chronic Heart Disease – with 150/90 mm/Hg target
- Stroke – with 150/90 mm/Hg target
- Diabetes- – with 150/90 mm/Hg target & further target of 140/80 mm/Hg
- Chronic Kidney Disease – with 140/85 mm/Hg target
- Peripheral Artery Disease – with 150/90 mm/Hg target.

The results are shown in tables and graphs below. Patients who have at least one comorbidity have a higher achievement level of the HYP003 indicator. The level is consistently 10% higher than those with no comorbidity. These results suggest patients have better general practice treatment when they have another condition that incentivised by the QOF. The results are notable when the indicator is retired for patients with no comorbidity, which results in 13.7% drop in blood pressure readings of 140/90 or below in the last 9 months. Comparing these results with at least one comorbidity there was only 7.82% decrease in patients meeting HYP003 indicator.

The results suggest that, in the absence of incentives, quality of care drops for both groups of patients, but more for patients who do not have a comorbidity that is incentivised by the QOF. Also after the HYP003 indicator is removed, there is an increase in missed blood pressure readings for patients with no comorbidities, which increases by 4.84% the following financial year.
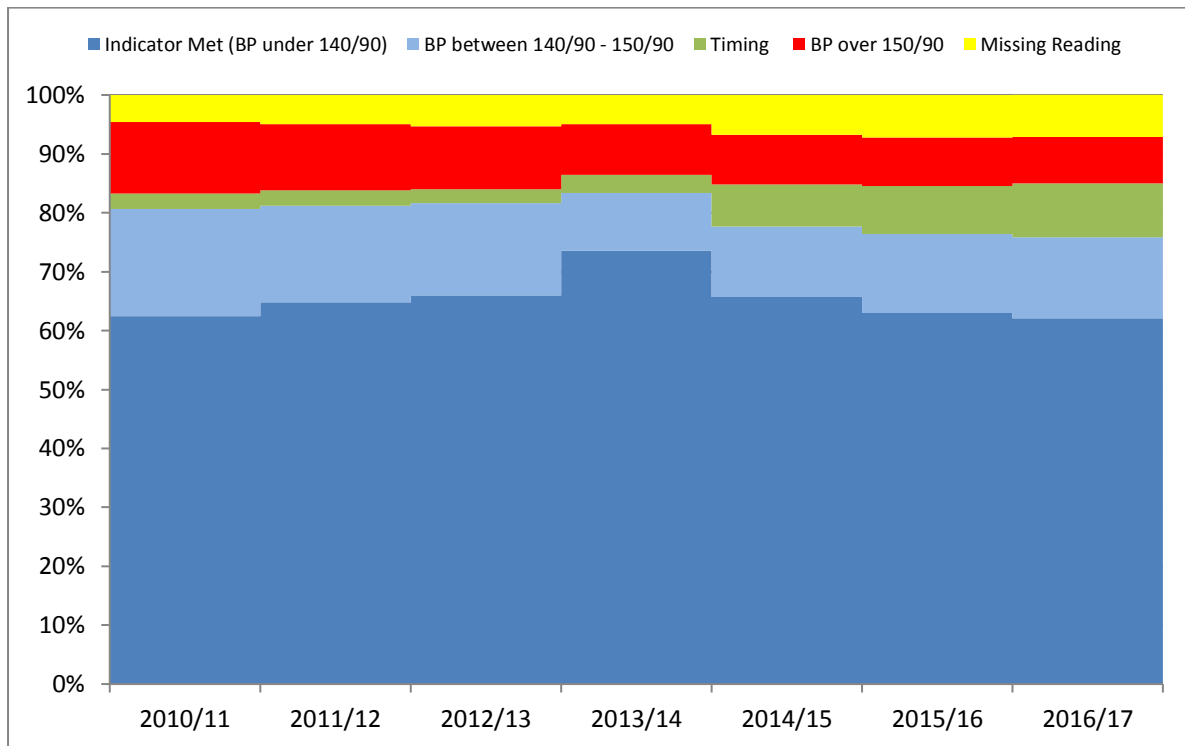
Measurement attainment and frequency, patients aged ≤ 79 years with comorbidity

Year	Met stricter level target	Met looser level target	Missed stricter timing target	HYP002 Indicator Met	Missed looser level target	No measurement
2007/08	60.55%	18.91%	2.18%	79.46%	14.47%	3.89%
2008/09	61.32%	18.25%	2.42%	79.57%	13.61%	4.40%
2009/10	61.32%	18.44%	2.55%	79.76%	13.23%	4.46%
2010/11	62.44%	18.25%	2.61%	80.69%	12.14%	4.55%
2011/12	64.83%	16.34%	2.62%	81.17%	11.29%	4.92%
2012/13	65.95%	15.67%	2.41%	81.62%	10.64%	5.33%
2013/14	73.58%	9.75%	3.11%	83.33%	8.59%	4.97%
2014/15	65.76%	11.91%	7.14%	84.80%	8.48%	6.72%
2015/16	62.97%	13.47%	8.07%	84.51%	8.29%	7.19%
2016/17	62.08%	13.78%	9.13%	84.98%	7.86%	7.16%

Measurement attainment and frequency, patients aged ≤ 79 years, no comorbidity

Year	Met stricter level target	Met looser level target	Missed stricter timing target	HYP002 Indicator Met	Missed looser level target	No measurement
2007/08	49.98%	22.47%	2.03%	72.45%	17.43%	8.10%
2008/09	50.46%	21.83%	2.41%	72.29%	16.79%	8.52%
2009/10	50.87%	21.75%	2.56%	72.62%	16.08%	8.73%
2010/11	51.89%	22.02%	2.45%	73.91%	14.78%	8.86%
2011/12	53.14%	21.13%	2.35%	74.27%	14.10%	9.29%
2012/13	53.88%	20.88%	2.43%	74.76%	12.80%	10.01%
2013/14	64.33%	11.36%	2.98%	75.69%	10.94%	10.39%
2014/15	50.62%	16.48%	7.15%	74.25%	10.51%	15.24%
2015/16	48.90%	17.43%	7.83%	74.16%	10.18%	15.66%
2016/17	48.68%	17.89%	8.34%	74.91%	10.25%	14.84%

Measurement attainment and frequency, patients aged ≤ 79 years with comorbidity

Measurement attainment and frequency, patients aged ≤ 79 years, no comorbidity
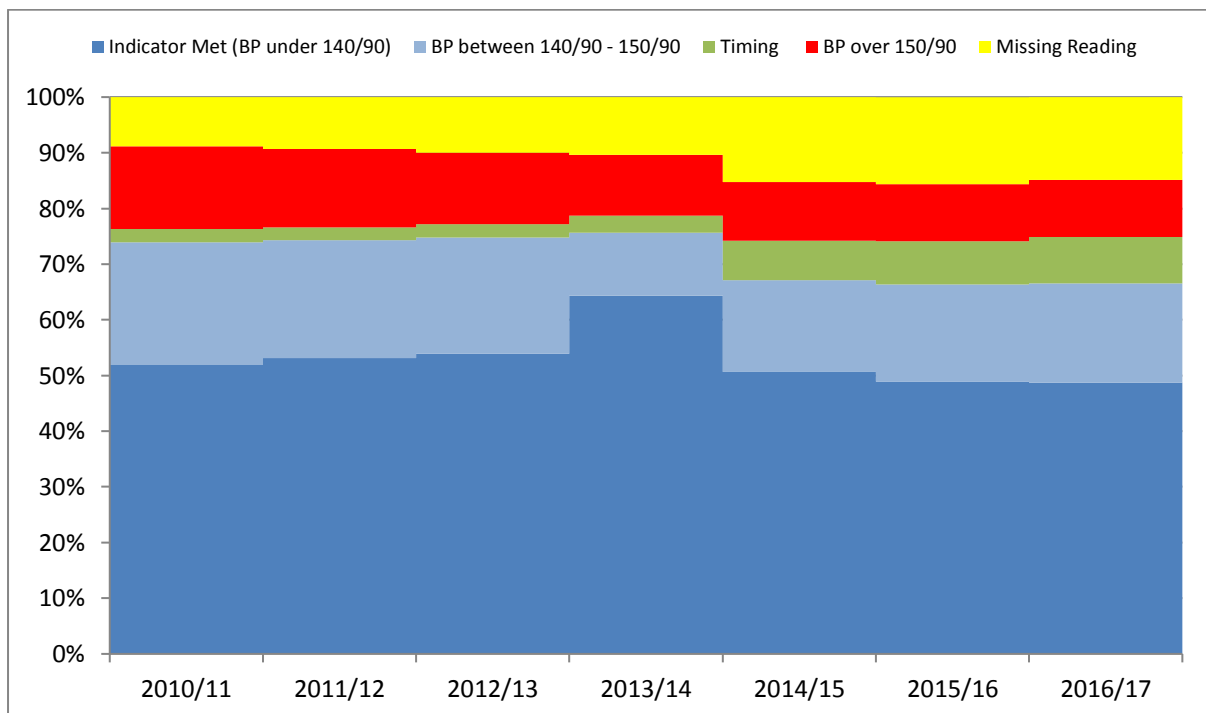
Indicator performance by level of area deprivation

The Index of Multiple Deprivation (IMD) is a composite measure designed to assess the relative levels of deprivation at small geographical areas. The IMD is reported at Lower-layer Super Output Areas (LSOAs), which have an average population of around 1,500 people or 650 households. Information on income deprivation, employment deprivation, education, skills & training deprivation, crime, barriers to housing and services, and living environment deprivation is obtained for each LSOA and combined using a weighted sum into the overall IMD score. Each of the 32,844 LSOAs are then ranked from most deprived (rank of 1) to least deprived (rank of 32,844).

In this analysis, we use information from 2015 (IMD2015). To maintain anonymity, LSOAs were classified into IMD quintiles, where the first quintile is the least deprived, and the fifth quintile is the most deprived. We use patient-level IMD; that is the IMD rank of the LSOA a patient lives in not the IMD rank of the LSOA in which their practice is located. It is important to note, however, that not all patients have an IMD score due to inclusion criteria.

For this analysis we have focused on indicator performance and how this varies across quintiles of deprivation.

Summary

Overall patients' deprivation level has no meaningful effect on indicator performance or removal, with no particular level having substantially higher performance than another. The only indicator that exhibited an effect of deprivation on performance was HYP002, where the least deprived areas performed better than the most deprived, however there was only around 2.5 p.p. difference in achievement.

CHD003

Pre-indicator removal, patients living in the least deprived areas had higher achievement in indicator performance, meaning that they had lower cholesterol readings compared to patients living the most deprived areas. Once the indicator was withdrawn, this trend continues with the patients living in the most deprived areas continuing to have the worst indicator outcomes.

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2007/08	74.73%	73.90%	73.76%	75.52%	71.71%
2008/09	73.67%	72.93%	72.95%	73.28%	70.65%
2009/10	74.15%	73.32%	72.72%	72.49%	70.64%
2010/11	73.37%	72.96%	72.37%	71.82%	69.44%
2011/12	72.70%	71.38%	69.84%	70.78%	67.71%
2012/13	71.77%	70.99%	69.20%	69.35%	68.64%
2013/14	72.11%	72.15%	69.42%	69.78%	66.67%
2014/15	59.10%	58.27%	57.68%	55.71%	56.24%
2015/16	59.18%	58.64%	56.58%	55.15%	54.47%
2016/17	57.98%	58.42%	57.15%	55.67%	55.39%
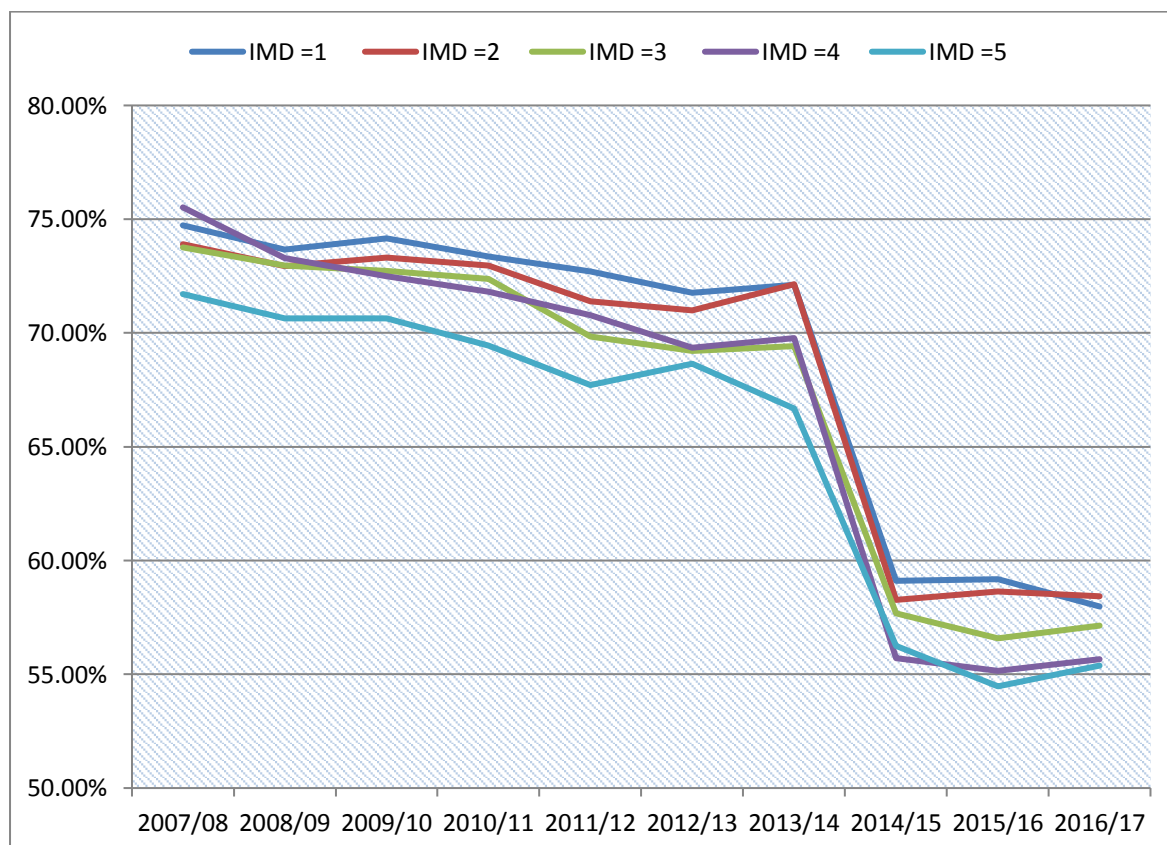
CKD002

For Chronic Kidney Disease, the patients most adversely affected by the indicator being withdrawn are those living the least deprived areas with a 9.08 p.p. drop in indicator performance. The magnitude of effect is smallest in patients whose IMD score is in the third quintile who experience a 5.94 p.p. drop in indicator performance post removal.

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2007/08	60.40%	59.27%	60.09%	57.96%	60.15%
2008/09	62.12%	61.16%	62.38%	60.92%	62.15%
2009/10	64.66%	61.75%	61.29%	63.19%	62.36%
2010/11	65.93%	65.71%	64.43%	65.92%	64.76%
2011/12	67.01%	66.16%	64.63%	67.41%	65.11%
2012/13	66.90%	66.44%	65.57%	65.60%	67.08%
2013/14	71.60%	69.31%	69.98%	69.39%	68.58%
2014/15	69.21%	67.69%	68.11%	68.23%	66.42%
2015/16	60.13%	59.87%	62.17%	61.73%	59.59%
2016/17	60.59%	60.09%	62.37%	62.66%	61.31%
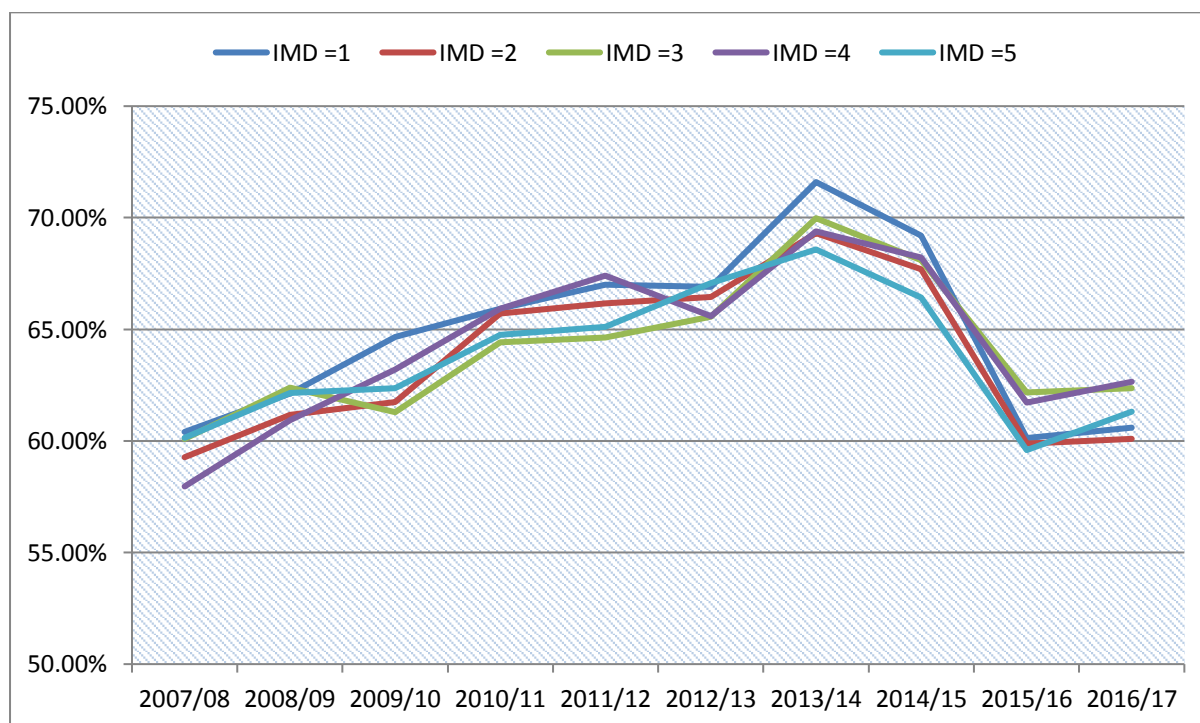
HYP002

Among patients diagnosed with hypertension, there was an increasing trend in the proportion of patients achieving blood pressure below 150/90 mmHg. The patients who live in the least deprived area (IMD=1) have the highest indicator performance whereas patients living in the most deprived areas experience the worst indicator performance, with slight improvements in indicator performance in the final year (2016/17).

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2007/08	74.41%	73.10%	72.66%	71.90%	72.89%
2008/09	74.96%	73.30%	73.39%	72.83%	72.25%
2009/10	75.09%	73.08%	73.40%	73.33%	72.36%
2010/11	75.94%	74.99%	75.07%	74.88%	73.65%
2011/12	77.38%	75.69%	75.16%	75.08%	73.91%
2012/13	77.51%	75.87%	75.66%	75.39%	74.91%
2013/14	79.15%	76.61%	76.30%	76.00%	75.04%
2014/15	80.18%	78.35%	77.99%	77.57%	75.73%
2015/16	80.27%	77.98%	78.08%	77.75%	76.44%
2016/17	80.44%	78.24%	78.66%	78.75%	77.97%
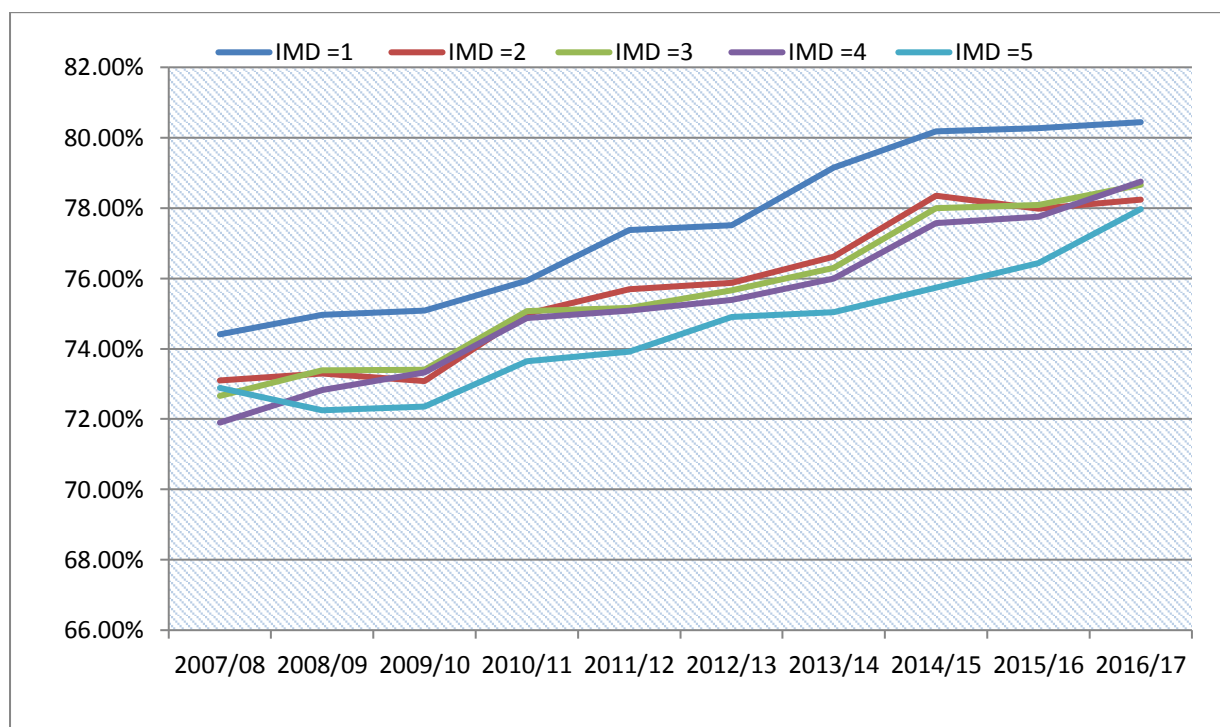
HYP003

The introduction of this indicator had the greatest impact on patients in the least deprived areas, with a 10.19 p.p. increase in patients achieving blood pressure below 140/90mmHg.The smallest increase was experienced by those patients living in the most deprived areas. However once this indicator was removed the drop in indicator achievement was highest in least deprived areas, with a 11.87 p.p. decrease in indicator achievement. For all quintiles, the introduction and removal of the indicator led to worse indicator performance as levels of achievement were consistently lower in 2014/15 compared to 2012/13.

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2007/08	53.94%	52.18%	53.33%	52.71%	55.77%
2008/09	55.36%	53.13%	54.95%	54.24%	55.28%
2009/10	56.13%	52.75%	54.68%	55.76%	54.48%
2010/11	56.53%	54.80%	55.93%	56.88%	55.53%
2011/12	58.85%	55.94%	57.25%	57.93%	57.10%
2012/13	59.45%	57.23%	58.04%	58.07%	57.98%
2013/14	**69.64%**	**66.94%**	**66.61%**	**66.60%**	**66.13%**
2014/15	57.77%	55.81%	56.27%	56.77%	54.39%
2015/16	55.90%	53.79%	54.17%	54.43%	54.47%
2016/17	56.24%	52.24%	53.53%	53.78%	54.12%
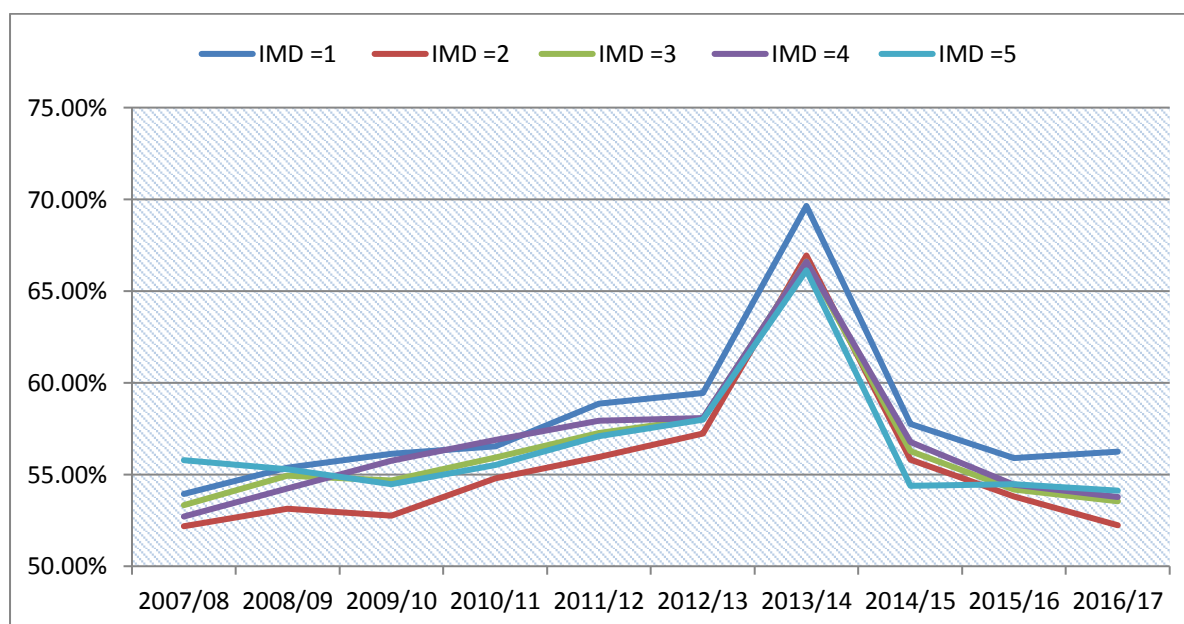
MH004

The graphs here show similar trends and achievement across all deprivation levels. No particular level of deprivation has a notably higher indicator performance and the levels vary year on year.

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2007/08	37.39%	45.45%	44.24%	41.16%	38.82%
2008/09	39.89%	48.67%	46.44%	42.78%	45.68%
2009/10	38.13%	49.30%	49.59%	49.62%	46.95%
2010/11	41.13%	49.32%	46.81%	50.12%	52.25%
2011/12	76.03%	76.23%	75.33%	77.83%	76.08%
2012/13	73.88%	74.26%	70.89%	74.88%	77.08%
2013/14	73.11%	72.63%	67.42%	67.76%	68.57%
2014/15	52.26%	57.38%	51.79%	53.16%	50.30%
2015/16	55.22%	54.82%	50.00%	50.83%	52.72%
2016/17	53.23%	56.36%	51.26%	52.76%	49.46%
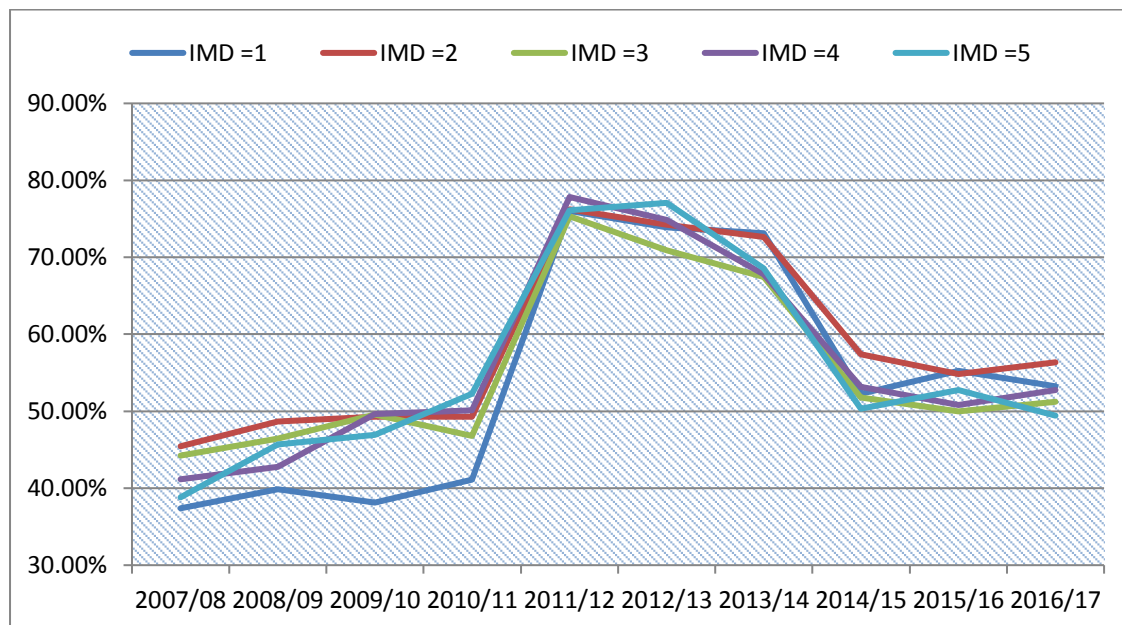
THY002

There are small differences in indicator performance by level of deprivation. When the indicator is removed, patients in the least deprived areas have higher levels of achievement compared to other deprivation levels.

Year	IMD =1	IMD =2	IMD =3	IMD =4	IMD =5
2006/07	93.98%	94.11%	94.55%	93.13%	93.08%
2007/08	94.07%	93.89%	94.37%	93.63%	93.61%
2008/09	93.16%	93.21%	94.22%	93.38%	93.14%
2009/10	92.93%	93.85%	93.59%	92.57%	92.89%
2010/11	93.96%	94.00%	93.97%	92.97%	92.78%
2011/12	94.80%	94.37%	92.79%	93.10%	93.14%
2012/13	94.12%	92.95%	93.02%	91.91%	92.70%
2013/14	91.74%	91.50%	89.98%	90.54%	89.38%
2014/15	80.68%	81.06%	82.07%	80.45%	78.50%
2015/16	83.19%	79.90%	78.85%	80.35%	77.09%
2016/17	83.23%	81.05%	81.74%	80.36%	79.20%
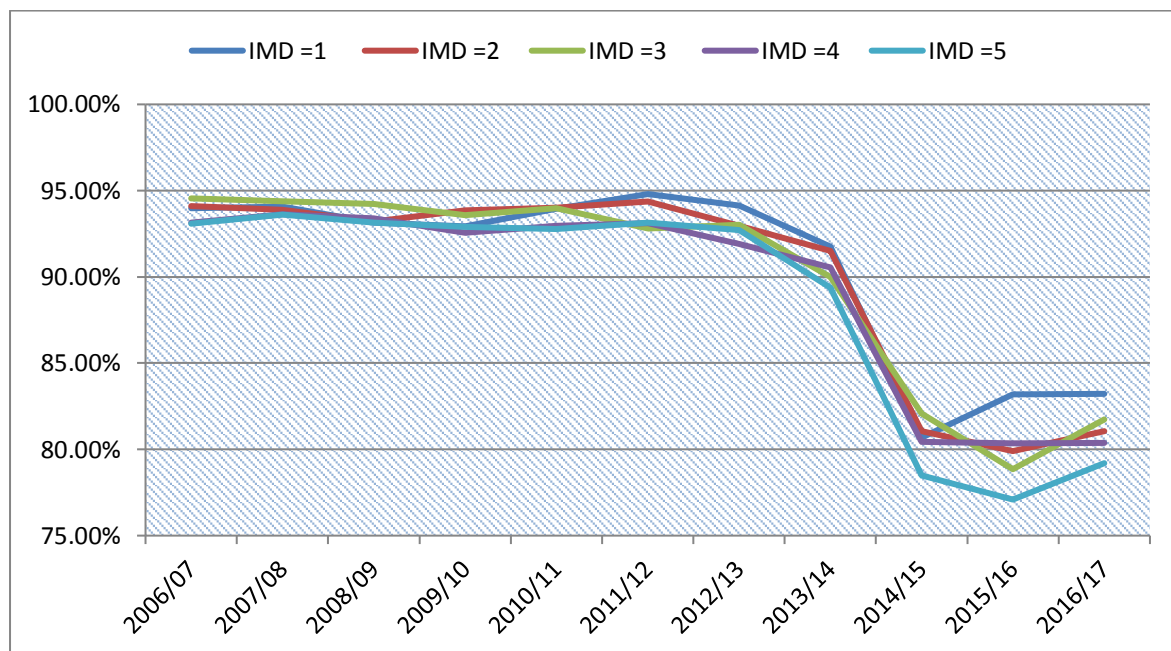
Indicator performance by Electronic Frailty Index (eFI)

The eFI is a predictive measure that aids clinicians in identifying older patients who are most at risk of falls and associated adverse outcomes (Clegg et al, 2016). The score is a cumulative total of the number of 'deficits' that a patient has. These deficits are identified in the CPRD through Read codes, and a higher eFI score indicates patients are "more frail". In total there are 36 possible deficits, but here we have excluded the deficit relating to polypharmacy[3] due to the complexities of deriving this deficit from the CPRD. We further excluded the clinical tests used to decide some of the deficits due to complexity and poor reporting of tests in the CPRD; however other diagnosis read codes still cover the deficits.

Once the cumulative score is calculated for each patient, we divide by total number of deficits, to determine frailty in the following categories:

- Fit: eFI score in the range 0 to 0.12;
- Mild Frailty: eFI score in the range 0.13 to 0.24;
- Moderate Frailty: eFI score in the range 0.25 to 0.36;
- Severe Frailty: eFI score above 0.36.

See the appendix for the complete list of deficits used when calculating the eFI from the CPRD data.

We used the above classifications to analyse indicator performance and missed readings to examine notable differences between the different levels of frailty.

Summary

For indicators that aim to control blood pressure, the patients with the lowest eFI score who are classified as "fit" perform worse in the indicators. Furthermore this patient group are more negatively affected by the removal of the indicator and have the highest percentage of missed readings. For CHD003, patients with severe frailty have the lowest indicator performance, with also the highest proportion of missed cholesterol readings.

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[3] Patients being prescribed more than five different drug therapies in a year

CHD003

Patients with mild frailty had consistently higher indicator performance pre and post indicator removal compared to 'fit' patients. This could be potentially due to comorbidities associated with other chronic conditions in QOF incentives; this assumption is supported in the proportion of missed cholesterol readings. The patients classified as fit had higher proportion of missed readings compared to those with mild frailty throughout the study period, which could explain this higher indicator performance. Furthermore, patients with severe frailty have the lowest indicator performance, with also the highest proportion of missed cholesterol readings.

CHD003 indicator performance

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	73.32%	75.78%	73.48%	72.48%
2008/09	72.47%	74.38%	72.37%	68.25%
2009/10	72.33%	74.48%	72.01%	70.21%
2010/11	72.06%	73.73%	71.52%	69.82%
2011/12	70.77%	72.48%	69.83%	67.90%
2012/13	70.10%	71.44%	69.60%	66.29%
2013/14	70.15%	72.26%	69.65%	64.04%
2014/15	58.02%	58.22%	58.30%	54.55%
2015/16	57.17%	58.23%	57.29%	54.67%
2016/17	58.00%	58.89%	56.24%	53.84%
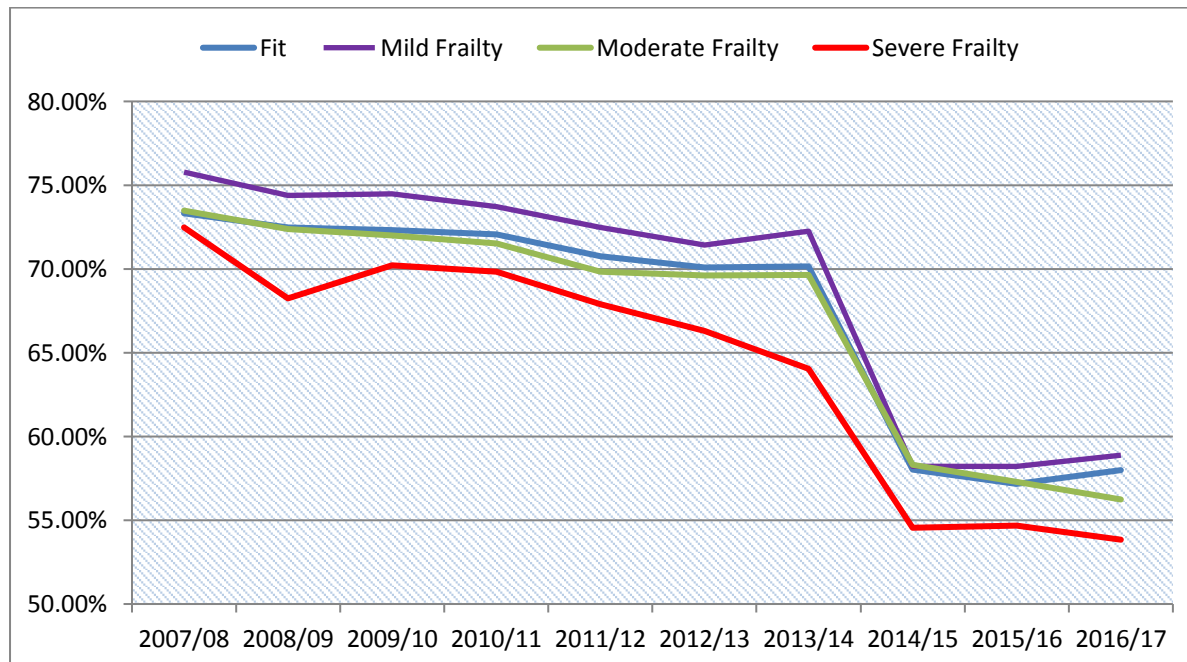
Missed Cholesterol Readings

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	12.67%	9.46%	10.44%	11.79%
2008/09	13.43%	10.56%	11.85%	16.00%
2009/10	13.74%	10.38%	12.68%	15.97%
2010/11	13.81%	11.83%	13.14%	16.76%
2011/12	15.61%	12.71%	14.78%	18.43%
2012/13	16.49%	13.59%	15.22%	18.86%
2013/14	13.62%	10.74%	12.90%	16.75%
2014/15	21.26%	20.69%	20.09%	22.73%
2015/16	25.46%	23.69%	25.17%	26.76%
2016/17	23.55%	23.22%	24.43%	28.27%
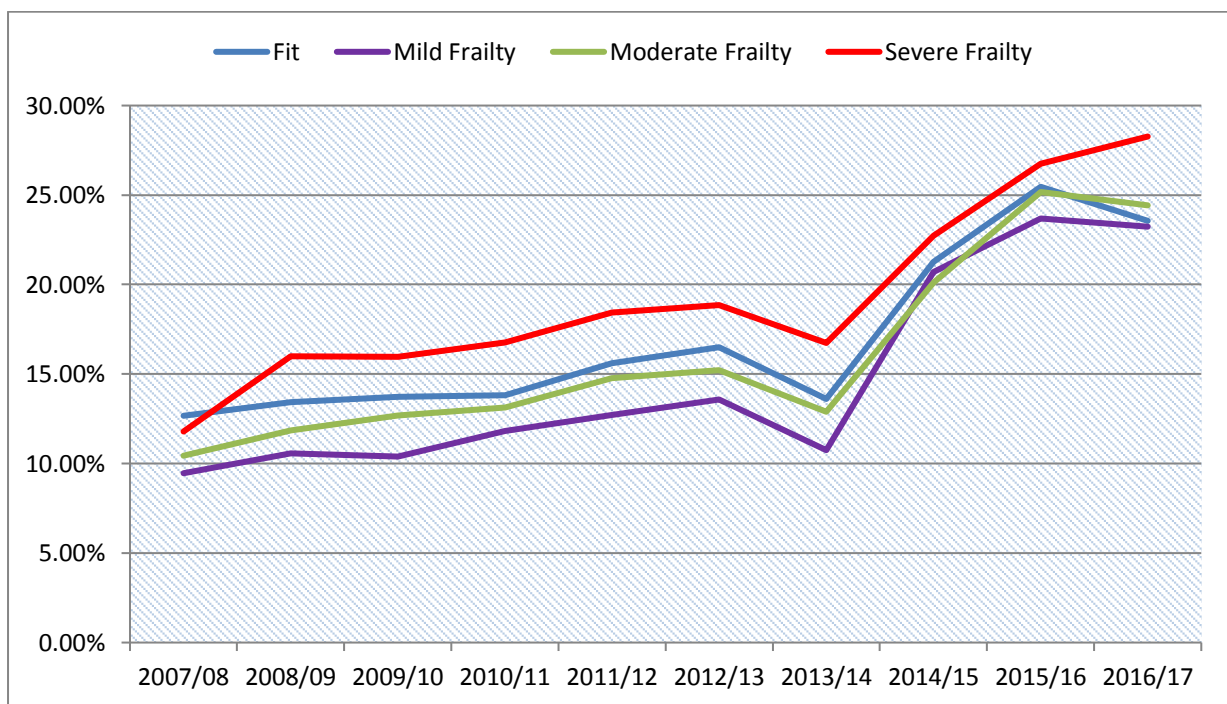
CKD002

For patients with Chronic Kidney Disease, the proportion of patients achieving the CKD002 indicator is highest amongst those with severe frailty up until 2013/14, when those with mild or moderate frailty reach higher indicator performance. The patients who are deemed as "fit" have the worst indicator performance and appear to be worst affected by the indicator removal with a 11.85 p.p. drop in achievement. Furthermore this patient group has the highest proportion of missed blood pressure readings, with this proportion rising further post-indicator removal to 18.03% of patients. This could be due to fit patients not having comorbidities that are incentivised in the QOF.

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	56.58%	60.40%	63.79%	65.09%
2008/09	57.65%	62.36%	66.21%	67.13%
2009/10	59.06%	63.55%	66.24%	68.79%
2010/11	62.01%	65.07%	67.82%	69.21%
2011/12	61.80%	67.01%	68.97%	69.43%
2012/13	62.89%	67.01%	68.97%	71.75%
2013/14	64.93%	72.74%	73.10%	70.58%
2014/15	64.91%	69.41%	71.25%	69.92%
2015/16	53.06%	61.70%	65.25%	66.41%
2016/17	53.21%	62.22%	66.93%	65.62%
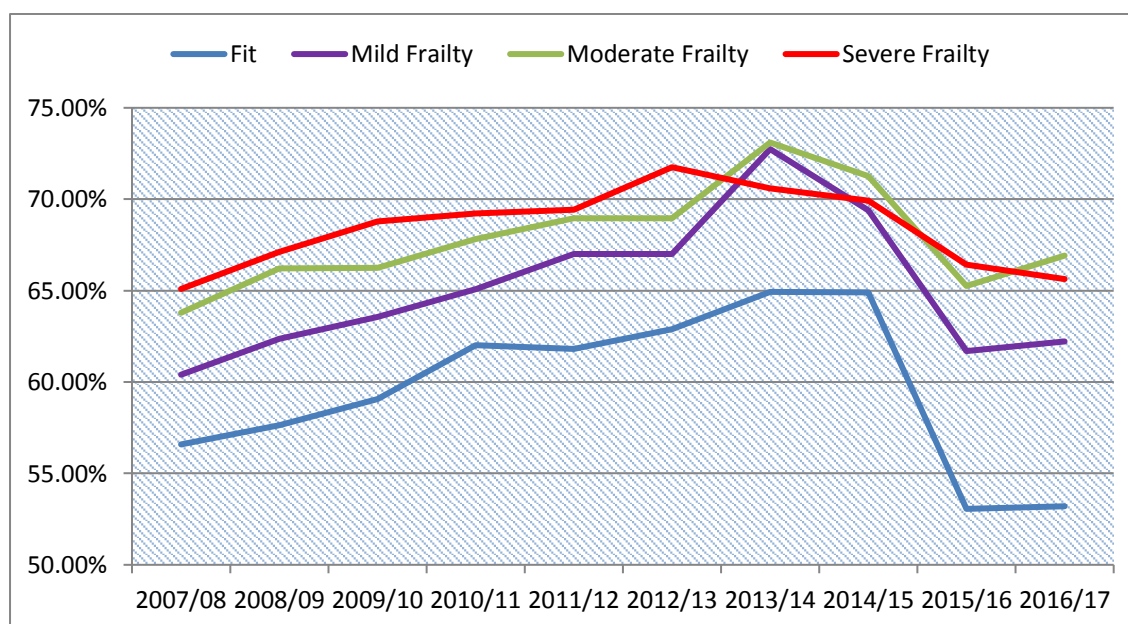
Missed blood pressure readings

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	12.02%	7.79%	6.44%	4.46%
2008/09	11.50%	7.09%	6.18%	5.56%
2009/10	10.28%	6.27%	5.41%	5.16%
2010/11	9.45%	6.11%	5.30%	5.58%
2011/12	10.44%	6.24%	4.83%	5.39%
2012/13	10.99%	7.07%	6.49%	5.80%
2013/14	11.58%	6.08%	5.38%	6.07%
2014/15	12.44%	7.78%	6.17%	6.58%
2015/16	16.74%	10.01%	7.76%	7.29%
2016/17	18.03%	9.00%	6.67%	6.19%
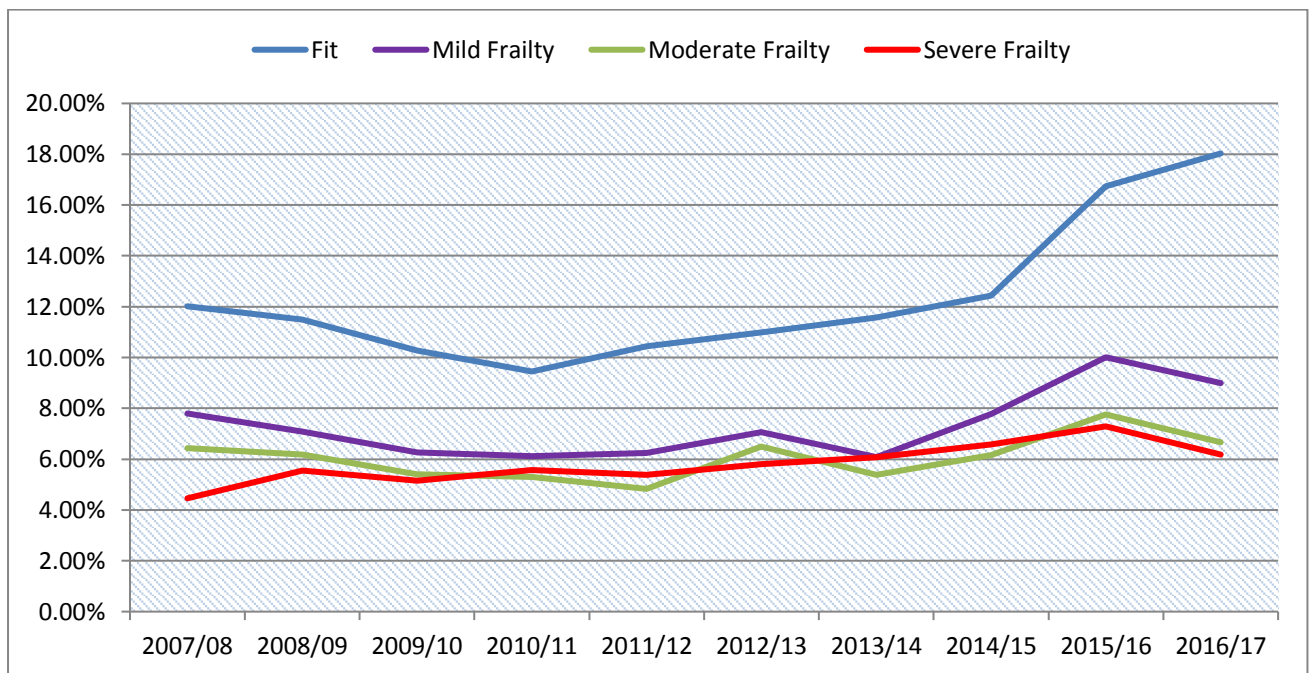
HYP002

For this indicator, which is still active, there is an overall increasing trend in patients achieving blood pressure below 150/90mmHg. Patients classified with mild or moderate frailty have the highest proportion of achievement in the indicator. There is a notable jump in indicator performance for patients with severe frailty in 2014/15. The patients classified as fit have the worst indicator achievement, and they have a 4.12p.p. increase in missed blood pressure readings between 2013/14 and 2014/15.

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	72.37%	76.17%	74.98%	72.59%
2008/09	72.33%	76.46%	76.04%	73.43%
2009/10	72.34%	77.27%	76.07%	75.36%
2010/11	73.72%	77.98%	77.18%	74.95%
2011/12	73.89%	79.08%	77.33%	75.37%
2012/13	74.48%	79.06%	78.06%	75.37%
2013/14	75.01%	80.90%	79.31%	75.42%
2014/15	75.10%	82.10%	83.02%	81.41%
2015/16	74.73%	82.12%	82.22%	79.98%
2016/17	75.31%	82.66%	83.59%	80.64%
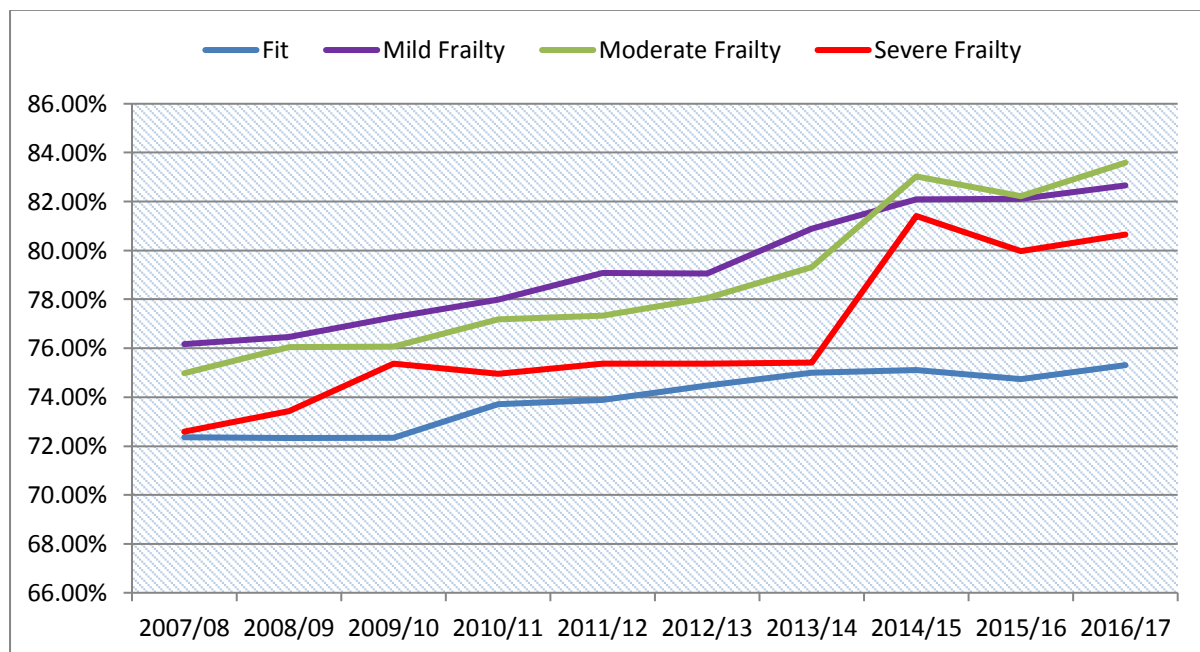
Missed blood pressure readings

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	7.72%	5.22%	6.42%	7.89%
2008/09	8.19%	5.71%	6.50%	8.36%
2009/10	8.57%	5.71%	6.82%	8.26%
2010/11	8.51%	6.06%	6.85%	8.45%
2011/12	9.35%	5.62%	6.78%	8.27%
2012/13	9.84%	6.55%	7.21%	9.89%
2013/14	10.56%	6.45%	7.30%	9.75%
2014/15	14.68%	8.90%	8.33%	9.51%
2015/16	15.31%	9.29%	9.15%	11.27%
2016/17	14.72%	9.00%	8.61%	10.74%
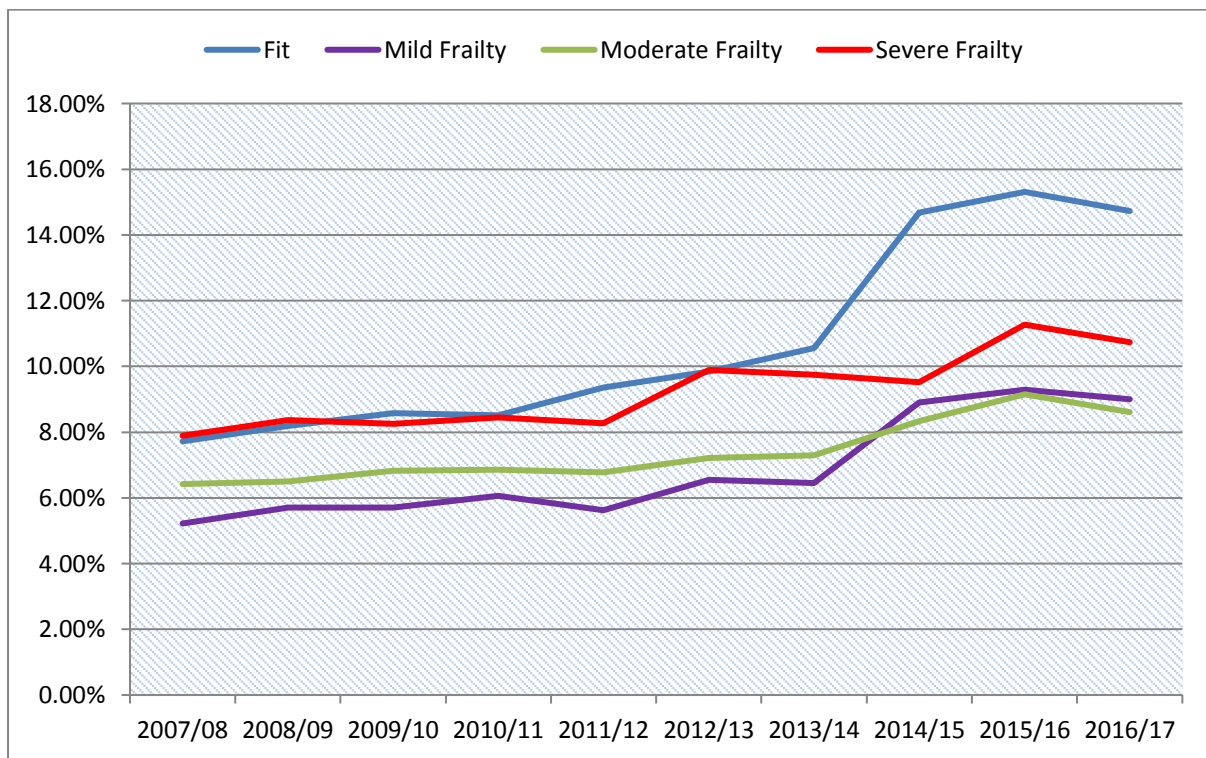
HYP003

When the indicator was active in 2013/14, the patients classified with moderate frailty had the highest indicator achievement, with 74.76% of patients achieving blood pressure below 140/90mmHg. Comparing 2012/13 and 2014/15, the introduction and removal of the indicator led to a lower achievement of blood pressure below 140/90mmHg, implying that this incentive did not have a lasting effect.

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	51.99%	57.99%	60.54%	63.08%
2008/09	52.30%	59.22%	62.11%	64.17%
2009/10	52.41%	59.30%	62.55%	64.28%
2010/11	53.66%	59.97%	62.90%	63.44%
2011/12	54.95%	62.03%	64.84%	67.47%
2012/13	55.49%	62.91%	66.46%	67.72%
2013/14	64.81%	72.79%	74.76%	72.22%
2014/15	52.24%	62.46%	66.31%	66.86%
2015/16	50.62%	59.50%	63.32%	61.33%
2016/17	50.00%	58.28%	64.58%	62.99%
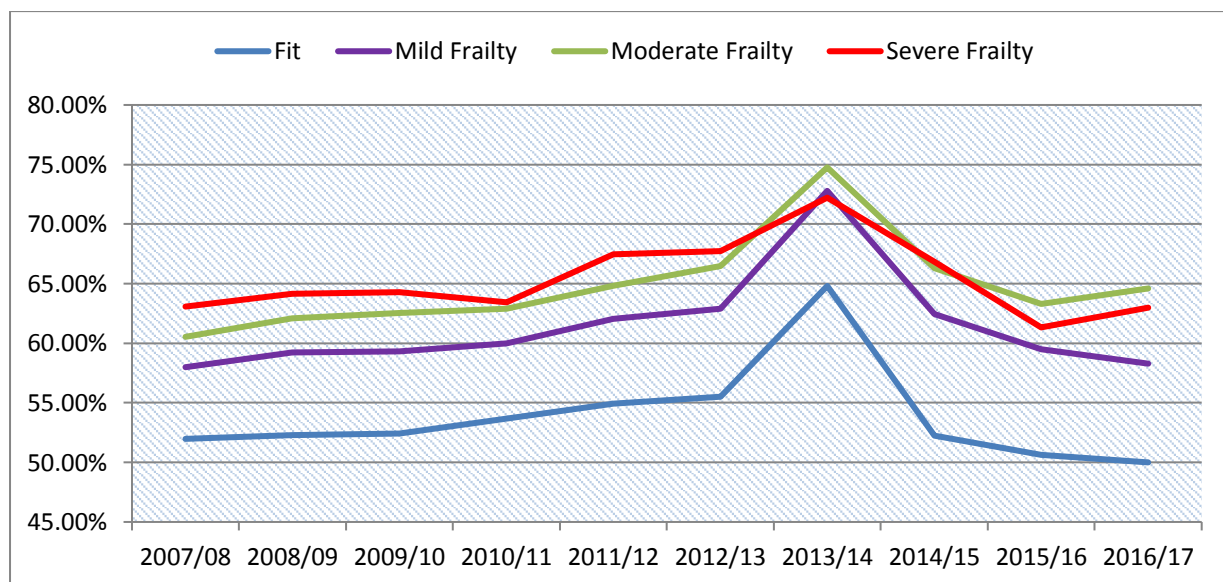
MH004

Patients classified as fit under the eFI have the worst indicator performance compared to the other groups of frailty. Furthermore they have the greatest fall in achievement when the incentive is removed; there is a 20.95 p.p. decrease in achievement. Post-indicator removal, the patients with moderate frailty experienced the smallest decrease in indicator performance, with a 11.51 p.p. decline. Both mild and severely frail patients experience similar declines in indicator achievement post removal.

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2007/08	32.52%	51.12%	64.66%	60.00%
2008/09	36.58%	55.15%	58.93%	56.10%
2009/10	38.15%	56.18%	55.56%	60.32%
2010/11	41.26%	55.17%	57.89%	70.31%
2011/12	72.03%	78.96%	78.81%	81.08%
2012/13	71.36%	77.56%	73.79%	77.92%
2013/14	68.05%	71.58%	70.30%	69.15%
2014/15	47.10%	55.09%	58.79%	51.89%
2015/16	47.91%	53.28%	56.47%	58.62%
2016/17	47.91%	54.84%	54.74%	57.76%
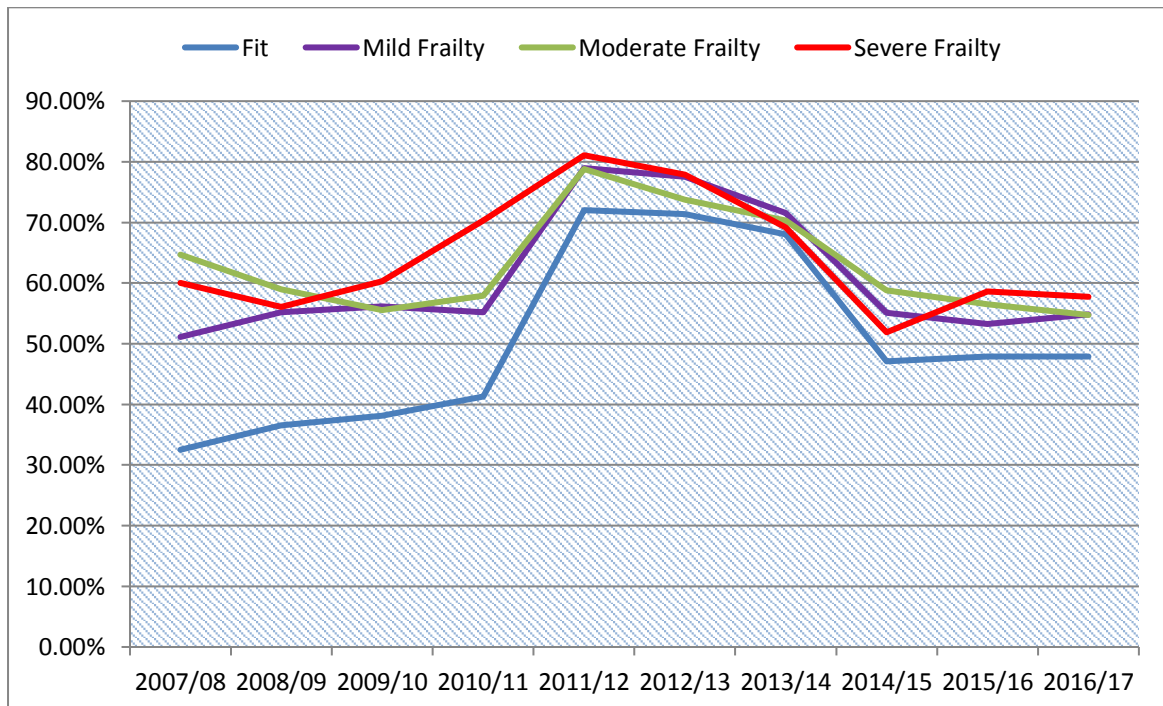
THY002

Patients with severe frailty have the worst indicator performance throughout the study period. Once the indicator is removed, all patients have similar levels of indicator achievement, with patients who are severely frail experiencing a further decline in indicator performance.

Year	Fit	Mild Frailty	Moderate Frailty	Severe Frailty
2006/07	92.99%	93.60%	93.79%	91.50%
2007/08	93.11%	93.58%	92.97%	92.67%
2008/09	92.68%	93.25%	93.12%	89.59%
2009/10	92.68%	92.92%	92.70%	88.85%
2010/11	92.64%	93.76%	92.16%	91.30%
2011/12	92.61%	94.04%	93.16%	91.35%
2012/13	91.96%	93.46%	92.59%	91.16%
2013/14	90.10%	91.21%	90.45%	88.64%
2014/15	79.13%	80.12%	80.34%	78.89%
2015/16	79.48%	79.41%	78.43%	79.44%
2016/17	80.80%	81.24%	79.55%	78.32%
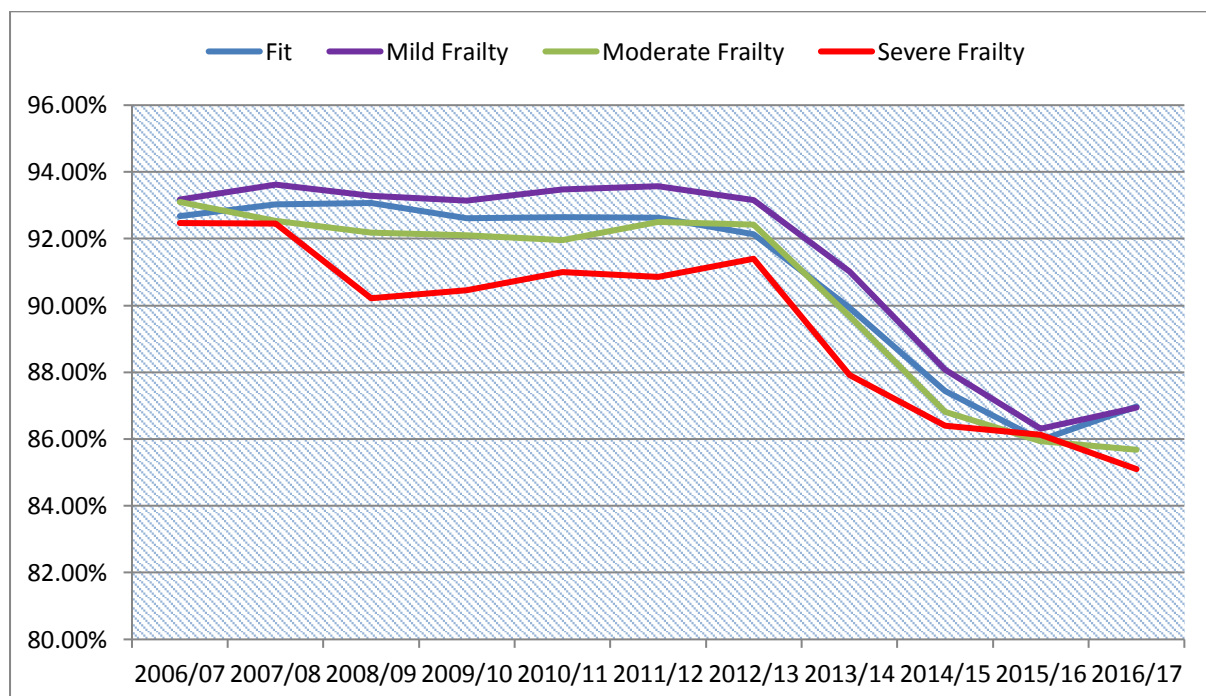
Indicator performance by Charlson Comorbidity Index (CCI)

The CCI is used to identifying and predict mortality of patients via weighting comorbid conditions. To identify these conditions we used the Read codes listed in the Khan et al paper[4], and used the appropriate weights to find individuals' scores. For simplicity, we have split scores in quartiles, with Q1 indicating bottom 25th percentile of CCI, up to Q4, the patients with the highest CCI score.

Summary

Across the majority of indicators patients with higher CCI have better indicator performance and are least affected by indicator removal, especially in CKD002. The reasoning behind this is potentially due to patients with more comorbidities having more rigorous care provided due to multi morbidities.

CHD003

Amongst patients with coronary heart disease, there is very little difference in the proportions of patients achieving cholesterol below 5mmol across the quartiles of CCI. Furthermore no particular quartile had a notably higher achievement than another. All quartiles experienced similar drops in indicator achievement post removal. Assessing the effects of missed readings on CCI showed across all quartiles the effects are similar with a rise in missed readings once the incentive was removed.

Indicator Performance

Year	Q1	Q2	Q3	Q4
2007/08	75.64%	73.06%	72.85%	73.67%
2008/09	74.52%	71.91%	71.87%	71.76%
2009/10	73.84%	72.86%	72.19%	72.22%
2010/11	73.24%	71.92%	72.21%	71.82%
2011/12	69.55%	70.84%	72.76%	71.79%
2012/13	68.82%	70.87%	71.43%	70.56%
2013/14	69.33%	70.19%	71.92%	70.44%
2014/15	56.11%	57.49%	60.43%	57.83%
2015/16	55.30%	57.70%	59.73%	57.39%
2016/17	56.51%	55.14%	60.98%	57.09%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score

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[4] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2820468/pdf/1471-2296-11-1.pdf
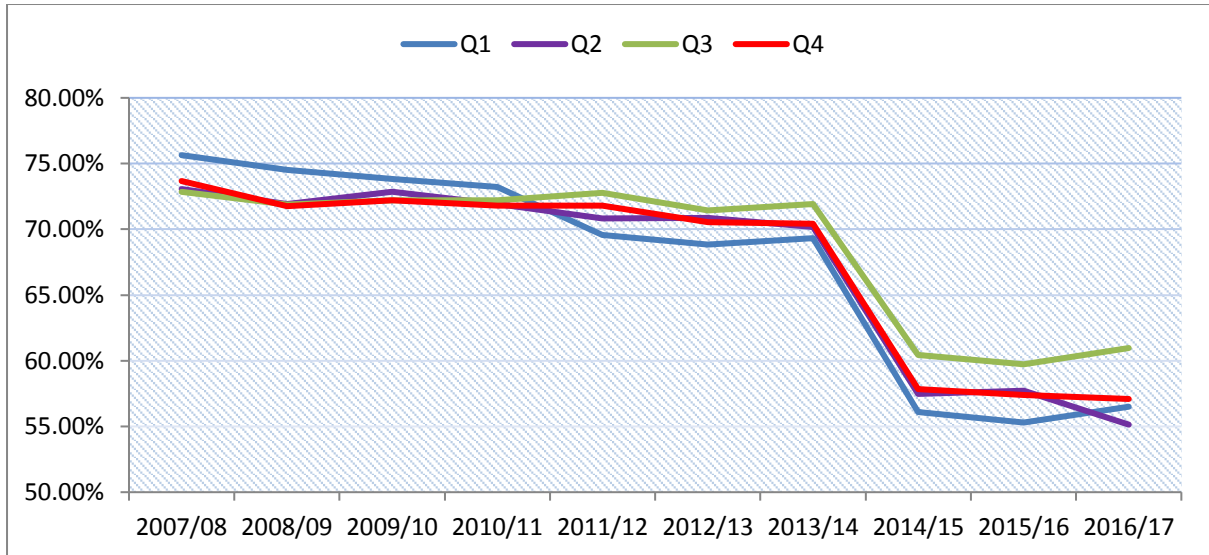
Missed Cholesterol readings

Year	Q1	Q2	Q3	Q4
2007/08	10.65%	10.76%	11.81%	11.17%
2008/09	11.09%	12.62%	13.24%	12.87%
2009/10	11.51%	12.10%	13.81%	12.71%
2010/11	12.09%	13.11%	14.62%	13.41%
2011/12	14.66%	14.41%	14.56%	14.19%
2012/13	15.99%	14.36%	15.05%	15.08%
2013/14	12.89%	13.16%	11.42%	12.83%
2014/15	21.94%	21.87%	20.20%	19.65%
2015/16	26.08%	24.55%	23.72%	24.57%
2016/17	23.97%	26.06%	22.82%	24.06%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
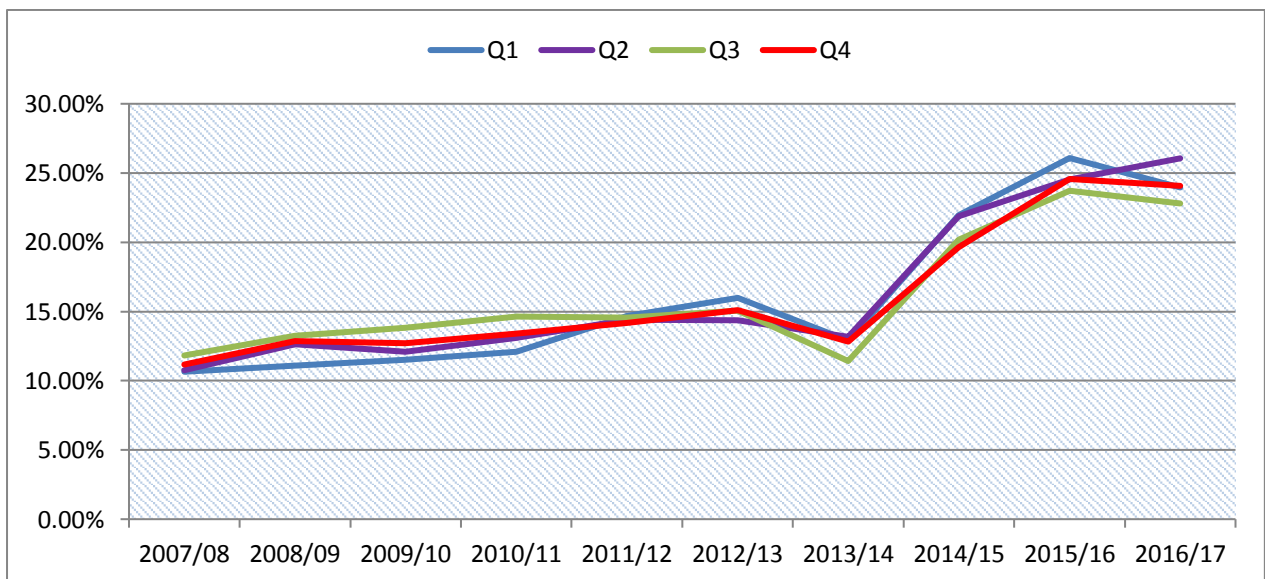
CKD002

Patients with higher values of the Charlson comorbidity index had greater indicator performance. Furthermore patients in highest quartile experience the lowest drop in performance when the indicator is removed with a 5.23 p.p. decline. These patients are associated with the worst health care and have the lowest probability of surviving the next 10 years. Patients in the first quartile have the highest proportion of missed blood pressure readings, with this figure rising post indicator removal.

Indicator Performance

Year	Q1	Q2	Q3	Q4
2007/08	59.07%	57.75%	61.58%	63.38%
2008/09	60.62%	59.49%	63.62%	66.05%
2009/10	61.77%	59.79%	65.03%	67.72%
2010/11	64.12%	62.91%	66.71%	67.62%
2011/12	63.52%	63.59%	67.75%	70.65%
2012/13	63.97%	64.40%	68.11%	70.84%
2013/14	68.14%	68.88%	71.88%	73.86%
2014/15	65.93%	66.89%	70.62%	71.55%
2015/16	54.12%	57.39%	65.30%	66.32%
2016/17	54.32%	58.08%	66.35%	66.74%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
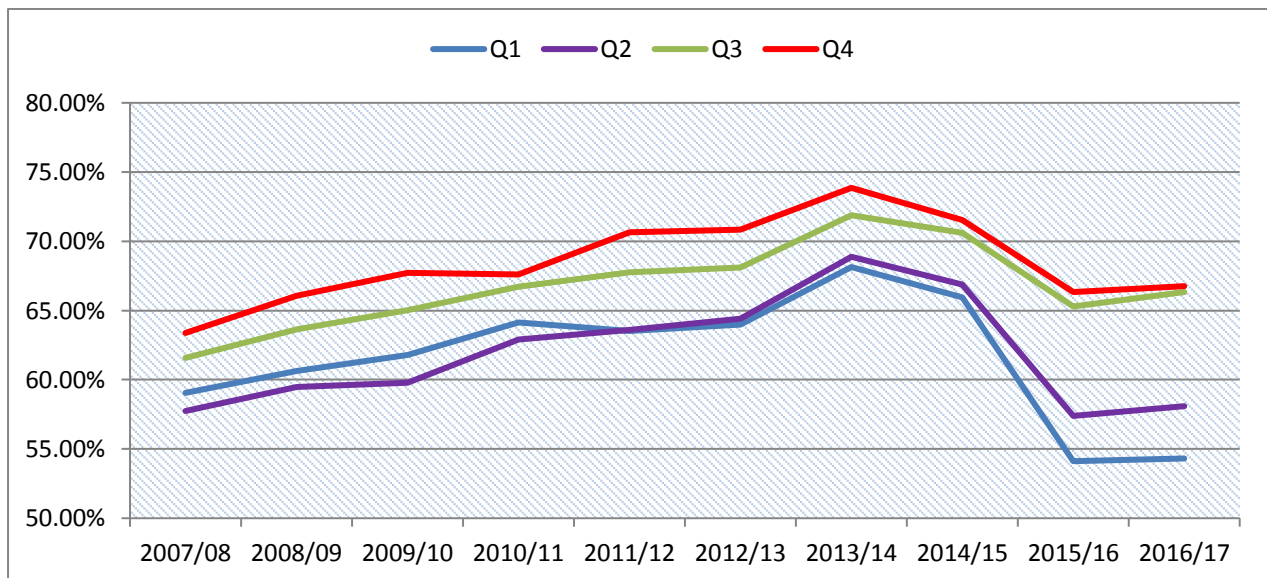
Missed blood pressure reading

Year	Q1	Q2	Q3	Q4
2007/08	9.89%	8.41%	8.01%	7.42%
2008/09	9.46%	8.05%	7.25%	6.72%
2009/10	8.13%	6.94%	7.30%	5.54%
2010/11	7.62%	6.64%	6.77%	5.70%
2011/12	9.17%	6.78%	6.18%	5.23%
2012/13	9.87%	7.47%	7.43%	6.21%
2013/14	9.48%	7.17%	6.57%	5.69%
2014/15	11.02%	8.26%	7.59%	6.62%
2015/16	15.44%	10.73%	9.24%	7.73%
2016/17	15.90%	10.87%	7.63%	6.82%
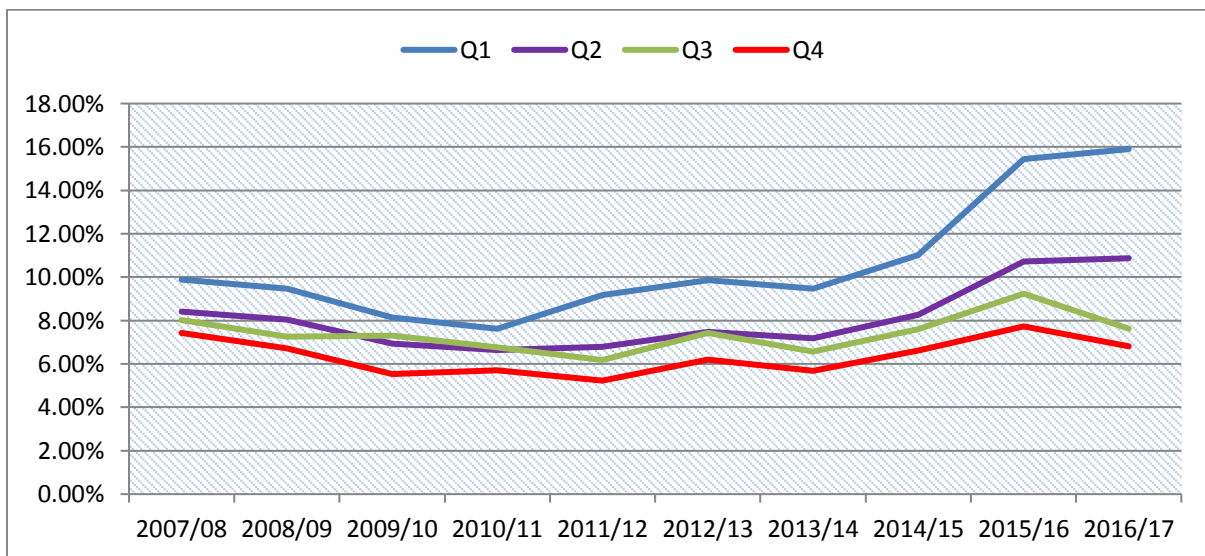
HYP002

There was an overall increasing trend in patients achieving blood pressure below 150/90 mmHg, with the worst indicator achievement reported in patients in the highest quartile of CCI. This is also shown in the proportion of missed blood pressure readings; there is a steady increase in proportion of missed readings, with the patients in highest quartile having the most missed readings.

Indicator Performance

Year	Q1	Q2	Q3	Q4
2007/08	75.61%	73.26%	76.69%	72.99%
2008/09	75.54%	73.07%	76.61%	73.40%
2009/10	76.25%	74.17%	76.21%	73.71%
2010/11	77.50%	74.66%	78.65%	74.66%
2011/12	78.42%	76.97%	79.39%	74.51%
2012/13	78.39%	77.44%	78.17%	75.39%
2013/14	79.70%	77.38%	81.09%	76.18%
2014/15	80.85%	80.80%	82.63%	76.84%
2015/16	80.52%	80.36%	82.26%	76.61%
2016/17	80.85%	81.36%	82.99%	77.37%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
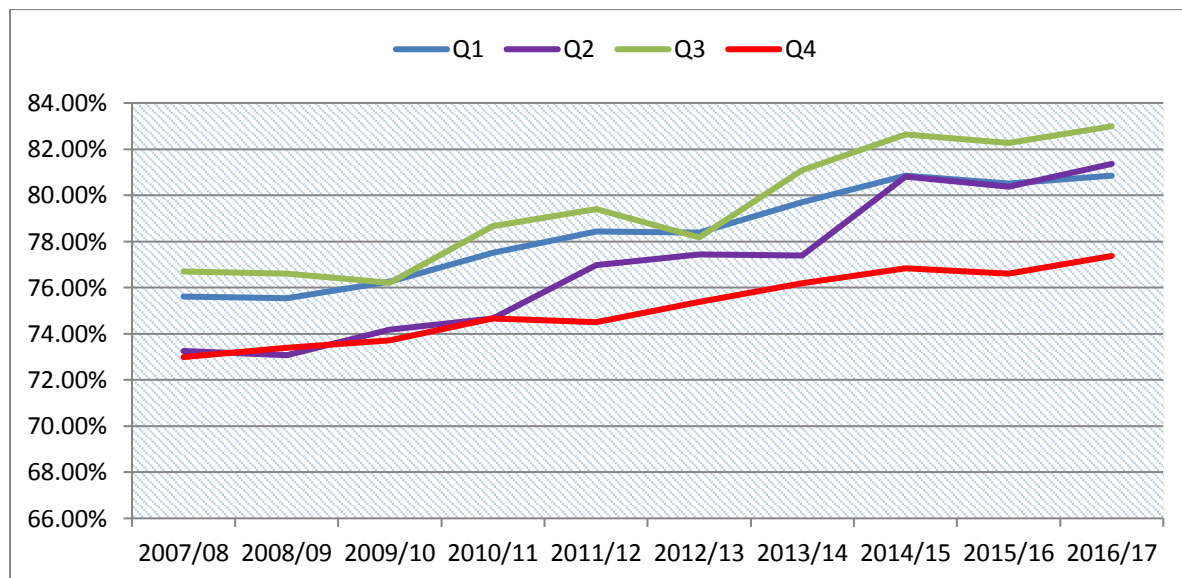
Missed Readings

Year	Q1	Q2	Q3	Q4
2007/08	6.10%	7.88%	5.75%	7.03%
2008/09	6.33%	8.45%	6.02%	7.47%
2009/10	6.45%	8.47%	6.42%	7.71%
2010/11	6.11%	8.11%	6.03%	8.02%
2011/12	6.07%	7.43%	5.51%	8.81%
2012/13	6.91%	8.51%	6.84%	9.18%
2013/14	7.09%	8.42%	6.44%	9.78%
2014/15	9.83%	10.07%	8.62%	13.25%
2015/16	10.29%	10.69%	9.49%	13.79%
2016/17	9.96%	10.13%	8.90%	13.28%
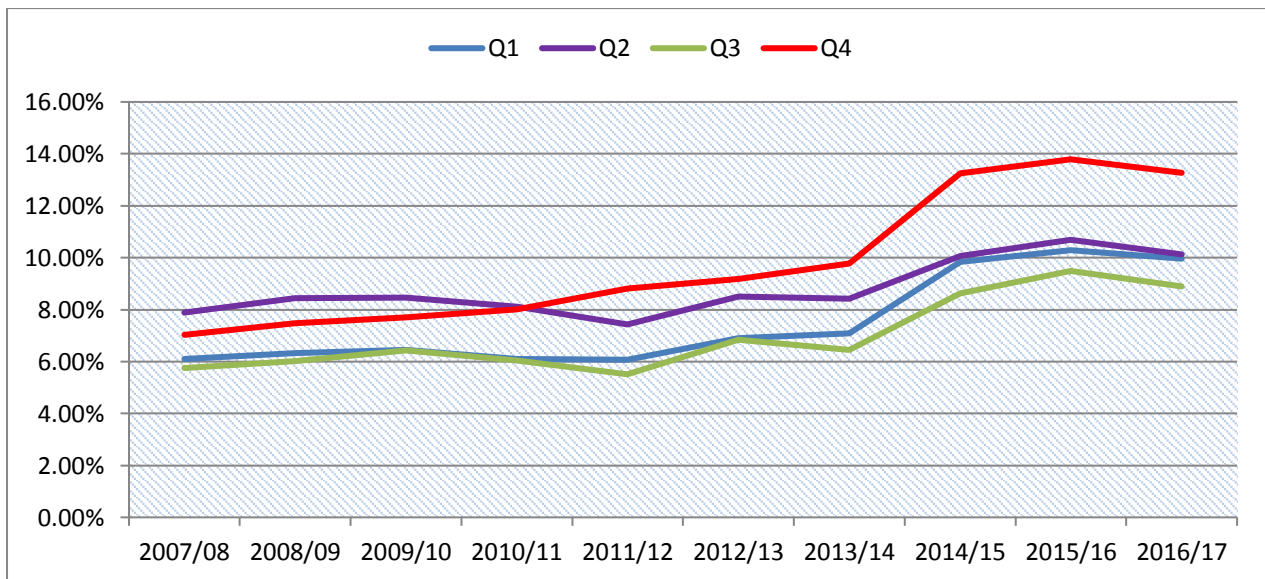
HYP003

For patients aged under 80 years, the patients in the second quartile of CCI have the highest indicator achievement, followed by that of patients in the third quartile. Patients in the 4th quartile have consistently the lowest indicator performance across the whole study period.

Indicator Performance

Year	Q1	Q2	Q3	Q4
2007/08	56.78%	56.40%	55.86%	53.04%
2008/09	57.78%	57.66%	57.97%	53.47%
2009/10	57.90%	58.79%	56.78%	53.88%
2010/11	58.93%	59.66%	58.43%	54.82%
2011/12	61.50%	63.91%	60.65%	55.38%
2012/13	62.11%	65.13%	60.66%	56.29%
2013/14	69.93%	72.80%	72.09%	66.14%
2014/15	60.08%	63.47%	60.93%	53.88%
2015/16	58.73%	63.19%	58.24%	51.21%
2016/17	57.54%	62.41%	58.07%	50.77%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
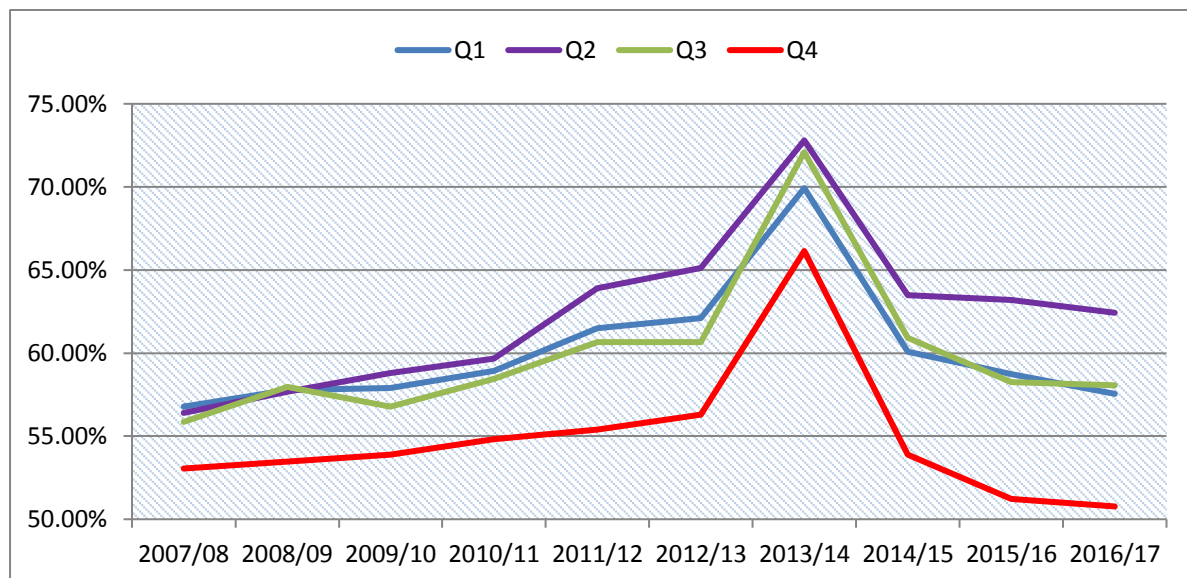
MH004

Patients with a higher CCI have better indicator performance. The effect of the removal of the indicator exhibits similar effects across all quartiles of CCI.

Indicator Performance

Year	Q1	Q2	Q3	Q4
2007/08	30.97%	40.00%	44.30%	54.30%
2008/09	35.85%	45.25%	46.73%	53.47%
2009/10	38.71%	46.65%	48.41%	51.27%
2010/11	39.51%	50.75%	51.16%	55.41%
2011/12	70.79%	74.68%	76.86%	79.82%
2012/13	72.05%	75.53%	73.50%	74.54%
2013/14	66.89%	70.43%	69.25%	72.27%
2014/15	47.70%	49.02%	52.30%	55.47%
2015/16	45.08%	53.39%	54.66%	52.99%
2016/17	45.93%	49.77%	54.73%	54.90%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
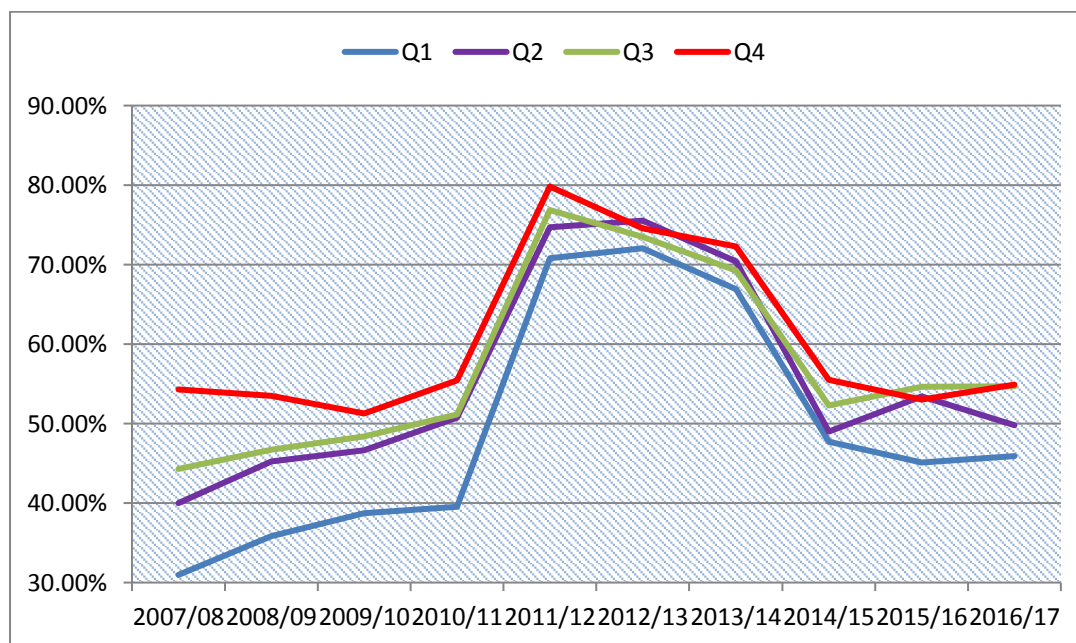
THY002

Patients whose CCI is in the second quartile have the highest indicator achievement, with the remaining quartiles clustered together.

Year	Q1	Q2	Q3	Q4
2006/07	93.10%	95.02%	92.37%	92.84%
2007/08	93.45%	94.74%	92.34%	92.38%
2008/09	92.84%	94.55%	91.77%	92.59%
2009/10	92.72%	94.71%	91.92%	91.64%
2010/11	92.99%	94.41%	92.38%	92.18%
2011/12	92.74%	94.44%	93.21%	92.70%
2012/13	92.39%	94.22%	91.90%	92.30%
2013/14	90.04%	92.46%	90.06%	90.35%
2014/15	79.51%	81.58%	78.97%	79.30%
2015/16	79.05%	81.83%	78.66%	78.89%
2016/17	80.83%	82.26%	80.62%	79.51%

Note: Q1 indicating bottom 25th percentile of CCI, up to Q4 the highest quartile of CCI score
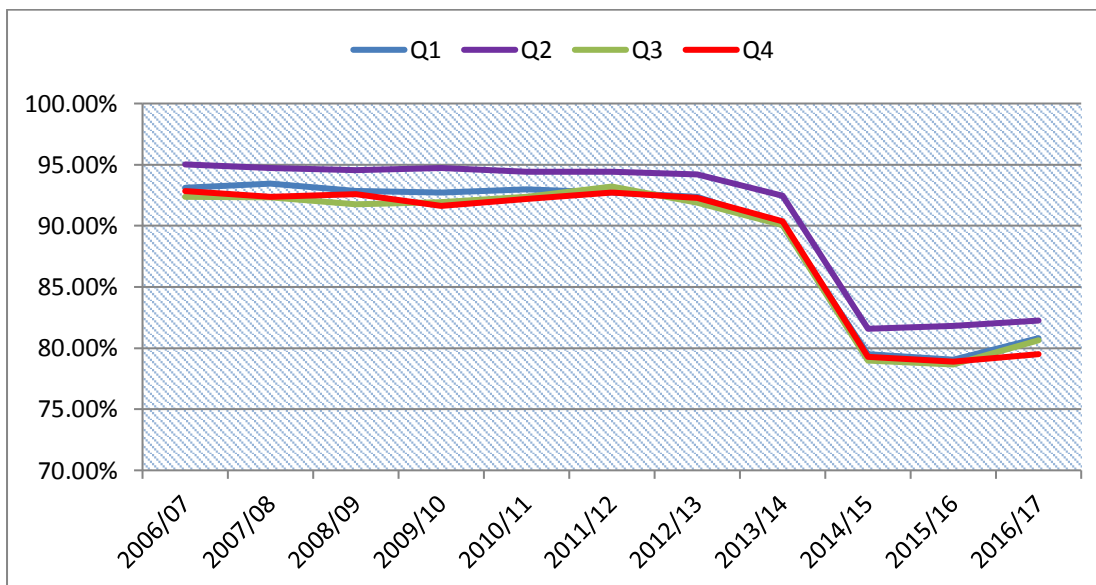
Consultation Rates

CHD003

Patients with Coronary Heart Disease experienced an increased number of consultations following indicator removal. This change is partly driven by the reduction in patients who have no GP visits in a year.

Visits	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
0	0.144	0.118	0.0979	0.074	0.058	0.023
1 to 5	0.1006	0.1026	0.1107	0.1158	0.1298	0.1292
6 to 10	0.1577	0.1632	0.159	0.1647	0.1714	0.1805
11 to 15	0.1548	0.1592	0.1618	0.1636	0.165	0.171
16 to 20	0.1323	0.1349	0.1383	0.1402	0.1426	0.1466
21 to 25	0.0984	0.0984	0.099	0.1027	0.1009	0.1043
26 to 30	0.0672	0.0689	0.0695	0.0709	0.0683	0.072
31 to 35	0.0449	0.0471	0.0493	0.0484	0.0458	0.0489
36 to 40	0.0296	0.0312	0.0334	0.0342	0.0333	0.0368
41 to 45	0.0198	0.0218	0.0221	0.0236	0.0238	0.0239
46 to 50	0.014	0.0152	0.0162	0.0168	0.0176	0.0172
51 +	0.0368	0.0393	0.0428	0.0452	0.0437	0.0467
N	88118	78415	65533	50113	31979	20483
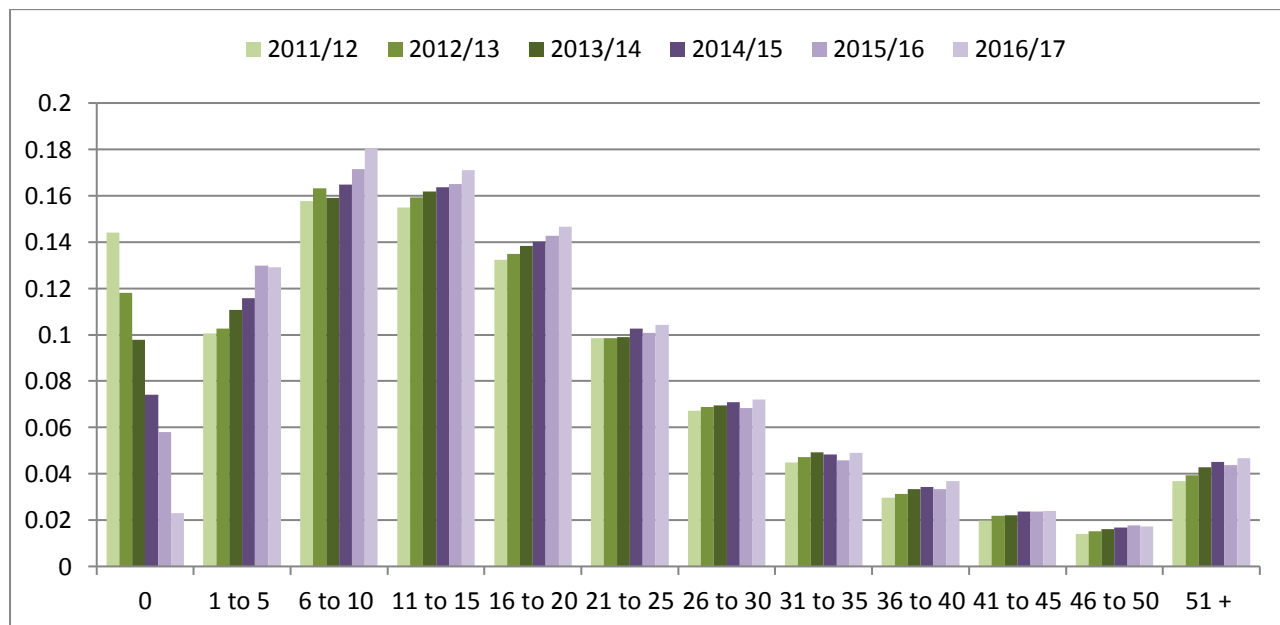
CKD002

The results here show a large percentage point drop in patients having no GP visits in a year, with increasing consultation rates across other categories.

Visits	2012/13	2013/14	2014/15	2015/16	2016/17
0	20.90%	16.14%	11.40%	5.40%	1.65%
1 to 5	11.60%	11.28%	12.31%	14.15%	13.78%
6 to 10	15.56%	16.18%	16.69%	18.56%	18.94%
11 to 15	15.04%	15.46%	16.03%	16.93%	17.58%
16 to 20	11.77%	12.34%	12.87%	13.55%	14.10%
21 to 25	8.16%	8.84%	9.20%	9.97%	10.37%
26 to 30	5.43%	6.15%	6.49%	6.55%	7.13%
31 to 35	3.57%	4.10%	4.37%	4.38%	4.74%
36 to 40	2.39%	2.81%	3.17%	3.03%	3.62%
41 to 45	1.54%	1.90%	2.05%	2.07%	2.18%
46 to 50	1.07%	1.18%	1.59%	1.54%	1.67%
51 +	2.97%	3.61%	3.85%	3.87%	4.24%
N	33050	31054	29047	27057	25022
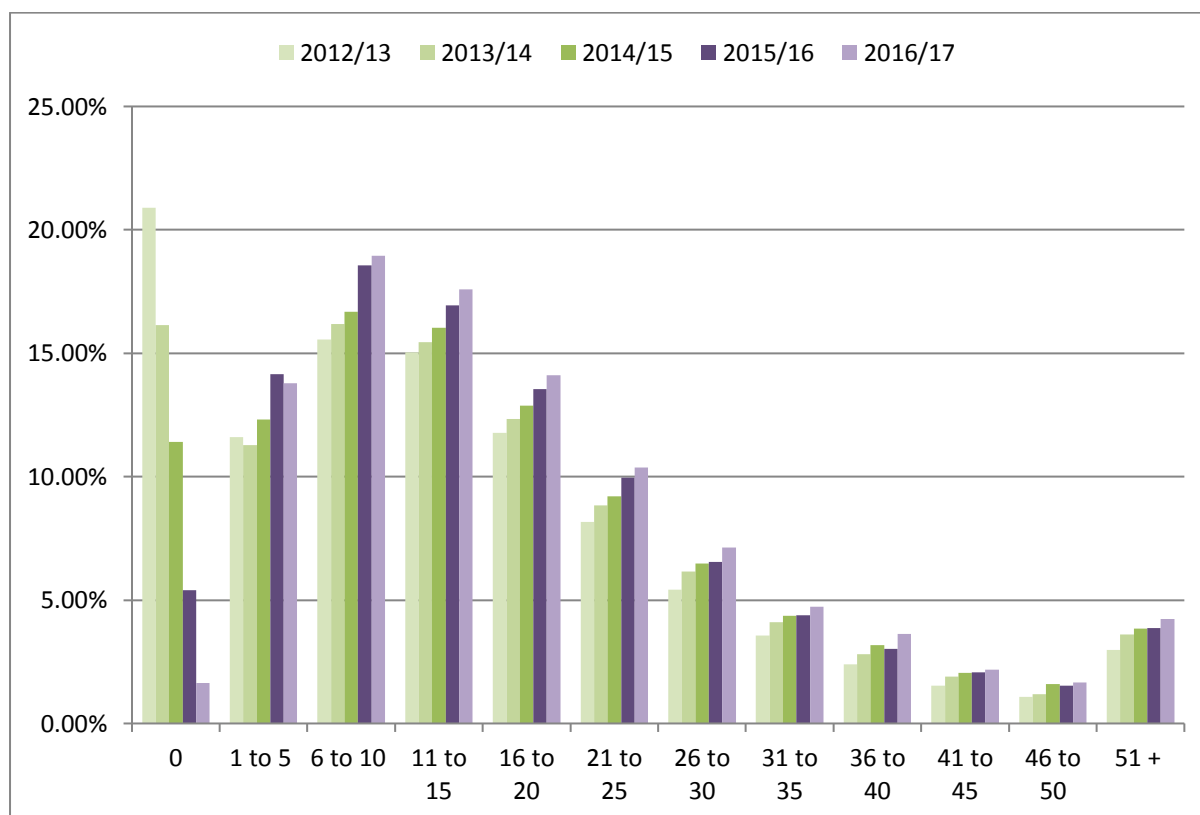
HYP003

For patients aged under 80 years old with hypertension from 2012/13 to 2016/17. In the year the indicator was active there was a decrease in proportion of patients having zero visits to the GP a year, however there is a trend apparent throughout the study period.

Visits to GP	2012/13	2013/14	2014/15	2015/16	2016/17
0	15.77%	12.59%	10.03%	6.90%	3.13%
1 to 5	15.75%	16.08%	17.10%	18.11%	18.95%
6 to 10	21.02%	21.43%	21.98%	22.87%	23.42%
11 to 15	17.14%	17.14%	17.92%	18.39%	19.09%
16 to 20	11.81%	12.47%	12.36%	12.70%	12.96%
21 to 25	7.25%	7.70%	7.72%	7.81%	8.22%
26 to 30	4.15%	4.53%	4.64%	4.65%	5.14%
31 to 35	2.50%	2.85%	2.86%	2.88%	3.11%
36 to 40	1.56%	1.67%	1.73%	1.87%	2.05%
41 to 45	0.98%	1.11%	1.14%	1.20%	1.29%
46 to 50	0.63%	0.73%	0.76%	0.82%	0.81%
51 +	1.45%	1.71%	1.75%	1.79%	1.83%
N	81534	77228	72913	68956	64889
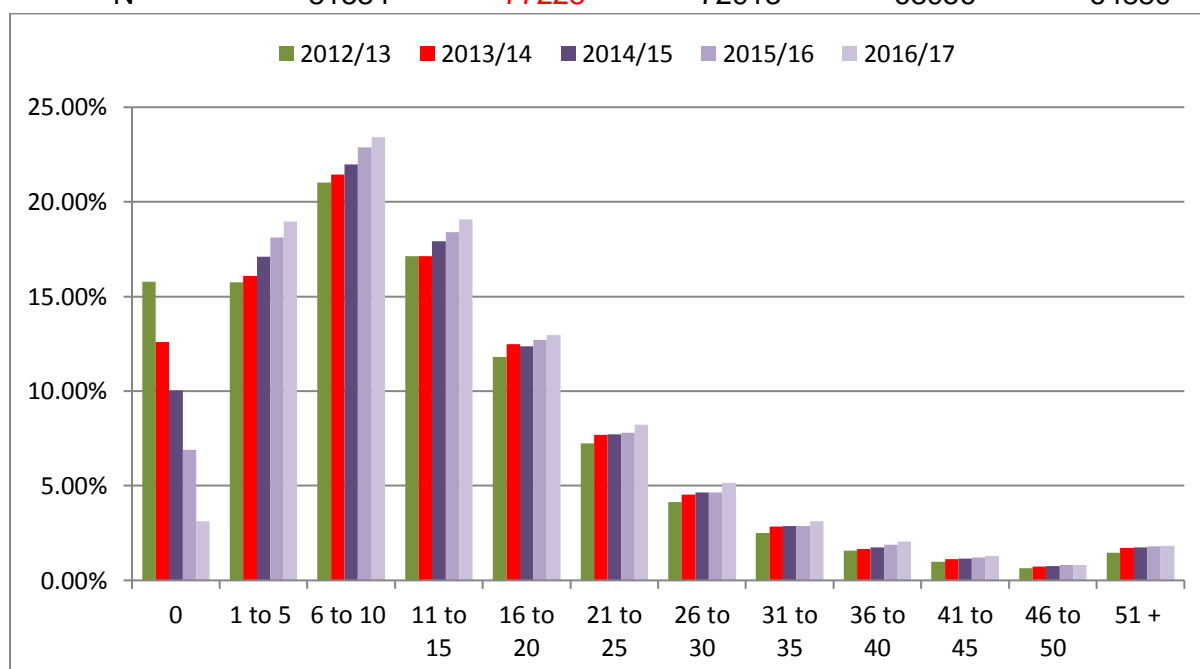
MH004

There is a small rise in consultation rates post indicator removal. However no great changes in consultation rates.

Visits	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
0	2.99%	2.58%	2.33%	2.22%	2.88%	3.01%
1 to 5	15.40%	15.65%	15.65%	15.55%	15.84%	14.21%
6 to 10	19.17%	18.83%	18.06%	17.72%	16.26%	16.98%
11 to 15	15.95%	16.41%	16.74%	16.92%	18.33%	16.86%
16 to 20	14.30%	14.74%	13.66%	12.95%	13.27%	13.97%
21 to 25	9.86%	9.70%	10.17%	10.62%	9.18%	10.56%
26 to 30	6.79%	6.67%	7.24%	7.41%	7.08%	6.30%
31 to 35	4.83%	4.43%	4.39%	4.39%	4.98%	4.74%
36 to 40	3.53%	3.52%	2.55%	3.25%	2.76%	3.33%
41 to 45	2.04%	1.93%	2.89%	2.06%	2.02%	2.57%
46 to 50	1.37%	1.59%	1.31%	1.60%	1.87%	1.69%
51 +	3.77%	3.94%	4.99%	5.31%	5.53%	5.78%
N	2546	2639	2664	2618	2570	2491
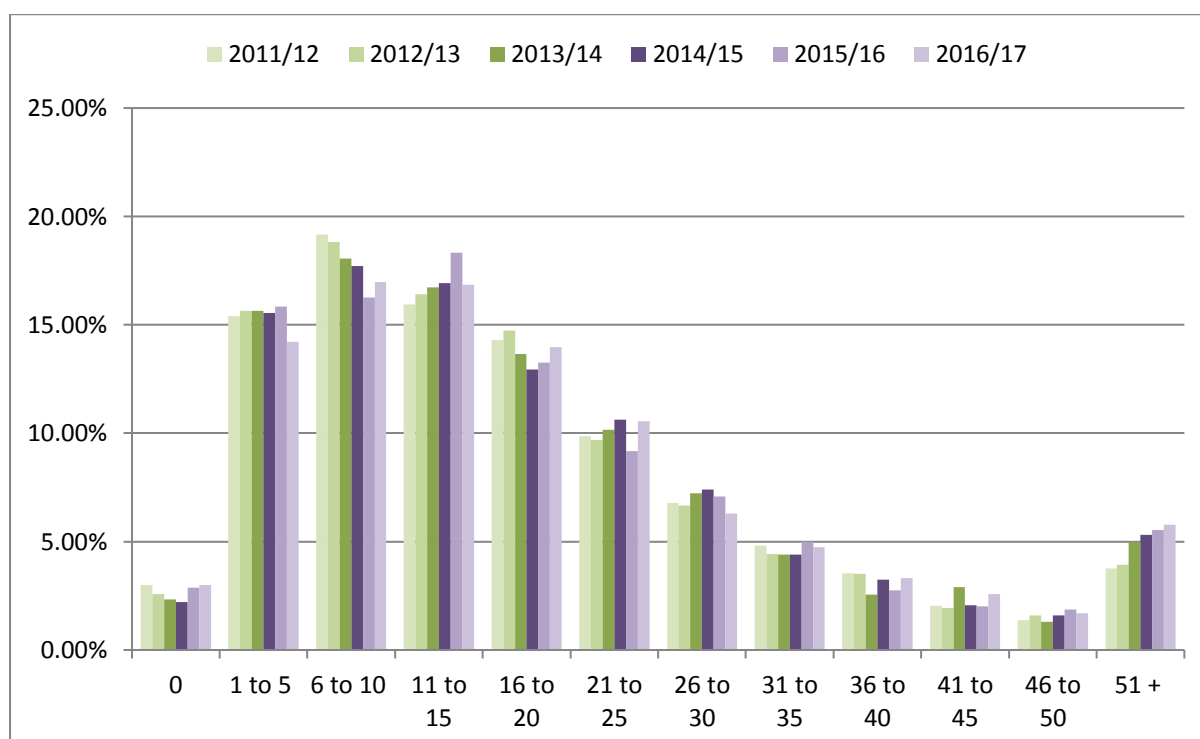
Drug Therapy

Summary

For hypertension patients aged under 80 years of age there is a spike in the proportion of patients prescribed 3 or more different types of antihypertensive medicatons in the year of HYP003 is active, and this drops back to the declining trend once the indicator is removed in the following year. For CHD patients there is an overall increasing trend in the proportion of patients on statins.

Coronary Heart Disease – Statins

For patients with Coronary Heart Disease, there is an increasing trend in the percentage of patients being treated with statins. The indicator was removed in 2014/15. The rising trend plateaus after this, with a small further rise in 2016/17.

Year	% on statins
2007/08	77.34%
2008/09	77.24%
2009/10	78.48%
2010/11	78.82%
2011/12	79.30%
2012/13	80.24%
2013/14	81.23%
2014/15	81.97%
2015/16	81.96%
2016/17	82.48%
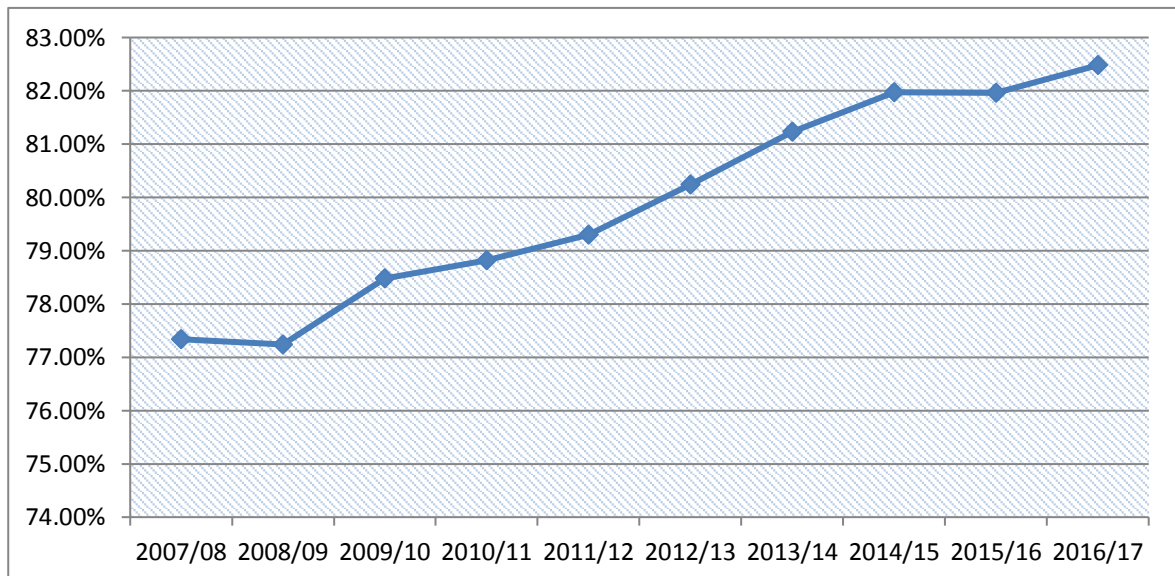
Hypertension – Antihypertensive

For each patient diagnosed with hypertension, we extracted data on the number of hypertensives they were prescribed in each year. This is in order to assess in the year HYP003 was active whether there more intensive treatment in order to lower blood pressure.

There was a rise in the proportion of patients being prescribed over three different antihypertensive medications when this indicator was introduced. This effect is more apparent in the line graph below, with a 0.8 p.p. increase in patients being prescribed three or more antihypertensive medications in 2013/14. The following year this proportion drops, suggesting an increase in intensity of treatment in the year the indicator was active.

Patients aged under 80 years old with Hypertension

Number of Antihypertensives	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
0	8.82%	8.53%	8.16%	8.18%	8.04%	7.88%
1	31.82%	32.32%	32.53%	33.02%	33.46%	34.02%
2	33.31%	33.28%	32.65%	33.22%	33.50%	33.52%
3	17.76%	17.48%	17.69%	17.34%	17.20%	16.83%
4	6.27%	6.25%	6.75%	6.33%	6.07%	6.01%
5	1.65%	1.72%	1.81%	1.53%	1.40%	1.43%
6	0.30%	0.34%	0.36%	0.31%	0.28%	0.26%
7+	0.08%	0.07%	0.05%	0.06%	0.05%	0.05%
N	69885	69151	67754	65973	64627	63071
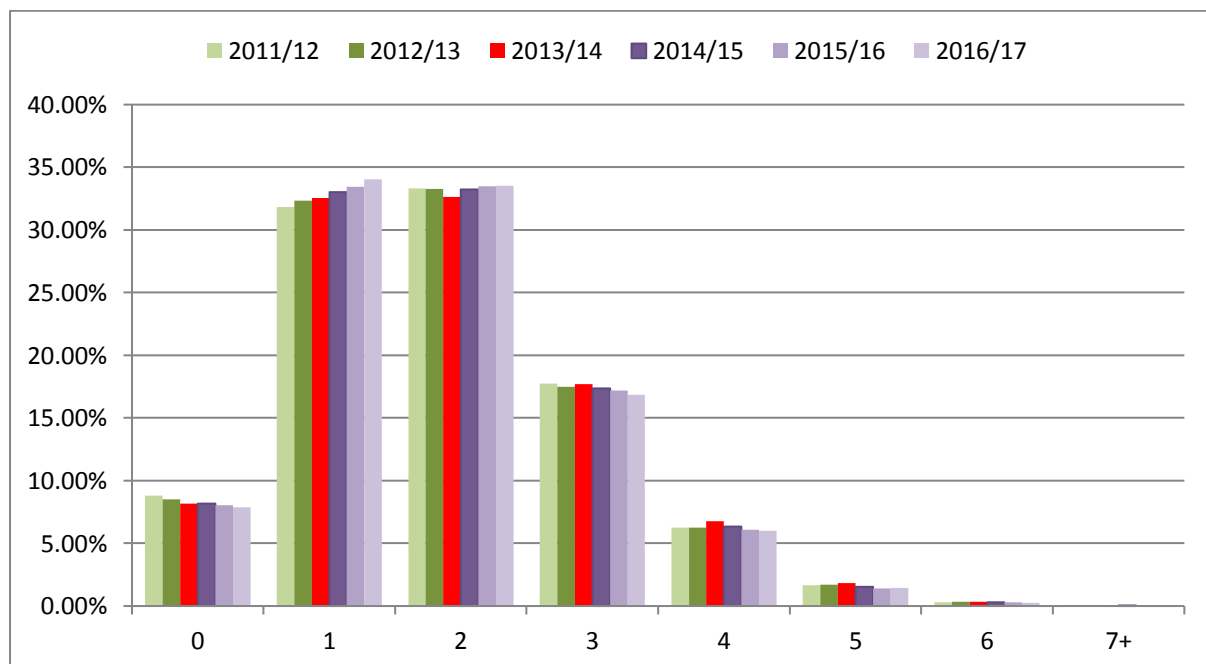
Percentage of patients on 3 or more different types of antihypertensive medications

Year	3 or more
2007/08	27.12%
2008/09	26.54%
2009/10	26.56%
2010/11	26.26%
2011/12	26.06%
2012/13	25.86%
2013/14	26.66%
2014/15	25.57%
2015/16	25.00%
2016/17	24.58%
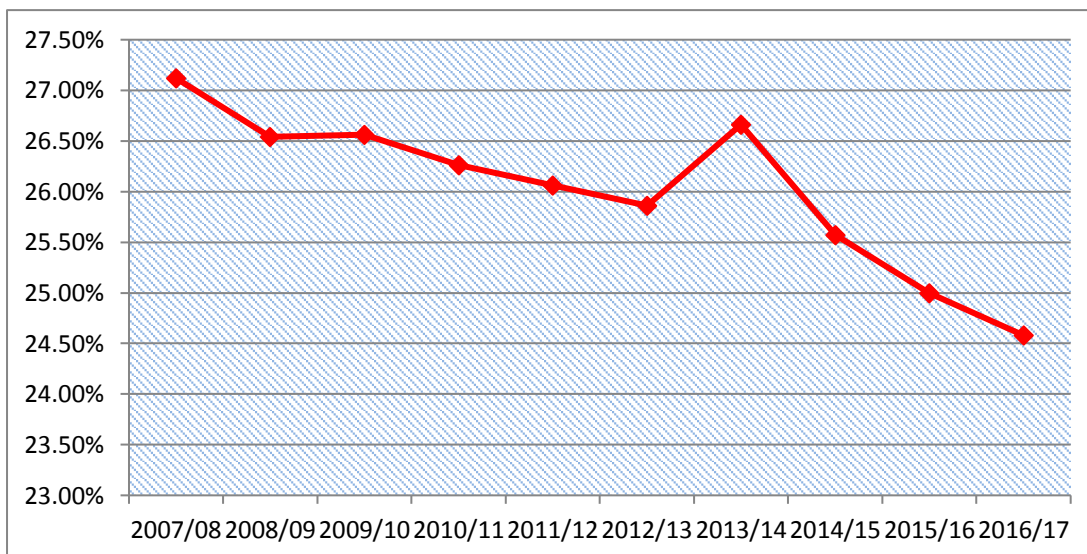
Monthly Activity

We examined the distribution of the month in which the reading was taken for each QOF indicator. This was to see if there was clustering of readings in the months before the end of the financial year, and if this pattern persisted after incentives were removed. The results are presented in histograms for each year, with the vertical red line indicating the start of the financial year.

Summary

For the all indicators the majority of the QOF activity takes places in the last 3 months of the financial year, and this trend does not change even after the indicator is removed. However this is only taking in account the last reading of the year and does not account for all readings in the year.

CKD002

For patients with chronic kidney disease, many blood pressure readings used to determine indicator achievement were taken in March in the years prior to the removal of the incentive. This pattern continues when the indicator is removed, however the proportion of readings take in March decreases with a greater proportion of readings taken earlier in the financial year.

Graphs by year

CHD003

The distribution of months of the readings used to determine QOF achievement does not vary after the indicator is removed. The distributions remain similar throughout the study period.

Graphs by year

HYP003

The indicator was introduced and removed in 2013/14. Overall there is a declining trend in readings taken in March, and post indicator removal more of the readings used to determine QOF attainment were taken in April, May and June.

Graphs by year
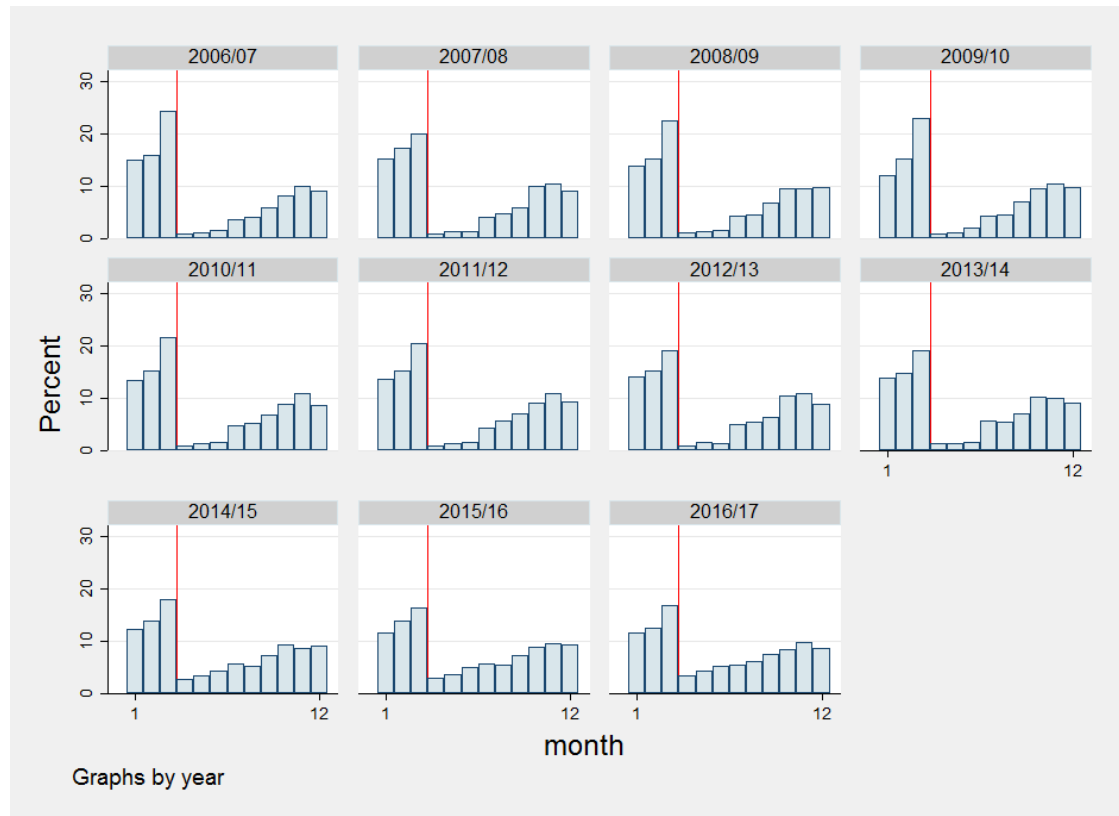
HYP002

Overall there is a shift in the trend of blood pressure readings taken just before the end of the financial year. This pattern is apparent in the graphs below, however due to this being the last blood pressure reading of the year it could indicate that patients are having fewer recorded readings.

Graphs by year

MH004

The effect of the removal of the indicator shows no pattern in the month of the reading taken for patients with Mental Health illness.

Graphs by year
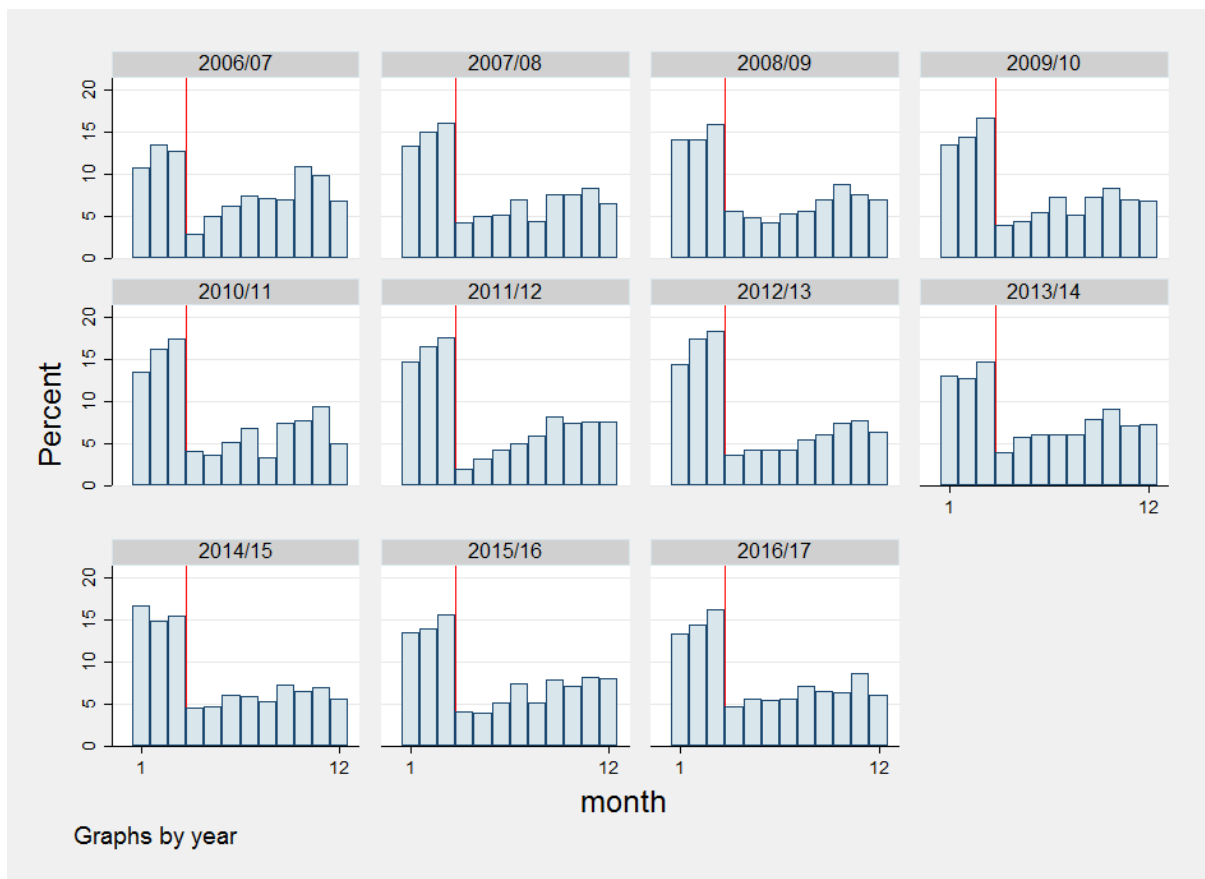
THY002

The pattern of the month of readings does not show variation in the readings.

Graphs by year
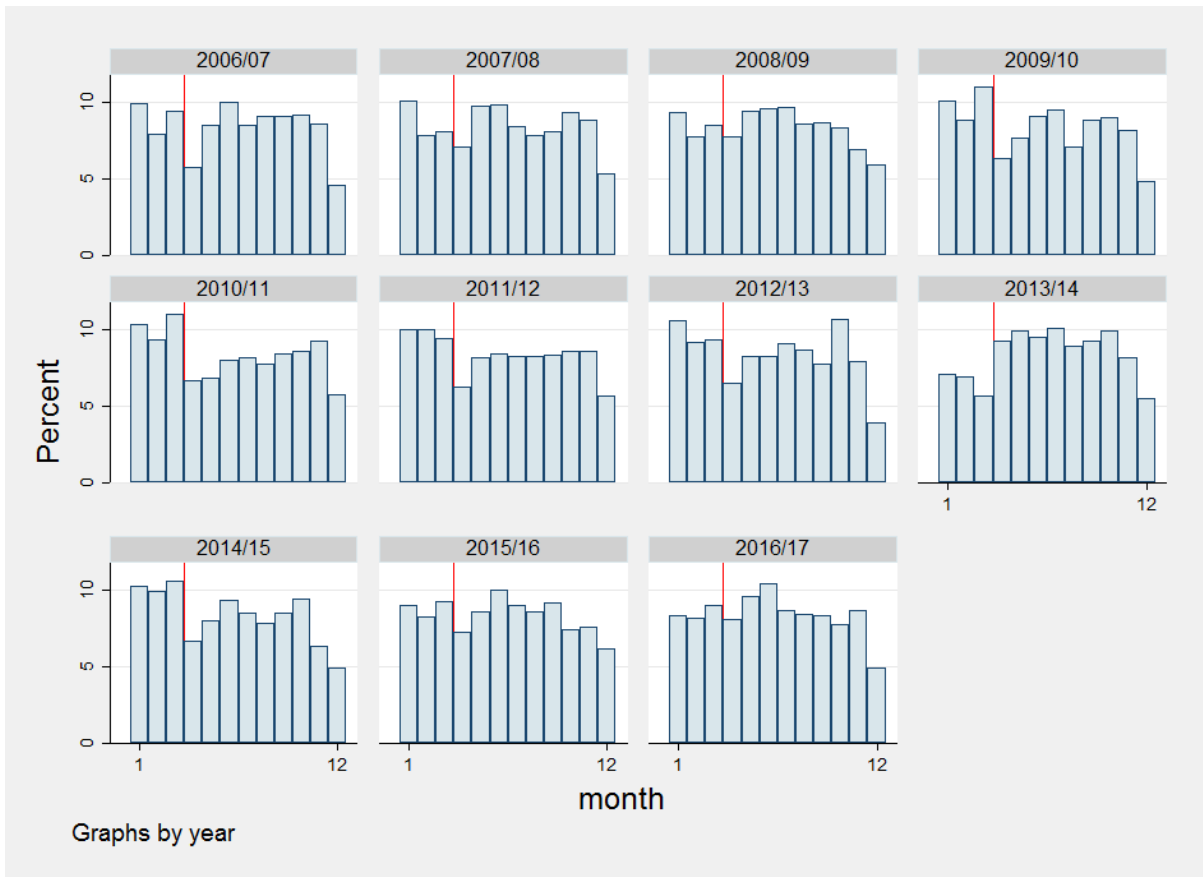
Statistical Models of the Determinants of Indicator Performance

Summary

The ITS models show, controlling for all covariates, that for all indicators apart from CKD002 there was a significant drop in performance due to removal of incentives. Furthermore for HYP003 and MH004 indicators the removals lead to a significant change in the post trend of indicator attainment.

Quantifying the overall "effect" of indicator removal

We used an interrupted time series (ITS) regression design to assess whether the changes in performance were statistically significant, following the removal of the incentives. ITS is a quasi-experimental approach that is widely used as a modelling strategy when randomisation is not an option, for example following a policy change at the national level. The advantage of this design, compared to a simple pre- and post-intervention comparison, is that it accounts for the pre-intervention trends. . In this case, the population is the patient group of interest, the policy is the removal of the indicator, and the time point is the financial year when the indicator is removed.

An ITS model primarily evaluates the "step-change", the change in outcome levels in the first post-intervention time point (i.e. the first year of removal), accounting for the pre-intervention trends. Additionally, it evaluates whether there is a trend change, following the intervention.

ITS analyses were conducted at the practice level, for simplicity and the use of existing statistical command. In the future we will conduct ITS analyses at the patient level, through more advanced modelling.

Examining heterogeneity in the "effect" of indicator removal across patient and practice characteristics

In order to determine the effect of indicator removal on different patient groups, we modelled the probability of achieving each indicator (a binary yes/no variable) controlling for year, age, gender, Charlson comorbidity index, deprivation quintile and electronic frailty index.

We then ran separate patient-level logit models interacting each control variable with year to have the adjusted effect for each control. Once each model was run we plotted the predictive margins for each variable.

Additionally, practice level analyses aimed to examine the role of two practice-levels: practice location IMD and practice list size. Analyses were controlled for mean practice CCI, age, gender, and eFi levels. Practice level deprivation and dichotomised list size (at 8000 patients).

We estimated two models at the practice level. The first included an interaction between year and practice level IMD. The second included an interaction between year and whether the list size was greater than 8000 patients.

Patient Level Effect of Indicator Retirement

For this analysis we focused on the patients who achieved the indicator in the year prior to indicator removal. We used a linear probability model to determine which patient groups were most affected by the indicator being withdrawn.

CHD003

Interrupted Time Series Analysis

The graph below shows the plotted time series of average indicator performance in both the pre- and post-periods. The pre-trend slope exhibits an increasing trend in indicator performance. However the slope coefficient is not significant meaning that there is no significant trend in indicator performance prior to the intervention. From the graph there is a clear drop in indicator performance when the incentive is removed. There is 10.84 p.p. drop in average indicator performance, with this effect being significant at the 5% level. After the intervention the new trend slope for indicator achievement shows a further decline in indicator performance, however this coefficient is not significant.

Intervention starts: 2014

Regression with Newey-West standard errors - lag(0)
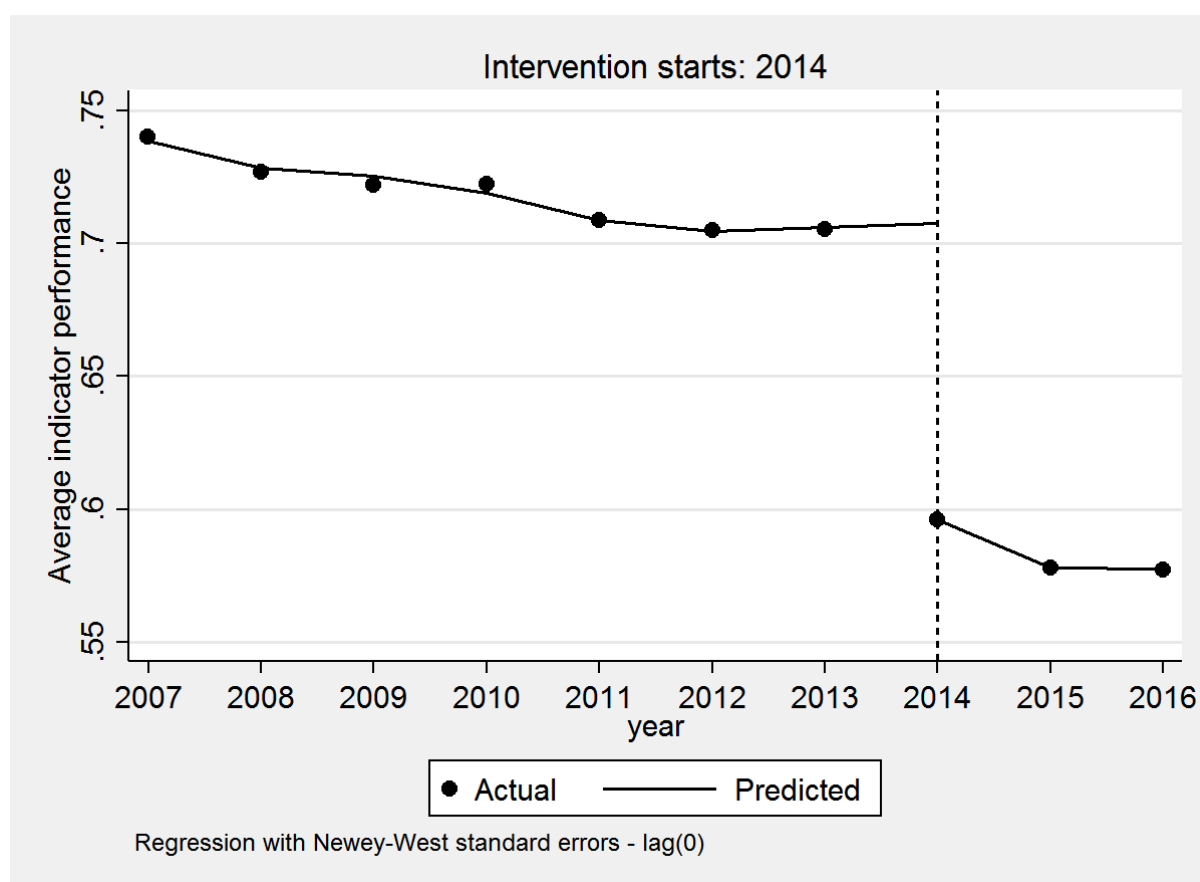
	CHD003	SE
Pre-trend	0.0122	0.0591
Effect of indicator removal	-0.1084**	0.0047
Trend after removal	-0.0275	0.0231
age	-0.0524	0.1033
gender	0.2526	5.9301
CCI	-0.0374	0.0701
actual_eFi	0.6355	2.7499
High deprivation (=1 if IMD>=4)	-0.4756	1.0480
_cons	4.6039	5.4497
Effect of removal	-0.0153	0.0364

Newey-west standard errors * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Patient-Level

When controlling for all the covariates, we find that the age categories of patients aged under 55 and over 85 years old have both the similar probability of achieving CHD003 during the time it is active. In 2013/14, the period prior to indicator being removed patients aged under 55 years had a probability of 62.27 p.p. of achieving the indicator, with those aged over 85 years had a probability of 61.96 p.p. However once this indicator is removed for both age groups the probability of achieving the indicator declines then these age categories diverges. For patients aged under 55 years have an increasing trend in probability of achieving the indicator, with by 2016/17 the probability of achieving cholesterol under 5mmol is 55.87 p.p. whereas the over 85 year olds probability of achieving the indicator declines with the probability in 2016/17 is 45.32 p.p.

Predictive Margins of agecat across financial years with 95% CIs
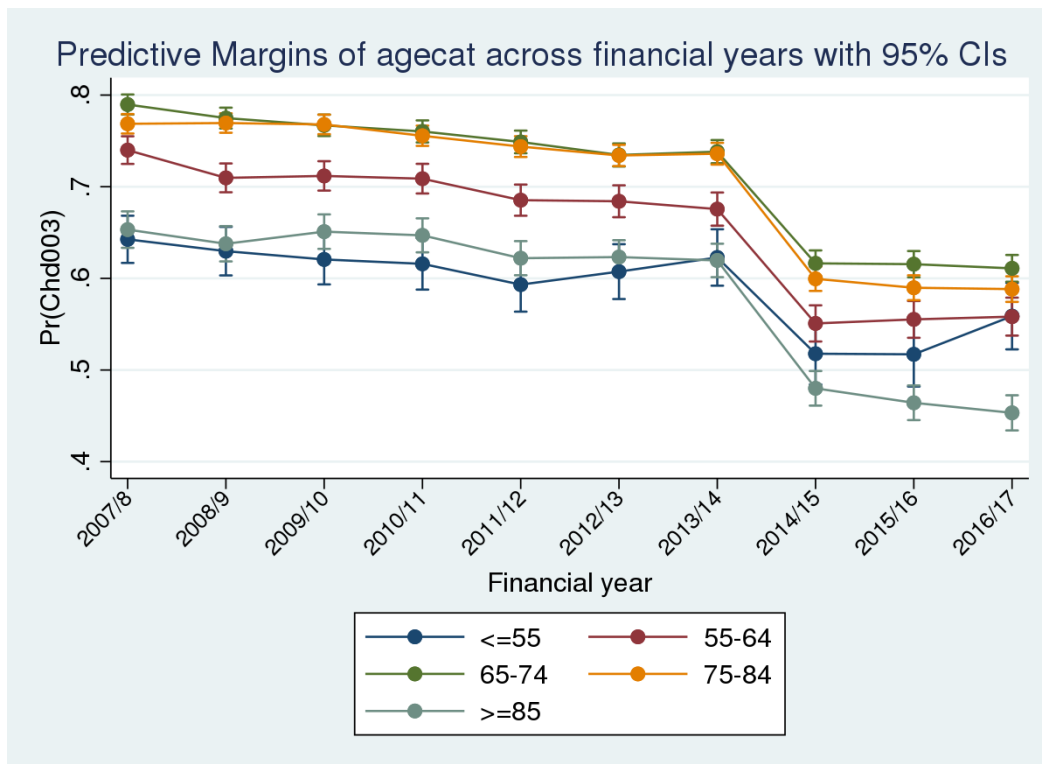
For the gender differences in indicator achievement, men are continuously approximately 15 p.p. more likely to achieve the indicator compared to women, with this inequality holding even after the indicator is removed. When comparing 2013/14 with 2014/15, the change in the probability of achieving the indicator for women is 10.46p.p., and for men this change is 14.04 p.p.

Predictive Margins of gender across financial years with 95% CIs
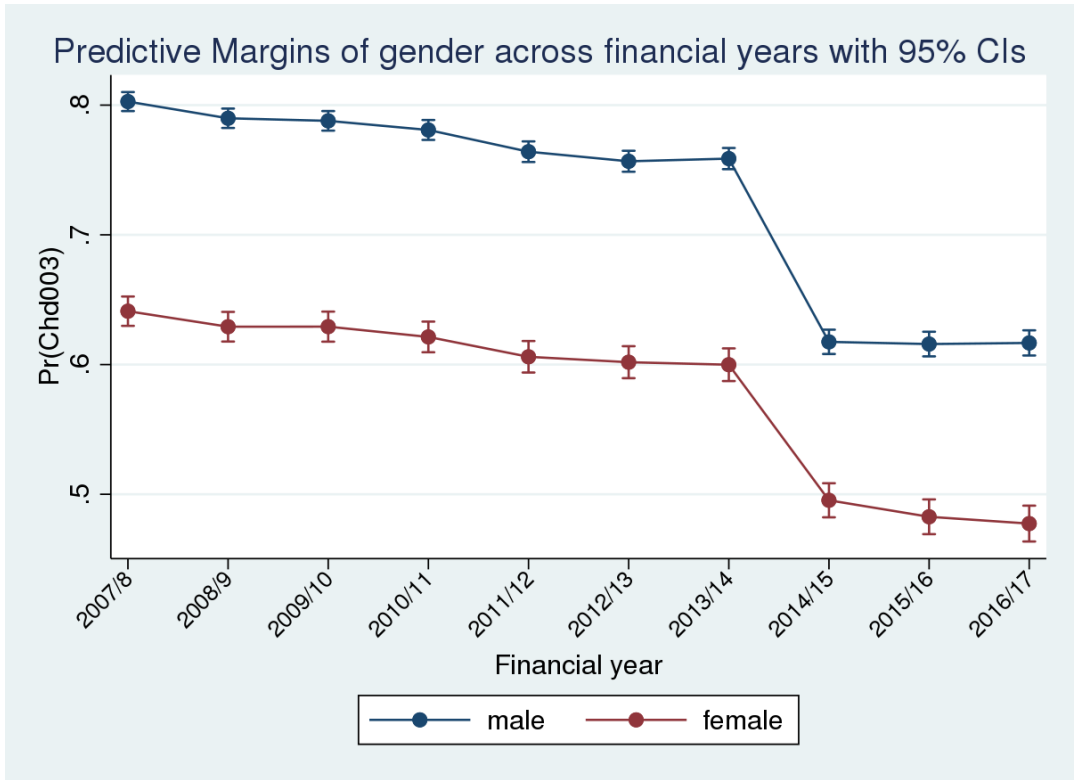
Assessing the effect by deprivation level shows that, during the period the indicator is active, there is no notable difference in indicator achievement on deprivation level, this effect continues when the indicator is removed. Once the indicator was removed there was approximately a 10 p.p decrease in probability of achieving cholesterol below 5mmol for all deprivation levels.

Predictive Margins of imd2015_5 across financial years with 95% CIs
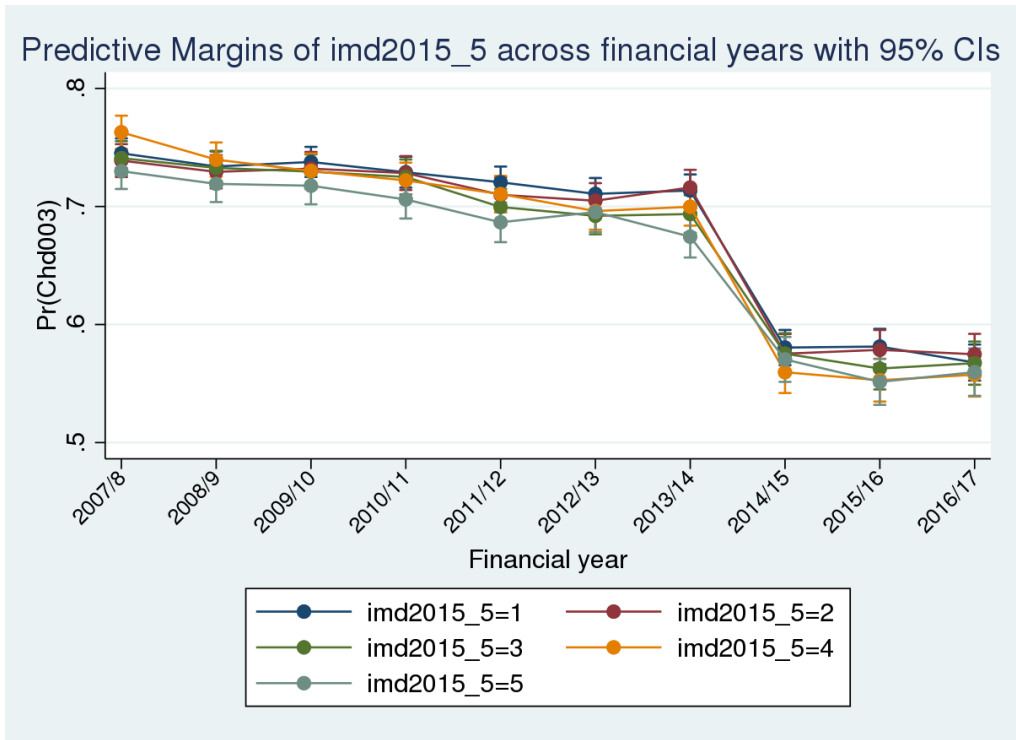
The patients frailty determined by the eFI shows patients who are classified as fit have a lower probability of achieving the indicator compared to that of the other categories. The effect of the indicator removal affected patients who were classified with mild frailty the greatest, with a decrease in probability of achieving the indicator by 13.84 p.p., compared to that of severely frail patients having a 8.90 p.p. decrease in probability of achieving the indicator.

Predictive Margins of eFi_level across financial years with 95% CIs
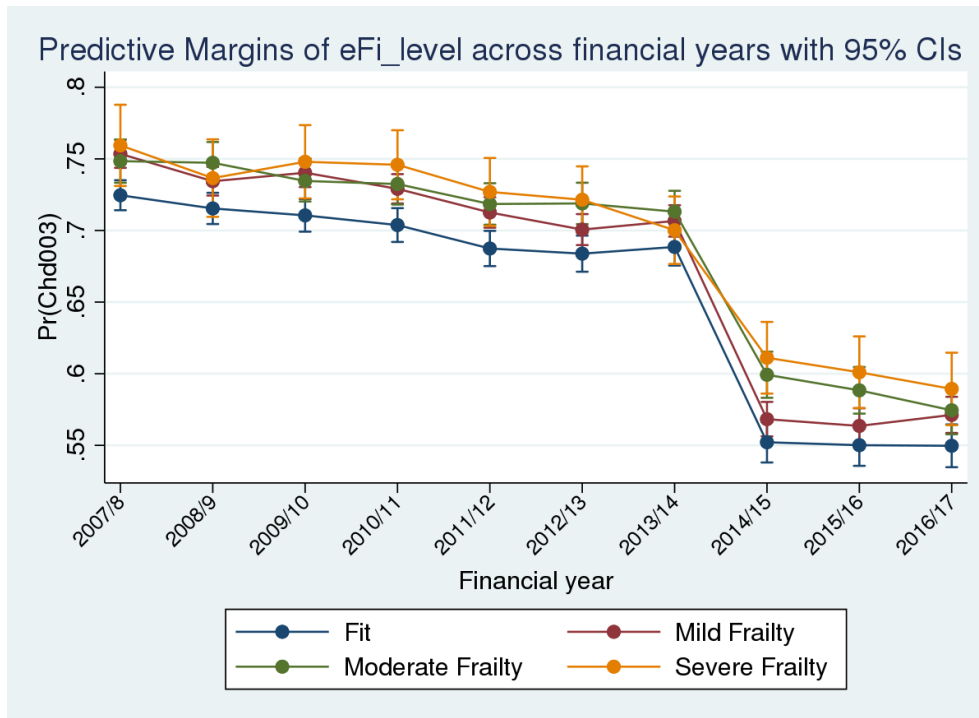
A similar effect is shown in that in categories of CCI; with patients with the lowest CCI (CCI ≤1) having the lowest probability of achieving the indicator compared to the other categories.

Predictive Margins of CCIcat across financial years with 95% CIs
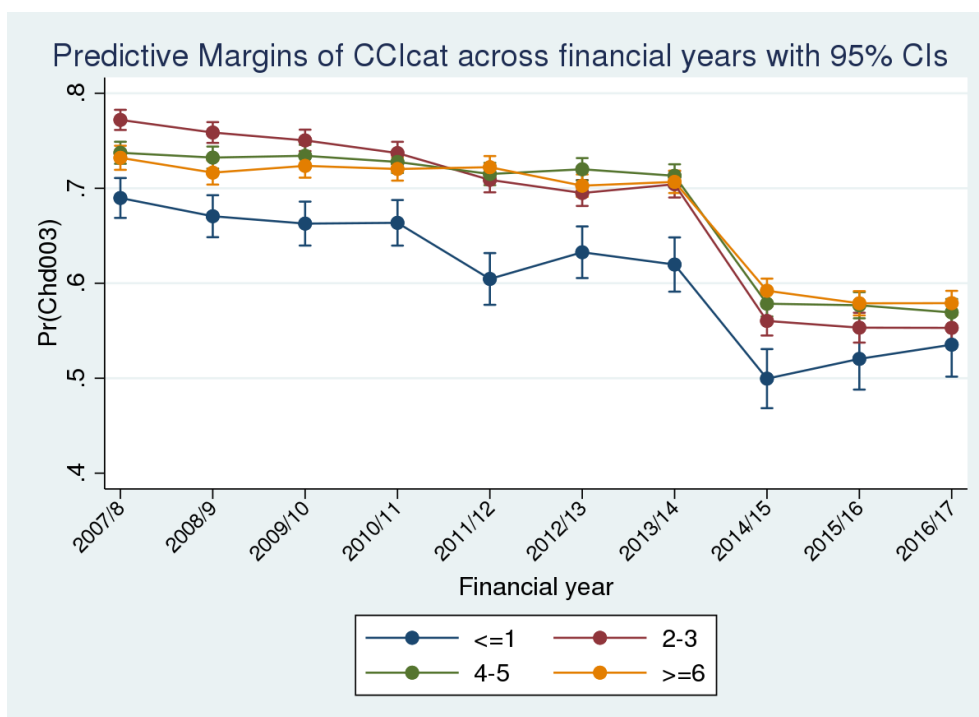
Practice-Level

When controlling for all of the covariates, the effect of practice level deprivation on indicator achievement shows practices in the least deprived areas have the best patient outcomes. The practices in the second least deprived areas (IMD= 2) are affected most by the removal of the indicator with a 15.29 p.p. decrease in average achievement. However practices in the least deprived areas are affected least by the indicator being retired, with a 10.89 p.p. decrease in average indicator performance.

Predictive Margins of e2015_imd_5 across financial years with 95% CIs
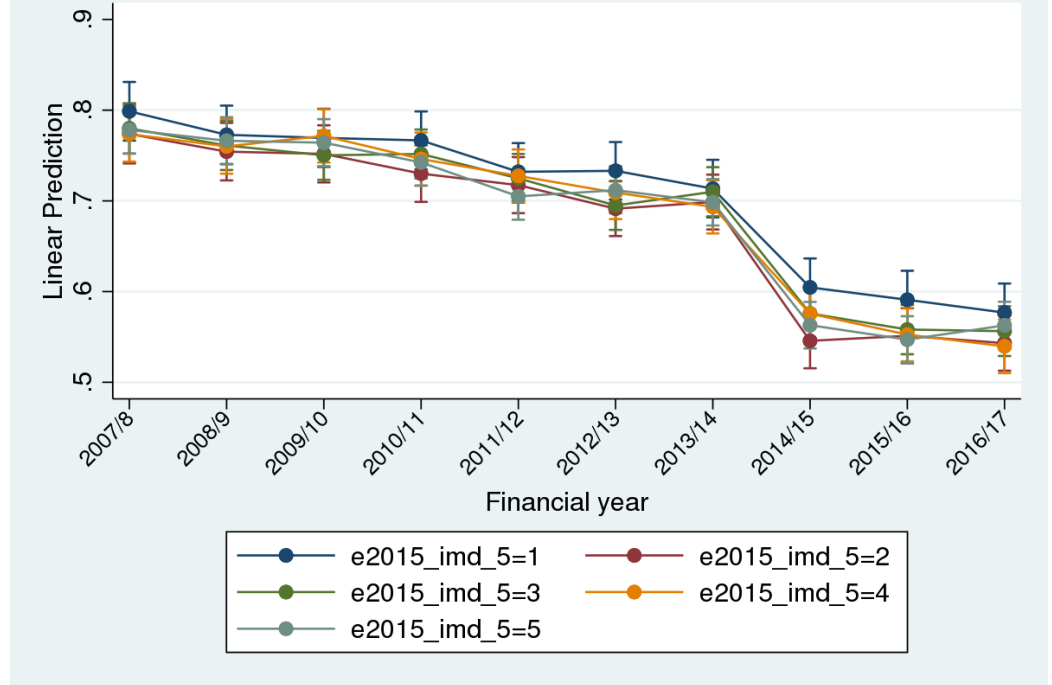
The effect adjusted for practice list size show that practice list size shows an ambiguous effect of list size on indicator performance, due to wide confidence intervals on smaller practices. Furthermore the effect on the removal of the indicator has similar effect with both sizes of practices having around 13 p.p. decrease in probability of achieving the indicator.

Predictive Margins of lsizecat across financial years with 95% CIs
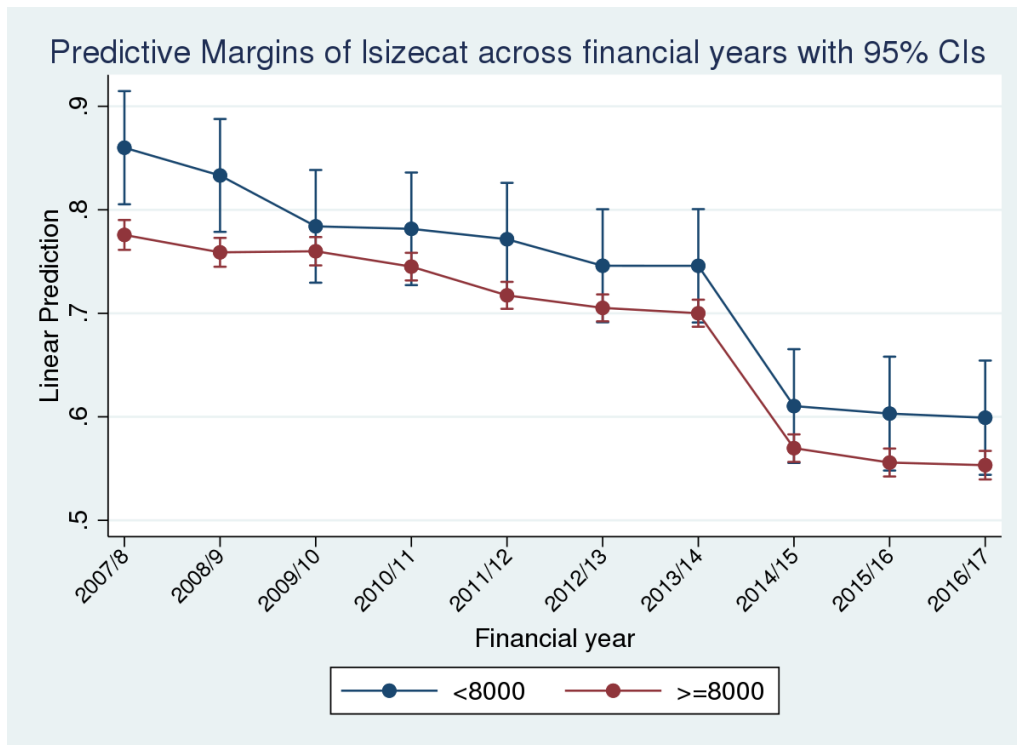
Patient Level Effect of Indicator Retirement

30.3% of patients who achieved the indicator in 2013/14 did not achieve the indicator in the following year when the indicator was retired. Patients aged over 85 years old had a 9.59 p.p. higher probability of not achieving the indicator compared to patients aged under 55 years, which was significant at the 0.1% level. Women were 4 p.p. more likely not to achieve the indicator when the incentive is removed compared to men, which is significant at the 0.1% level. Patients with higher CCI scores were less likely to fail the indicator once the incentive was removed, compared to the baseline group CCI ≤1.

	Probability of not achieving the indicator in 2014/15 conditional on having achieved it in 2013/14
Age Category (Base: <55)	
55-64	-0.0315
	[-0.0707,0.00765]
65-74	-0.0476[*]
	[-0.0887,-0.00664]
75-84	-0.0154
	[-0.0574,0.0265]
>=85	0.0959[***]
	[0.0493,0.142]
Female (Base: male)	0.0400[***]
	[0.0261,0.0539]
CCI (Base: 0-1)	
2-3	-0.0698[***]
	[-0.104,-0.0360]
4-5	-0.0918[***]
	[-0.129,-0.0551]
>=6	-0.117[***]
	[-0.156,-0.0782]
IMD Quantile (Base: 1)	
2	0.00249
	[-0.0222,0.0272]
3	0.0156
	[-0.0125,0.0438]
4	0.0317[*]
	[0.00167,0.0618]
5	0.0142
	[-0.0178,0.0462]
eFi level (Base: no frailty)	
Mild Frailty	0.00224
	[-0.0155,0.0200]
Moderate Frailty	0.0147
	[-0.00763,0.0370]
Severe Frailty	0.0337[*]
	[0.00226,0.0651]
_cons	0.370[***]
	[0.325,0.416]
N	25480
Mean	0.303

95% confidence intervals in brackets
[*] *p* < 0.05, [**] *p* < 0.01, [***] *p* < 0.001
Robust Standard errors clustered at practice level.

CKD002

Interrupted Time Series

The pre-trend analysis shows an increasing trend in indicator achievement, but the slope coefficient is not statistically different from zero. The drop in average indicator performance when the indicator is retired is also not statistically significant. There is a positive change in slope in indicator performance post-intervention but this is also not statistically significant.

Intervention starts: 2015

Regression with Newey-West standard errors - lag(0)
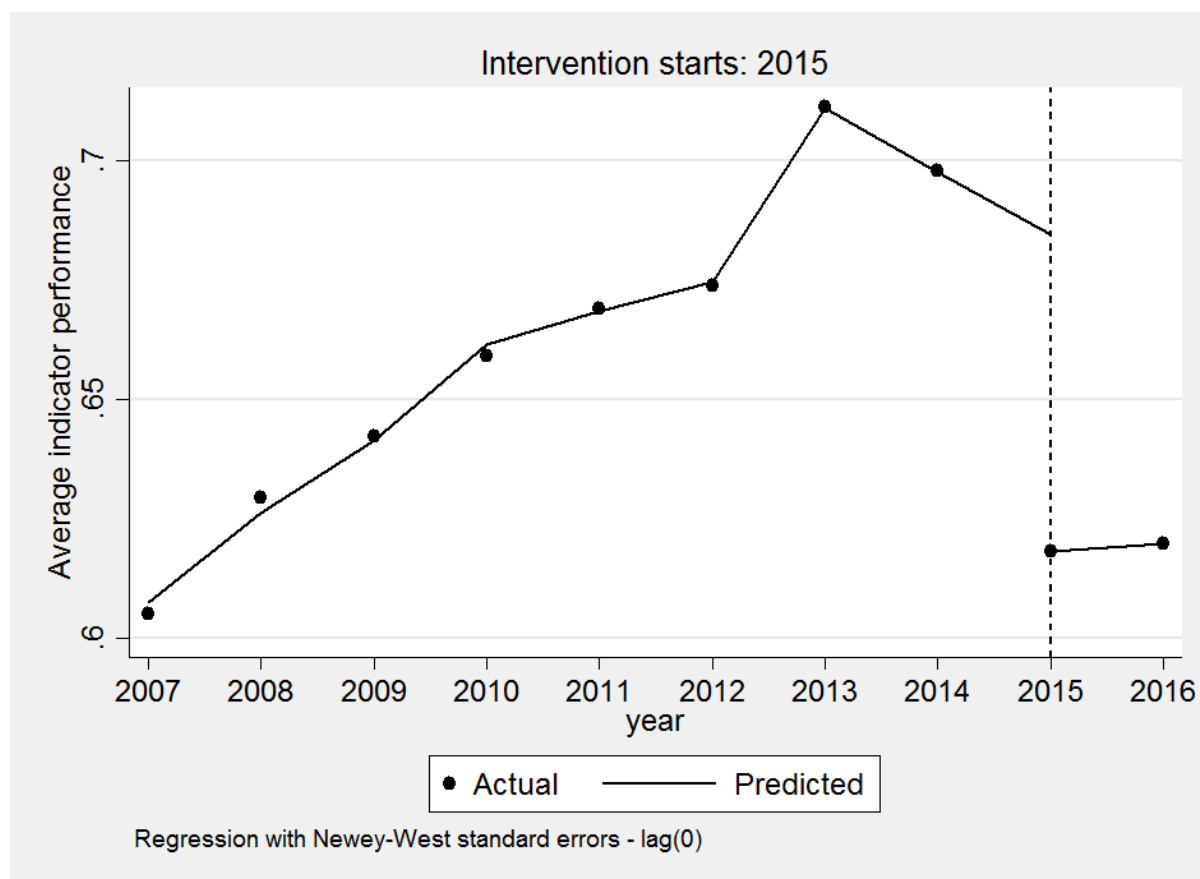
	CKD002	SE
Pre-trend	0.0149	0.0192
Effect of indicator removal	-0.1032	0.0288
Trend after removal	0.0580	0.0570
age	0.2013	0.1069
gender	3.0646	2.4285
CCI	-0.0392	0.0855
actual_eFi	-10.1527	1.8309
High deprivation (=1 if IMD>=4)	-1.5318	0.6125
_cons	-13.9920	6.7167
Effect of removal	0.0729	0.0400

Newey-west standard errors * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Patient Level

Assessing the effect of indicator performance on different age categories adjusted for the covariates shows that patients aged over 85 years old have the lowest probability of achieving the indicator throughout all apart from 2014/15. The effect of removing the indicator in the year 2015/16, had the greatest magnitude on the patients aged 55 to 64 years with a 8.71 p.p. decrease in probability of achieving the indicator, whereas the age group of the 85 years had smallest magnitude effect of a 7.17 p.p. decrease in probability of achieving the indicator.
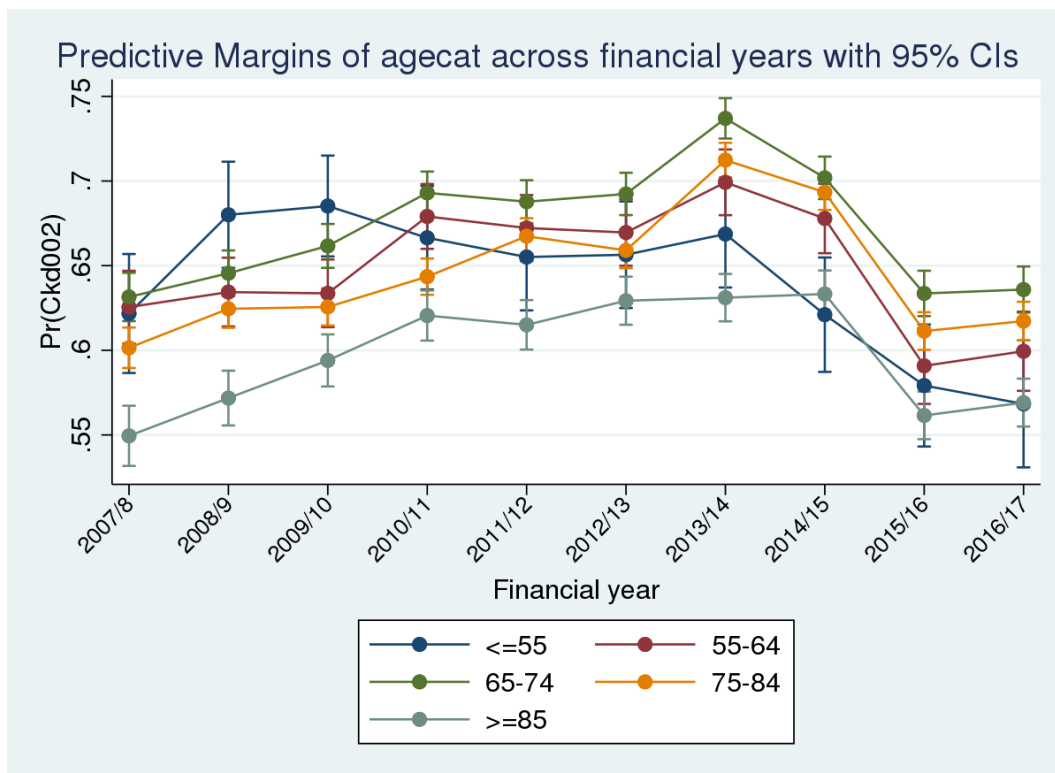
The model evaluating indicator performance on gender, showed throughout the study period men had a higher probability of achieving the indicator compared to women. The effect of the indicator being withdrawn was greater for women than men, who experienced a 8.57 p.p. decrease in probability of achieving the indicator, compared to men who had a 5.86 p.p. decrease.

Predictive Margins of gender across financial years with 95% CIs
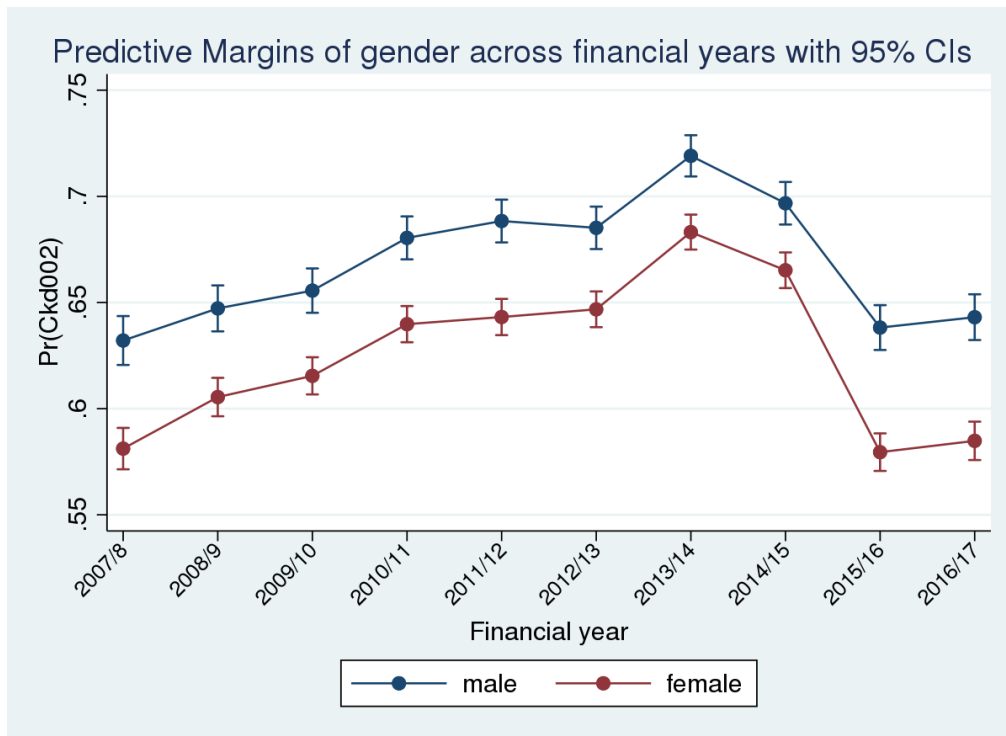
Patient level deprivation exhibits no noticeable differences in the probability of achieving the indicator. The effect of the indicator being withdrawn was higher in patients in the most and least deprived areas with a 9.15 p.p. decrease in probability of achieving the indicator. For those in the middle categories they had a 6 p.p. decrease in probability of achieving the indicator.

Predictive Margins of imd2015_5 across financial years with 95% CIs
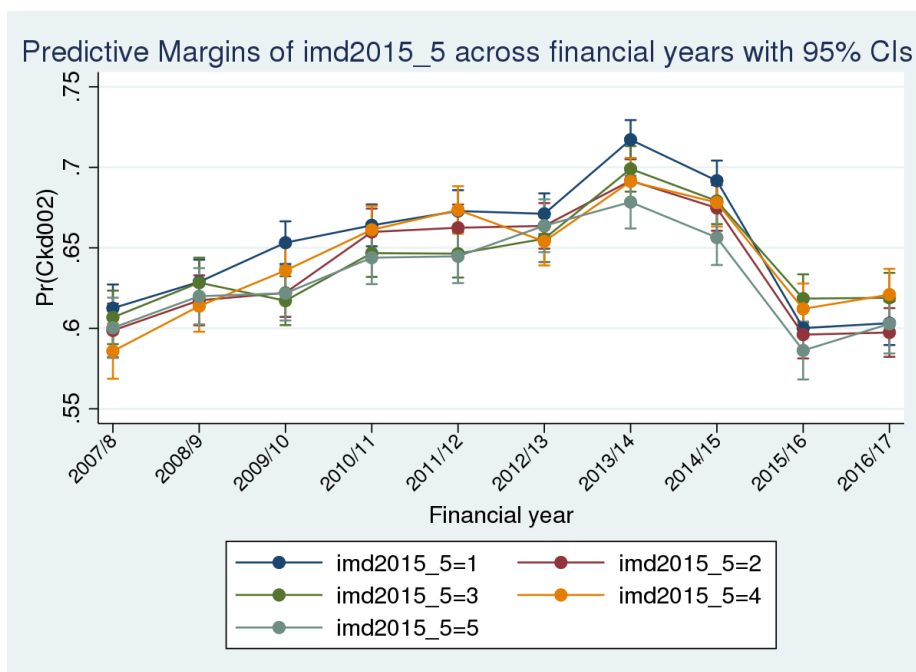
The effect of patients' frailty level had important effects on indicator achievement. Patients who were classified as fit had the lowest probability of achieving the indicator, and were also affected more by the indicator being withdrawn. This patient group had a 11.20 p.p. decrease in probability in achieving the indicator, compared to that of the severe frail

patients who had a only a 5.55 p.p. decrease in probability in achieving the indicator from 2014/15 to 2015/16.

Predictive Margins of eFi_level across financial years with 95% CIs
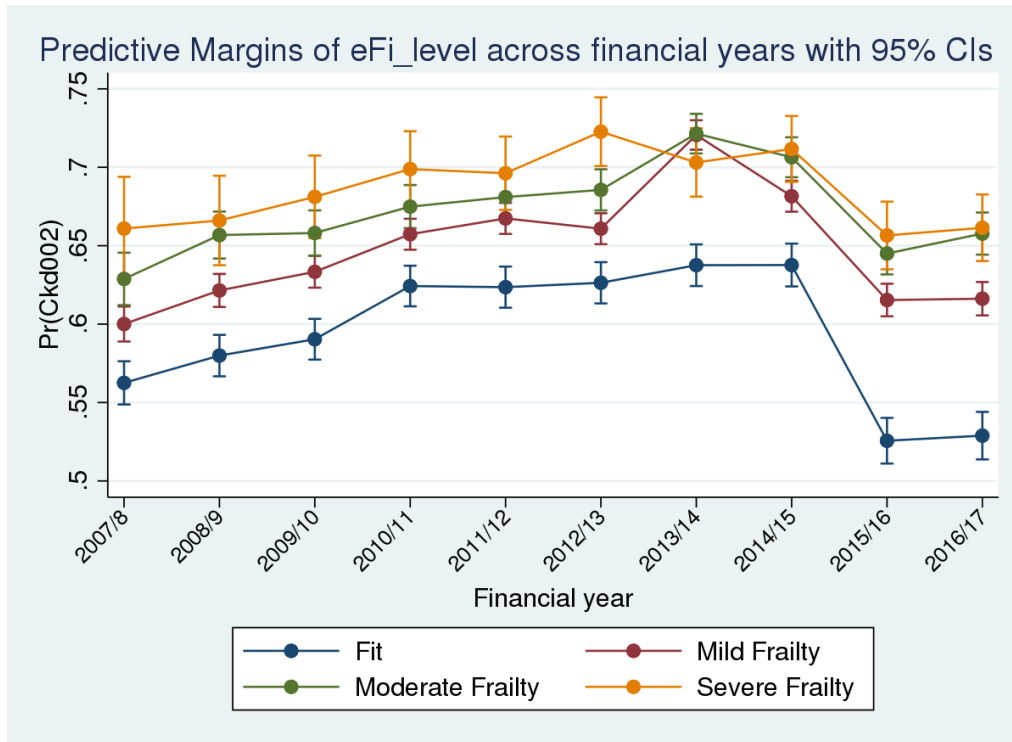
Similar effects of the eFI appear in the CCI model, with patients with the lowest CCI having the lowest probability of achieving the indicator however were not the patient group most affected by the removal of the indicator. The patient whose CCI score between 2 to 3 had the most adverse effects, with a 11.34 p.p. decrease in the probability of achieving the indicator from 2014/15 to 2015/16.

Predictive Margins of CCIcat across financial years with 95% CIs
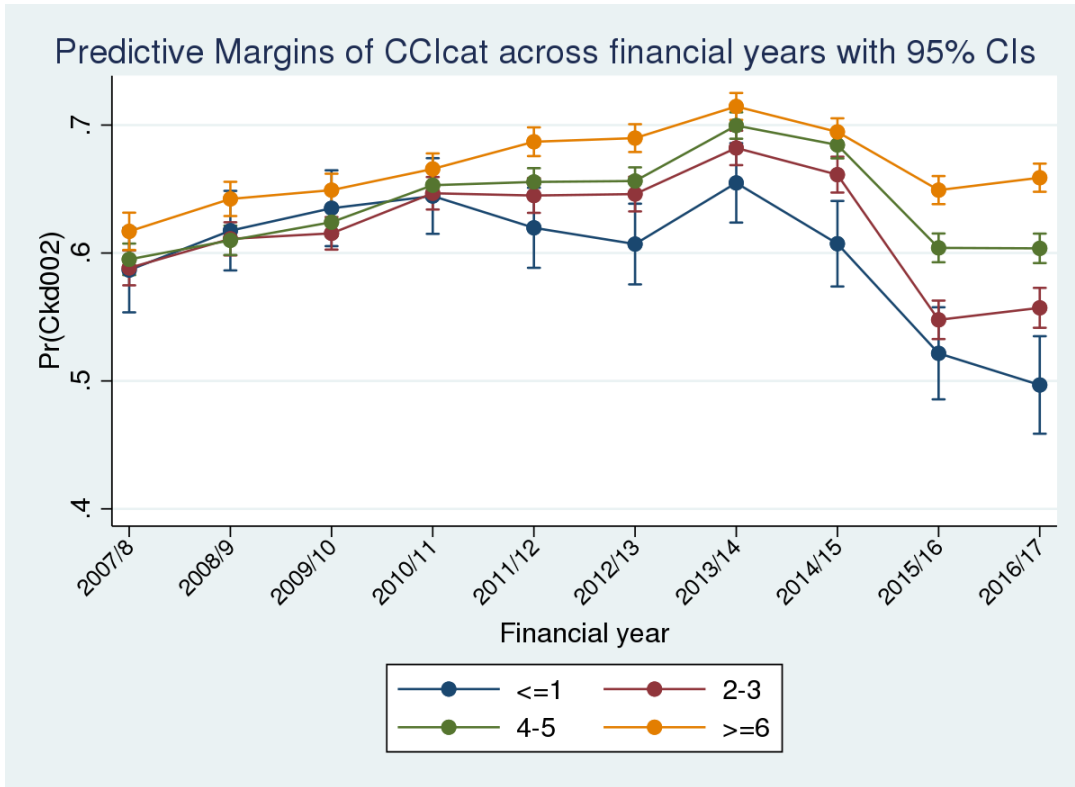
Practice Level

The adjusted effect of practice level IMD on indicator achievement shows no differing effect between deprivation levels. There is also no clear effect of practice list size on probability of achieving the indicator, with similar patterns in probability of achievement however wide confidence intervals making inference unclear.

Predictive Margins of e2015_imd_5 across financial years with 95% CIs

Predictive Margins of lsizecat across financial years with 95% CIs
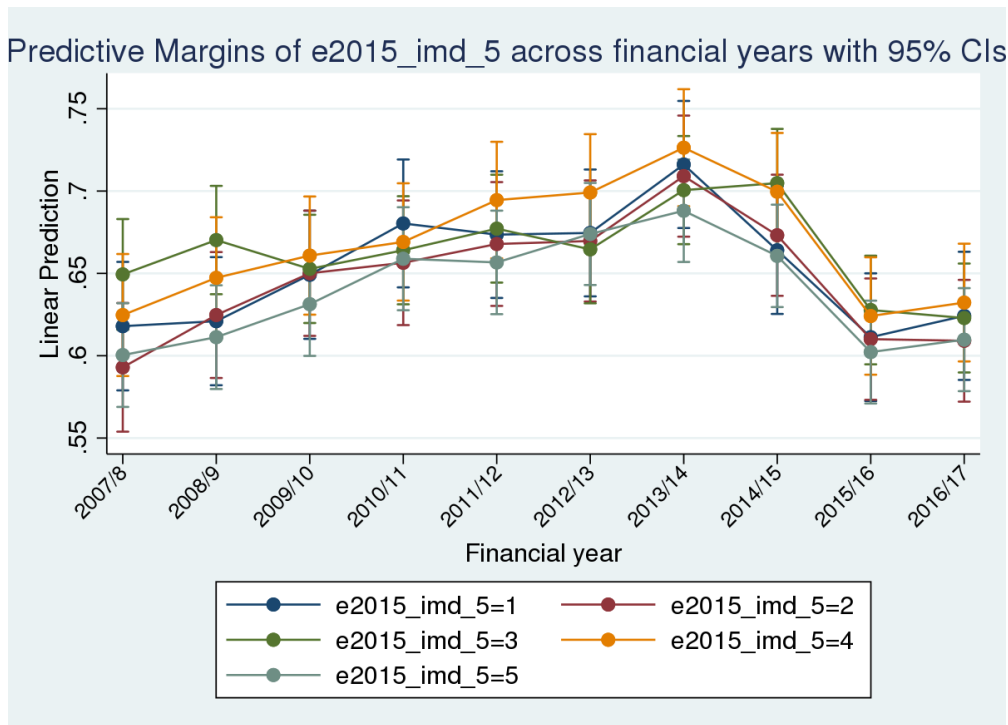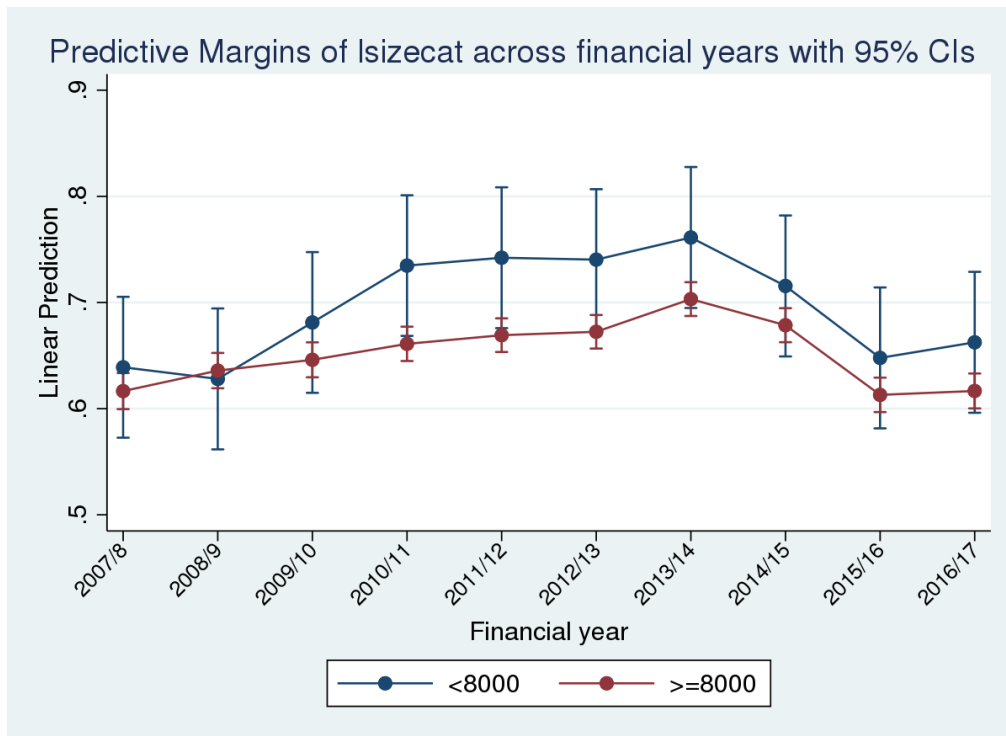
Patient Level Effect of Indicator Retirement

32% of patients who achieved the indicator in 2013/14 did not achieve the indicator in the following year when the indicator is retired. Patients aged over 85 years are particularly affected by the removal of the incentive, with that group 11.1 p.p. more likely not to achieve the indicator given they achieved the year prior to removal. Furthermore patients with higher CCI scores were less likely to fail the indicator compared to the baseline. Similar effects were observed for the patient's eFI level, with patients who are frailer having a lower probability of not achieving the indicator. There are no significant differences by deprivation level in the probability of patients not achieving the indicator in the year the incentive was removed.

	Probability of not achieving the Indicator in 2014/15 conditional on having achieved it in 2013/14
Age Category (Base: <55)	
55-64	0.00371
	[-0.0508,0.0583]
65-74	0.00893
	[-0.0424,0.0602]
75-84	0.0446
	[-0.00984,0.0989]
>=85	0.111***
	[0.0546,0.167]
Female (Base: male)	0.0506***
	[0.0359,0.0653]
CCI (Base: 0-1)	
2-3	-0.0741**
	[-0.125,-0.0228]
4-5	-0.129***
	[-0.182,-0.0756]
>=6	-0.170***
	[-0.224,-0.117]
IMD Quantile (Base: 1)	
2	-0.00334
	[-0.0282,0.0216]
3	-0.0149
	[-0.0427,0.0129]
4	-0.00904
	[-0.0373,0.0193]
5	0.00944
	[-0.0218,0.0407]
eFi level (Base: no frailty)	
Mild Frailty	-0.0601***
	[-0.0811,-0.0392]
Moderate Frailty	-0.0729***
	[-0.0996,-0.0461]
Severe Frailty	-0.0743***
	[-0.106,-0.0426]
_cons	0.431***
Age Category (Base: <55)	[0.381,0.482]
N	18980
Mean	0.321

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Robust Standard errors clustered at practice level.

HYP002

Patient Level

The adjusted effect of age on hypertension patients having a blood pressure reading below 150/90 mmHg shows that patients aged under 55 years and over 85 years have the lowest probability of achieving this. There is an overall increasing probability of achieving this indicator, with those aged 65 to 74 years having the highest probability of achievement.
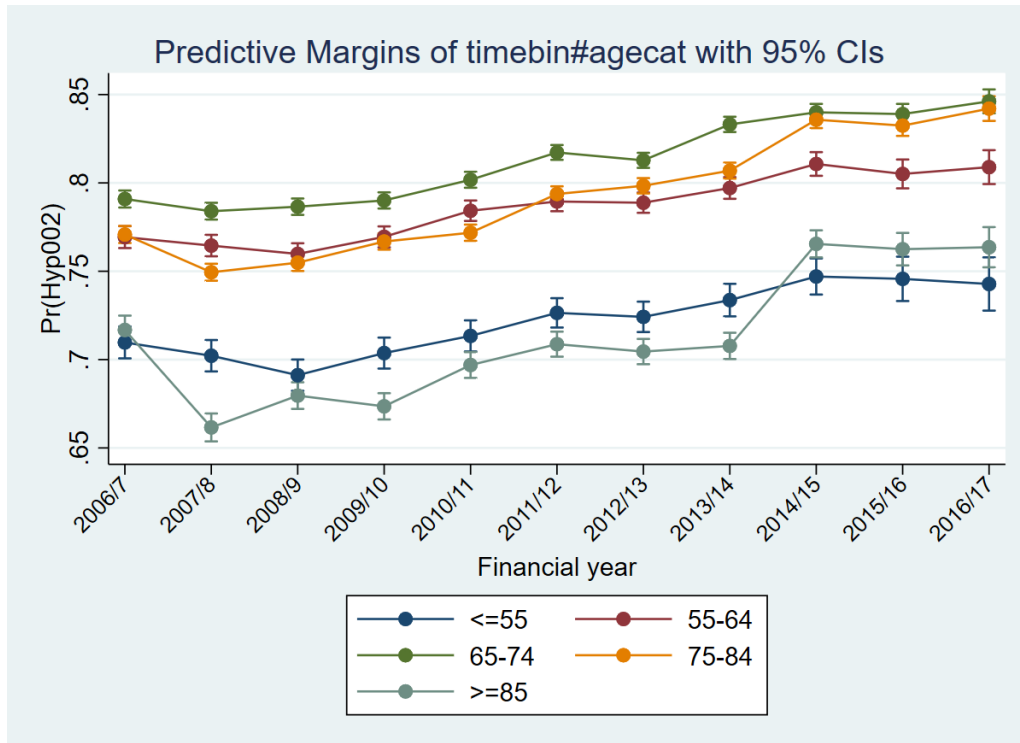
Assessing the gender adjusted effect of the indicator achievement shows that throughout the study period men have higher probability of achieving the indicator, with approximately being 2 p.p. more likely.

Predictive Margins of timebin#gender with 95% CIs
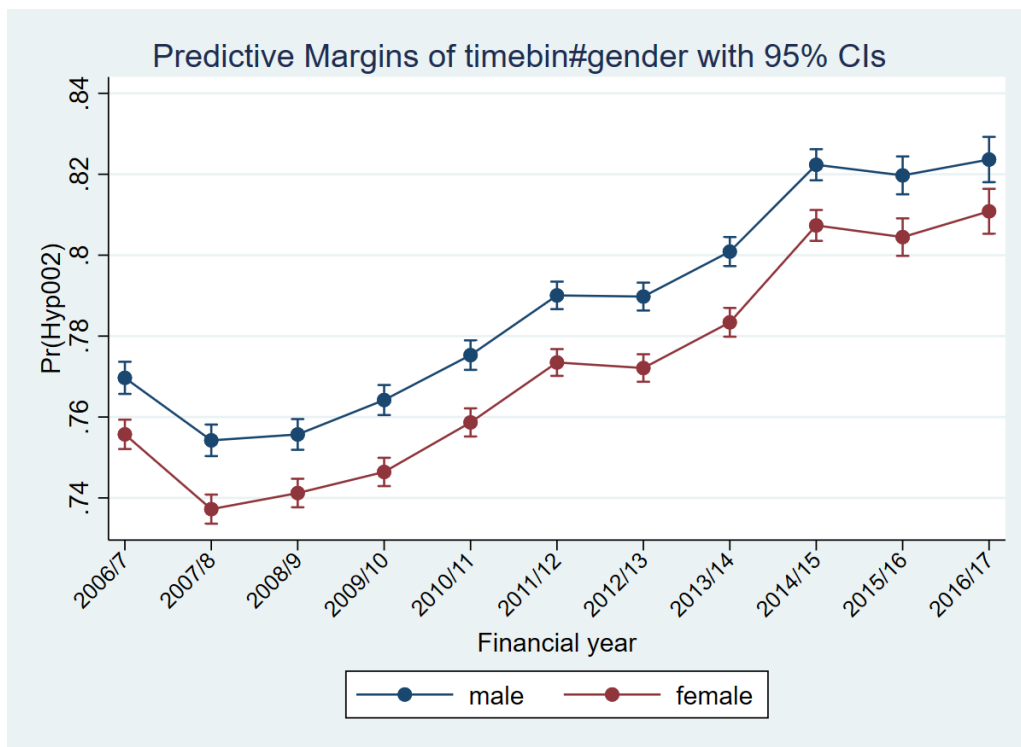
The adjusted effect of deprivation the indicator achievement shows that from 2011/12 the patients living the least deprived areas have a higher probability of achieving the indicator. However overall there is little effect of deprivation on achievement.

Predictive Margins of timebin#imd2015_5 with 95% CIs
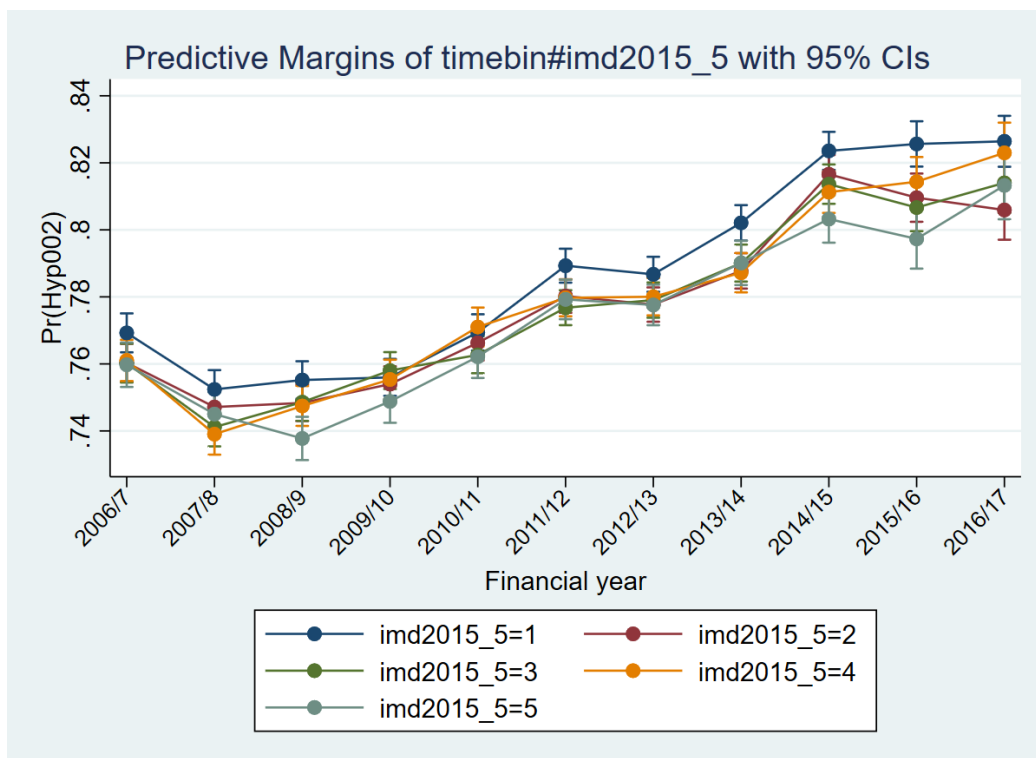
The patients' level of frailty is similar for patients with mild to severe frailty, with those classified as fit having lower probability of achieving the indicator. The results suggest that more frail patients have a higher probability of having blood pressure below 150/90mmHg than fitter patients.

Predictive Margins of timebin#eFi_level with 95% CIs
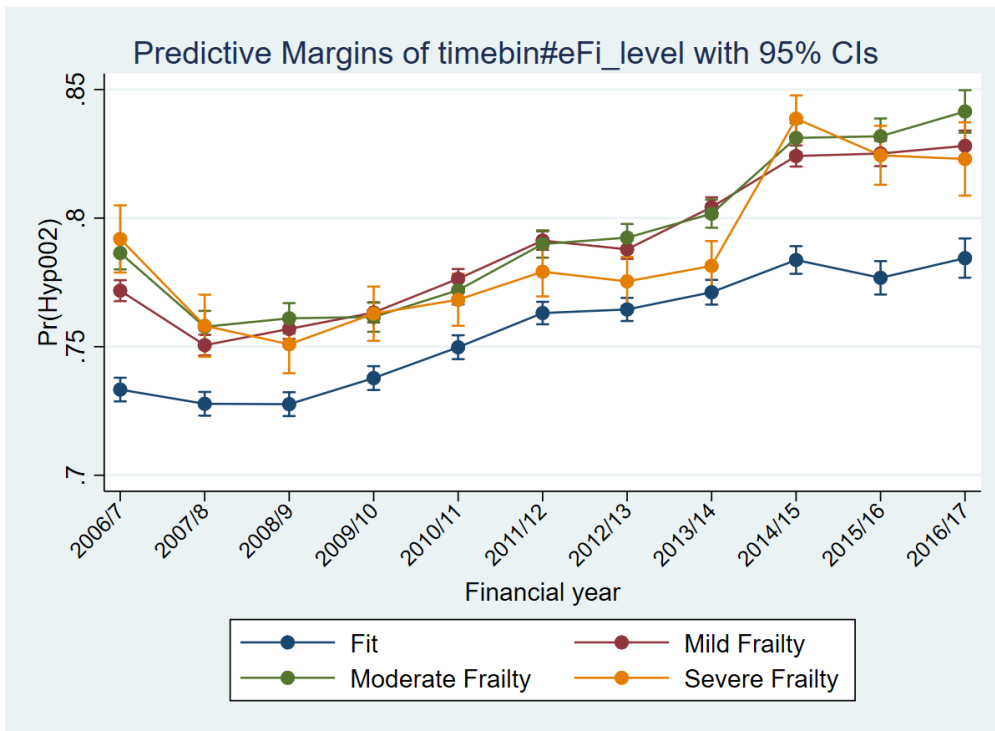
Similar effects to CCI on indicator achievement to that of frailty level, with patients of CCI≤1 having the lower probability of indicator achievement. However confidence intervals of these patients begin to widen to give more ambiguous effects.

Predictive Margins of timebin#CCIcat with 95% CIs
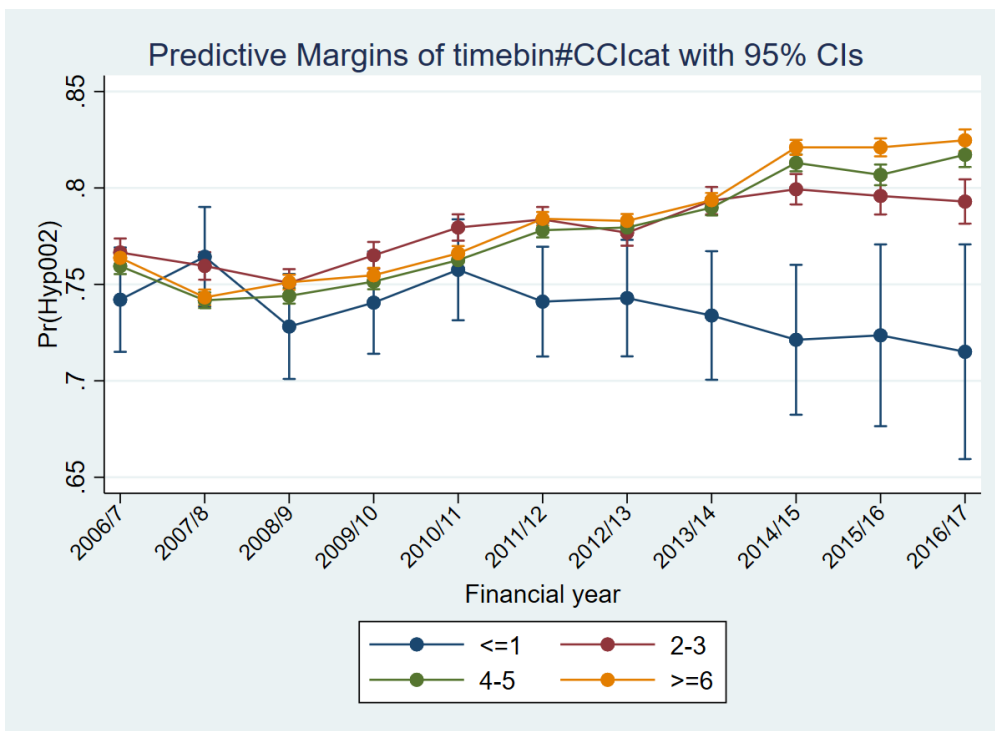
Practice Level

The adjusted effect of practice level IMD on indicator achievement, shows for the majority of the of the study period the practices in the least deprived areas having the greatest probability of achieving the indicator.

Predictive Margins of timebin#e2015_imd_5 with 95% CIs
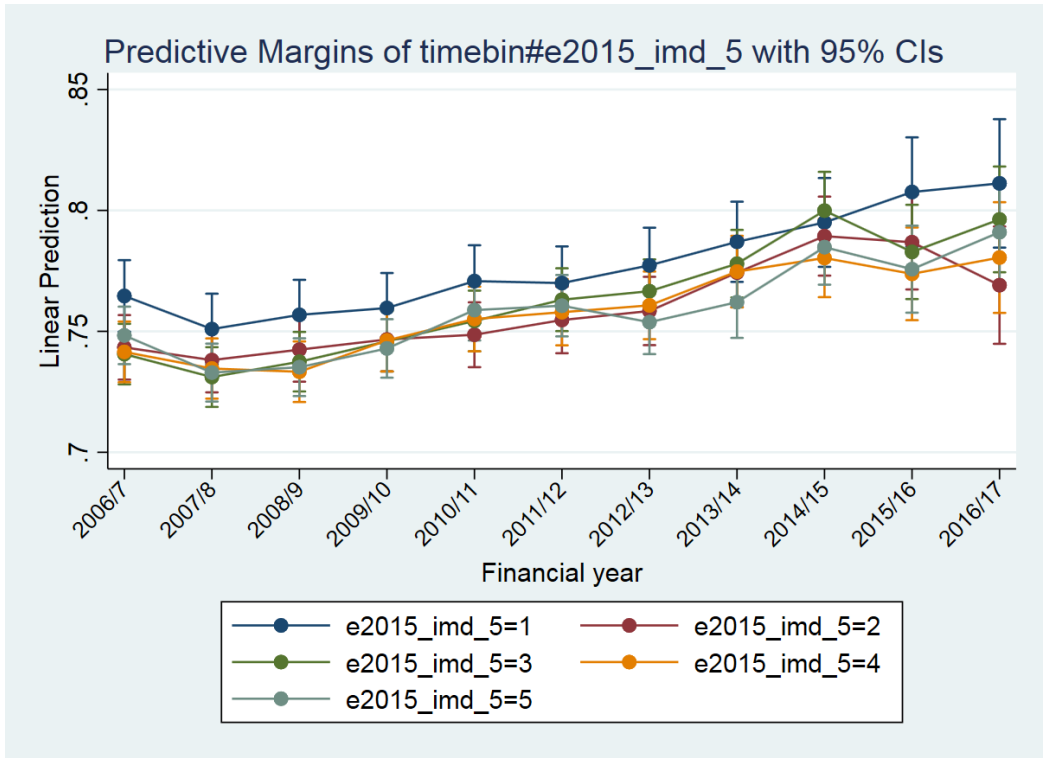
The effect of practice list size on indictor achievement shows across the majority of the study period that practices with a list size of less than 8000 have a higher probability of achieving the indicator.

Predictive Margins of timebin#lsizecat with 95% CIs
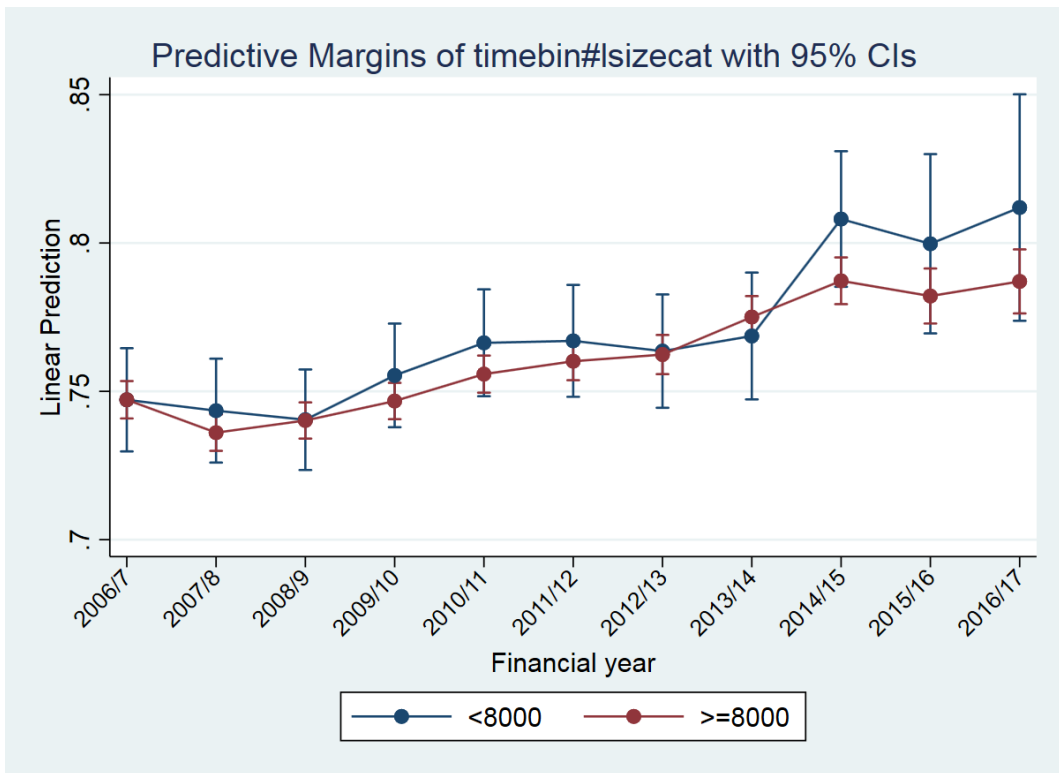
HYP003

Interrupted Time Series

It is noticeable that the indicator was only introduced in 2013/14 and removed the following year. The pre-trend analysis for this indicator shows no significant trend in achievement. The effect of the intervention indicates a significant decrease in indicator achievement, with the coefficient having a 10.25 p.p. decrease which is significant at the 5% level. Furthermore there has been a significant effect on the trend of indicator achievement post intervention which this having a decreasing slope statistically significant at the 10% level.

Intervention starts: 2014

Regression with Newey-West standard errors - lag(0)
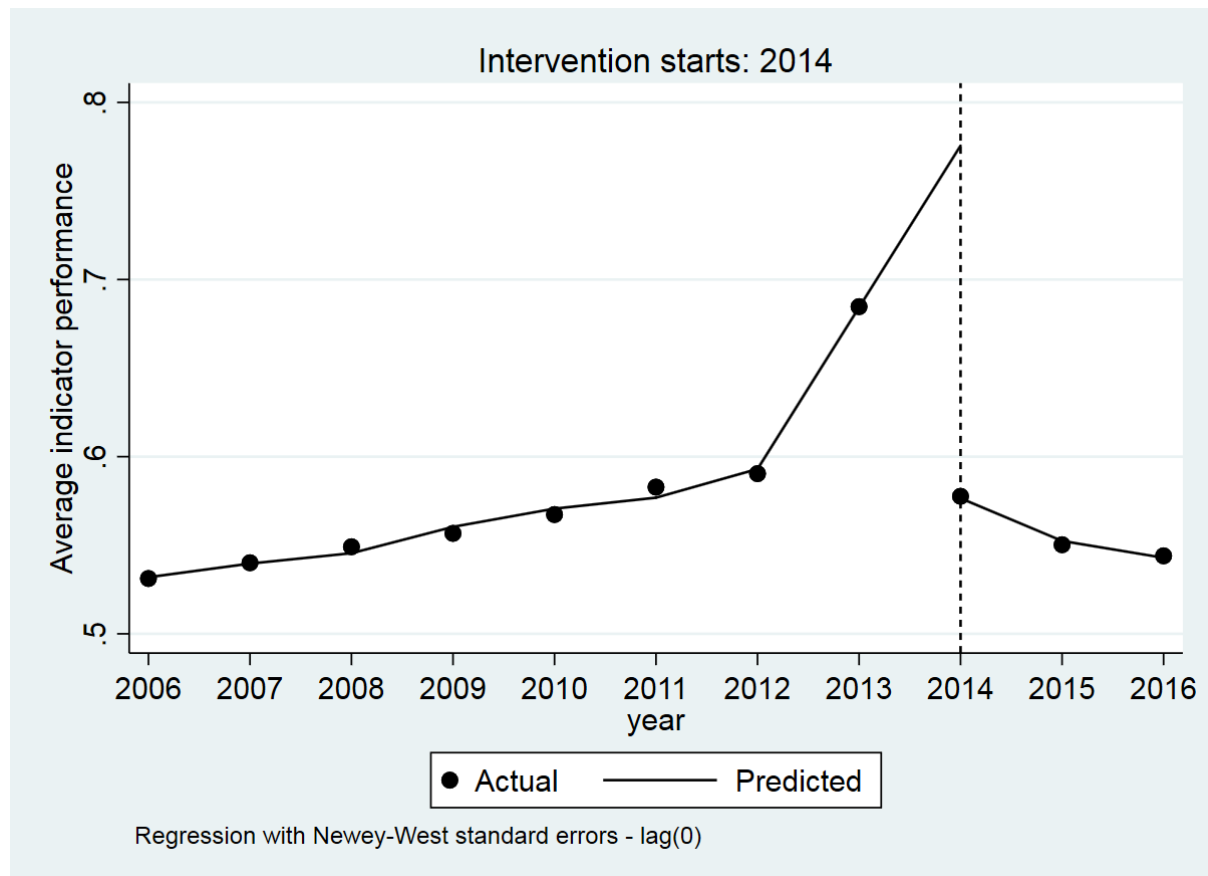
	HYP003	SE
Pre-trend	-0.01	0.04
Effect of indicator removal	-0.1025**	0.0132
Trend after removal	-0.0424	0.0268
age	0.0104	0.1539
gender	-6.9742	11.8035
CCI	1.0121	0.3474
Actual eFi	-10.2594	9.6515
High deprivation (=1 if IMD>=4)	-3.8400	1.3845
_cons	0.4021	3.0664
Effect of removal	-0.0553*	0.0158

Newey-west standard errors * p < 0.05, ** p < 0.01, *** p < 0.001

Patient Level

Prior to the indicator being introduced there was an increasing trend across all age categories. The introduction and removal of the indicator in 2013/14 led to a spike in

indicator achievement. The most adversely effected patients were those aged under 55 years, with when comparing 2012/13 to 2014/15, they have had a 2.9 p.p. decrease in probability of achieving blood pressure below 140/90 mmHg. In the year the indicator was active the patients aged 65 to 74 years increased the probability of achieving the indicator by 9.31 p.p., when the indicator was removed the following year this probability decreased by 10.11 p.p. to below that of before the intervention.

Predictive Margins of timebin#agecat with 95% CIs
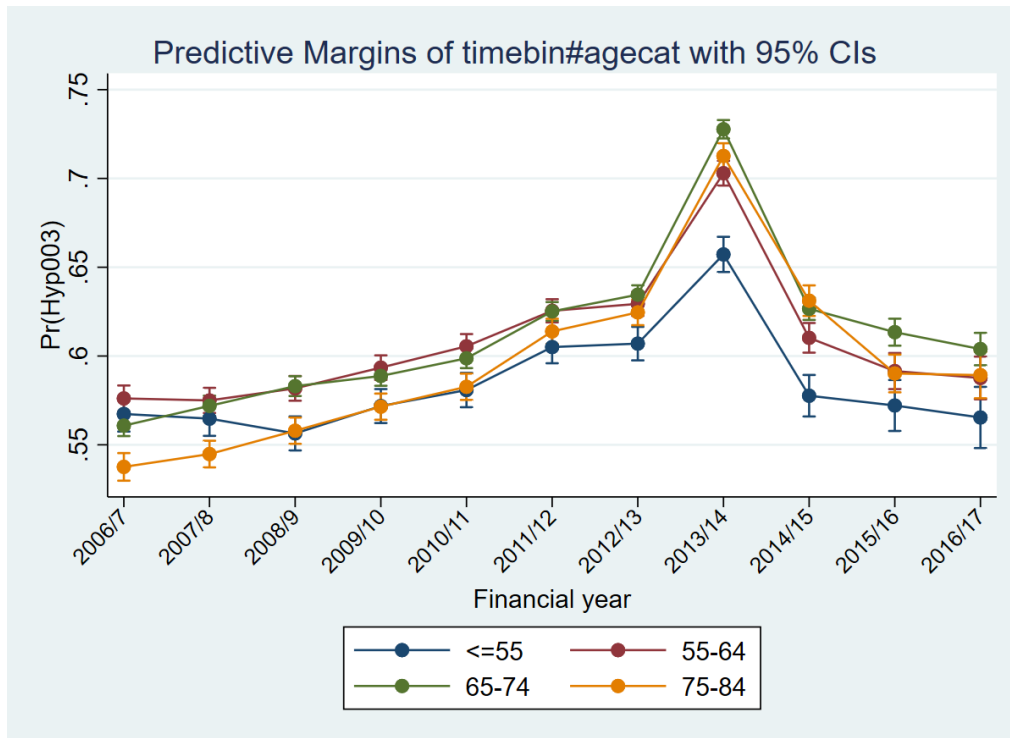
In comparing the differences in gender in the adjusted model, the effect for both men and women have nearly the same probability of achieving the indicator. However interestingly when the indicator is removed the following the year men and women have similar probability of achievement, but in the years to follow this begins to diverge, and by 2016/17 men are 2 p.p. more likely to achieve the retired indicator than women.

Predictive Margins of timebin#gender with 95% CIs
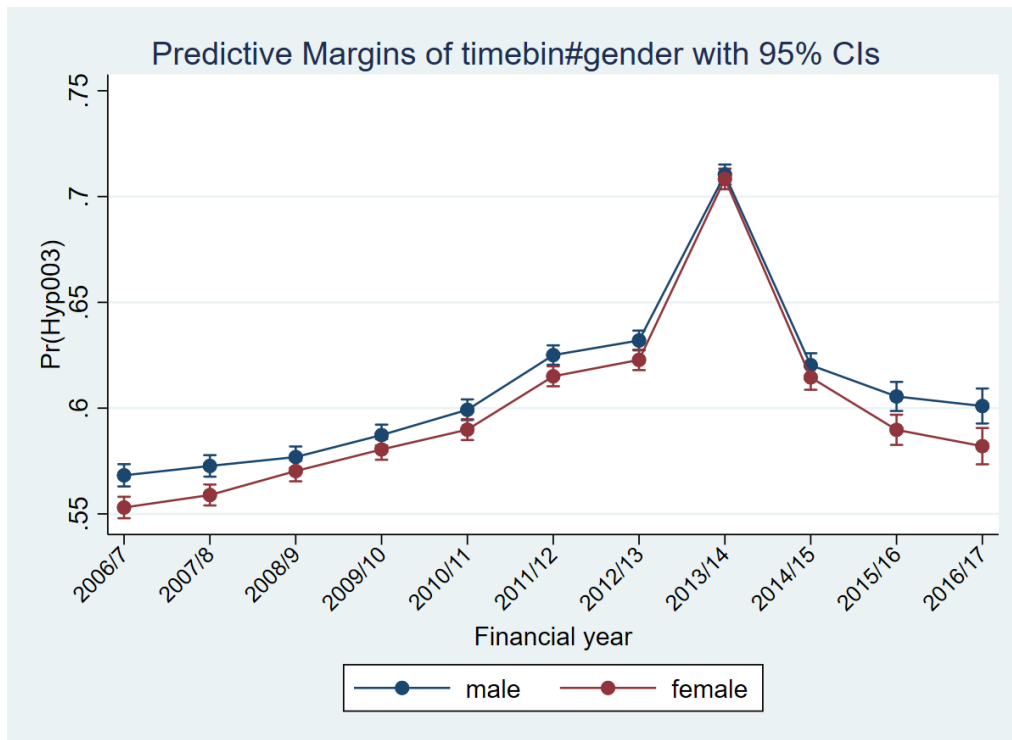
The effect of adjusted IMD on indicator achievement shows that the year the indicator was active, the patients living the least deprived areas have the highest probability of indicator achievement. For all levels of IMD the probability of achieving the indicator is greater in the period before the indicator was active than in the period after it is removed.


Predictive Margins of timebin#imd2015_5 with 95% CIs
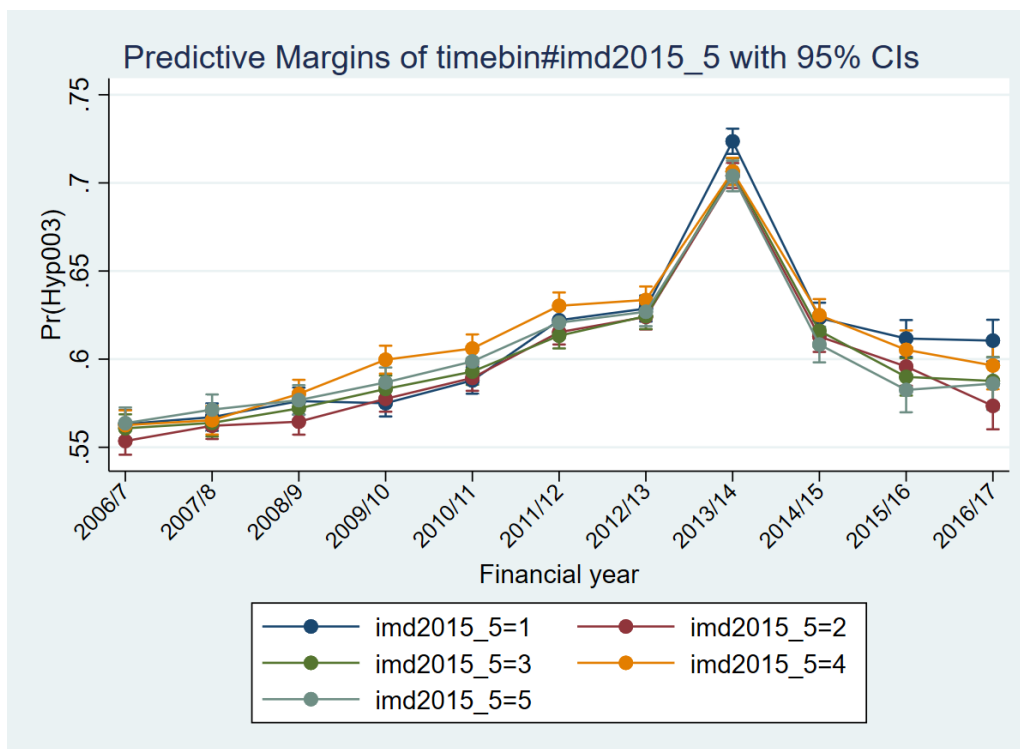
The effect of adjusted eFI on indicator achievement shows patient with severe and moderate frailty has the highest probability of achieving the indicator in the period it was active. The patients classified as fit have the largest drop in probability when the incentive is removed,

with a 10.74 p.p. decrease. The severely frail patients appear to be least affected by the introduction and removal of the indicator, and have the highest probability of achieving.

Predictive Margins of timebin#eFi_level with 95% CIs
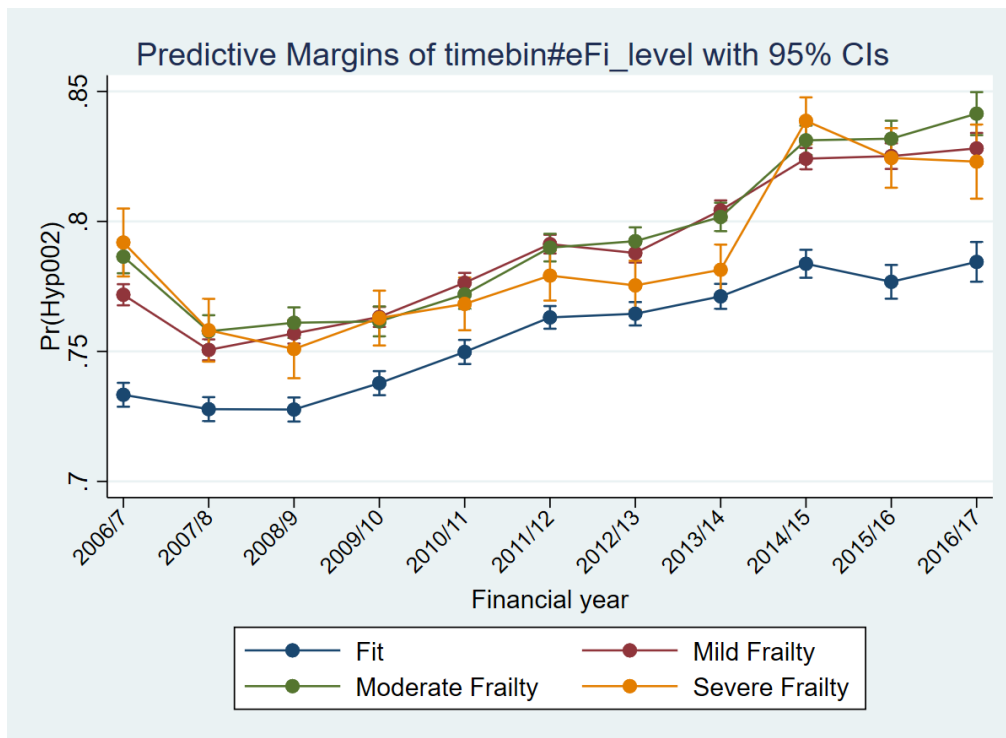
Similar effects on the adjusted CCI effects as that of the eFI, with the patients with the lowest CCI category being most affected by the indicator being withdrawn and having the lowest probability of achievement.


Predictive Margins of timebin#CCIcat with 95% CIs
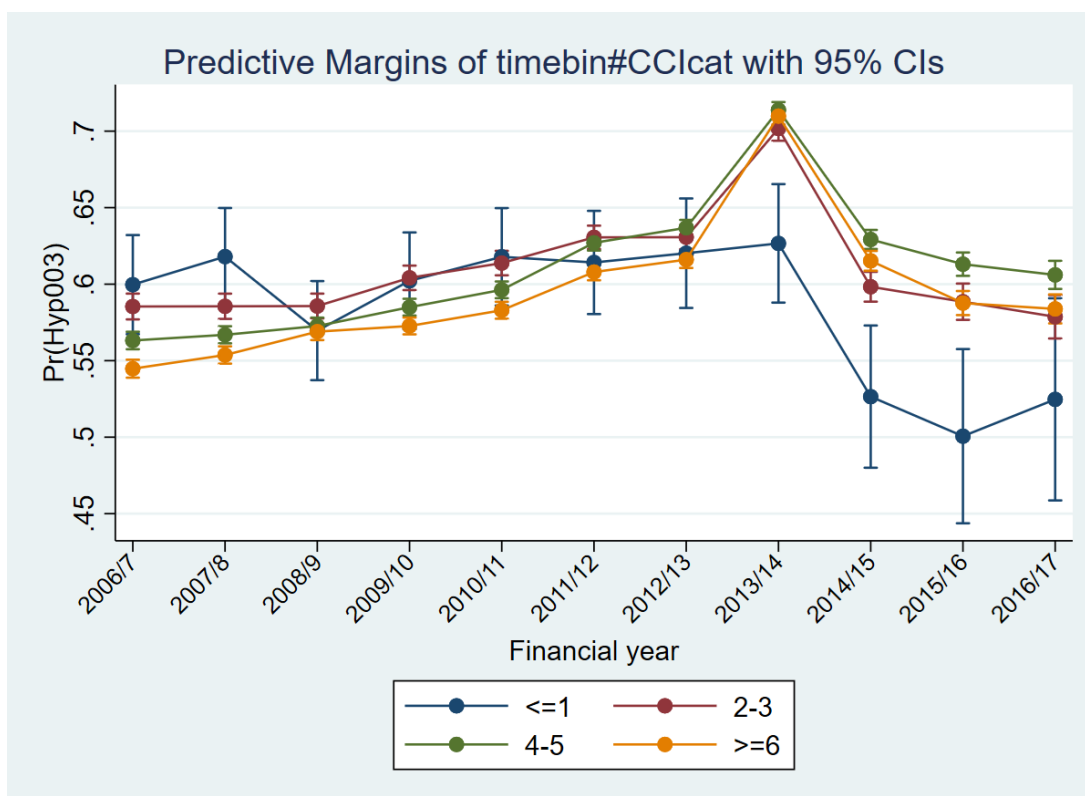
Practice Level

The adjusted effect of practice level IMD on indicator performance shows practices in the least deprived has the highest probability of indicator achievement in the year the year the indicator was active. Furthermore practices in the most deprived areas have the lowest probability of indicator achievement; however the variation between highest and lowest is 4 p.p.

Predictive Margins of timebin#e2015_imd_5 with 95% CIs
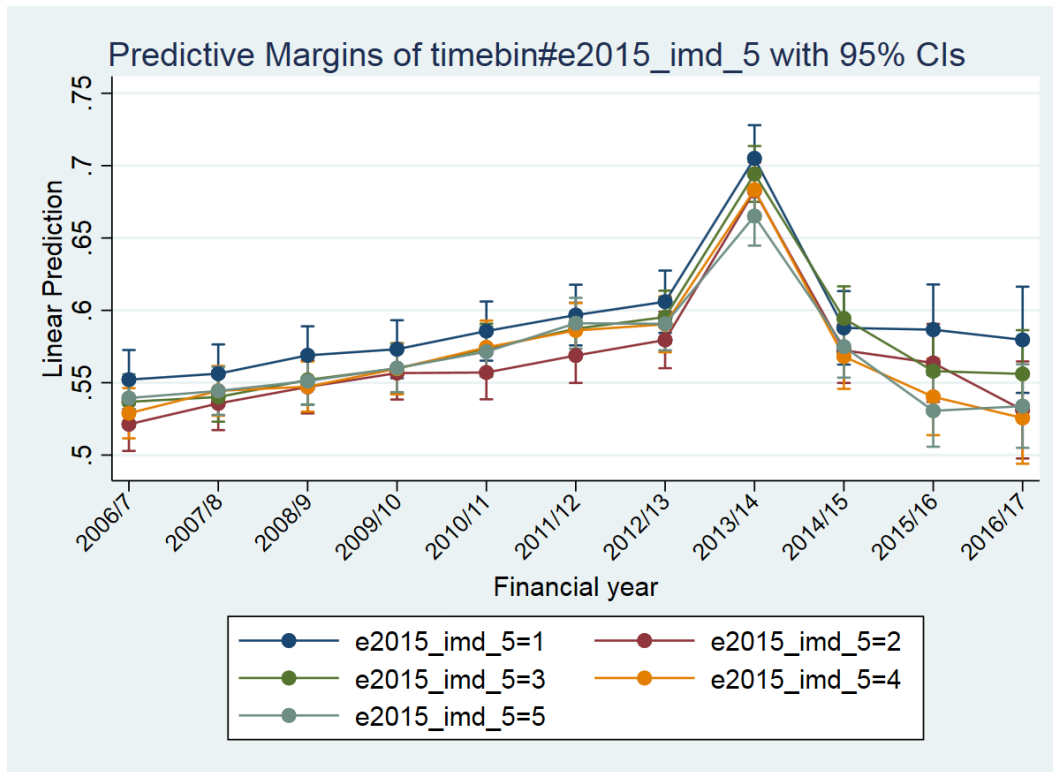
Similar results with practice list size on indicator performance shows small practices have higher probability of indicator achievement compared to the larger practices. However the confidence intervals on the smaller practices are a lot wider than that of the bigger practices.

Predictive Margins of timebin#lsizecat with 95% CIs
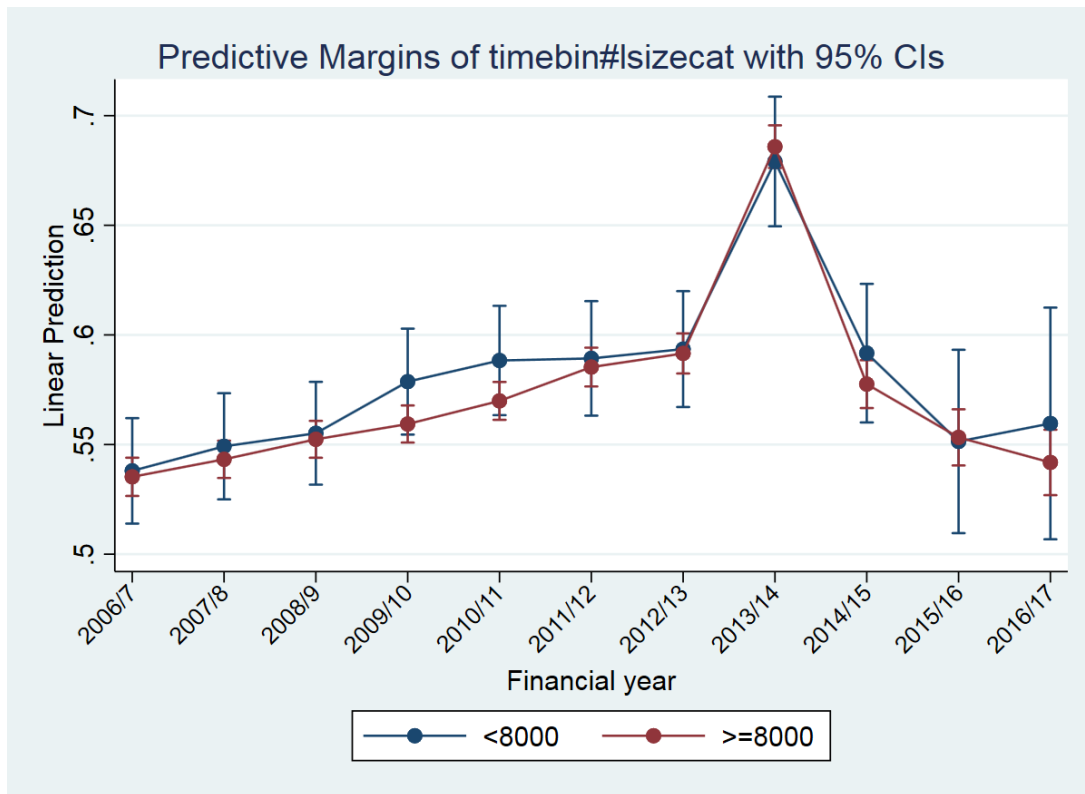
Patient Level Effect of Indicator Retirement

31.8% of patients who achieved the indicator in 2013/14 did not meet the indicator in the following year. In the year after the indicator is removed, women were 0.9 p.p. more likely not achieve the indicator given they achieved the indicator in the previous prior. Patients who have a higher frailty level were less likely to not achieve the indicator compared to fit patients; with patients who are severely frail are 8.81 p.p. less likely to not achieve the indicator.

|	Probability of not achieving the Indicator in 2014/15 conditional on having achieved it in 2013/14
Age Category (Base: <55)	
55-64	-0.0104
	[-0.0306,0.00975]
65-74	-0.0106
	[-0.0310,0.00974]
75-84	-0.00653
	[-0.0283,0.0152]
Female (Base: male)	0.00948*
	[0.000118,0.0188]
CCI (Base: 0-1)	
2-3	-0.0118
	[-0.0797,0.0561]
4-5	-0.0398
	[-0.108,0.0280]
>=6	-0.0221
	[-0.0898,0.0455]
IMD Quantile (Base: 1)	
2	0.00968
	[-0.00567,0.0250]
3	0.00529
	[-0.0112,0.0218]
4	-0.000237
	[-0.0197,0.0192]
5	0.0149
	[-0.00488,0.0347]
eFi level (Base: no frailty)	
Mild Frailty	-0.0454***
	[-0.0570,-0.0338]
Moderate Frailty	-0.0643***
	[-0.0819,-0.0468]
Severe Frailty	-0.0881***
	[-0.115,-0.0612]
_cons	0.379***
	[0.312,0.446]
N	38582
Mean	0.318

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Robust Standard errors clustered at practice level.

MH004

Interrupted Time Series

The indicator was introduced in 2011/12, which is noticeable in the graph below by the increased indicator achievement. Due to this, the slope coefficient is not significant in the pre-trend. The effect of the intervention, i.e. the indicator being removed, has a significant negative effect the 1% level, with a 25.05 p.p. decrease in average indicator performance. The effect on post intervention trend is not significant meaning after the indicator is removed there is no pattern in average indicator performance.

Regression with Newey-West standard errors - lag(0)
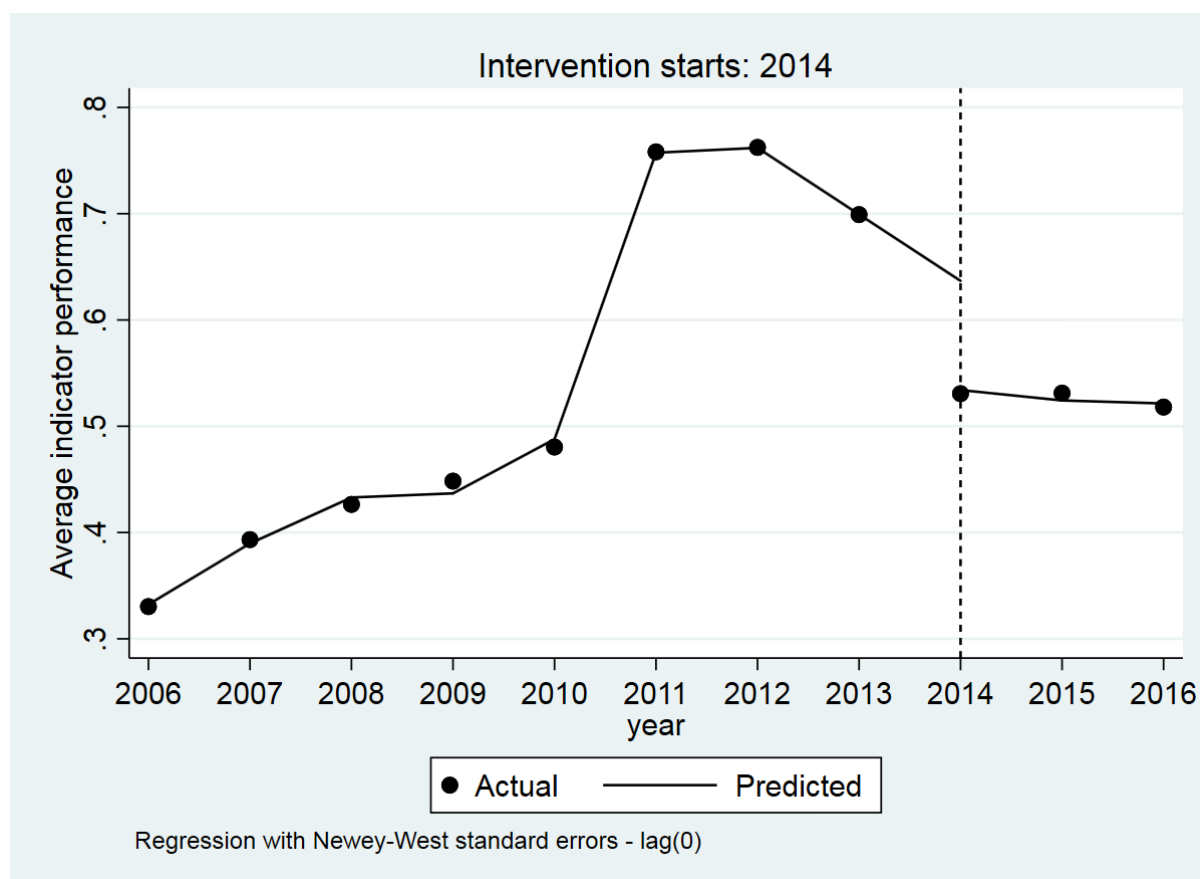
	MH004	SE
Pre-trend	-0.1795	0.0691
Effect of indicator removal	-0.2505***	0.0121
Trend after removal	0.1532*	0.0375
age	0.0026	0.1418
gender	11.1251	9.4094
CCI	1.8688***	0.1193
actual_eFi	11.1142	7.7004
High deprivation (=1 if IMD>=4)	5.4607*	1.6937
_cons	-13.5435	9.7682
Effect of removal	-0.0263	0.0482

Newey-west standard errors $^{*} p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$

Patient Level

From when the indicator was active from 2011/12, there is a pattern in younger patients with mental health illness having increased probability of achieving the indicator in the adjusted model. However when assessing the change in probability from 2013/14 to 2014/15 from when the indicator was withdrawn, the youngest age category (under 55s) were more adversely affected with a 16.86 p.p. decrease in the probability of achieving the indicator. In comparison to the eldest age category (over 85s), they had a 13.40 p.p. decrease in probability of achieving the indicator when the incentive was removed.


Predictive Margins of timebin#agecat with 95% CIs
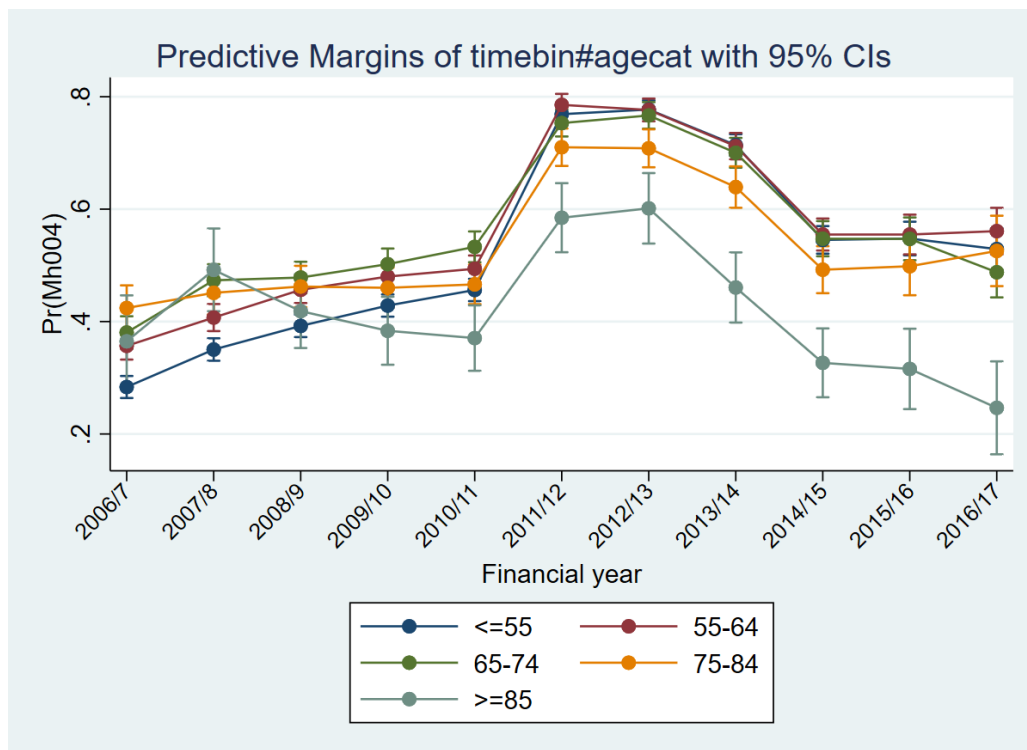
The adjusted gender effect on indicator achievement show for both men and women they follow a similar pattern. The effect of the removal of the indicator led to a 16.90 p.p. decrease in probability of achieving the indicator for men, and a 15.20 p.p. decrease for women, implying that men were more adversely affected. However after this indicator was removed the probability of having a hdl:cholesterol reading remained stable for men, and there was a further decline for women.

Predictive Margins of timebin#gender with 95% CIs
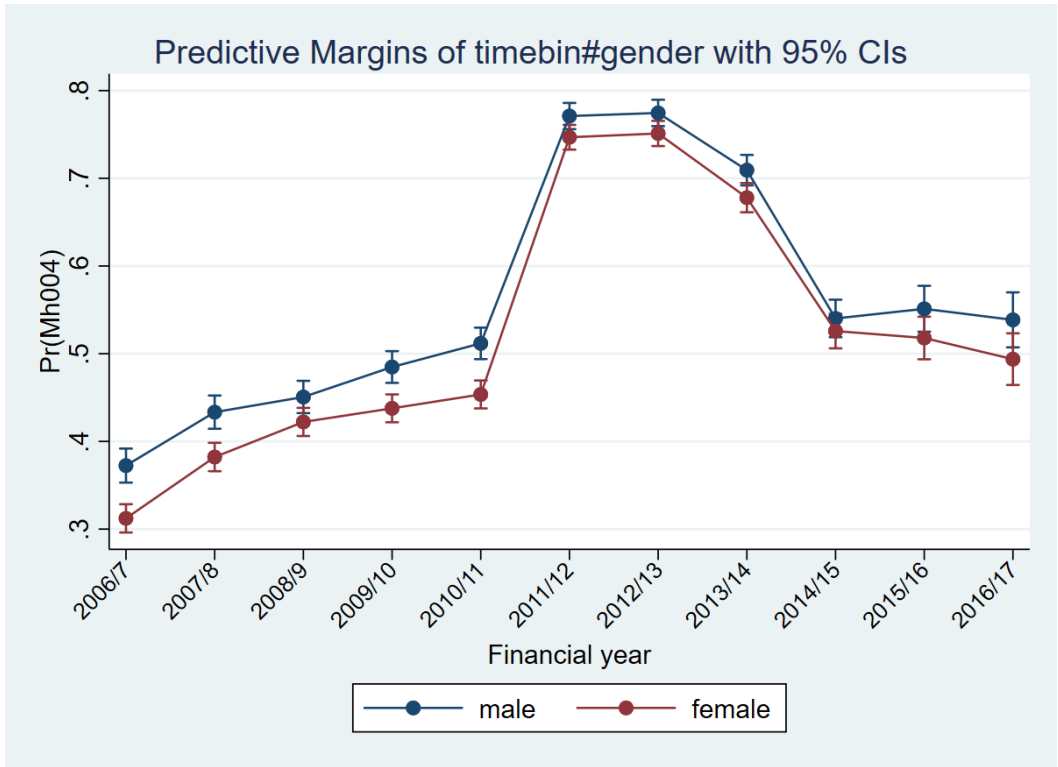
The adjusted IMD effect on indicator achievement showed for all deprivation levels a similar pattern in probability of achievement. When assessing the effect of the removal of the indicator, the patients living the least deprived areas were most adversely affected, with a 18.17p.p. decrease in probability of indicator achievement. The patients in the second least deprived areas (IMD=2) were least affected by the removal with a 13.86 p.p. decrease in probability of achieving the indicator.

Predictive Margins of timebin#imd2015_5 with 95% CIs
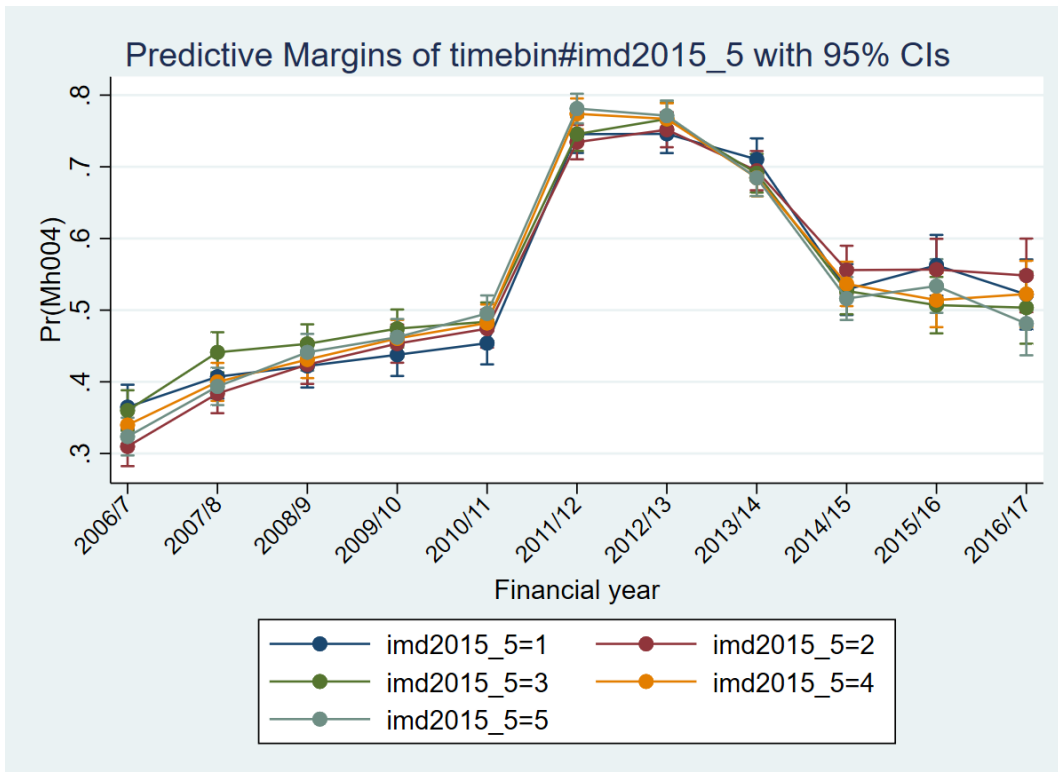
From the predicted plots on the pattern of frailty level on predicted probability show for the majority of the study period (apart from 2013/14), the patients classified as fit to have the lowest probability of indicator achievement. This patient group was also most adversely affected by the indicator being removed with a 19.77 p.p. decrease in the probability of achieving the indicator when the incentive was removed. The severely frail patients appear to be least affected by the removal of the indicator due to a 1.57 p.p. drop in probability of achieving, however there is drop already in the probability in 2013/14, and prior to this severely frail patients had the highest probability of achieving the indicator.

Predictive Margins of timebin#eFi_level with 95% CIs
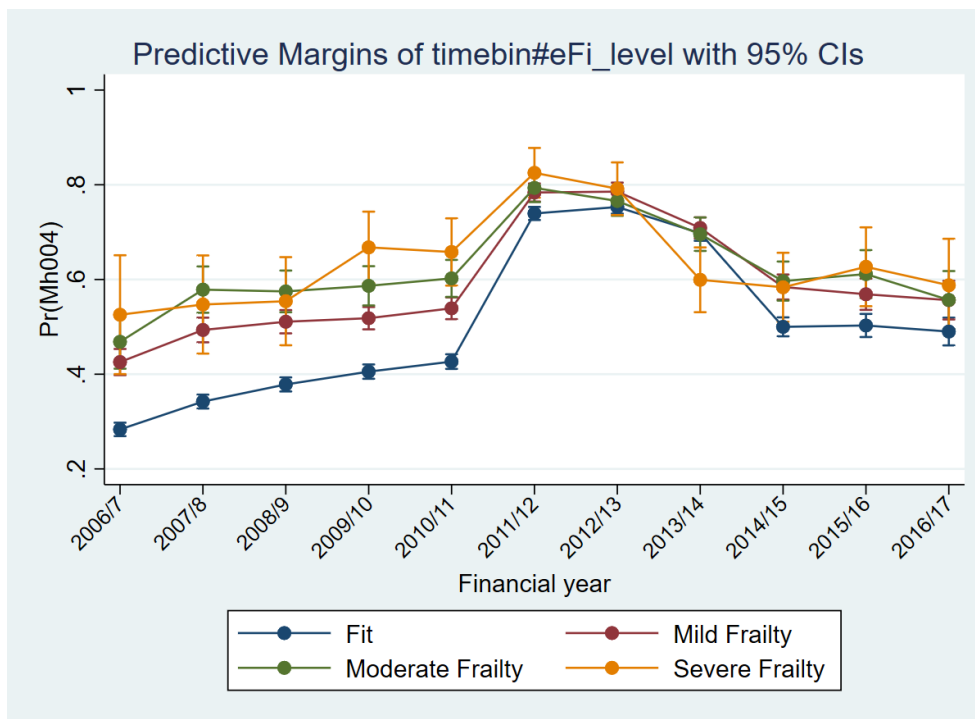
The pattern of patient's CCI on indicator achievement adjusted for covariates show categories follow similar trends, with no specific category having a notably higher or lower probability of indicator achievement. When looking at the effect of the removal of the indicator on CCI categories, the patients who have a CCI≤1 are most adversely affected by the removal with a 18.16 p.p. decrease in the probability of indicator achievement. Those patients who score CCI of 2 or 3 have a reduction in probability of 17.27 p.p. from when the indicator is removed. The patients who have the highest CCI score (CCI≥6), meaning their chance of mortality is worse, are less affected by the removal of the incentive, and have a 10.05 p.p. decrease in probability in achieving the indicator from 2013/14 to 2014/15.
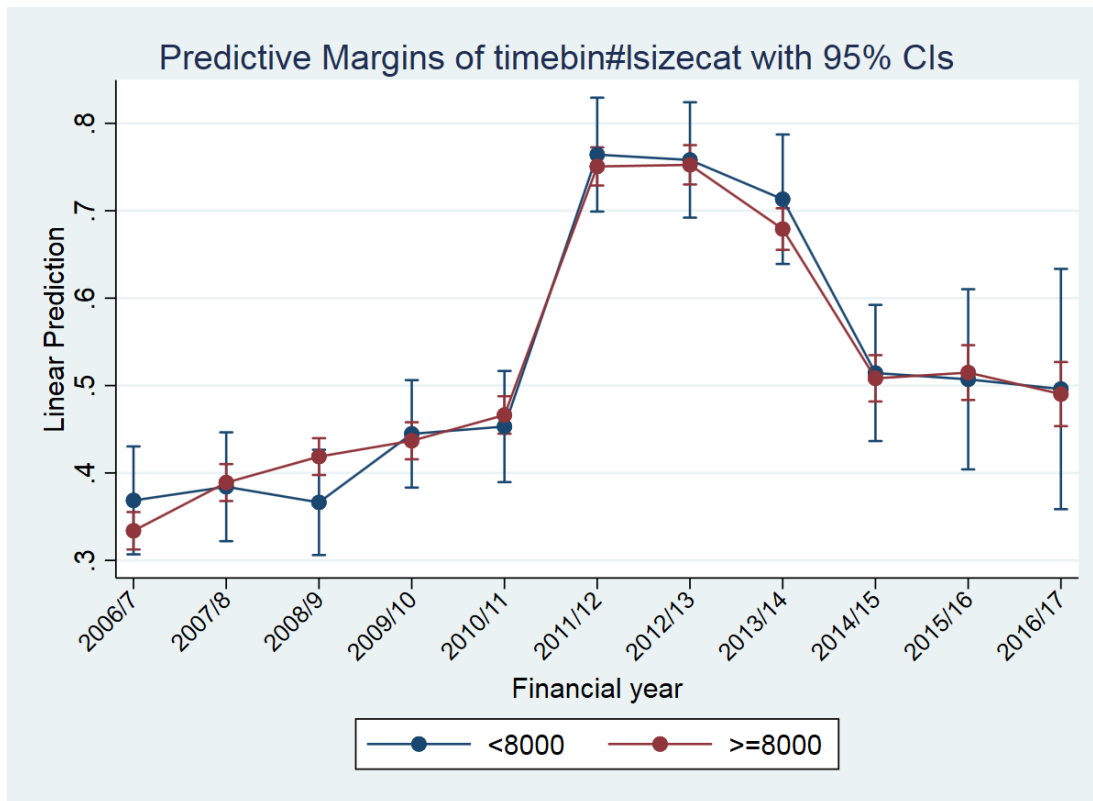
Predictive Margins of timebin#CCIcat with 95% CIs
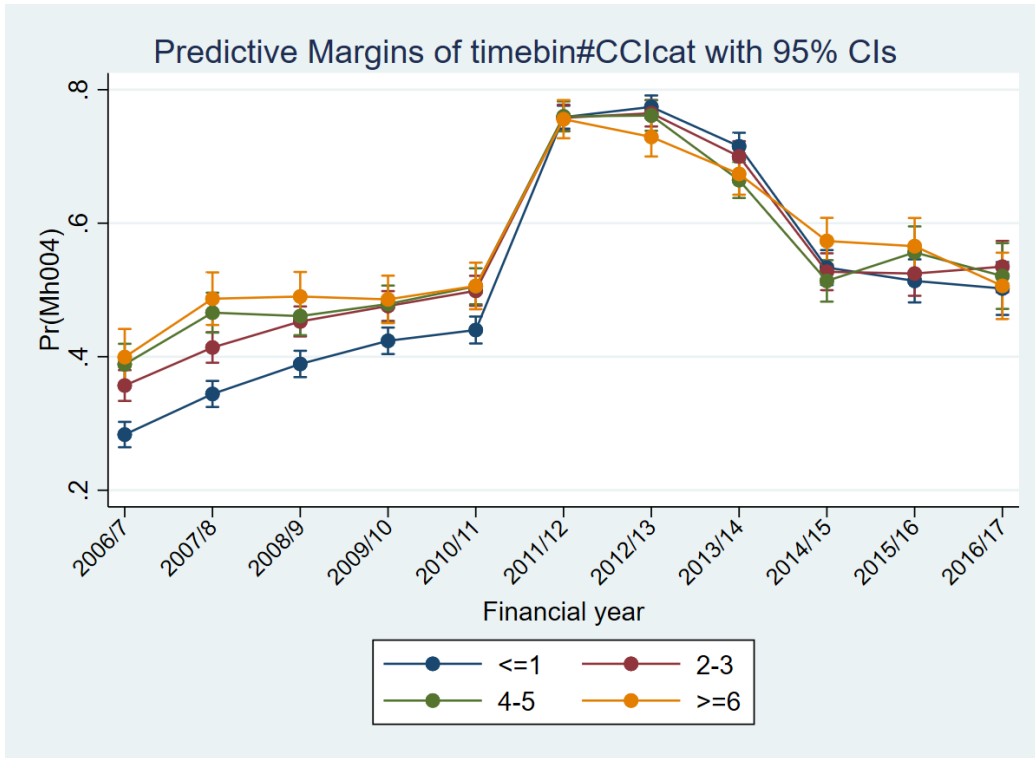
Practice Level

The effect of practice level IMD on indicator performance shows no clear effect on probability of achieving the indicator.

Predictive Margins of timebin#e2015_imd_5 with 95% CIs
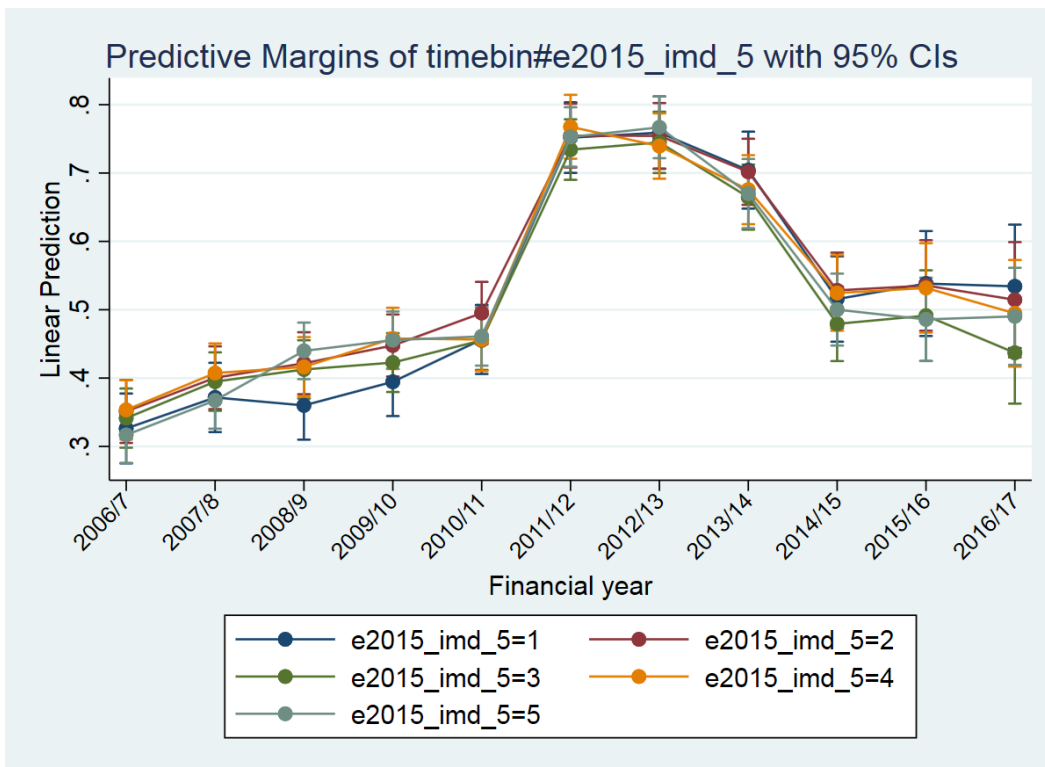
There is no clear effect of practice list size on indicator performance.

Predictive Margins of timebin#lsizecat with 95% CIs

Patient Level Effect of Indicator Retirement

41% of patients did not achieve the indicator if they had achieved the indicator in the previous year. Patients aged over 85 years were 20.2 p.p. more likely not to meet the indicator in the year of retirement, which is significant the 0.1% level. Patients who were more frail had a lower probability of failing the indicator.

|	Probability of not achieving the Indicator in 2014/15 conditional on having achieved it in 2013/14
Age Category (Base: <55)	
55-64	-0.0271
	[-0.0791,0.0248]
65-74	-0.0268
	[-0.0824,0.0288]
75-84	0.0349
	[-0.0314,0.101]
>=85	0.202***
	[0.0935,0.311]
Female (Base: male)	0.0145
	[-0.0215,0.0506]
CCI (Base: 0-1)	
2-3	-0.0458
	[-0.0942,0.00253]
4-5	-0.0328
	[-0.0882,0.0226]
>=6	-0.0902**
	[-0.156,-0.0241]
IMD Quantile (Base: 1)	
2	-0.0293
	[-0.0902,0.0316]
3	0.0107
	[-0.0494,0.0708]
4	-0.00479
	[-0.0677,0.0581]
5	0.00279
	[-0.0587,0.0643]
eFi level (Base: no frailty)	
Mild Frailty	-0.0785***
	[-0.119,-0.0382]
Moderate Frailty	-0.111***
	[-0.172,-0.0498]
Severe Frailty	-0.104*
	[-0.198,-0.0105]
_cons	0.492***
	[0.426,0.557]
N	3091
Mean	0.413

95% confidence intervals in brackets
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Robust Standard errors clustered at practice level.

THY002

Interrupted Time Series

The graph below shows the plotted time series of average indicator performance in both the pre- and post-periods. The pre-trend slope exhibits a steady indicator performance before 2013/14, however the coefficient on this slope is not significant. The coefficients show a significant decrease of 11.46 p.p. when the indicator is withdrawn which is significant at the 1% level. Following indicator removal, the change in slope is positive and significant at the 10% level.
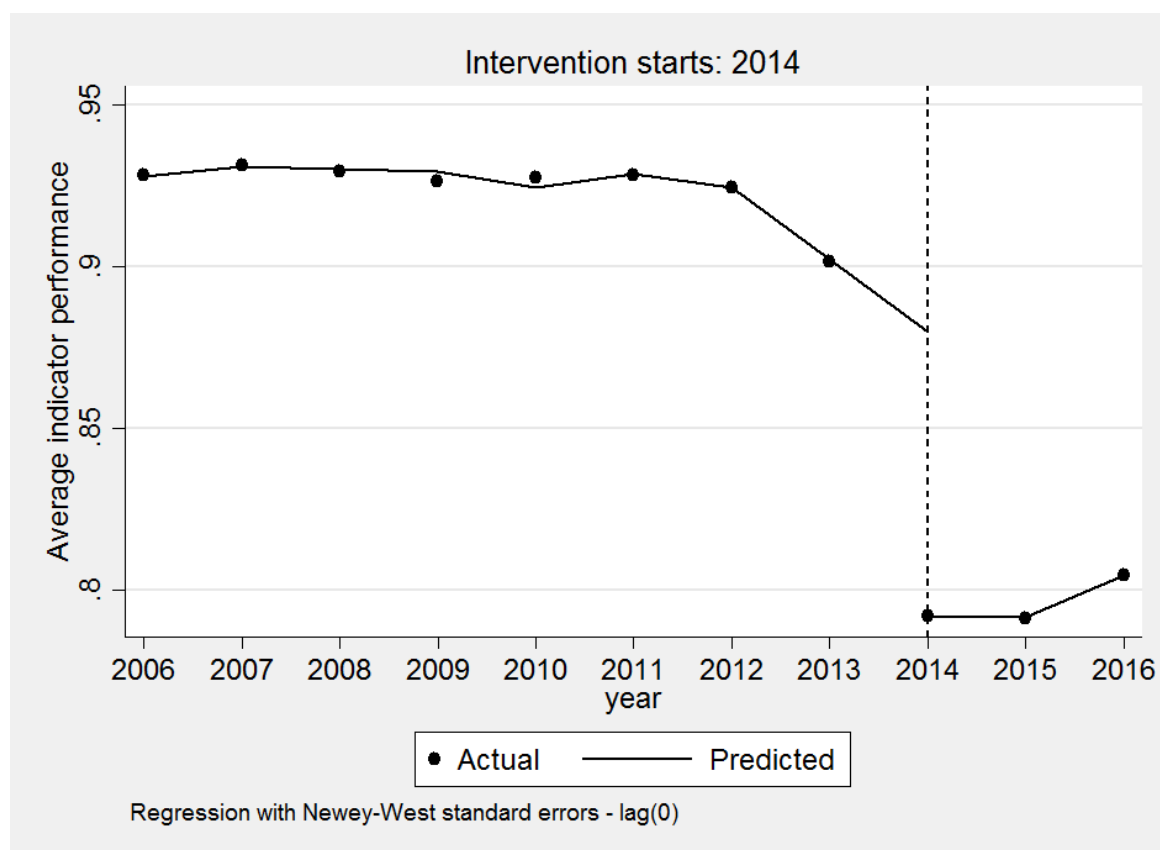

|	THY002	SE
Pre-trend	-0.0011	0.0203
Effect of indicator removal	-0.1146***	0.0027
Trend after removal	0.0102	0.0174
age	-0.0533**	0.0092
gender	1.1224	2.1332
CCI	0.0400	0.1110
Actual eFi	2.8196	1.1427
High deprivation (=1 if IMD>=4)	0.8906	0.2393
_cons	2.7164	1.1838
Effect of removal	0.0091*	0.0030

Patient Level

The youngest (under 55 years) and older (over 85 years) patients have a lower probability of achieving the indicator in the adjusted model. Furthermore patients aged 65 to 74 years have the highest probability of achieving the indicator. The effect of the retirement of the indicator has greatest impact on patients aged over 85 years, who had a 11.21 p.p. drop in probability of achieving the indicator. Whereas patients aged under 55 years were least affected by the retirement as they experienced a 9.22 p.p. drop in probability of achievement.

Predictive Margins of agecat across financial years with 95% CIs
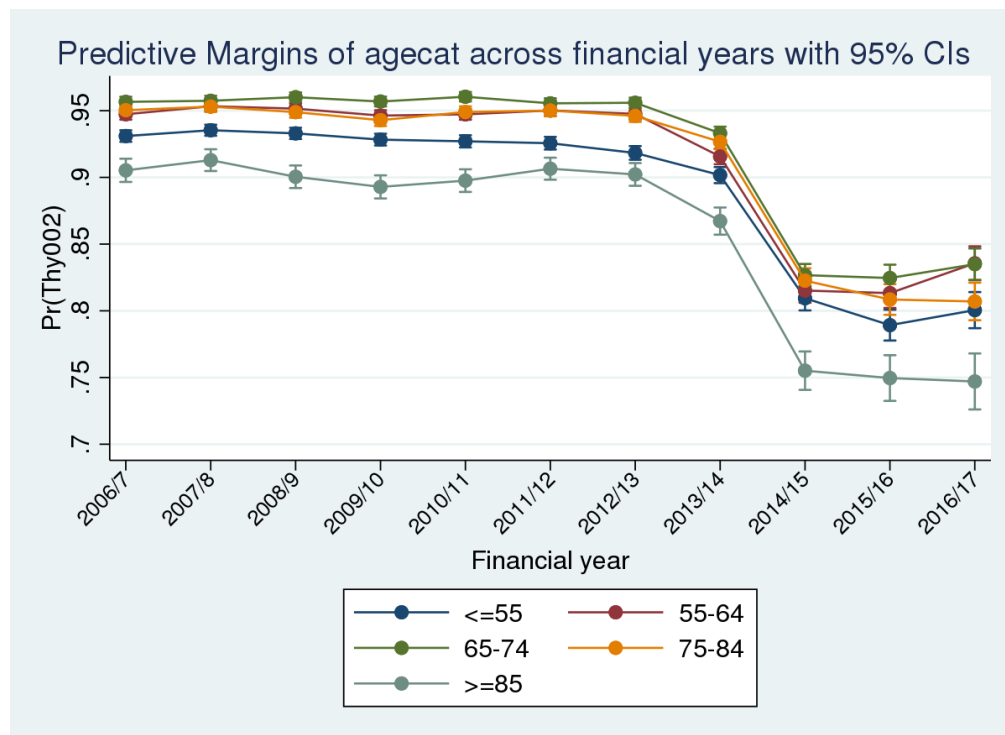
Throughout the whole time period women have a higher probability of achieving the indicator than men. Furthermore men were more affected by the retirement of this indicator, with a 11.31 p.p. drop in probability of achieving the indicator compared to women who had a 9.97 p.p. drop in probability.

Predictive Margins of gender across financial years with 95% CIs
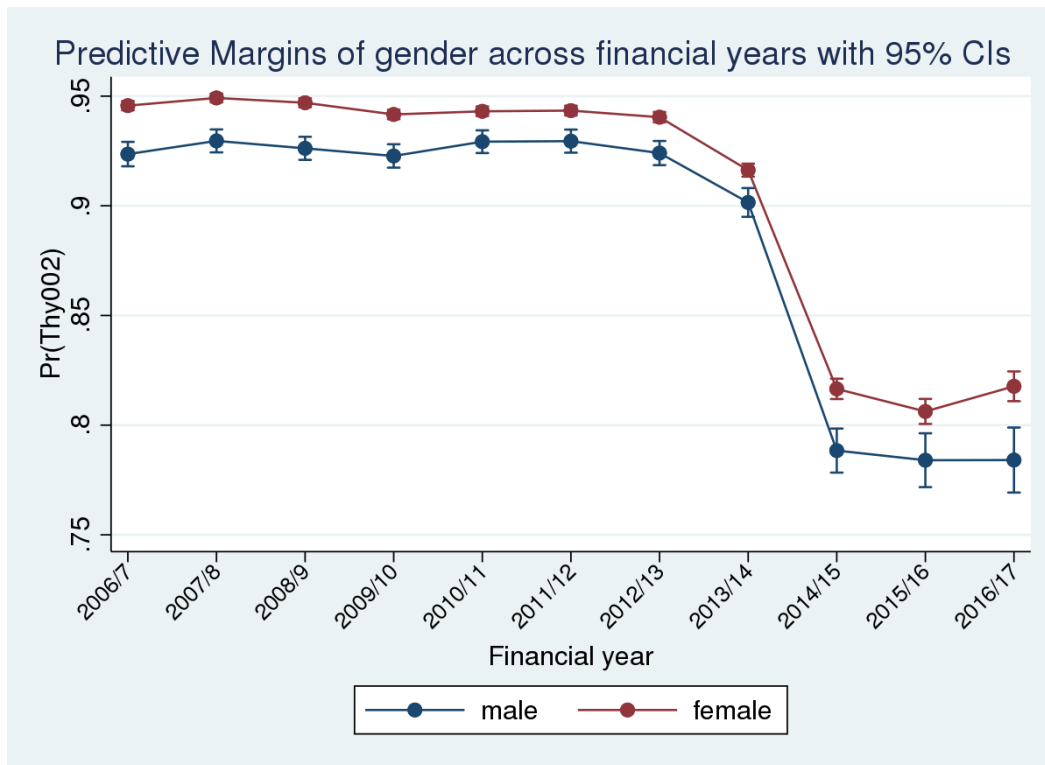
The adjusted model shows prior to the indicator being removed there was no notable difference in patients' deprivation level on their probability of indicator achievement. Once the indicator was removed patients who lived in the least deprived areas have better health outcomes than other levels of deprivation. However this difference in probability is small and there is improvements in probability in 2016/17 for all other deprivation levels for achieving the retired indicator.

Predictive Margins of imd2015_5 across financial years with 95% CIs
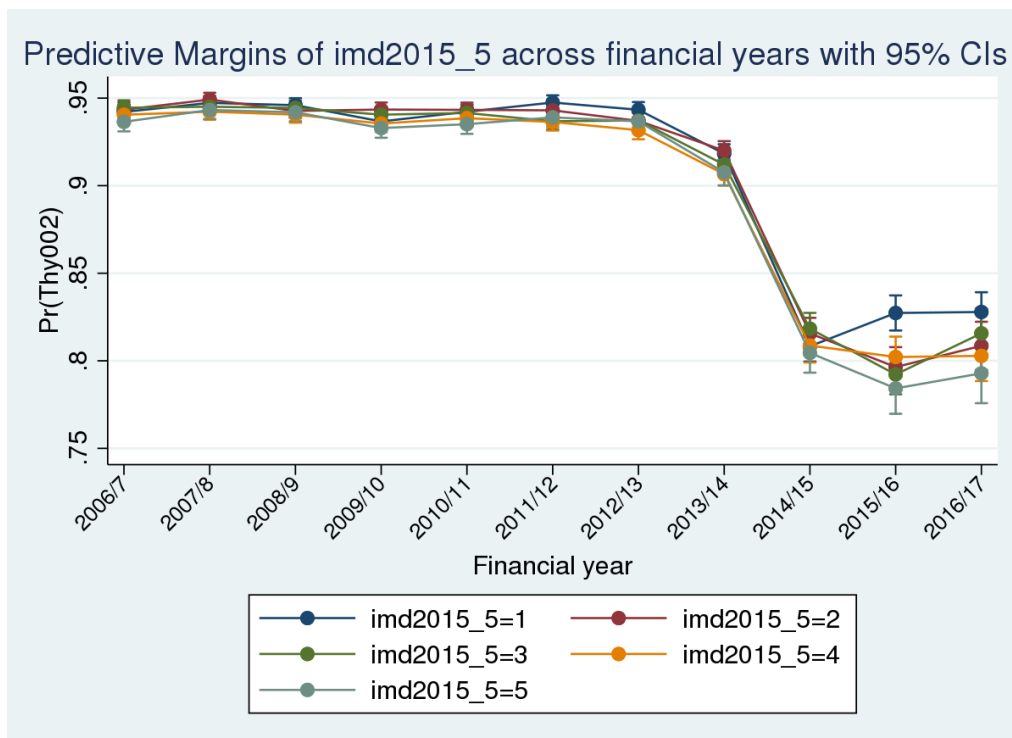
The adjusted model shows no notable variation in indicator achievement across eFI level prior to its retirement. When the indicator is removed patients classified as severely frail were least affected the by the incentive being withdrawn, with the patients classified as fit being most adversely affected.

Predictive Margins of eFi_level across financial years with 95% CIs
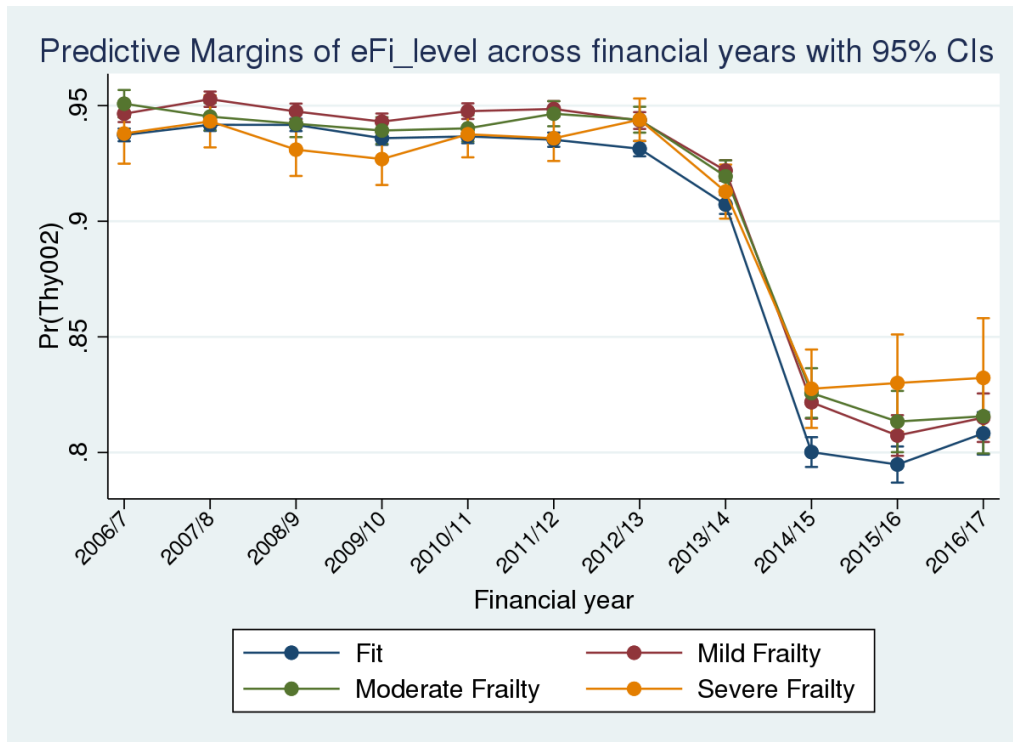
The adjusted model shows patients with a CCI score of 2 to 3 having the highest indicator achievement prior to the incentive being removed; furthermore this patient group were most affected by the incentive being removed with the largest drop in probability of achieving.


Predictive Margins of CCIcat across financial years with 95% CIs
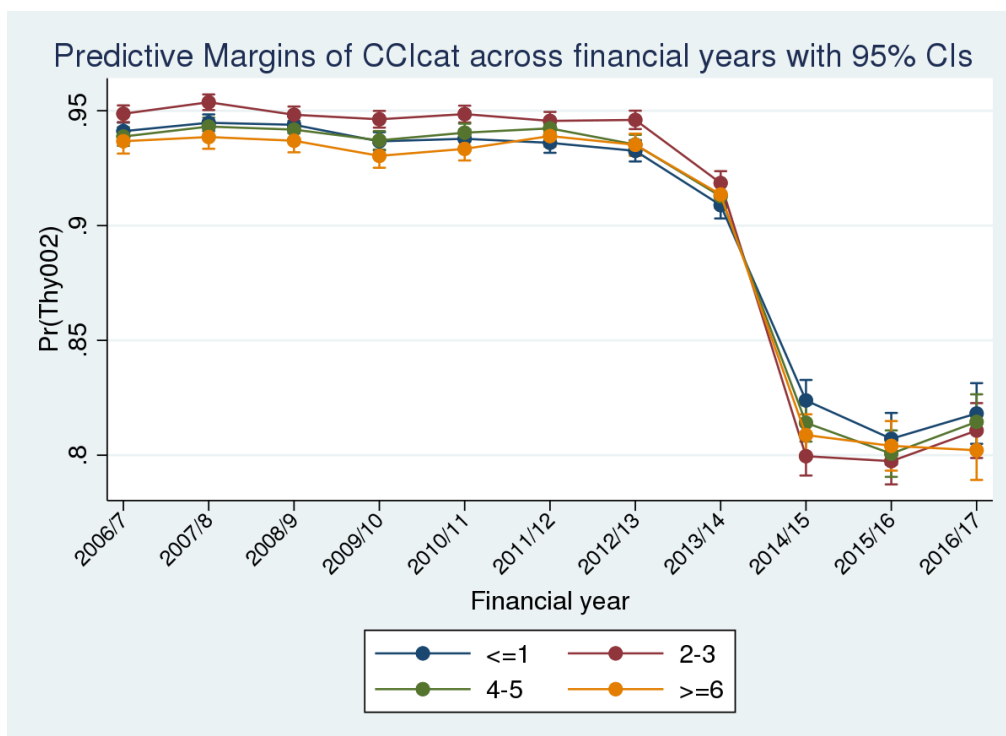
Practice Level

The adjusted model shows that practices in the least deprived areas have higher indicator achievement; however this probability of achieving is only marginally higher than the other quintiles of deprivation. Post- indicator removal there appears to be a slight increasing trend in probability of achieving the indicator, however expanding confidence interval give for ambiguous interpretation.

Predictive Margins of timebin#e2015_imd_5 with 95% CIs
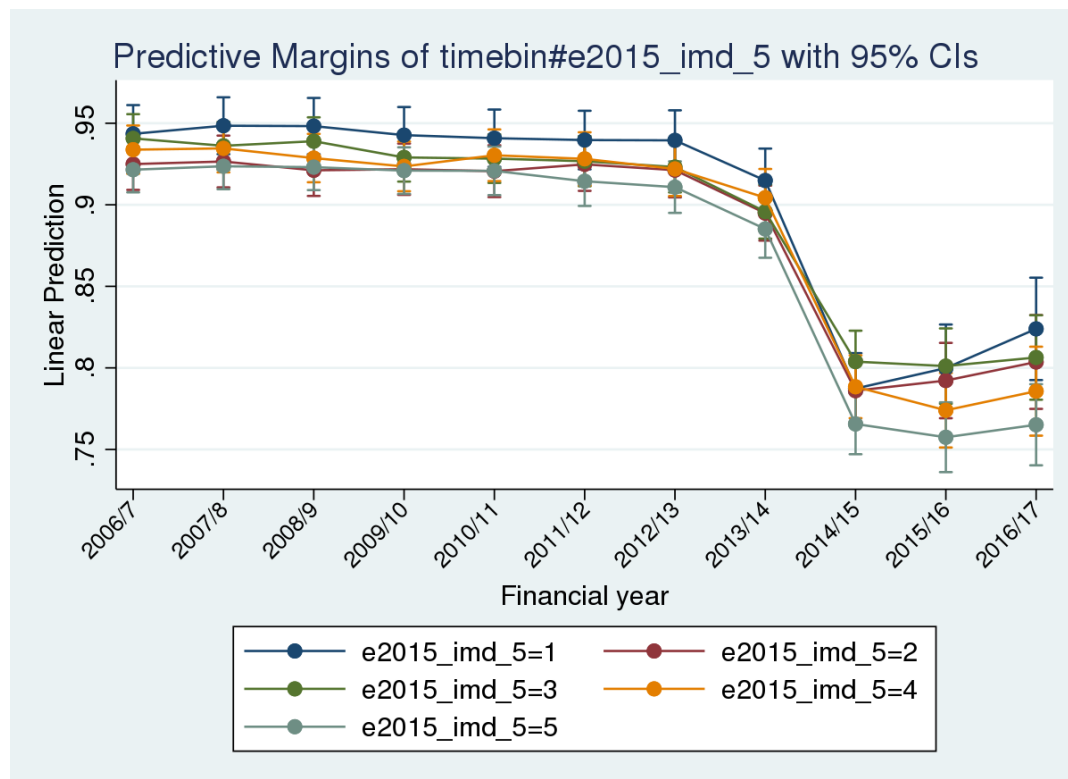
Larger GP practices have consistently higher indicator achievement than that of smaller practices, when this indicator is removed the larger GP practices experience greater drops in indicator achievement. Post indicator removal there are largely ambiguous effects due to widening confidence intervals of smaller practices.

Predictive Margins of timebin#lsizecat with 95% CIs
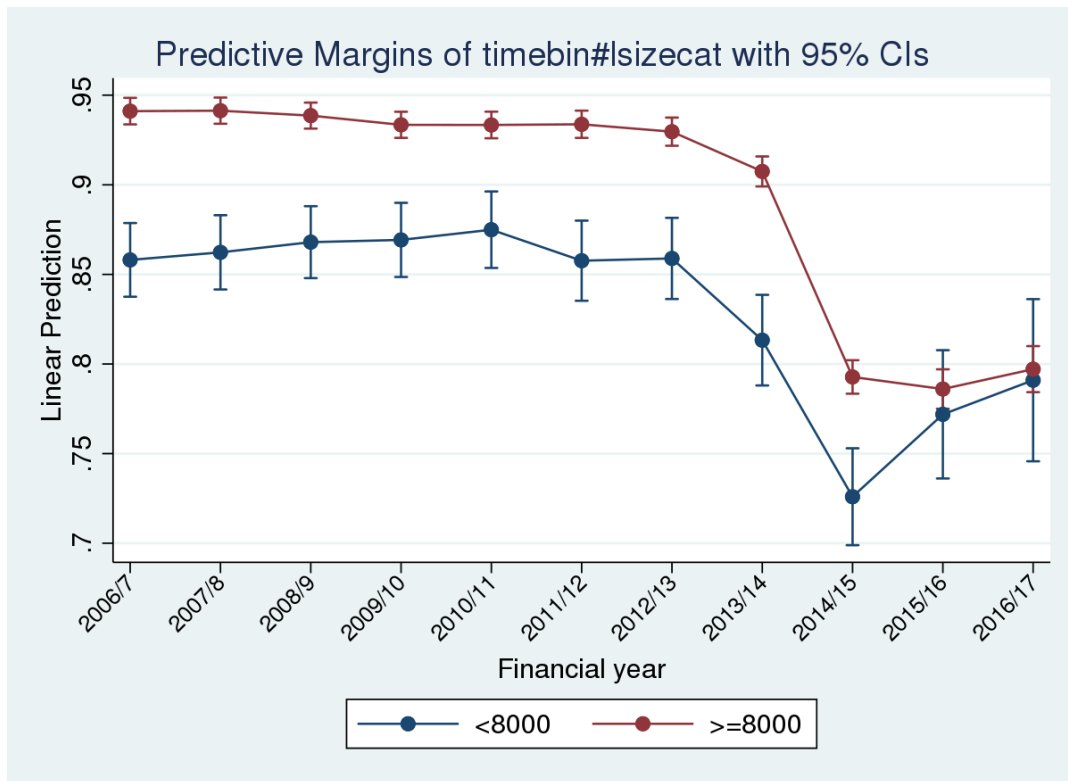
Patient Level Effect of Indicator Retirement

18% of patients who achieved the indicator in 2013/14 did not meet the indicator in the following year. Patients aged over 85 years were 6.54 p.p. more likely to not achieve the indicator in the following year when it was retired which is significant at the 0.1% level. Furthermore females were more likely achieve the indicator in the following year compared to males, which is significant at the 1% level.

	Probability of not achieving the Indicator in 2014/15 conditional on having achieved it in 2013/14
Age Category (Base: <55)	
55-64	-0.00218
	[-0.0170,0.0126]
65-74	-0.0105
	[-0.0286,0.00756]
75-84	-0.00338
	[-0.0236,0.0168]
>=85	0.0654***
	[0.0422,0.0886]
Female (Base: male)	-0.0234***
	[-0.0356,-0.0111]
CCI (Base: 0-1)	
2-3	-0.00383
	[-0.0192,0.0116]
4-5	-0.00635
	[-0.0233,0.0106]
>=6	-0.00662
	[-0.0250,0.0118]
IMD Quantile (Base: 1)	
2	-0.00857
	[-0.0251,0.00791]
3	-0.0106
	[-0.0307,0.00944]
4	-0.00176
	[-0.0227,0.0192]
5	0.00418
	[-0.0208,0.0292]
eFi level (Base: no frailty)	
Mild Frailty	-0.0222***
	[-0.0337,-0.0108]
Moderate Frailty	-0.0213*
	[-0.0400,-0.00260]
Severe Frailty	-0.00974
	[-0.0410,0.0215]
_cons	0.216***
	[0.193,0.238]
N	29148
Mean	0.180

95% confidence intervals in brackets
* p < 0.05, ** p < 0.01, *** p < 0.001
Robust Standard errors clustered at practice level.

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